Carnegie Mellon University
Research Showcase @ CMU

Human-Computer Interaction Institute | School of Computer Science

2004

Taking it Out of Context: Collaborating Within and Across Cultures in Face-to-Face Settings and via Instant Messaging

Leslie D. Setlock
Carnegie Mellon University

Susan R. Fussell
Carnegie Mellon University

Christine Neuworth
Carnegie Mellon University

Follow this and additional works at: http://repository.cmu.edu/hcii

Recommended Citation
.

This Conference Proceeding is brought to you for free and open access by the School of Computer Science at Research Showcase @ CMU. It has been accepted for inclusion in Human-Computer Interaction Institute by an authorized administrator of Research Showcase @ CMU. For more information, please contact research-showcase@andrew.cmu.edu.

Taking It Out of Context: Collaborating within and across Cultures in Face-to-Face Settings and via Instant Messaging

Leslie D. Setlock, Susan R. Fussell, Christine Neuwirth
Carnegie Mellon University
5000 Forbes Avenue
Pittsburgh, PA 15213 USA
+1 412-268-7125
[lsetlo, sfussell, cmn]@cs.cmu.edu

ABSTRACT
As new communications media foster international collaborations, we would be remiss in overlooking cultural differences when assessing them. In this study, 24 pairs in three cultural groupings—American-American (AA), Chinese-Chinese (CC) and American-Chinese (AC) –worked on two decision-making tasks, one face-to-face and the other via IM. Drawing upon prior research, we predicted differences in conversational efficiency, conversational content, interaction quality, persuasion, and performance. The quantitative results combined with conversation analysis suggest that the groups viewed the task differently—AA pairs as an exercise in situation-specific compromise; CC as consensus-reaching. Cultural differences were reduced but not eliminated in the IM condition.

Categories and Subject Descriptors
K.4.3 [**COMPUTERS AND SOCIETY**]: Organizational Impacts – *computer-supported cooperative work*

General Terms
Experimentation, Human Factors

Keywords
CSCW, distributed work, empirical studies, collaborative writing, coordination mechanisms, intellectual teamwork, cross-cultural communication

1. INTRODUCTION
Technologies that enable people to collaborate remotely have been available for many years, and a great deal of research on the effects of these technologies on the collaborators' communication has been performed. Similarly, the issues of cross-cultural communication and business organization have been the focus of significant research in recent years. Yet to date there has been little work on cultural differences on computer-mediated collaborations. As computer-mediated communication allows more collaboration across distance, and therefore across cultures, research on computer-mediated communication would be remiss in overlooking the issue of cultural differences (as distinct from straightforward language barriers) in assessing the usefulness of current technologies.

Research on cultural differences in computer-mediated communication to date has largely focused on issues of how people learn and interact with the technology [32][47]. Other research, like Isbister, et al's, Helper Agent, attempts to provide an artificial cultural mediator [26]. These projects, however, require that the system establish a normative interaction pattern, a process that inherently requires choosing certain communication strategies over others.

The most notable research in this area, done by Massey, Hung, Montoya-Weiss and Ramesh [35], studied participants' subjective ratings of satisfaction with asynchronous communication. Lower satisfaction levels of Asian participants were attributed to the unavailability of prompt feedback and social cues. These results are confounded by a media condition that is asynchronous as well as remote: Participants were deprived of both synchronous verbal feedback as well as nonverbal feedback. But asynchronous communication is only one point in the design space. Instant messaging (IM), for example, supports synchronous feedback and text-based substitutes for nonverbal behaviors (e.g., smileys), and thus may better support the communication styles of various cultures. Anderson and Hiltz [1] compared face-to-face discussions to those via an asynchronous decision-support system found little difference between homogeneously American and culturally diverse teams.

In this paper, we consider the effects of synchronous computer-mediated communication on culture-based communication styles among homogeneous pairs from different cultures as well as culturally diverse pairings. In particular, we explore the interaction between the availability (or lack thereof) of social context in instant messaging and high- and low-context cultures. High-context cultures are those for which the meaning of a communication is embedded in the situation, the relationship between the communicators, and their shared beliefs, values and norms; low-contrast cultures are those in which relationships and situational factors play a minimal role, and communications can largely be taken at face value [20]. The primary goals of the project are

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

CSCW'04, November 6–10, 2004, Chicago, Illinois, USA.

Copyright 2004 ACM 1-58113-810-5/04/0011…$5.00.

to understand the role of culture in both face-to-face and synchronous computer-mediated collaborations, to discover how culture and media interact to shape perceptions of the quality of teamwork and task performance, and to identify ways in which computer-mediated communication technologies can better support cross-cultural collaborations.

We first present the theoretical background behind our study. Then, we present findings from a laboratory study of 24 pairs of dyads performing a joint decision-making task. We contrast how three types of dyads—homogeneous American (US-born) pairs, homogenous mainland Chinese pairs, and cross-cultural Chinese/American pairs—perform the task in two media conditions—face-to-face or IM. We explore the ways collaborators communicated and coordinated their work during the decision-making task, the points of disagreement they experienced, the extent to which they were able to persuade one another, and the quality of their performance.

2. Dynamics of Collaborations

Collaborations require participants to agree upon a set of goals, and ways to achieve those goals. A decision-making task, specifically, also requires participants to establish a shared language and communication media in which to work toward these goals. These processes are likely to be influenced by team members' cultural backgrounds, the media through which they communicate, and interactions between culture and medium.

In this section we consider five aspects of the collaborative process—conversational grounding, message content, quality of interaction, persuasion, and performance. We discuss how cultural factors, communications media, and interactions between the two can affect each aspect of collaboration.

2.1 Conversational Grounding

The term *grounding* refers to the interactive process by which communicators exchange evidence in order to reach mutual understanding [7].

In a decision-making task, before collaborators negotiate a decision, they typically must reach a mutual understanding about the nature of the task and the options available to them. Research has shown that these tasks are demonstrably more efficient when people share greater amounts of *common ground*—mutual knowledge, beliefs, goals, attitudes, etc. [8][9] Participants in conversations construct and expand their common ground over the course of the interaction on the basis of *linguistic co-presence* (because they are privy to the same utterances) and/or *physical co-presence* (because they inhabit the same physical setting) [8]. Participants also share certain amounts of common ground before they begin to communicate, based on membership in the same group of population [8]. Previous research has shown that pairs sharing community memberships based on gender [15], age [24], and geographical background [25] can communicate more effectively than pairs that do not share this information. In the current paper, we extend this line of work by examining how co-membership in a cultural group influences the conversational grounding process.

