

Paper Title:

Supporting Culture in Computer-Supported Cooperative Work

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Biography

Lu Xiao is PhD student at the School of Information Sciences and Technology, Penn State University (USA). Her research area is human-computer interaction and computer-supported cooperative work. Her current research projects include groupware design of supporting geospatial collaboration and long term participatory design with local non-profit community groups on computer technologies that support community activities. She obtained her Master's degree in Computer Engineering from the University of Florida. In Fall 2002, she started her Ph.D. program on Human-Computer Interaction at Virginia Tech. Since then, she has been working with John M. Carroll, her academic advisor, and Mary Beth Rosson.

Gregorio Convertino is PhD student and research assistant at the School of Information Sciences and Technology, Penn State University (USA). His research domain is human-computer interaction and computer-supported cooperative work (CSCW). His current area of research is the study of Activity Awareness in CSCW, and the development of evaluation methodologies for studying cooperative systems. He obtained his Master's degrees in Psychology from the "Sapienza" University of Rome (Italy). He collaborated with Daniela Petrelli and Antonella De Angeli on the HIPS European research project (Hyperaudio) to design and evaluate a palmtop intelligent guide for museum settings. In 2002 he was awarded the Fulbright Scholarship and started the PhD program in Computer Science at Virginia Tech (Virginia, USA). Since then he has collaborated with Dr. John M. Carroll, his academic advisor, and Dr. Mary Beth Rosson at the Center for HCI at Virginia Tech. He is currently in the School of Information Sciences and Technology at the Pennsylvania State University (USA).

Eileen M. Trauth is Professor of Information Sciences and Technology at The Pennsylvania State University and Director of the Center for the Information Society. Her research interests are at the intersection of socio-cultural and organizational influences on IS and the IS profession. In 2003 she was the recipient of an E.T.S. Walton Distinguished Visitor Award from Science Foundation Ireland to continue her research on socio-cultural aspects of Ireland's information economy. Her original work is chronicled in *The Culture of an Information Economy: Influences and Impacts in the Republic of Ireland*. In 2002 Dr. Trauth received a grant from the National Science Foundation to examine socio-cultural influences on gender in the American IS profession. She has been a visiting scholar in several countries where she has conducted research on socio-cultural influences and impacts. Dr. Trauth has also published papers on qualitative research methods and is the editor of *Qualitative Research in IS: Issues and Trends*. She serves on the editorial boards of several international journals. Eileen M. Trauth can be reached at etrauth@ist.psu.edu.

Mary Beth Rosson is Professor of Information Sciences and Technology at Pennsylvania State University. Prior to joining Penn State in 2003, she was a professor of computer science at Virginia Tech for 10 years and a research staff member at IBM's T. J. Watson Research Center for 11 years. Rosson's research interests include scenario-based design and evaluation, the use of network technology to support collaboration,

especially in learning contexts, and the psychological issues associated with use of high-level programming languages and tools. She is co-author of *Usability Engineering: Scenario-Based Development of Human-Computer Interaction* (Morgan Kaufmann, 2002), author of *Instructor's Guide to Object-Oriented Analysis and Design with Application* (Benjamin Cummings, 1994), as well as numerous articles, book chapters, and tutorials. More information is available at <http://ist.psu.edu/rosson>.

John M. Carroll is Edward Frymoyer Chair Professor of Information Sciences and Technology at the Pennsylvania State University. His research interests include methods and theory in human-computer interaction, particularly as applied to networking tools for collaborative learning and problem solving. He has written or edited 14 books, including *Making Use* (MIT Press, 2000), *HCI in the New Millennium* (Addison-Wesley, 2001), *Usability Engineering* (Morgan-Kaufmann, 2002, with M.B. Rosson) and *HCI Models, Theories, and Frameworks* (Morgan-Kaufmann, 2003). He serves on 9 editorial boards for journals, handbooks, and series; he is a member of the US National Research Council's Committee on Human Factors and Editor-in-Chief of the *ACM Transactions on Computer-Human Interactions*. He received the Rigo Career Achievement Award, from ACM (SIGDOC), the Silver Core Award from IFIP, and was elected to the CHI Academy. In 2003 he received the CHI Lifetime Achievement Award from ACM.

