

Why Distance Matters: Effects on Cooperation, Persuasion and Deception

Erin Bradner and Gloria Mark

Dept. of Information and Computer Science

University of California, Irvine

Irvine, CA 92697-3425, USA

+1 949-824-5955

{gmark,eradner}@ics.uci.edu

ABSTRACT

In this study, we examine how geographic distance affects collaboration using computer-mediated communication technology. We investigated experimentally the effects of cooperating partners being in the same or distant city on three behaviors: cooperation, persuasion, and deception using video conferencing and instant messaging (IM). Our results indicate that subjects are more likely to deceive, be less persuaded by, and initially cooperate less, with someone they believe is in a distant city, as opposed to in the same city as them. Although people initially cooperate less with someone they believe is far away, their willingness to cooperate increases quickly with interaction. Since the same media were used in both the far and near city conditions, these effects cannot be attributed to the media, but rather to social differences. This study confirms how CSCW needs to be concerned with developing technologies for bridging social distance, as well as geographic distance.

Keywords

CSCW, distance collaboration, empirical study, video, instant messaging, cooperation, deception

INTRODUCTION

Distance collaboration has been an area of research interest in the CSCW community for over 15 years. This research topic is more relevant now than ever, as geographically distributed organizations are steadily increasing their use of technology to support collaboration across distance. Yet, despite the resources that organizations are investing in these technologies, it remains unclear how distance affects collaboration.

In an extensive review of studies of distributed and collocated work, Olson and Olson identified relevant factors that make a difference in these work contexts [24].

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'02, November 16–20, 2002, New Orleans, Louisiana, USA.
Copyright 2002 ACM 1-58113-560-2/02/0011...\$5.00.

Teams with common ground, who do loosely coupled work, and that have high levels of collaboration readiness seem to be more likely to succeed. This study, along with other studies of distance work [5, 7, 17] lead us to believe that distance between people who collaborate does matter. The open question is: why does it matter?

The physical proximity of people influences collaboration. Kraut et al. found that people located closer in a building were more likely to collaborate [12]. They found that physical proximity increases not only the frequency, but also the quality of communication among collaborators. Allen [1] proposed that if you are farther than 30 meters from someone you might as well be several miles apart. These studies suggest that when people are farther apart than a certain radius – Allen's claim is that this critical distance is 30 meters – their interaction is negatively impacted.

But does the amount of distance matter with computer-mediated interaction? Poster [28] claims that computer-mediated communication generates new forms of social systems by bridging distances between people. It has also been claimed that through computer-mediated communication, people can develop commonalities [10]. While researchers have examined various dimensions of information and social exchange with computer-mediated communication [c.f. 11, 16], there is still much to be learned about the social-psychological effects of geographic distance on collaboration. No one has empirically tested whether the actual *amount* of distance makes a difference with communication technology. In this study, we are interested in examining how distance matters when people use computer-mediated communication technology.

In the empirical study we describe below, our goal is to understand how interaction might change among unacquainted users when one believes that their collaborating partner is far away, e.g. across the country, as opposed to in the next building or same city. Certainly there are differences in culture, time zones, and language when people communicate with others in different countries or in different regions within a country. But our question is rather: what are the effects on interaction, if

any, of pure distance when cultural factors and tasks are held constant? Organizations are continuing to become more distributed [4], and it is becoming increasingly more common for *ad hoc* collaborations to span organizational as well as geographic boundaries. Moreover, quite often, collaborating partners do not know each other during these *ad hoc* interactions. Both authors have conducted fieldwork in distributed organizations where they have observed such types of *ad hoc* meetings across distance.

Intuitively, we might believe there is no difference if your collaborating partner is located in a neighboring city, or across the country. But a number of studies have led us to question this. In particular, experimental studies suggest that there are three ways that interaction might be affected by the amount of distance between partners:

Cooperation. Experiments using the social dilemma paradigm have shown that distance affects cooperation. In an experiment using the prisoner's dilemma (PD) game, subjects were seated in the same room either close together (3 feet) or at a distance of 20 feet from each other [30]. At 20 feet compared to 3 feet, there were significantly fewer cooperative choices and smaller earnings between the two players. Another study showed that people choose to sit further from others when participating in a competitive task compared to a cooperative task [31].

Persuasion. Persuasion is a feature of collaboration between humans and computers that may be affected by geographic distance – even when that distance is bridged by technology. Two studies [18, 20] found that persuasion decreases as the perceived physical distance increases between a user and a computer providing persuasive arguments. This phenomenon occurs even if the computer interface provides human-like responses.

Deception. In two related studies, Moon [18, 19] found that people inflated their survey responses as distance increased between a respondent and a computer administering the survey. This research used the Paulhus Deception Scale (PDS) [27] to test the amount of deception.

These studies have not looked at people collaborating together through computer-mediated communication. We believe that it is relevant for CSCW to understand how geographic distance affects computer-mediated communication.

Interaction and distance

Much of the research on the effects of distance between people is based on the work of Latané. His studies have attributed physical distance to influence, friendship formation, persuasion and perceived expertise. Latané's [14] theory of social impact claims that the degree of social intimacy is the inverse of the amount of physical distance between people. A central assertion of this theory is that the time spent interacting, paying attention, recollecting, and attempting to persuade others all decline with distance. These variables constitute the *social impact* that one

individual has on another. The social impact of any given individual on another is seen as the sum of the social ties (e.g. persuasiveness and status), physical proximity and temporal immediacy separating them. An empirical study on memorable interactions by Latané et al. [15] shows results that are consistent with his theory. He found that the degree to which people influence each other appears to decrease as the distance separating their homes increases.