Grounding processes are also influenced by the medium of communication. Clark and Brennan [7] argue that different communication media have features that change the costs of grounding. For example, the media may change the time speakers have to plan an utterance, the evidence from which speakers can infer a listener's state of understanding, or the listener's ability to provide feedback to show understanding or ask for clarifications [7]. A number of studies have shown that grounding is more difficult via computer-mediated communications systems than it is in face-to-face settings (e.g., [13][16][17][30]) and that grounding via IM can be particularly difficult when visual context is lacking [18]. In general, richer media have been found to be more beneficial for tasks that require views of the workspace than for discussion tasks. Nonetheless, we expect that negotiations in a decision-making task will be less efficient via IM than in face-to-face settings.

Edward Hall [20] describes culture as the entire system of communication, including (but not limited to) words, actions, postures, gestures, tones of voice, facial expressions, use of time and space. Of these, only the words exist unaltered in lean communication media. Triandis [48] describes culture as the mental framework resulting from shared beliefs, values, symbols and social ideals. One such difference is the expectations regarding conversational grounding (largely explicit or largely implicit) and that consequently, communications media may affect grounding in different ways for members of different cultures. High-context, collectivistic cultures, for example, such as those in Asia place more value on feedback and social cues that may be reduced or eliminated in some forms of computer-mediated communication than do low-context cultures [20].

Cross-cultural communication typically (barring translation software) takes place in one language, thereby requiring that some participants communicate in a non-native language. Although there may be some moderation in the appearance of cultural traits when one communicates in a second language, research shows that people still adhere largely to the communication style and social norms of their own culture [43].

Richer computer-mediated communication tools, such as video conferencing systems, provide added social context [12][44]. In Veinott et al. [50], video was found to be useful for non-native speakers, but not especially so for native speakers. The simulated visual co-presence allowed partners access to richer context clues about their mutual understanding (quizzical looks, halting action, raised eyebrows) indicating that common ground had not yet been established and more clarification was needed. While the richer media may assist in the direct conveyance of an idea, it can also have social drawbacks. Media permitting access to social cues can work against common ground by way of allowing stereotypes. They may allow just enough social presence to be aware of differences, but not enough to work through them. Matheson posited that if participants using computer-mediated communication tools were given social information (in this case, gender) they would frame their companions' contributions in accordance with the relevant stereotypes [36].

2.2 Message content

In addition to conversational grounding, cultures differ in other aspects of communicative style. Here, we focus specifically on inclusive language (such as use of "we" vs. "I"), and politeness phenomena, two linguistic characteristics hypothesized to be important to negotiation and decision-making contexts and to vary by culture [37])

Inclusive language. Cross-cultural research has found sizeable differences between western and eastern cultures in terms of the extent to which people identify themselves as individuals

or as members of a collective (e.g., [34][49]; see [41] for a recent review.) Members of Eastern cultures, particularly those from China, are significantly more likely to view themselves as members of a collective than are members of Western cultures such as the United States. We hypothesized that this individualistic-collectivistic dimension would be reflected in a greater use of "we" pronouns and other inclusive language by members of Eastern cultures and a greater use of "I' pronouns and self-promoting language by members of Western cultures.

Politeness. In a negotiation and decision-making context, one aspect of conversational style that may be especially important is politeness. According to Brown and Levinson [5], linguistic politeness covers a range of phenomena by which people demonstrate concern for their own and others' social images or "faces". For example, indirect requests such as "could you close the door" are considered more polite than directives to "close the door."

Politeness may be especially important during negotiation processes (requests, disagreements, etc), where threats to others' face may be high**.** Furthermore, because cultural groups differ in norms for when and how polite language will be used [22][23], linguistic politeness may be a source of intercultural tensions during decision-making tasks. Other culturally-influenced variables such as the perceived imposition of a request, the relative status of requester and requestee, and social distance also influence politeness levels [23]**.** These other factors may be weighted differently in different cultures leading to apparent mismatches of politeness in cross-cultural communication [22][23]. Knowledge of politeness strategies is part of the knowledge that members of the same culture share.

Communication medium can likewise be expected to shape politeness and inclusive language. Early work by Kiesler and colleagues, for example, showed that text-based conversations were less polite than face-to-face ones [27]. Brennan and Oheaeri discussed this difference in terms of costs and benefits of certain politeness mechanisms, specifically hedging. They concluded that perhaps users could learn to identify situations where the increased labor and time involved in politeness maneuvers over electronic media are worthwhile and utilize that effort more effectively [3]. What is clear is that communication media differ in their degree of social presence, and different media may correspond better to different cultural politeness styles. Massey and colleagues [35] found that Americans found it much easier to convey their opinions and felt more able to explain themselves via asynchronous communications tools than did Asian participants. This was attributed to Americans' low-context communication style, which was better suited to the lack of feedback. The Asian politeness strategies require more feedback and utilize meaningful silences not supported in that media.

2.3 Quality of interaction

Factors such as ease of conversational grounding and linguistic politeness can influence participants' perceptions of the quality of an interaction. Due to the difficulties in grounding and differences in cultural norms for politeness discussed above, participants may experience less satisfaction with cross-cultural interactions than with same-culture interactions..

The technology necessitated by a remote collaboration may also affect collaborators' impressions of each other and the task itself [39]. Communication media can also affect the light in which a collaborator's efforts are seen by others [e.g., [10]. When less is known about a remote collaborator's immediate experiences, people may be more likely to attribute problems in communications such as delays and awkward expressions to internal, dispositional factors (e.g., disinterest in the task, rudeness) rather than external causes (e.g., network problems or a bad keyboard).

The medium may, itself, negatively affect a collaborator's impression of the contributions or personality of a remote colleague. In Neuwirth, et al's research, there was a significant difference in attributions of personal integrity and a trend associating negative scores for likeability with written feedback as opposed to verbal in a critique of an article [39].

Massey et al.'s [35] findings using asynchronous communications media suggest that the cultural differences in conversational grounding and politeness strategies we have discussed earlier would be likely to interact with the medium of communication to affect perceived quality of interaction. In particular, when the medium makes it difficult for members of a culture to use their preferred linguistic strategies, the absence of these strategies may be erroneously attributed to dispositional factors rather than external constraints of the technology.

2.4 Persuasion

Persuasion in the context of a decision-making task refers to the extent to which one team member can convince the other(s) that his/her viewpoint is correct. A sizeable literature on persuasion processes has shown that people are more persuaded by similar others (e.g., [4][33]). More recently, Bradner and Mark [6] found that the increased social distance among distributed team members decreased cooperation and lowered persuasion. Thus, we can expect that in same-culture teams, members will be more open toward their partners' suggestions and ideas than in cross-cultural teams.