Supporting Culture in Computer-Supported Cooperative Work

A B S T R A C T

Culture plays an important role in collaboration. Human-Computer Interaction (HCI) researchers have investigated how cultural factors may affect design and evaluation of user interfaces. Information System (IS) researchers have studied the impact of culture on international teams and organizations. Computer-Supported Collaborative Work (CSCW), a field located between the research on single user applications and that on organizational issues, is increasingly facing the need of accounting for cultural factors in order to understand, support and evaluate collaboration. People from different cultures may have different value systems and attitudes towards the same collaborative activity, which will affect both group relationships and group performance. Appropriately supporting cross-cultural coordination represents a new challenge for CSCW design. In this paper, we review prior studies, discuss alternative approaches to design, and suggest a theoretical tool that may inform future research on the culture in CSCW.

I N T R O D U C T I O N

C O M P U T E R S U P P O R T E D

C O L L A B O R A T I V E W O R K (C S C W)

Information Technology (IT) has a significant impact on our lives beyond mere information access and distribution. IT shapes access to services, technology, and people. The design and use of IT can change people's communication style and the way they work either individually or in a group. The recent introduction of groupware and Computer Supported Collaborative Work (CSCW) systems enables people to collaborate with fewer time and space constraints, and affects people's lives and their cultures in the long-term.

CSCW is a new and fast developing research field. The terms groupware and CSCW were coined in the mid-1980s. The study of CSCW and groupware could be defined as a middle field of research in between the study of single user applications (e.g. human-computer interaction (HCI) research) and that of applications for organizations (e.g. information systems (IS) or management information system (MIS) research) (Grudin, 1994). CSCW studies the way people work in groups as well as technological solutions that pertain to computer networking with associated hardware, software, services

and techniques (Wilson, 1991). There are several alternative labels used to denominate computer-supported collaborative work applications: groupware, group support systems (GSS), collaborative computing, workgroup computing, and multiuse applications.

Some of the key issues studied in CSCW include Computer-Mediated Communication, awareness and coordination, and multi-user interfaces. However, there has been very limited research to account for culture in CSCW. In this paper, we discuss the role of culture in design and implementation of CSCW systems that support work in cross-cultural contexts. We first present two different perspectives on culture in the literature. We then review prior research in both HCI and IS fields, and follow with a summary of preliminary research work in CSCW about cross-cultural group work. We conclude discussing alternative approaches to design, and suggesting a theoretical tool that may inform future research on the cultural factors in CSCW.

C U L T U R E

Culture is "an integrated system of learned behavior patterns that are characteristic of the members of any given society. Culture refers to the total way of life of particular groups of people. It includes everything that a group of people thinks, says, does and makes -- its systems of attitudes and feelings. Culture is learned and transmitted from generation to generation."

(Kohls, 1996, p. 23.) Two distinct perspectives on culture are represented in the literature: *culture is relatively constant vs. culture is variable and situated*. The major advocate of the first perspective (where culture is a constant entity, based on shared assumptions) is Hofstede, who defines culture as “the collective programming of the mind which distinguishes the members of one group or category of people from another” (Hofstede, 1980, p. 25). Researchers who hold the first perspective on culture also define culture as beliefs, values and assumptions, which are reflected in artifacts, symbols, and behaviors (e.g., Kroeber and Kluckhohn, 1963). Schein defined organizational culture as a set of implicit assumptions shared within the group that determine its perspective of and reaction to various environments (Schein, 1992).