Another theory that motivated our work is Tajfel's social identity theory [33]. This theory suggests that each of us constructs our self-image by associating with 'our group.' The borders, membership and similarities among members in 'our group' change over time, but in general, people who live and work near us are more a part of our group than people who live and work far from us. This does not necessarily mean that they are similar to us, simply that we tend to view our cohorts in a more positive light, and superior to others, because we desire to be viewed by those same cohorts as superior to the outsiders.

Related work concerns the study of propinquity, rooted in Tajfel's 'social identity' theory. Propinquity is the nearness in kin, place or time between two individuals. Propinquity was attributed to be the motivating factor in friendship formation among people in a city housing project [21], state police at a training school, and college students sharing a dormitory [23]. Propinquity may arise from living in the same building or even from seating arrangements determined by alphabetic adjacency [23]. Although the metric for propinquity differs across studies, it consistently impacts social interaction.

We find the question of propinquity intriguing because the efforts of many CSCW researchers, including ourselves, involve applying technology to the problem of overcoming geographic distance using collaboration technology. The implicit assumption is that once a communication channel is established among a geographically distributed work group, all members of that group are on equal footing in the "virtual meeting room" that emerges. Indeed, research exists to suggest that status and gender effects are reduced when computer conferencing technologies are used [32] and, that technologies such as video may improve collaboration [25], while instant messaging may increase feelings of connectedness [22]. Thus, although we don't dispute that technology effectively bridges physical distance, the theories of propinquity, social identity, and social impact urge us to question if technology can bridge the social distances associated with geography.

EXPERIMENTAL DESIGN AND PROCEDURE

We chose an experimental paradigm to test the effects of distance on technology-mediated interaction. Though studying distance interaction in an organizational context could provide us with a contextualized understanding of behavior, we chose an experimental approach because it better enables us to focus specifically on the three social behaviors of cooperation, persuasion, and deception.

In order to be able to generalize to more than one communications medium, we chose to examine the effects of video-conferencing and Instant Messaging (IM). We deliberately chose media that provided contrasting modes: text and visual information. In other work, we have investigated the social affordances of both video conferencing and IM [3, 22].

To examine the effect of geographic distance on persuasion, deception, and cooperation, we presented subjects with the following tasks: the desert survival task [13], the Paulhus Deception Scales (PDS; [27]) and the prisoner's dilemma game. The desert survival task tests the extent to which a participant can be persuaded to change her evaluation of the relative importance of items needed to survive in the desert. The PDS is an instrument used to examine scores for impression management and deception. The prisoner's dilemma game is used to assess the willingness to cooperate. Together, we use these tasks to measure the effects of technology and geography on persuasion, on the tendency for deception, and on cooperation. Each task is described in more detail later.

Levels of distance

We used a between-subjects design, with two factors: geographic distance (near or far) and media type (video or instant messaging). Table 1 summarizes the experimental design. Subjects were randomly assigned to conditions.

In the "Same city" (Near) condition, participants were told

Factor	Levels of Factors
Distance (between-subjects)	Same City (Near) Distant City (Far)
Media Type (between-subjects)	Video Instant Messaging

Table 1. Experimental design

that their collaborating partner (a paid confederate) was communicating with them from an office somewhere in the same city, in Irvine, California. In the "Distant city" (Far) condition, participants were told that their collaborating partner was in Boston (approximately 3,000 miles away). All participants understood that Boston was located at a considerable geographic distance from where they were located.

In reality, we used the same confederate in the entire experiment, and she sat in a neighboring room. She was approximately the same age as the subjects. The confederate was asked not to reveal personal information, e.g. where or if she had attended school, to minimize affinity between the confederate and the study participants. No subjects reported being previously acquainted with the confederate. The confederate was told what condition the subjects were in (i.e. Boston or Irvine) so that she could respond appropriately if subjects asked where she was located or what time of the day it was.

Experimental room and setup

The experiment was conducted in the Groupware Laboratory on the University of California, Irvine campus, which has two adjacent rooms. The subject sat in one room in front of a computer.

Video condition. In this condition, a digital camera and 19-inch diagonal TV screen were positioned immediately to the right of the subject's computer monitor. The camera captured the subject's image; the TV displayed a video image of the confederate. When the image of the confederate was displayed, the dimensions of the face and torso were roughly equivalent to the true dimensions were she to physically sit where the video monitor was placed¹. The confederate appeared to be looking directly at the subject. The confederate sat in the adjacent office. Contrary to what the participant was led to believe, the confederate did not see the participant's image. A phone with a headset in both offices provided a voice connection between the participant and confederate in this condition only.

Instant messaging condition. In this condition, the participant communicated with the confederate only via instant messaging, without video or audio. The instant messaging tool used was AOL's Instant Messenger[®]. This tool allowed the confederate and the participant to type messages to one another in real time. Each new message was displayed on the recipient's screen after the sender pressed the Enter key. Thus, messaging was quasi-synchronous since the unit of transmission was an entire message rather than a key stroke (or word).