2.5 Task Performance

The characteristics of collaboration described above can be expected to influence how well teams perform a task. Lundeberg and colleagues [32] found that American participants were more likely to believe that they did better than they had actually done, whereas Chinese participants were more likely to believe that they had done worse than they had actually done. In Lundeberg's study, participants worked on mathematical problems and American participants performed more poorly than Chinese participants. In negotiation and decision-making tasks, such as those studied in the current research, we anticipate no main effects of culture.

Numerous prior studies comparing performance in face-to-face and computer-mediated settings have found faster performance times and lower errors in face-to-face settings [16]. The effects of media on performance are further likely to be moderated by participants' cultural background.

Media Richness Theory states that task effectiveness is best when the task needs are matched to media richness [12]. The "task needs," when the task involves clear communication, differ between cultures since people from different cultures communicate and reach decisions differently [19]. High context cultures, like Chinese, rely more on social cues, facial expressions, vocal tones and situational awareness to communicate effectively, the IM medium may be less

appropriately matched to the task for the CC groups, resulting in lower task performance in that condition. [20]

2.6 The Current Study

The current study seeks to begin to understand the role of culture in both face-to-face and computer-mediated collaborations, to discover how differences in communication and organizational expectations interact with task completion and participant comfort and/or satisfaction, and to identify ways in which computer-mediated communication technologies can better support cross-cultural collaborations.

American students and visiting Chinese students were chosen because the Chinese and American cultures represent opposite ends of the spectrum in terms of the contextualization required in politeness and grounding. Previous research has established Chinese culture as a relatively high-context one, with interactants feeling a need for extensive grounding [20]. Politeness varies dramatically based on status and social distance [23] American culture is relatively low-context, and interactants seem to need minimal grounding. American politeness levels are based more on the specific situation, and couched less in the overall social context [23]. We therefore expect these two groups to provide two poles that can help gauge the impact of cultural expectations on synchronous, multi-cultural use of computer-mediated communications media. Americans and Asians are also increasingly frequent collaborators, making this issue all the more pressing. Chinese and American participants were paired either with someone of either same or different cultural background, forming the following three possible pairings: American/American (AA), American/Chinese (AC) and Chinese/Chinese (CC).

By including two homogeneous cultural groups, American and Chinese, we attempt to clarify the results of Anderson and Hiltz' finding that culturally diverse teams reached a higher degree of consensus than homogenous teams [1]. We consider whether homogeneity in combination with lean medium leads to lower consensus, as Anderson and Hilts suggest (homogeneously CC/AA v. heterogeneous AC), or whether the cultural framework (low-context AA v. high-context CC) of the team members determines their level of consensus-reaching ability.

Instant messaging (IM) was chosen as the communication media because it allows synchronous communication similar to a face-to-face collaboration. It features a dialog history, through which communicators can reference their progress on the task and request clarification, supporting linguistic co-presence [14][38]. As an effect of the remote synchronicity, the context of the communicators' relationship and situation is lost. Unlike Massey, et al's work, which employed asynchronous communication media, in IM communicators do not have the opportunity to edit and revise their thoughts prior to sending without losing time in the interaction [35]. While chat is an increasingly common medium for business communication, the quick, concise communication, largely devoid of context, seems more suited to low-context than high-context cultures [35]. We therefore expect this medium to show cultural effects.

We use a combination of quantitative and qualitative analyses to examine five sets of hypotheses:

- *Conversational Efficiency:* Because of a relatively lower need to establish common ground, we hypothesized that AA pairings would complete the task with the fewest turns and words in both conditions. We expected the AC pairings to have the most difficulty establishing common ground and thus to take the most turns and words in both conditions. CC pairs were expected to be intermediate. In addition, we expected that media condition would affect conversational efficiency such that all pairs would require more turns and words to complete the task in the IM condition than in the face-to-face condition. Finally, we predicted an interaction between media condition and culture group, such that the effects of media on conversational efficiency would be greatest for AC, intermediate for CC, and least for AA pairs.
- *Conversational Content*: We hypothesized that CC pairs would be more polite and express more "we"-ness in their language than the other cultural groups. We further hypothesized that AA pairs would show the least politeness and we-language, and that AC pairs would be intermediate. In addition, we hypothesized that pairs would be less polite and express less we-ness in IM than in FF conversations.
- *Quality of Interaction*: We hypothesized that there would be no main effect of culture group on rated quality of interaction, but that all groups would perceive their interaction to be of lower quality in IM. We also predicted an interaction between culture group and media such that homogeneously-paired participants from low-context cultures (AA) would be the least affected by use of IM, whereas CC pairs, because they are from a high contact culture, would be the most affected by use of IM. Mixed AC pairs were expected to be intermediate.
- *Persuasion*: We hypothesized that same-culture (AA or CC) pairs would show more agreement, both pre- and post-communication, than mixed-culture (AC) pairs. We did not anticipate any effects of media condition on agreement.
- *Task Performance*: We hypothesized that there would be no effect of culture group on performance because the items were balanced in terms of familiarity to Chinese and American participants. We did, however, expect that participants in all groups would perform the task better FF than via IM. No interaction was expected between culture and medium.

3. METHOD

3.1 Design

The data for this paper comes from a laboratory study in which pairs of participants negotiated a modified version of two decision-making tasks (the Desert Survival Task and the Arctic Survival Task) while either face-to-face or distributed, communicating via the AIM instant messaging program. This study is part of a broader research project investigating various factors affecting distributed and collocated collaborations. In this paper, we use a combination of quantitative and qualitative analyses to examine relationships between high- and low-context cultures and high- and low-context communication mediums in the course of a collaborative task.

3.2 Participants

Forty-eight participants were recruited from the Carnegie Mellon University and University of Pittsburgh communities. Half of the participants were nationals of the United States who

spoke English as their first language. The remaining participants were visiting students from the People's Republic of China whose first language was Chinese, and who had been in the United States for fewer than two years. The Chinese students were all fluent, or nearly fluent, in spoken and written English. The students signed up individually, and were partnered by the experimenter. While it is possible that some of the students – both Chinese and American – had met prior to the experiment, they did not sign up as partners nor were they aware of their partner's identity or ethnicity prior to the experiment.