The other perspective on culture characterizes it as variable, historically situated, and evolving with the context. Rather than being a holistic and relatively stable entity, culture is seen as fragmented, variable, contentious, and “in-the-making” (e.g., Brightman, 1985; Prus, 1997). The values and attitudes of the working group affect the behavior of the group, whose collective patterns of behavior contributes to the group culture. The group culture, in return, has significant impact on the values and attitudes of the group. This cyclic relationship is true for not only working groups or organizations, but also for nations (Davison and Jordan, 1996).

B A C K G R O U N D

C U L T U R E : A R E S E A R C H I S S U E I N M U L T I P L E D I S C I P L I N E S

In this section, we review studies from different research fields that have investigated the role of culture in computer technology. We first describe prior research in HCI and IS (or MIS) literature. Then we focus on studies that have accounted for cultural factors in CSCW and groupware.

C U R R E N T R E S E A R C H I N H C I & I N F O R M A T I O N S Y S T E M

HCI researchers have investigated how cultural factors may affect design and evaluation of single-user applications (e.g., Barber and Badre, 1998; Marcus, 2000; Marcus and Gould, 2000; Sheppard and Scholtz, 1999). The research in this domain has focused on research issues such as cultural usability (e.g., Barber and Badre, 1998) and the design of intercultural user interfaces (UI) (e.g., Marcus, 2000). An instance of the impact of culture on UI design pertains the meaning of colors. The color ‘red’, for example, in some cultures is associated with danger, anger, and so on (Dix and Mynatt, 2004). In other cultures, such as in China, it is more commonly associated with happiness and good luck. Designing UI for multi-cultural audiences may require

interfaces that adapt the standards to the cultural context of the specific audiences.

Several IS (or MIS) studies have investigated the influence of cultural factors on the use of information systems. Table 1, reproduced from Ward and Ward (2002), summarizes a number of studies on GSS and culture. Setting future agendas for IS research at the group level of analysis, Walsham observed that “There are clear agendas here for IS researchers to investigate in more detail the role of groupware in multi-cultural contexts” (Walsham, 2000, p. 204).

Author	Activity	Results	Groups researched
Tan et al. 1993	Influence of minority source	Status influence altered	
Aiken et al. 1993	Effective use of technology	Effective regardless of culture of language	Malaysia and American groups
Watson et al. 1994	Adoption of technology	Culture will shape adoption of GSS features Meeting designers need to match tools and communication to meeting goals and cultural norms	Singapore and US groups
Niederman, 1997	New technology New meeting norms	Reaction similar Some differences	
Aitkinson and Pervan, 1998	Anonymity	Higher productivity	Four National groups
Abdat and Pervan, 1999			Indonesian groups
Anderson 2000	Cognitive conflict task	No difference for pre-meeting consensus, influence equality and post-meeting consensus No difference for consensus change Higher levels of perceived process gains, perceived decision satisfaction, perceived decision process satisfaction, and perceived quality of discussion	Multicultural and US groups

Table 1. Research on GSS and culture (reproduced from Ward and Ward, 2002)

C U L T U R E I S S U E I N C S C W A N D G R O U P W A R E

Located between HCI and IS research, CSCW has given increasing attention to cultural factors in CSCW and groupware. CSCW researchers have acknowledged the relevance of culture to appropriately design groupware and to successfully support cooperative work. For example, Olson and Olson (2001, p. 412) have observed that remote teams misunderstand each other because of cultural differences. Dix and his colleagues have observed that lack of consideration for different cultural perception and habits about personal space (proxemics) may have unpleasant effects in cross-cultural meetings (e.g., Dix and Mynatt, 2004). The following section discusses two distinctive examples of system design that supports cross-cultural communication.

D E S I G N A P P R O A C H E S O F S U P P O R T I N G C U L T U R E I N C O L L A O B R A T I O N

Okamoto, Isbister, Nakanishi, and Ishida (2002) have designed and implemented large screen systems that support cross-cultural communication that happens synchronously with communicators either at the same location or in remote locations. In their large screen systems, communicators' real

image can be seen from the large screen thus enabling their communication through nonverbal cue. Communicators' cultural background and shared information based on their profiles are presented on the large screen, including language knowledge, culture literacy and experience (e.g., how long the person has been immersed in the culture), and culture affinity and ties (e.g., how many friends the person has from certain countries). The idea of the system is to provide support for culture awareness to improve communication.