Subjects

All participants were undergraduates from the department of Information and Computer Science at the University of California, Irvine. All were naïve to the purposes of the study and were each paid \$12 for participating. A total of 98 subjects participated. Approximately half (46%) were female.

Procedure

The experiment took one hour. After the student signed a consent form, a 5-minute orientation was given in which the participant was shown how to scroll through the on-screen instructions. After the researcher completed the orientation, she placed a fake phone call to a person she identified as the other participant in the experiment. She asked if that participant was ready to start, and in the video condition, she passed the phone (with headset) to the participant and left the room. In the IM condition she hung up the phone and left the room after she saw that initial contact via IM had been established. After the tasks were completed, subjects responded to a 16-item questionnaire and were asked to make a drawing to represent where they

¹ The TV monitor was placed at a distance determined to be outside the 'personal' space of an American [6].

perceived the confederate to be, relative to them. Subjects were then debriefed and paid.

Experimental tasks

As described earlier, we chose three experimental tasks to measure three types of interaction behavior, based on previous research findings. The subjects performed all tasks, and the order in which the tasks were presented to each subject was counterbalanced across conditions.

Paulhus Deception Scales

The Paulhus Deception Scales (PDS) [27], independently measures two social desirability factors – self-deceptive enhancement and impression management. It is a 40-item instrument that measures the tendency to give deceptive responses. Deception is operationalized as inflated self-evaluations that over-report socially desirable behavior. The PDS and earlier variants of it have been in use since the 1970's. The validity of this instrument is supported by many studies [c.f. 27, 2]. The procedure for administering the Paulhus Deception Scale requires simply that the study participant complete the survey by ranking each survey item on a scale of 1 to 5, where 1 equals *Not True* and 5 equals *Very True*. The survey asks questions such as: *I am a completely rational person* and *I sometimes drive faster than the speed limit*.

In the video condition, the confederate and the subject interactively completed the survey. The confederate read each question aloud to the participants, repeated the questions if asked, and solicited verbal responses. The confederate then recorded the participants' responses on a score sheet.

In the instant messaging condition, the confederate copied each survey question from a prepared file and pasted each one separately into the IM screen. (Copying ensured consistency in the presentation of the question. Yet to dismiss suspicion of impossibly fast typing, the participant was made aware that the confederate was copying the questions from a file.) The participant responded to each question using the 5-point scale. The confederate recorded each response on a score sheet.

Measure

The Paulhus Deception Scales contains two subscales: Self-Deceptive Enhancement (SDE) and Impression Management. SDE is the tendency to give what a participant believes are honest, but are in fact inflated descriptions of herself. For example, since it is humanly impossible to be utterly rational, an extreme response (i.e. *very true*) to the statement "*I am a completely rational person*" would increase the respondent's SDE score. Impression Management is the tendency to give inflated self-descriptions. A positive response (i.e. *very true*) to the statement "*I always obey laws, even if I'm unlikely to get caught*" would increase a person's impression management score. The inventory was hand scored and analyzed using the PDS Profile Scale[®][27].

Desert Survival Situation

The Desert Survival Situation is a widely used group development training tool [13]. For this task, participants are asked to imagine they have crash-landed in the Sonora Desert, in the middle of summer. They and the other participant (confederate) are the only survivors. They are told 12 items have been recovered from the crash and each participant is asked to rank the 12 items in order of importance to their survival. Once they complete the initial ranking, they are asked to exchange their rankings with the other participant (confederate). The confederate uses the subject's rankings and a reshuffling key to generate, on the fly, her ranking that she returns to the subject. For example, in every case, the item that is top on the participant's list was moved to the 4th position by the confederate and the second item on the participant's list was moved to the 8th position, and so on. The participant and the confederate then 'discussed' the rankings. To establish herself as experienced in this area, the confederate communicated the following information in the discussion: *I've got *some* experience here... last summer, I helped out on a research project in Atacama, Chile*. The participant is instructed to ask questions of the confederate regarding the relative position of items in the list. Unbeknownst to the participant, the confederate had a script of responses. There were 24 responses in all, two for each item. The responses were arguments why each item should be raised or lowered in the ranking. If the subject's response was lower than the confederate's response, the confederate used the standard argument to try to convince the subject to raise her ranking, or vice-versa. For example:

- 1) Raise in Ranking: *obviously, we need the map to know where the nearest water and town is.*
- 2) Lower in Ranking: *a pilot's air map, which is what I assume we have, isn't going to show small water sources and shelters, which is all we can hope to find nearby.*

After the discussion, the participant is then asked to write down his or her final ranking.

Measure

We measured persuasion by comparing the participants' final score against the confederate's score. However, since the confederate's ranking is generated by reordering the participant's ranking we are able measure the degree to which the subject adjusted his or her scores as a result of the confederate trying to persuade her. A correlation was calculated between each participant's initial and final ranking. High correlation between the participant's first and second ranking indicates low persuasion, i.e. they kept close to their original responses. Low correlation indicates high persuasion, i.e. they deviated from their original responses. There may, of course, be normal variation between a subject's first and second responses, but since we assume that such variation is normally distributed among subjects, a significant difference between conditions would indicate persuasion.