3.3 Materials

Participants collaborated on two scenario tasks, the Desert Survival Task and the Arctic Survival Task, products of the Human Synergistics company. The goal of these tasks is to rank salvaged items in order of importance for the survival of the team. Participants completed the tasks in pairs. First, they ranked the items individually, then negotiated and completed a joint ranking, and finally completed a second individual ranking. Items included a "gallon can of maple syrup" and a "hand ax" (Arctic Survival Task) and "Book 'Edible Plants of the Desert'" and "loaded .38 caliber pistol" (Desert Survival Task.) Items were ranked from 1 (most important item for survival in this simulation) to 6 (least important item for survival in this simulation.)

Participants also completed a post-task questionnaire following each task, which assessed their experience with the communication media and partner. The questionnaire included such items as "This method of working together was effective," and "We disagreed often." Items were rated from 1 (strongly disagree) to 7 (strongly agree.)

In the distributed condition, participants were seated at computers equipped with AIM (America Online Instant Messaging program).

3.4 Procedure

Participants were brought to the laboratory and instructed about their task and the media (lapel microphones and the AIM program) used in each condition. Following the brief instructions, they were situated in the correct location for their first trial, either in the same section of the room or separated by a divider. They completed the individual item ranking, had 20 minutes in which to complete the joint ranking (a single, mutually agreed-upon ranking), and then completed the final individual ranking. Each trial was followed by a post-task questionnaire. After both trials were completed, participants completed the Schwarz Values Survey. They were then debriefed and compensated.

3.5 Coding

The face-to-face sessions were transcribed, and both the transcriptions and the IM logs were coded for number of turns per participant per trial, and for the percentage of words in several content categories including use of "we" pronouns, and terms pertaining to affect, cognitive mechanisms, and social interaction.

For linguistic analysis, we use Text Analysis and Word Count (TAWC) a software package developed by Adam Kramer. TAWC is similar to Pennebaker and Francis Linguistic Inquiry and Word Count (LIWC) tool [42] but contains enhancements to standardize the processing of logs from various sources (in this case, AIM logs and transcription of collocated discussion) [28].

3.6 Measures

Conversational Efficiency. For each pair, we calculated the number of speaking turns and total number of words per task. Because the turn variable was positively-skewed, with a few participants taking a large number of speaking turns, we recoded high values to a maximum score equaling the mean plus two standard deviations.

Conversational Content. We used the TAWC software to compute percentages of words used by each pair falling into four categories: pronouns (subdivided into "i", "we", and "you" pronouns), affective language (e.g., *happy, angry*), cognitive mechanisms (e.g., *understand, accept)*, and social interaction (e.g., *family, chat*).

Quality of Interaction. Participants' ratings on the 12 post-task questions were subjected to factor analysis with Varimax rotation. The results indicated the presence of three factors, one corresponding to how well the pair collaborated (e.g., "my partner was responsive to my ideas," "my partner treated me fairly"), one corresponding to how well the pair performed the task (e.g., "we wasted time on this task," "we agreed on our final answers") and one corresponding to how frustrated participants felt during the task (e.g., "the task was frustrating"). These factors accounted for 30%, 27% and 13% of the variance, respectively. Participants received an individual score by averaging their responses to questions loading on each factor; then these scores were averaged across pair members to create team-level scores.

Persuasion. We assume that persuasion is reflected by changes in the size of the differences between participants' pre- and post-discussion rankings. Initial agreement was computed by summing the absolute values of the differences in scores for each item prior to the pairs' discussions. Final agreement was computed by summing the absolute values of the differences in scores for each item after the pairs' discussion.

Task Performance. Performance was measured by the distance between the pairs' joint rankings and expert rankings provided by Human Synergistics. Distance was computed as the sum of the absolute value of the difference in scores for each item.

4. RESULTS

We discuss the findings in five parts: conversational efficiency, conversational content, quality of interaction, task performance and partner agreement. The hypotheses were tested by Repeated Measures ANOVAs in which media condition (FF or IM) was a within-subjects variable and cultural grouping (AA, AC or CC) was a between-subjects variable. Because trial and task (arctic vs. desert) showed no effects on any of the dependent measures in our preliminary analyses, we did not include them in the final ANOVAs reported below.

4.1 Efficiency

We hypothesized that AA pairs would use the fewest words and turns, followed by CC pairs and then AC pairs. This hypothesis was partially supported. Because total words and turns were highly correlated ($r = .89$), we report only the findings for turns here.

As can be seen in Figure 1, AA pairings required the fewest speaking turns to complete the task. Contrary to our expectations, however, the CC pairs were the least efficient and the AC pairs were in the middle. A repeated measures ANOVA indicated that these differences were highly significant ($F [2, 19] = 12.41, p < .0001$).

In addition, there was a main effect for media condition ($F [1, 19] = 12.41, p < .005$). Pairs required fewer speaking turns to complete the task when they communicated via IM. There was also a significant culture group by media interaction ($F [2, 19] = 5.46, p = .01$). As can be seen in Figure 1, differences between cultural groupings were lessened in the IM condition.

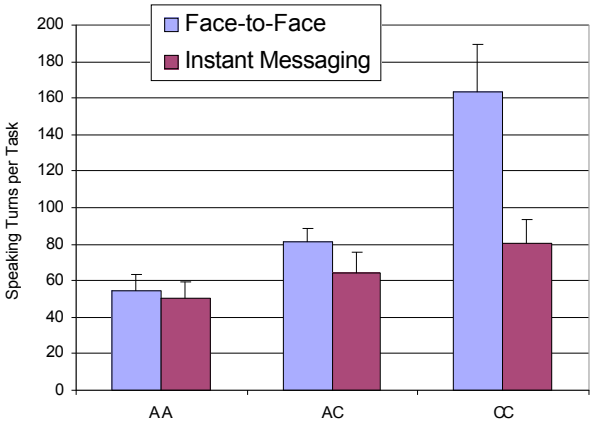

Figure 1: Mean number of speaking turns per trial and pair by culture group and media condition. (AA = American only, AC = Mixed American Chinese, CC = Chinese only.)

4.2 Conversation Content

Conversational content was analyzed using Pennebaker and Francis' [42] categories and our own count of conversational hedges. Two measures were found to vary by cultural grouping (see Table 1). First, CC pairs used more "we" pronouns than did the other two groups ($F [2, 19] = 3.64, p < .05$). CC pairs also used more social language ($F [2, 19] = 6.74, p < .01$).

Table 1. Percentages of words per category by culture group (s.d. in parentheses). Note: Means marked with different superscripts are significantly different from one another.