Grill, Kronsteiner, and Kotsis (2003) suggested creating a culture translation agent to support cross-cultural communication information. Using Hofstede's (1980) definition of culture as "collective programming of the mind", Grill et al. assume that different programming of the minds leads to alternative code bases (i.e., alternative common ground) in communication (Clark and Brennan, 1991). The authors propose the idea of implementing a cultural translation system that helps overcome the misunderstanding in communication due to different code bases. In such a culture translation system, a culture translation agent (CTA) is created as a modular agent. Such an agent functions as a communication support tool that monitors whether messages sent between communicators might cause misunderstandings due to culture difference and notifies communicators about it. The CTA uses a matching algorithm to compare phrases and terms in the message with a code base constructed based on code bases of the relevant cultures.

Although the idea of implementing a CTA to support cross-cultural communication seems to be promising, overall we consider Okamoto et al.'s design approach more favorable. Privileging the perspective that culture is dynamic and context-dependent, we argue that a static code base cannot reflect the dynamic features of culture (specifically referring to the cultural factors that significantly affect group collaboration). For example, things that would normally cause miscommunication because of cultural difference between the communicators may rather be understood well because one has been exposed to the other's culture for an extended period. In this case, a culture translator may not be useful for communication. Instead, the existence of a translator may be an obstacle for communicators to learn each other's culture, which could have been a positive outcome of cross-cultural communication. Compared to CTA, Okamoto et al.'s approach takes into account the dynamic features of culture (e.g., an individual's culture literacy and experience are provided on the large screen, and communicators are able to see each other and communicate directly). Thus, the system supports cross-cultural communication by providing individual cultural background information while simultaneously enabling face-to-face communication.

We believe that appropriately supporting cross-cultural coordination represents a new challenge for CSCW design. In fact, people from different cultures may have different value systems and attitudes towards the same

activity (e.g. expectations and assumptions on labor division and deadlines), different understanding of rules of the group, etc. Such differences generally affect both work relationships and group performance.

F U T U R E T R E N D S

A C T I V I T Y T H E O R Y : A U S E F U L T H E O R E T I C A L T O O L

Activity theory is a useful tool to understand cultural mediation in human activities. In agreement with ecological approaches to HCI and in contrast to individual-centric theories, activity theory emphasizes the connection rather than the separation between human cognition and human action (Bødker, 2003). Culture is viewed as a primary mediator in human activities.

The *cultural-historical approach* put forth by Russian cultural-historical scholars Leontiev, Luria, and Vygotsky draws on Marx's historical materialism and focuses on the function of culture in human development by considering the contributions of *cultural artifacts*, historical development, and practical activity (Cole, 1998). Activity Theory was born from this perspective where the primary unit of analysis is the activity, i.e., the "fundamental type" of context (Bødker, 1991; Korpela, Mursu, and Soriyan, 2001). Building on this basis, Engeström has depicted the intertwined relationships among subject, object, and community of the activity through a triangular model (Figure 1). The central Subject-Object-Community triangle

is then extended to include socio- cultural forms of mediation: instruments, rules, and division of labor (Engeström, 1987).

