

# Designing as if trust mattered

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## ABSTRACT

Historically, builders of CSCW tools have not focused on the creation of trust among users as a critical design goal. Yet, high levels of trust produce a number of benefits, including reduced coordination and communication costs. These benefits are particularly salient and desirable for geographically distributed workers. Therefore, to the extent that support for geographically distributed work is a key CSCW goal, CSCW tools should include features that enhance trust. This paper draws on the experience of a geographically distributed organization to identify aspects of long distance relationships associated with increased trust. Survey data collected within the organization showed that non-work interaction was positively correlated with trust to the same degree as more predictable factors, such as personal familiarity with distant sites and level of overarching shared group identity. In addition, interactive communication media had an unexpectedly positive relationship to non-work interaction, compared to less interactive media, which were negatively related. We conclude with a discussion of how CSCW tools can use these findings to improve production and maintenance of trust in geographically distributed organizations.

## Keywords

Geographically distributed work; trust; design of CSCW applications

## INTRODUCTION

It is increasingly common for organizations to have geographically distributed workforces. For instance, firms have moved rapidly to globalize their operations, both to serve new markets and to tap new resources. The parallel

pace of development of site-spanning technologies, such as email and other collaboration tools, has provided important infrastructure to support globalization. Yet, work practices have been slow to adapt to these transformations.

Specifically, long distance relationships continue to be qualitatively different from local relationships. For example, at a distance the richness of communication is diminished and the structure of communication is much more formal. While in the past these differences were experienced by small numbers of workers, usually at elite levels within organizations, today it is common for many levels of employees to interact regularly with distant colleagues. Therefore, the inherent limitations of long distance communication now have broader impact on organizations, with corresponding consequences for productivity. These limitations are particularly acute in terms of trust formation among geographically distributed co-workers.

We feel CSCW designers are well positioned to produce tools that can enhance levels of trust. However, since trust has not been a conventional design focus, there is little guidance on application features that will encourage trust. Our goal in this paper, then, is to direct the selection and development of CSCW tools to provide hospitable settings for trust formation and maintenance. We do this in two stages. First, we describe characteristics of work and communication positively associated with trust, as observed within a geographically distributed unit of Lucent Technologies. Second, we use these characteristics to identify trust-enhancing features found in past CSCW applications and to define requirements for new features.

### *The nature of collective trust*

Trust is not a well-developed construct in the CSCW literature. In the small body of work that does address trust, the focus is often on narrowly defined contexts such as: credibility of data sources [29, 1]; confidence in recommenders [27]; trustworthiness of transaction partners [6]; formal systems of logic for cooperation [17]; and cooperation with simulated actors [26]. We feel it is

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worthwhile to broaden the treatment of trust to focus on collective trust in work groups, particularly geographically distributed groups.

Evidence from Jarvenpaa and Leidner's [15] study of global virtual student teams suggests that low levels of collective trust are associated with lower team performance. Our examination of trust expands upon Jarvenpaa and Leidner in two important ways. First, we focused on workers in an actual organization. The evolution of trust in authentic work situations differs from student groups because: the expectation of future interaction motivates creation of trustworthy relationships; long term relationships support trustworthiness through routines and culture; and higher stakes for successful performance place a greater premium on trust formation. Second, we emphasized openness and reliability as core elements of trust. These dimensions, termed "emotional trust" and "cognitive trust" after McAllister [21], represent critical aspects of successful collaboration, including willingness to share difficulties with others (e.g., emotional trust) and adherence to deadlines (e.g., cognitive trust). Details of the two trust dimensions are elaborated below.

Emotional trust refers to the development of non-calculative and spontaneous emotional bonds and affect among two or more people, and is demonstrated through confidence and openness in sharing ideas, feelings and concerns. Emotional trust is important to the extent that it elicits "communal relationships" [5]. Communal relationships are characterized by sensitivity to personal and work-related needs of colleagues and an orientation to support these needs with no demand for reciprocation. Also, the existence of emotional trust provides reinforcement under adverse conditions. For instance, in the face of a crisis the existence of emotional bonds can be a source of strength or solidarity that helps to reinforce confidence and maintain morale [23].