	AA		AC		CC	
Pronouns	11.31^{a}	(2.12)	11.43^{a}	(2.40)	12.03^{a}	(2.56)
I	4.60^{a}	(1.58)	3.92^{a}	(1.76)	4.40^{a}	(0.96)
We	0.86^{a}	(0.53)	$1.56^{a,b}$	(1.19)	1.99^{b}	(0.93)
You	2.32^{a}	(1.43)	2.78^{a}	(1.62)	3.30^{a}	(2.00)
Affective	4.62^{a}	(1.34)	4.23^{a}	(1.34)	4.30^{a}	(1.18)
Cognitive	8.67^{a}	(2.32)	8.81^{a}	(1.78)	8.96^{a}	(1.70)
Social	5.46^{a}	(1.46)	5.94^{a}	(1.14)	6.95^{b}	(1.36)
Hedges	1.29^{a}	(1.25)	1.44^{a}	(1.28)	1.52^{a}	(0.88)

Main effects of media condition were found on several of our linguistic measures (see Table 2). Pairs in the face-to-face condition used a higher percentage of pronouns ($F [1, 19] = 15.51, p < .001$), more "I" pronouns ($F [1, 19] = 8.88, p < .01$), more "you" pronouns ($F[1, 19] = 17.88, p < .0001$) and somewhat fewer affective terms ($F [1, 19] = 3.78, p = .07$). No other main effects and no interactions were significant.

To investigate the effects of culture and media on politeness, we developed a list of hedges and measured their frequency as a percentage of words in the same way that we computed the Pennebaker measures. As shown in the bottom row of Table 1, there were no effects of culture on hedges ($F [2, 19] < 1$, *ns.*]. However, as shown in Table 2, hedges were more frequent in face-to-face conversations than they were in IM conversations ($F [2, 19] = 13.06 p < .005$).

Table 2. Percentages of words by category and media condition (s.d. in parentheses). Note: Means marked with different superscripts are significantly different from one another. [note: the affective differ at p < .07]

	FF		IM	
Pronouns	12.84^{a}	(2.13)	10.34^{b}	(1.81)
I	4.96^{a}	(1.58)	3.67^{b}	(1.12)
We	1.45^{a}	(0.98)	2.07^{a}	(1.07)
You	3.38^{a}	(1.44)	2.21^{b}	(0.98)
Affective	3.97^{a}	(1.14)	4.17^{a}	(1.30)
Cognitive	8.69^{a}	(1.66)	8.68^{a}	(2.19)
Social	6.34^{a}	(1.40)	6.17^{a}	(1.44)
Hedges	1.85^{a}	(1.00)	0.99^{b}	(0.53)

4.3 Quality of Interaction

Participants' post-task questionnaire responses were factored into three scales: collaboration, task performance, and frustration. On the collaboration scale, CC pairs rated their interaction as better than either the AC or AA pairs ($F [2, 21] = 4.11, p < .05$), but there was no effect of media condition and no interaction. Mean scores were 6.24, 5.81 and 6.53 for AA, AC and CC pairs, respectively. For the task performance and frustration scales, there were no main effects or interactions.

Table 3. Scores on collaboration, task performance, and frustration factors by culture group (1 = lowest, 7 = highest). Note: Means marked with different superscripts are significantly different from one another.

Scale	AA	AC	CC
Collaboration	$6.24^{a,b}$	5.81^{a}	6.53^{b}
Task Performance	4.98^{a}	4.42^{a}	5.52^{a}
Frustration	2.13^{a}	2.31^{a}	2.25^{a}

4.4 Persuasion

Agreement was calculated by summing the absolute difference between pair members' individual rankings both pre- and post-discussion. As shown in Figure 2, there were no significant differences between culture groups in pre-discussion rankings, but there was a significant effect of culture group on post-discussion rankings ($F [2, 21] = 3.60, p = .05$). The CC pairs showed very little difference in their final individual rankings ($M = .56$), AC pairs showed the most

difference (M = 4.50), and AA pairs were intermediate (M = 2.88). Contrary to expectations, no effects of medium were found on persuasion (F [1, 21] < 1, *ns*), nor were there any interactions between medium and cultural group (F [2, 21] = 1.23, *ns*)

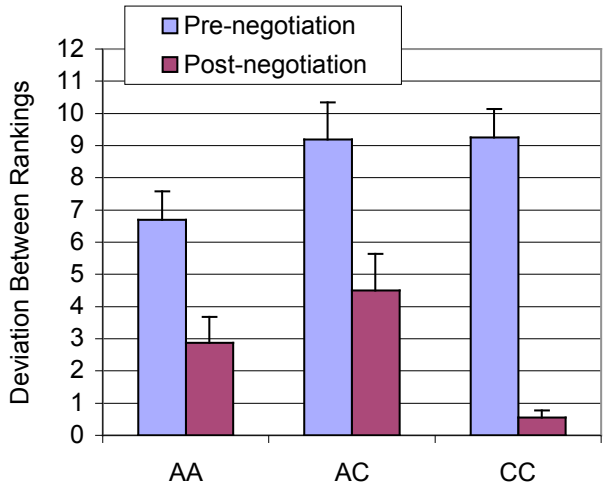

Figure 2: Agreement in pre- and post-discussion private rankings by culture group (AA = American only, AC = Mixed American Chinese, CC = Chinese only).

Post-hoc comparisons indicated that the CC and AC groups differed significantly from one another, but no other pair-wise comparisons were significant. It thus appears that in contrast to other pairings, members of CC pairs were persuaded that their joint rankings were correct and provided the same ranking in their final individual judgments. We return to this issue in the section on qualitative analyses of the conversations below.

4.5 Task Performance

As described earlier, task performance was assessed by comparing joint rankings to expert rankings provided by Human Synergistics. No differences were found between culture groups or media conditions. Mean absolute deviation from expert rankings were 9.59, 9.12, and 9.38 for the AA, AC, and CC groups, respectively, and 9.27 and 9.50 for the FF and IM conditions, respectively (all F < 1, ns).

Better performance (i.e., lower deviation scores) was slightly correlated with numbers of words and speaking turns (r =.26 and -.25, respectively, both p < .10). Interestingly, better performance was also correlated positively with the use of "we" pronouns (r = .42, p < .005) and negatively with the use of "I" pronouns (r = -.37, p =.01) and discussion of cognitive mechanisms (r = -.33, p < .05).