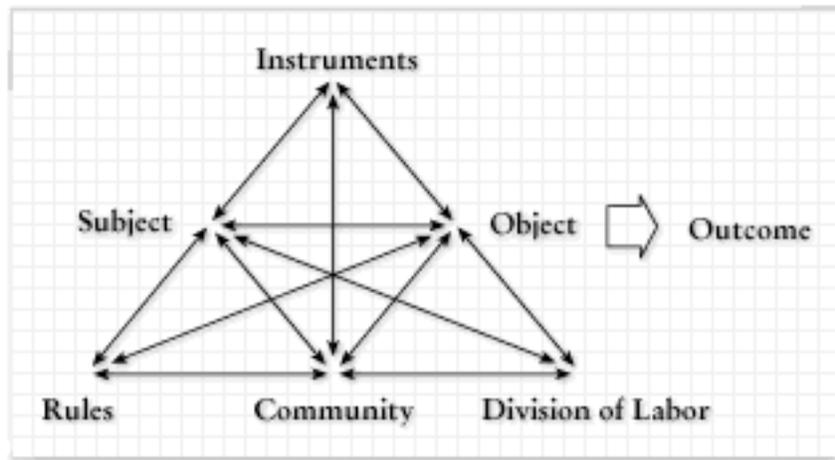


Figure 1. Engeström's model of human activity (1987)

Supporting collaborators' awareness has been a central concern for CSCW researchers. Globally, three major forms of awareness have been studied in CSCW research: *social awareness* (who is present), *action awareness* (what are they doing), and the more general awareness of the entire activity (Carroll, Neale, Isenhour, Rosson, and McCrickard's, 2003). With the aim of accounting for cultural factors in group cooperation, we suggest the inclusion of cultural mediation as part of the activity awareness concept. Specifically, drawing on Engeström's (1987) activity model, we propose a comprehensive concept of awareness in CSCW, which accounts for collaborators' awareness of cultural mediators such as group norms and rules, division of labor, and collaborative tools.

However, Engeström's model is based on the assumption of a single, shared cultural context. This model needs to be extended in order to describe and explain collaborative phenomena among people of different cultures. In fact, different cultures generally imply different artifacts, rules and ways of dividing labor.

Cross-cultural collaboration requires the additional task of negotiating meanings at a cultural level. Future research issues about awareness of cultural mediation in CSCW include: study of awareness breakdowns due to lack of visibility or misunderstandings about cultural differences; study of the process of building common ground (Clark and Brennan, 1991) in cross-cultural settings; and study of the influence of cultural background information on group performance.

C O N C L U S I O N

In this paper, we have reviewed the current understanding of culture as a factor in CSCW. Using two examples to illustrate different approaches to design CSCW systems that support cross-cultural communication (culture translation system vs. support for cross-cultural communication and awareness), we give suggestions for system design that takes into account the culture factor. We have also suggested directions of future research on the culture factor in CSCW and groupware. We suggest the introduction of

culture mediation awareness to the concept of activity awareness. The best solution is CSCW systems that support culture mediation awareness by providing information to users about on group culture.

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T E R M S A N D T H E I R D E F I N I T I O N

Culture: "an integrated system of learned behavior patterns that are characteristic of the members of any given society. Culture refers to the total way of life of particular groups of people. It includes everything that a group of people thinks, says, does and makes -- its systems of attitudes and

feelings. Culture is learned and transmitted from generation to generation" (Kohls, 1996, Page 23).

Hofstede's Cultural Dimensions: Hofstede identified five dimensions of national culture: power distance, uncertainty avoidance, individualism, masculinity, and long-term time vs. short-term orientation.

Computer-Supported Cooperative Work (CSCW): A field located between HCI and IS research fields, CSCW studies the way people work in groups as well as technological solutions that pertain computer networking with associated hardware, software, services and techniques (Wilson, 1991).

Context: the structure or environment where special interactions occur (Giddens, 1984).

Groupware: "computer-based systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment" (Ellis et al., 1991).

Activity theory: Activity Theory construes activity as a collective phenomenon. Activity is pursued by individual or groups within a community, working toward shared objectives or motives, and recruiting and

transforming the material environment, including shared tools, data, social and cultural structures, and work practices (Kuutti, 1991).

Awareness: “an understanding of the activities of others, which provides a context for your own activity” (Dourish and Bellotti, 1992).