Prisoner's Dilemma Game

In the prisoner's dilemma game, subjects are presented with the scenario that they and the other participant (confederate) have been each given \$10. On each round, independently, each person must decide to keep the \$10 or give it away. The payoffs after each decision round depend on the decisions of both people (Table 2). Six rounds are played, although the players are not told in advance when the game will end. The 'dilemma' arises because the ramification of each decision (reward or penalty) depends on the decision of the other player, yet how the partner will decide is unknown. Participants are told they can discuss their decisions with the other participant if they choose. In the video condition, discussion took place by using the telephone connection and video. In the IM condition, discussion took place using IM. However, in both conditions, participants were instructed to enter their final decision in a separate screen. They were told that the confederate could not see the decision screen. Instead, they were told a computer program would return a payoff once a decision from both players was received. A separate screen displayed the payoffs to the subjects after each round.

	I give \$10	I keep \$10
Other gives \$10	I get \$20 Other gets \$20	I get \$30 Other gets \$0
Other keeps \$10	I get \$0 Other gets \$30	I get \$10 Other gets \$10

Table 2: Payoffs for Prisoner's Dilemma

Measure

The confederate was instructed to give the \$10 (i.e. cooperate) in all trials across all subjects. We chose to have the confederate cooperate in all trials because doing so maintained a consistent stimulus across all trials and because this strategy had been successfully used by others to measure willingness to cooperate [c.f. 26]. The confederate was asked to think about their decision, discuss it if they chose to, then enter the decision where indicated on the screen. The decision that the participant made on each of the six rounds was recorded. We also recorded the decision to discuss a strategy or to announce the intended response before the first decision was made.

RESULTS

We report the findings for each measure below. It is important to note that neither effects of task order nor gender were detected in any of our analyses. Also, wrap up interviews strongly suggest that the confederate came across as 'nice' and 'neutral' with regard to her evaluation of the participants. Furthermore, because the confederate could not see the participant's image, her orientation towards each participant was not affected by the physical

appearance of the participant. Thus, physical attraction, or charisma and coercion of the confederate would not be likely explanations of our findings. In wrap up interviews, subjects reported that they believed the same-distant city manipulation. For example, one participant said, "*She says she is in Boston. I don't doubt that.*" Furthermore, after the experiment, when we revealed to participants that the confederate was in the next room, they were quite shocked to learn this.

Paulhus Deception Scale

The results for the Paulhus Deception test show a significant difference in deception by geographic location of the confederate ($F(1, 94)=4.37, p<.05$). The deception mean for the Distant city condition was 2.69 ($sd = 2.37$) and the mean for the Same city condition was 1.82 ($sd = 1.79$). People who believed that the confederate was in a distant city gave more deceptive answers to her than those who believed that the confederate was in the same city. According to the standard PDS scoring, deception scores are generated by only extreme responses (1, not true or 5 very true) to questions such as: *I am a completely rational person*. Thus, the number of extreme responses significantly increased. Type of media (video or IM) had no effect on deception ($F(1, 94)=0.36, p<.55$). We found no interaction between media and place ($F(1,94)=1.55, p<.22$).

Desert Survival

For each subject, we calculated the correlation between their first and their final ranking of the 12 survival items. A correlation of one would indicate that the subject retained her initial ranking, and thus was not persuaded to change the ranking. Correlation values less than one would indicate that some change had occurred. We analyzed the distribution of correlation values across conditions. The mean correlation between subjects' first and second responses was $r = .49$ ($sd = .51$) in the Distant city condition, and $r = .35$ ($sd = .51$) in the Same city condition. An ANOVA showed that this difference is significant ($F(1, 94) = 4.14, p<.05$). No effect for media ($F(1,94)=1.66, p<.21$), or interaction was found ($F(1,94)=.04, p<.85$). Thus, those in the Same city condition were more persuaded by the confederate than those in the Distant city condition.

Prisoner's Dilemma Game

A decision to 'give the \$10' is considered a cooperative choice since, when reciprocated, it results in the highest collective payoff. Likewise, since the decision to 'keep \$10' results in a sub-optimal payoff collectively, regardless of the partner's choice this decision is considered non-cooperative.

Figure 1 shows the percentage of times participants made the choice to cooperate across six trials. Percentages for both Same city (Near) and Distant city (Far) conditions are displayed. Figure 1 shows that the participants who