4.6 Qualitative Analysis of Dialogues

In order to understand the differences in communication among culture groups and how these were affected by media condition, we examined a subset of conversations from each condition in detail. The analysis revealed three inter-related qualitative differences between different culture group's conversations—the depth to which they analyzed the motivations for their rankings, the approach they took to the task, and the extent to which they invested in relationship development. We discuss each of these observations in more detail below.

4.6.1 Depth of analysis

The most striking observation from the transcripts was that the culture groups differed in the depth to which they discussed each item. Illustrative examples are shown in Table 4. As can be seen, the AA pairs were more likely to negotiate placement order rather than analyze the reasons for the ordering. In contrast, CC pairs often discussed the potential uses and value of the items in detail. Interestingly, CC pairs gave justification for items even when they initially agreed upon the rankings, as seen in the second example in Table 4.

Table 4. Illustrative examples of discussion of the value of the mirror in the desert task from the IM condition. (AA = American only, CC = Chinese only).

AA	CC
P1: why did you put the mirror as 4? P2: you could use it to signal for help or soemthing like that P1: that's true...okay maybe make it 5 then? [16]	P1: what's the use of mirror? P2: so jacket is not last, or mirror is? P2: mirror is for asking help mainly, I guess P1: how about using pistol to ask for help? P1: mirror can be last if we have pistol in front of it. P2: yes, so either mirror or jacket is the least important P1: shoot the sky is better than a mirror. P1: right. P2: ok, mirror P1: I guess jacket is more important than mirror.
P1: mirror last? P2: yeah [12]	P2: and then mirror P2: since mirror helps others to find them P1: yeah

4.6.2 Task investment

Related to the differences in depth of analysis, AA and CC pairs differed in the extent to which they attempted to complete the task "correctly" or even to negotiate complete agreement on item rankings. Many AA pairs sought to reach a negotiated solution to which they could both quickly agree, as illustrated in the following examples (Pair 8 [top] and Pair 20 [bottom], AA).

P1: ah, wait, I thought it was axe then matches then canvas
P2: okay
P2: that'll work too.

P2: axe is 3?
P2: u want to change to 4
P1: 4
P1: yeah
P2: ok
P2: done [AA20]

In contrast, as the examples in Table 4 demonstrated CC pairs sought internal consensus, i.e. – to come to true shared belief about the values of the items, and were willing to invest more time and thought into discussing the scenario.

4.6.3 Relationship investment.

Finally, as suggested by our previous analysis of "we" pronouns and social language (Table 1 above), CC pairs appear to value the relationship-building aspect of interpersonal communication more highly than do AA or AC pairs. CC pairs sometimes provided a type of meta-statements about the status of their negotiations (e.g., "so this time we are different most of the time [Pair 2, CC]" that we never saw in other pair types. They also offered supportive statements about their task progress, as in the following example [Pair 25, CC]:

P2: So the first two things are water and pistol.
P1: maybe ☺
P1: totally agree
P2: OK, we have made the first choice! Congratulations!
P2: Then we need to think more

Examples of this sort rarely occurred in the AA or AC pairs.

5. DISCUSSION

The results provide insight into the effects of culture and communications medium, as well as the interaction of the two, on communication and performance in a joint decision-making task.

5.1 Conversational grounding

As we had expected, there were both cultural and media effects on conversational grounding. As anticipated, AA pairs were the most efficient regardless of communications medium. However, we found that CC, rather than AC, pairs were least efficient in both face-to-face and IM settings.

Our qualitative analyses of the transcripts suggest that the additional words and turns used by CC pairs was not simply a consequence of the fact they were using a second language or generally less efficient at performing the task. Instead, it appears that the longer exchanges between CC pairs were attempts to create a deeper cognitive agreement.

One way to interpret these findings is in terms of Clark's notion of grounding utterances to the extent required for "current purposes" [9]. It appears that CC and AA pairs viewed the task differently and thus their criteria for messages being sufficiently well-grounded differed. This interpretation is consistent with Eastern/Western organizational research. Teng, Calhoun, Cheon, Raeburn, and Wong, who found that Eastern managers sought more understanding of implicit meanings and multiple cues in decision-making tasks, while their Western counterparts relied on readily accepted sources of information with explicit meanings [47]. This highlights the dangers of using simple measures like word and turn counts to characterize performance on tasks in intercultural settings.

5.2 Message content

We had predicted that CC pairs would use more linguistic politeness than AA or AC pairs. This hypothesis was not supported. However, although the results did not show effects of culture on politeness markers *per se*, this may be a problem with the usual operationalization of politeness (in terms of hedges, subjunctive, and other specific kinds of words.) This operational definition fails to capture the type of politeness seen here, but the concept is present in the more in-depth nature of the CC pairs' conversation. The CC pairs appear to express politeness through queries of their partner's thoughts and leanings to avoid overt disagreement (e.g., "What's your opinion?", "so the mirror should be third?"). These types of queries were virtually never observed in the AA pairs. We are currently developing a more detailed conversational coding scheme that will capture this form of politeness.

5.3 Quality of interaction

We had anticipated a main effect of medium on participants' ratings of the quality of their interactions and an interaction between culture and medium such that CC pairs were adversely affected by IM whereas the other groups were not. Instead, we found a significant effect of culture but no effects of medium and no interaction. CC pairs rated their interaction quality more highly than the other groups, which did not differ from one another. One likely explanation for this result is that the CC pairs, because they had actually discussed in depth the reasoning for their ordering of the ranked items, felt more satisfied with the process and outcome.

5.4 Persuasion

Although Hiltz and Anderson found that homogenously American groups had a slightly lower level of persuasion (as demonstrated through the post-negotiation consensus) than heterogeneous groups, most previous research suggests that people are persuaded more by similar others (e.g., [1][4][33]). Thus we had predicted that members of same-cultural pairs would be more influenced by their partners than members of cross-cultural pairs. Contrary to Anderson & Hiltz, we found less persuasion in the mixed-culture groups than in the same-culture groups. We found that CC pairs were much more persuaded by one another, as evidenced by very low differences in participants' individual post-task ratings. We attribute this effect to the depth to which CC pairs, but not AA or AC pairs, discussed the reasons behind their rankings. We are currently performing a more detailed analysis of the conversations in each condition, with a focus on persuasion processes, in hopes of elucidating the source of the large culture effects on persuasion.

5.5 Task Performance

We had not anticipated finding cultural differences in performance because the tasks were selected to draw upon general knowledge with which both American and Chinese participants were equally familiar. We did, however, expect to find somewhat worse performance in the IM condition than in the face-to-face condition. Instead, we found no results of either culture or media on performance.