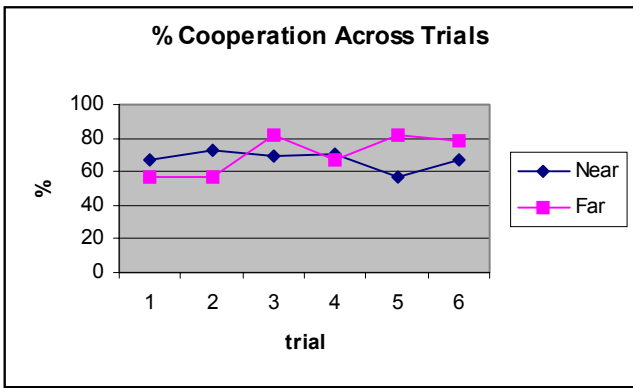


Figure 1: Percentage of Cooperation across Trials

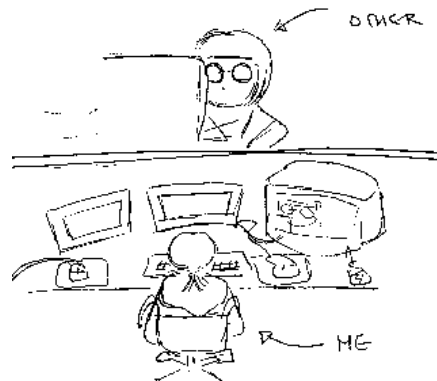
believed they were interacting with a person in a distant city were less likely to cooperate on the first two trials than those who believed the other person was in the same city. Cooperation then increased on the last two trials. A repeated measures analysis, with trials as a within-subjects factor, shows the difference between same and distant city conditions to be significant ($F(1,91)=3.38, p<.05$). No effect of media was found ($F=(1,91)1.47, p<.22$), nor was an interaction found. By collapsing the subjects over the media condition, we found that cooperation in the distant city condition significantly increased between trial 1 and trial 6, from 57% to 78% ($t(48) = -2.22, p<.03$). However, when the subject believed the confederate to be in the same city, no change was observed (it was 67% at trial 1 and trial 6). Thus, there is a significantly different pattern of cooperation, depending on whether the partner is in the same or distant city.

We recorded discussion between the participant and confederate because it has been repeatedly shown that discussion promotes cooperation (30, 26). Our data also show that participants chose to discuss their strategy fairly infrequently, only 30% of the time, across all conditions. A chi-square test showed that the frequency of discussion (between the participant and confederate regarding strategy) is related neither to the geographic distance of the confederate nor type of media used.

Thus, our data show that initially subjects were less willing



a. Map (far)



b. Adjacent (very near)

Figure 2: Subjects' drawings depicting the location of the confederate

to cooperate with a partner in a distant city compared to someone in the same city. However, over trials, people became more willing to cooperate with a distant city partner. At trial 6, they were somewhat *more* willing to cooperate with a person farther away than with one close.

Images of distance

After the subjects performed the three tasks in the experiment, they were asked to draw on paper where they perceived the other participant to be relative to them. Subjects produced a wide range of drawings. The following categories emerged from the data. The drawings depict that the participant and confederate were:

- 1) very near or adjacent to each other, e.g. they were sitting across from each other in the same room (Figure 2b).
- 2) close, but not in the same room or building, e.g. they were in two different buildings on the same road or in the same city.
- 3) very far from each other. Many subjects used a United States map as a frame of reference, and indicated where each person was sitting with dots (Figure 2a).

Figure 2 shows two examples of drawings from these categories. Two independent coders, who were blind to the conditions, coded the pictures according to these three categories. A miscellaneous category was also added, as some drawings did not fit into the categories. The two coders had 97% agreement of their coded responses.

	Very near	Same city	Far away
Boston	12	1	23
Irvine	27	10	1

Table 3. Coding results (counts) of drawings.

The coding results are shown in Table 3. Drawings for fifteen subjects were not collected. A chi-square test shows that there is a highly significant difference in the drawing category as a function of the distance of the confederate $\chi^2_{(2)}=33.3, p<.001$. This is not particularly surprising; distance was a dependent variable. What is surprising, is that people in the Same city condition, drew *more* pictures

that were coded as ‘very near’ as opposed to ‘Same city’ This is surprising because ‘Same city’ more accurately reflected the condition they were told they were in. This suggests to us that subjects in the Same city condition considered their interactions with their partner as though they were very nearby. However, in the Distant city condition, people imagined their partner to be geographically far away, and not “nearby”.

DISCUSSION

Our findings indicate that the geographical distance of a collaborating partner affects one’s willingness to initially cooperate with, be persuaded by, and deceive that partner. If people believed that their partner was far away in a distant city, they initially cooperated less than if they believed the partner was close. However, cooperation increased with interaction. On the other hand, if one believed their partner to be close, the amount of cooperation did not increase with interaction. In addition, people were less persuaded by a person that they believed to be distant from them, compared to being in the same city. Also, people were more likely to give deceptive (positive) portrayals about themselves to a partner that they believed to be in a distant city, as opposed to the same city.

These results were surprising to us, especially considering the fact that the same video and text media were used in both Same and Distant city conditions. The confederate appeared the same in the video image, and with IM wrote the same messages to all subjects. The amount of network delay was no different between the Same and Distant city conditions. Yet people regarded the confederate differently. They considered her different enough to change how they cooperated, deceived, and were persuaded by her. These effects cannot be attributed to the media, or technical differences, but rather due to social perceptions.

With regard to cooperation on the prisoner’s dilemma task, we found that participants in the Distant city condition were less likely to trust the confederate initially, yet trust increased by slightly over 20% (from 57% to 78%) between the first and the last trial. In a wrap-up interview, one participant in the video condition discussed his reactions about the distant confederate in these words:

I took [i.e. did not cooperate] the first few times and she was smiling a little and I thought she was gonna take [not cooperate] it too. So I was like “OK, I’ll give her a couple throws, and see what she’s like. If she wants to keep it more later.” So I gave it out [cooperated]. Why? Because I wasn’t sure if I wanted to lie to her and give her a little fake like, “oh, I’m going to give it to you this time but the next few times I’m going to take it.” But then she gave it a third time too, so that made me trust her more. So, I just gave it all. And I noticed

that I was getting money anyways and she was getting money too, so it was good for both of us.