Surprisingly, task performance was fairly poor overall, suggesting that this task is more difficult than it might appear on the surface. Although lengthier discussion of the items was positively correlated with performance, this correlation failed to attain significance. During our qualitative analysis of the conversations we observed that many pairs could not identify the basic needs in a survival setting (for example, some did not know that one can last longer without food than water). In our future detailed coding of the transcripts, we will be assessing the accuracy of participants' statements to determine whether pairs were able to evaluate the goodness of their partners' arguments during the discussion.

5.6 Limitations and Future Directions

One obvious limitation of the current study is our focus on just two cultures, American and Chinese. As we noted in the introduction, these cultures were chosen because they represent opposite ends of the high- and low-context spectrum. Although we expect the findings to generalize to

other high and low context cultures, future research is needed to properly address issues of generalization. Furthermore, we grouped participants using a very broad definition of culture (country of origin). One of our next steps will be to analyze participants' responses on the Schwartz Value Survey to determine what cultural characteristics (e.g., the extent to which they value things like autonomy vs. agreement) might be influencing the interactions. [45]

A second limitation is our choices to focus on two communication media: face-to-face and IM. We chose IM to build upon Massey et al.'s work [35] using asynchronous text-based communication. IM provides the synchronous feedback and text-based substitutes for nonverbal behavior that high-context cultures may find valuable. In support of this interpretation, we found that IM reduced, but did not eliminate, the effects of culture on conversational efficiency and content. Although we did not test it directly, the results suggest that it is the synchronicity of the medium rather than its richness that is important for supporting remote work among members of high-context cultures.

Finally, some limitations to the generalizability of the findings stem from the nature of the task. IM appears to be a suitable medium for negotiation during joint decision-making tasks such as our survival tasks. In other types of collaborations, such as those involving physical objects and actions, richer media may be required (cf. [30]).

6. CONCLUSION

The combination of the agreement and efficiency differences combined with the preliminary text analysis suggests that the CC and AA pairs approached this scenario very differently. The AA pairs viewed the tasks as an exercise in situation-specific compromise, while the CC pairs approach it as a consensus-reaching task. In other words, while the AA participants work to complete a mutually acceptable joint rating form, the CC participants work to reach agreement on the relative worth of the items involved.

7. ACKNOWLEDGEMENTS

This material is based upon work supported by the National Science Foundation under Grants #0325087 and #0329077. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. We thank Sara Kiesler, Susan Strauss, Suzanne Weisband, Shalom Schwarz and Romie Littrell, for their helpful input into the design and analysis of this study. We thank Adam Kramer for adapting his TAWC software for our project and for running analyses, and Mariesa Cash, Monica Datta, Sarah Shipul and Jim Zheng for their assistance in running experiments and coding data.

8. REFERENCES

[1] Anderson, W. N. & Hiltz, R. S. (2001). Culturally heterogeneous vs. culturally homogeneous groups in distributed group support systems: Effects on group process and consensus. *Proceedings of the 34th Hawaii International Conference on System Sciences*.

[2] Armstrong, D., & Cole, P. (2002). Managing distances and differences in geographically distributed work groups. In P. Hinds & S. Kiesler (Eds.) *Distributed work* (pp. 167-186). Cambridge, MA: MIT Press.

[3] Brennan, S., & Ohaeri, J. (1999). Why do Electronic Conversations Seem Less Polite? The Costs and Benefits of Hedging. *Proceedings, International Joint Conference on Work Activities, Coordination, and Collaboration (WACC '99)* (pp 227-235). San Francisco, CA.

[4] Brock, T.C. (1965). Communicator-recipient similarity and decision change. *Journal of Personality and Social Psychology, 1,* 650-654.

[5] Brown, P., & Levinson, S (1987). Universals in Language Usage: Politeness phenomena. In E. Goody (Ed.), *Questions and politeness* (pp. 56-289). Cambridge,: Cambridge University Press.

[6] Bradner, E., & G. Mark. (2002). Why distance matters: Effects on cooperation, persuasion, & deception. *Proceedings of CSCW '02* (pp. 226-235). NY: ACM Press.

[7] Clark, H. H. & Brennan, S. E. (1991). Grounding in communication. In L. B. Resnick, R. M. Levine, & S. D. Teasley (Eds.). *Perspectives on socially shared cognition* (pp. 127-149). Washington, DC: APA Press.

[8] Clark, H. H. & Marshall, C. E. (1981). Definite reference and mutual knowledge. In A. K. Joshi, B. L. Webber & I. A. Sag (Eds.), *Elements of discourse understanding* (pp. 10-63). Cambridge: Cambridge University Press.

[9] Clark, H. H., & Wilkes-Gibbs, D. (1986). Referring as a collaborative process. *Cognition, 22*, 1-39.

[10] Cramton, C. D. (2001). The mutual knowledge problem and its consequences for dispersed collaboration. *Organizational Science, 12,* 346-371.

[11] Curtis, B., Krasner, H. & Iscoe, N. (1988). A field study of the software design process for large systems. *Communications of the ACM*, *31*, 1268-1287.

[12] Daft, R.L. & Lengel, R.H. (1984). Information richness: a new approach to managerial behavior and organizational design. In L. L. Cummings & B.M. Staw, (Eds.), *Research in organizational behavior 6,* (pp. 191-233). Homewood, IL: JAI Press.

[13] Doherty-Sneddon, G., Anderson, A. H., O'Malley, C., Langton, S., Garrod, S. & Bruce, V. (1997). Face-to-face and video mediated communication: a comparison of dialogue structure and task performance. *Journal of Experimental Psychology: Applied*, *3,*105-125.

[14] Erickson, T., Smith, D.N., Kellogg, W.A., Laff, M., Righards, J.T., & Bradner, E. (1999) Socially translucent systems: Social proxies, persistent conversation, and the design of "babble". *Proceedings of CHI '99* (pp.72-76). NY: ACM Press.

[15] Fussell, S. R., & Krauss, R. M. (1992). Coordination of knowledge in communication: Effects of speakers' assumptions about what others know. *Journal of Personality and Social Psychology*, *62*, 378-391.

[16] Fussell, S.R., Kraut, R.E., & Siegel, J. (2000). Coordination of communication: Effects of shared visual context on collaborative work. *Proceedings of CSCW 2000* (pp. 21-30). NY: ACM Press.