This quote suggests that participants approached the distant confederate with some initial suspicion. Yet, if this suspicion is met with cooperation (which is always the case, because the confederate always cooperated) then that suspicion is likely to be dismissed. In addition to intuitively understanding that trust is a main component of cooperation, participants also seemed to be cognizant of the signals that cooperative or uncooperative behavior would send off. One subject in the Boston condition characterized it as a question of being a ‘humanitarian’ or ‘winner.’ She described:

I didn’t know if the strategy was to seem like a humanitarian or to win the most money... So, when I saw that I was starting to rack up a bunch of money, well I felt bad because she didn’t have any money so I gave when she would give. She seems like a pretty nice person.

Now consider the high deception scores that were recorded in the PDS for participants in the Distant city condition. These scores suggest that people are more apt to present themselves in the best light, through deception, if they are interacting with someone who they believe is distant from them compared to someone who is close in the same city. Recall that high deception scores arise from responses of ‘strongly agree’ to questions such as: *The reason I vote is because my vote can make a difference.* Taking these two findings together, we interpret them to mean that both the high frequency of cooperation (after six trials of interaction) and inflated self-evaluations in the distance condition are both examples of wanting to seem charitable (i.e. humanitarian) and positive to someone far away.

However, although our prisoner’s dilemma data suggest that cooperation among geographically remote partners increases across trials, we wonder if it would persist over time. Related research examining trust among geographically distributed work teams suggests that distributed teams may exhibit a tendency to quickly form trust but that this trust is ephemeral [8]. It is unclear if the cooperative behavior that appears in our data is an example of what has been called “quick trust.” Further research is needed to clarify this.

Interpretations

In this section, we propose a few interpretations of our findings. Broadly speaking, we find that social identity theory and social impact theory best characterize our data. We draw on these two related theories because they both underscore the effects of physical proximity on social interaction. Because it suggests that people evaluate the skills of those near them to be superior to the skills of distant others, social identity theory helps us understand why people might be more convinced of the expertise of a person who is near rather than remote and far away from them. Social impact theory suggests people at a distance

are less apt to influence others' impressions of them. We use this finding to interpret our deception and cooperation data.

A natural interpretation of our data is that being in the same city with others promotes feelings of similarity. Perhaps they were more persuaded by, cooperated with, and deceived less, the same city confederate because they simply felt she was similar to them. Although there certainly is some validity to this interpretation, we find that it oversimplifies the issues. Does dissimilarity with those far from us compel us to be deceptive and uncooperative? We think not, and although we do find that reactions to distant persons tend to be deceptive and initially uncooperative, our questionnaire data do not support the theory that people who are remote from us are dissimilar. In response to the questionnaire statement "*I felt that I had a lot in common with the confederate,*" we found no significant difference between subjects for the near and far conditions nor for the media used. Of course, people may change their criteria when they evaluate commonality with others. For example, when answering the questionnaire, they may have felt they had much in common, as they were similar ages. But when it comes to cooperating with another, they may evaluate the other's similarity to them in a completely different way.

Social impact theory

When the confederate was not a local, why were subjects more likely to inflate themselves through deception? This is where we return to social impact theory [14]. If people intuitively know they are disadvantaged by distance – i.e. ill-equipped to influence a remote person to form a favorable image of them – they may stretch the truth to compensate. In responses to our survey, subjects confirmed that it was more likely that they would meet the Same city participant (i.e. confederate) in person some day compared to the Distant city participant ($F(1,94)=10.60, p<.003$). This expectation of meeting may reassure subjects that they will be able to enhance or otherwise modify the image the confederate holds of them should the need arise. With the confederate geographically remote, there is little likelihood of meeting her in person and the image portrayed must be favorable. Thus, it may be easier to deceive the confederate when one believes she is remote. On the other hand, if people believe they are more likely to meet the partner, they may be less likely to deceive them. After all, if they do meet each other some day, their deception will be "found out".

Social impact theory also provides a compelling interpretation of our persuasion data. Research shows that we are more apt to be persuaded by people who live close to us [14]. Our findings of the same city condition are consistent with this. Even with video, which communicates rich visual information, the confederate is less persuasive to the subject when she is geographically remote. Her arguments in the desert survival game are less convincing

and participants' final rankings are more closely correlated with their initial rankings than with the confederate's rankings.

Finally, our drawing data show that people in the Same city condition conveyed the confederate to be "very near", often in the same room as them. This occurred even though people were told that the confederate was in the same town. These "very near" portrayals were made less than half as often with people in the Distant city condition, who mostly depicted the confederate as being across the nation. This exaggerated closeness in the Same city condition could be interpreted that the near confederate had a greater impact on the confederate. Again, this impact manifested itself in the form of increased persuasion, truthfulness and somewhat more initial willingness to cooperate.

Social identity theory

A second possible explanation for our results which expands on the "similarity" hypothesis is the ecological model of social identity proposed by Tajfel [33]. Social identity theory suggests that we are less likely to trust, cooperate and attribute expertise to individuals who are further from us compared to those who are near. In our questionnaire, subjects responded that they considered the confederate in the same city to have significantly more expertise on the survival task than those in the distant city ($F(1, 96) = 4.32, p<.05$). In other words, subjects attributed expertise in a manner consistent with Tajfel's model. It is possible that subjects were more persuaded by the near confederate because they felt she had more expertise. Yet subjects in the near condition did not report in the questionnaire that they felt they had more in common with the confederate than did subjects in the far condition. Thus, empirical support for social identity theory to explain our findings is tentative, at best.

Absence of media effects

An open question is why we did not find effects of media for the behaviors we examined. We were initially quite surprised that no effects of the different media (video and IM) emerged while we found effects of perceived distance. Here we caught ourselves making the common, yet indefensible assumption that video should provide more opportunity for persuasion, and should engender more cooperation and truthfulness simply because it affords more visual and verbal cues from a person than written text. Yet, as Sellen [29] discovered, video does not appear to provide benefits in interaction above high quality audio. Thus, our study contributes to this growing body of literature that questions the behavioral effects of video in interaction. Although it has been shown that cooperation in the prisoner's dilemma game is significantly greater when communication via voice (speakerphone) is enabled compared to text messaging [9] our findings indicate that it may not be technology itself, but rather geographic distance between oneself and a collaborator that affects one's willingness to cooperate.

Limitations

One limitation of our study is that we used a female confederate. We do not feel this poses a valid concern, however, because we did not find a gender difference across any of the measures.

The fact that we conducted our research in the context of the laboratory rather than in a context of the workplace presents a greater concern for us. Compared to a laboratory setting, absence or presence of deception, trust and persuasion among acquaintances in the workplace has higher stakes. Also in this experiment, we paired individuals who were unacquainted. Yet, people in the workplace can draw on a number of cues to make inferences about their distant coworkers, even if they never meet them. For example, they can ask where their organizational home is, or their job title, or what group they work with. Nevertheless, there are still many factors they do not know, especially about partners in remote sites, that may affect their interaction.

Another possible limitation is that our subjects did not believe the manipulation, i.e. that the confederate was in a distant or in a same city. Our interviews with the subjects refute this; some were quite shocked when we debriefed them and informed them that the confederate was right next door. Our drawing data also argue against this: we would have expected equal numbers of drawings in both conditions to portray the confederate as being in the next room. But we did not find this. We found far more in the Same city condition. It is more accurate to refer to the independent variable in this experiment as *perceived* distance rather than actual distance, since in all cases the confederate was located in the same town as the subject.

Also, we do not know how the effects of distance might change over time. The effects we found may disappear once an individual becomes well acquainted with the distant partner, or if they meet face-to-face. Yet this, and related limitations, are characteristic of all experimental studies of this kind. We propose, simply, that the tasks and collaboration context that we constructed in our laboratory represent *ad hoc* interactions among unacquainted collaborators. Although the use of *ad hoc* teams appears to be common in the organizations we have studied in the field, further, preferably longitudinal, studies are needed to expand our understanding of the effects of distance.

IMPLICATIONS AND CONCLUSIONS

We draw some high-level implications for CSCW researchers and practitioners from our results. First, the data strongly indicate that the geographic distance between collaborating and previously unacquainted partners *matters*. The ability to persuade another and the willingness to initially cooperate decrease with distance while deception of another person increases with distance. Social impact theory, and to a lesser extent, social identity theory, may explain these social effects that occur with computer-mediated communication over distance. Our results

challenge the notion that once distance communication is mediated by technology, the geographical distance between participants is irrelevant.

Although one might expect that video, compared to IM, would enable an individual to more effectively persuade another – due to the increase in non-verbal conversational cues in video – our data fail to support this hypothesis.

Additionally, our results on cooperation suggest that the effects of distance can be swiftly overcome through successive interactions over time (if the partner indicates that you can trust her). We suggest trust-building interactions at the outset of collaboration, though the effectiveness of this approach needs further research.

We argue that these findings call for a re-examination of the role of collocation in collaboration. They urge us to extend our analysis beyond issues of interaction frequency, activity awareness and communication technology richness and take a more ecological approach. They compel us to examine the social implications of geographic distribution, not simply as it applies to computer-supported cooperative work, but also to cooperative play. One approach to validating the findings reported here is to determine if members of distributed teams report a reluctance to cooperate or be persuaded by those who are physically more remote from them. Another approach is to examine if distributed gamers orient differently to people they believe live near them.

In summary, our findings represent an underexplored phenomenon at the heart of distance collaboration. They challenge the common assumption that, once a communication channel is established, the physical distribution of members of a technology-mediated collaboration is irrelevant. We are currently involved in an effort to incorporate behavioral practices that may mitigate the effect of distance into virtual teaming guidelines for a large, distributed engineering organization. Yet, since our understanding of the effects is still in its infancy, and empirical evidence of the usefulness of the practices have not been collected, we will report progress on the issue in future work.

REFERENCES

1. Allen, T. J. (1977). *Managing the Flow of Technology*. Cambridge: MIT Press.
2. Booth-Kewley, S., Edwards, J. E., & Rosenfeld, P. (1992). Impression management, social desirability and computer administration of attitude questionnaires: Does the computer make a difference? *Applied Psychology*, 77(4), 562-566.
3. Bradner, E., & Mark, G. (2001). *Social Presence in Video and Application Sharing*. In Proceedings of Conference on Supporting Group Work (GROUP '01), Boulder, Colorado, 154-161.
4. Castells, M. (1996). *The Rise of the Network Society*. Oxford: Blackwell.