[17] Fussell, S. R., Setlock, L. D., Yang, J., Ou, J., Mauer, E. M., & Kramer, A. (in press). Gestures over video streams to support remote collaboration on physical tasks. *Human-Computer Interaction.*

[18] Gergle, D., Millen, D., Kraut, R., & Fussell, S. (2004). Persistence matters: Making the most of chat in tightly-coupled work. *Proceedings of CHI '04* (pp. 431-438). NY: ACM Press

[19] Gudykunst, W. & Ting-Toomey, S. (1988). *Culture and Interpersonal Communication*. Newbury Park, CA Sage.

[20] Hall, E. 1976/1981. *Beyond culture*. NY: Doubleday Anchor Books.

[21] Herbsleb, J. D., Mockus, A., Finholt, T. A., & Grinter, R. E. (2000). Distance, dependencies, and delay in a global collaboration. In *Proceedings of CSCW 2000* (pp. 319-328). New York: ACM Press.

[22] Holtgraves, T. (1997) Styles of language use: Individual and cultural variability in conversational indirectness. *Journal of Personality and Social Psychology*, *73*, 624-637.

[23] Holtgraves, T. & Yang, J. (1992) Interpersonal underpinnings of request strategies: General principles and differences due to culture and gender. *Journal of Personality and Social Psychology, 62,* 246-256.

[24] Hupet, M., Chantraine, Y., & Neff, F. (1993). References in conversation between young and old normal adults. *Psychology and Aging, 8,* 339-346.

[25] Isaacs, E., & Clark, H. H. (1987). References in conversation between experts and novices. *J. of Experimental Psychology: General*, *116*, 26-37.

[26] Isbister, K., Nakanishi, H., Ishida, T., & Nass., C. (2000). Helper Agent: Designing an assistant for human-human interaction in a virtual meeting space. In *Proceedings of CHI 2000* (pp. 57-64). NY: ACM Press.

[27] Kiesler, S., Siegel, J., & McGuire, T. W. (1988). Social psychological aspects of computer-mediated communication. In Computer-supported cooperative work: A book of readings (pp. 657-682). Morgan Kaufmann.

[28] Kramer, A.D.I, Fussell, S. R., & Setlock, L. D. (2004) Text analysis as a tool for analyzing conversation in online support groups. *CHI 2004 Late Breaking Results*.

[29] Kraut, R. E., Fussell, S. R., Brennen, S. E., & Siegel, J. (2002). Understanding effects of proximity on collaboration: Implications for technologies to support remote collaborative work. In P. Hinds & S. Kiesler (Eds.) *Distributed work* (pp. 137-162). Cambridge, MA: MIT Press.

[30] Kraut, R. E., Fussell, S. R., & Siegel, J. (2003). Visual information as a conversational resource in collaborative physical tasks. *Human-Computer Interaction*, *18,* 13-49.

[31] Little, J., Granger, M. Adams, E., Holvikivi, J., Lippert, S., Walker, H., & Young, A. (2001) Integrating cultural issues into the computer and information technology curriculum. *ACM SIGCSE Bulletin Inroads*, *33*, 136-154.

[32] Lundeberg, M., Fox, P., Brown, A., and Elbedour, S. (2000) Cultural Influences on Confidence: Country and Gender. *Journal of Educational Psychology, 92,* 152-159.

[33] Mackie, D.M. (1986) Social identification effects in group polarization. *Journal of Personality and Social Psychology*, *50,* 730-728.

[34] Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review, 20,* 568–579.

[35] Massey, A., Montoya-Weiss, M., Hung, C. & Ramesh, V. (2001) When culture and style aren't about clothes: Perceptions of task-technology "fit" in global virtual teams. In *Proceedings of the ACM 2001 Group Conference* (pp. 207-213). NY: ACM Press.

[36] Matheson, K. (1991) Social cues in computer-mediated negotiations: Gender makes a difference. *Computers in Human Behavior, 7*, 137-145.

[37] Morand, D. (1995) Politeness as a Universal Variable. *The International Journal of Organization Analysis, 3,* 52-74

[38] Nardi, B.A., Whittaker, S., & Bradner, E. (2000) Interaction and outeraction: Instant messaging in action. *Proceedings of CSCW 2000* (pp.79-88). NY:ACM Press.

[39] Neuwirth, C. M., Chandok, R., Charnet, D., Wojahn, P. & Loel, K (1994). Distributed collaborative writing: A comparison of spoken and written modalities for reviewing and revising documents. *Proceedings of CHI 1994* (pp. 51-57). NY: ACM Press.

[40] Olson, G. M., & Olson, J. S. (2000). Distance matters. *Human-Computer Interaction, 15*, 139-179.

[41] Oyserman, D., Coon, H. M. & Kemmelmeier, M. (2002). Rethinking individualism and collectivism: Evaluation of theoretical assumptions and meta-analyses. *Psychological Bulletin, 128,* 3-72.

[42] Pennebaker, J.W., & Francis, M.E. (1999). *Linguistic Inquiry and Word Count: LIWC* [software program for text analysis]. Lawrence Erlbaum Associates.

[43] Ralston, D., Cunniff, M., Gustafson, D. (1995) Cultural Accomodation: The effect of language on the responses of bilingual Hong Kong Chinese managers. *Journal of Cross-Cultural Psychology*, 26, 714-727.

[44] Straus, S., & McGrath, J. Does the Medium Matter? The Interaction of task type and technology on group performance and member reactions. (1994) *Journal of Applied Psychology*, 79, 87-97

[45] Schwartz, S. (1992) Universals in the content and structure of values: Theoretical advances and empirical tests in 20 Countries. In M. Zanna (Ed) *Advances in Experimental Social Psychology*, 25, 1-65.

[46] Setlock, L. D., Fussell, S. R., Kiesler, S., & Weisband, S. (under review). *Managing work trajectories in collaborative writing*.

[47] Teng, J., Calhoun, K. Cheon, M. Raeburn, S., Wong, W. (1999) Is the East really different from the West: A cross-cultural study on information technology and decision making. *Proceedings of the 20th International Conference on Information Systems (*pp. 40-46). Atlanta, GA: Association for Information Systems.

[48] Triandis, H. (1980). Values, attitudes, and interpersonal behavior, In Nebraska Symposium on Motivation, 1979: *Beliefs, Attitudes, and Values* (pp. 195-259). Lincoln, NE: University of Nebraska Press.

[49] Triandis, H. C. (1989). The self and behavior in different cultural contexts. *Psychological Review, 96,* 506–520.

[50] Veinott, E., Olson, J., Olson, G. & Fu, X. (1999) Video helps remote work: Speakers who need to negotiate common ground benefit from seeing each other. In *Proceedings of CHI 1999* (pp. 302-309). NY: ACM Press.