5. Finholt, T. A., & Olson, G. M. (1997). From laboratories to collaborative: A new organizational form for scientific collaboration. *Psychological Science*, 8(1), 28-35.
6. Hall, E. T. (1966). *The hidden dimension*. (1st ed.). Garden City, N.Y.: Doubleday.
7. Herbsleb, J. D., Klein, H., Olson, G. M., Brunner, H., Olson, J. S., & Harding, J. (1995). Object-oriented analysis and design in software project teams. *Human-Computer Interaction*, 10 (2/3), 249-292.
8. Jarvenpaa, S., & Leidner, D. (1998). Communication and Trust in Global Virtual Teams. *Journal of Computer-Mediated Communication*, 3(4).
9. Jensen, C., Garnham, S., Drucker, S., & Kollock, P. (2000). *The Effect of Communication Modality on Cooperation in Online Environments*. In Proceedings of Conference on Human Factors in Computing Systems (CHI '00), The Hague, Netherlands, 470-477.
10. Jones, S. E. (1995). *CyberSociety 2.0 : revisiting computer-mediated communication and community*. Thousand Oaks, CA: Sage Publications.
11. Kiesler, S., & Sproull, L. (1991). Group decision making and communication technology. *Organizational Behavior and Human Decision Process*, 52(1), 96-123.
12. Kraut, R. E., Egidio, C., & Galegher, J. (1990). Patterns of Contact and Communication in Scientific Research Collaboration. In J. Galegher & R. E. Kraut (Eds.), *Intellectual Teamwork: Social and Technological Foundations of Cooperative Work*. Hillsdale, NJ: Lawrence Erlbaum, 149-172.
13. Lafferty, J. C., Eady, P. M., & Elmers, J. (1974). *The Desert Survival Problem*. Plymouth, Michigan. Experimental Learning Methods.
14. Latané, B. (1981). The psychology of social impact. *American Psychologist*, 36(4), 343-356.
15. Latané, B., Liu, J. H., Nowak, A., Bonevento, M., & Zheng, L. (1995). Distance Matters: Physical Space and Social Impact. *Personality and Social Psychology Bulletin*, 21(8), 795-805.
16. Lea, M., & Spears, R. (1991). Computer-mediated communication, de-individuation and group decision-making. *International Journal of Man-Machine Studies*, 34(2), 283-301.
17. Mark, G., Grudin, J., & Poltrock, S. (1999). *Meeting at the Desktop: An Empirical Study of Virtually Collocated Teams*. In Proceedings of Computer Supported Cooperative Work (CSCW '99), Copenhagen, Denmark, 159-178.
18. Moon, Y. (1998). *The Effects of Distance in Local versus Remote Human-Computer Interaction*. In Proceedings of Conference on Human Factors in Computing Systems (CHI '98), Los Angeles, CA, 103-108.
19. Moon, Y. (1998). Impression Management in Computer-Based Interviews: The Effects of Input Modality, Output Modality, and Distance. *Public Opinion Quarterly*, 62(4), 610-622.
20. Moon, Y. (1999). The Effects of Physical Distance and Response Latency on Persuasion in Computer-Mediated Communication and Human-Computer Communication. *Journal of Experimental Psychology: Applied*, 5(4), 379-392. <http://www.ascusc.org/jcmc/>
21. Nahemow, L., & Lawton, M. P. (1975). Similarity and Proximity in Friendship Formation. *Journal of Personality and Social Psychology*, 32(2), 205-213.
22. Nardi, B., Whittaker, S., & Bradner, E. (2000). *Interaction and Outeraction: Instant Messaging in Action*. In Proceedings of Computer Supported Cooperative Work, Seattle, Washington, 79-88.
23. Newcomb, T., M. (1961). *The Acquaintance Process*. New York: Holt, Rinehart and Winston.
24. Olson, G. M., & Olson, J. S. (2000). Distance Matters. *Human-Computer Interaction*, 15(2/3), 139-178.
25. Olson, J., Olson, G., & Meader, D. (1995). *What mix of video and audio is useful for small groups doing remote real-time design work?* In Proceedings of Human Factors in Computing Systems (CHI'95), Denver, CO, 362-368.
26. Parise, S., Kiesler, S., Sproull, L., & Waters, K. (1996). *My Partner is a Real Dog: Cooperation with Social Agents*. In Proceedings of CSCW'96, Boston, MA, 399-408.
27. Paulhus, D. L. (1984). Two-component model of socially desirable responding. *Journal of Personality and Social Psychology*, 46(3), 598-609.
28. Poster, M. (1995). *The Second Media Age*. Cambridge, MA: Polity Press.
29. Sellen, A. J. (1995). Remote conversations: The effects of mediating talk with technology. *Human-Computer Interaction*, 10(4), 401-444.
30. Sensenig, J., & Reed, T. (1972). Cooperation in the prisoner's dilemma as a function of interpersonal distance. *Psychonomic Science*, 26(2), 105-106.
31. Sommer, R. (1969). *Personal space: The behavioral basis of design*. Englewood Cliffs, N.J.: Prentice-Hall.
32. Sproull, L., & Kiesler, S. (1991). *Connections: New Ways of Working in the Networked Organization*. Cambridge, MA: MIT Press.
33. Tajfel, H. (1978). *Differentiation between social groups : studies in the social psychology of intergroup relations*. London: Academic Press.