Cognitive trust refers both to judgements of competence and reliability about the other members of a team [16, 18]. Judgments of competence are based upon predictably professional behavior (i.e., correct task execution), while reliability refers to the congruence between words and actions (i.e., fulfilling commitments). In work settings, cognitive trust is important to the extent that it allows people to count on others to provide promised contributions to a project according to agreed upon plans and schedules. Without this confidence, workers must invest additional effort in monitoring co-workers. As Ouchi [25, p. 846] observes "People must either be able to trust each other or to closely monitor each other if they are to engage in cooperative enterprise." Also, the lack of cognitive trust may lead individuals to engage in costly defensive behaviors. For instance, in this situation, individuals may feel the need for legal contracts to protect their interests. An informal but equally costly form of defensive behavior is placing multiple requests to multiple colleagues to

increase the likelihood that a particular need gets satisfied, such as asking for the same service from different people.

#### *Threats to trust in long distance relationships*

A main threat to trust comes from distance. As the principle "trust needs touch" highlights [12], physical proximity encourages the establishment of trustworthy relationships. For example, geographically distributed colleagues miss the face-to-face interactions that are common among co-located colleagues. Experiments and field studies have shown an association between face-to-face conversations and trust, including higher rates of cooperation in social dilemma tasks [28]. We believe the connection between proximity and trust is greater for emotional trust than for cognitive trust. Specifically, cognitive trust can be demonstrated more easily at a distance than emotional trust. For example, replying to email promptly is one way for distant workers to demonstrate their reliability. By contrast, emotional trust is harder to achieve at a distance, particularly without any prior face-to-face contact. For instance, evolution of an affective bond often occurs through gradual escalation across opportunistic conversations, not necessarily related to work. Occasions for such encounters at a distance are limited by the intentional and formal nature of long distance communication. That is, a conference call with colleagues and superiors is not an ideal environment to probe for similarities with others that may form the basis for a deeper relationship.

#### *Some preliminary observations of factors influencing trust in a distributed setting*

As a preliminary exercise, we conducted over fifty interviews with employees of the Network Element Group (NEG), a geographically distributed software engineering department within Lucent Technologies<sup>1</sup>. These interviews occurred in the course of six site visits during the period September, 1997 through July, 1998. At the time of our study, NEG was a new organization with 117 employees located mainly in Germany and the United Kingdom (UK), but also in India and in North America. Despite adherence to a formal software development process, NEG employees frequently encountered unexpected events, such as delays, new customer requests, or unanticipated interactions between software modules. Respondents' descriptions of these unexpected events provided insight into factors that influenced the level of trust in long distance relationships within NEG. Key factors were: a) familiarity; b) shared group identity; and c) communication.

Familiarity. Familiarity refers to a condition of mutual understanding that must be satisfied before trust can emerge. For example, it is much easier to build trust when behavioral norms are mutually understood, than when these norms must be explained, or worse, are incomprehensible.

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<sup>1</sup> All unit and individual names are pseudonyms.

We believe mutual understanding is enhanced when people have personal exposure to other ways of thinking and acting. This point is supported by observations of the importance of face-to-face meetings for trust building in virtual teams (e.g., [19]). In the context of NEG, personal exposure came when workers traveled and spent time at other sites (e.g., British workers to Germany and vice versa). In particular, visits to the other sites helped workers to understand that behavior which was normal at their home site could be seen as unusual or negative by workers at other locations. For example, NEG managers had an intuitive grasp of the importance of exchanges between sites through a practice that one manager described as “hostage taking.” That is, in advance of critical cross-site conference calls, managers would send a representative from each participating site to the opposite site (i.e., the hostage). In this way, the representatives could help translate and interpret, both literally and culturally, within the call.

Another interesting illustration of the benefit of increased familiarity concerned a manager based in Germany and his early interactions with subordinates at the UK site. While the manager spoke fluent English, he was accustomed to framing suggestions as follows: “You should do...” Later, the manager was surprised to discover that the British workers had interpreted his suggestions as directives. The confusion stemmed from the manager’s use of “should” as a direct translation of the German word “sollen” -- which in conversational German does not have the same imperative meaning that it does in English. After spending more time at the UK site, the manager learned to frame his suggestions more carefully. For their part, the British workers learned that “should” did not always indicate a direct command.

Shared group identity. Shared group identity refers to the sense that members of a group feel they are like others in their group and that their group is distinct from other groups. For example, it is much easier to build trust with someone perceived to be similar as opposed to someone who seems different. In addition, a sense of common purpose, particularly in the face of adversity, can create circumstances that build strong emotional bonds that encourage openness and expression of feelings. Within NEG, workers often formed their group identification based on their home site (i.e., NEG-Germany, NEG-UK and so forth) or on their functional role (i.e., “testing” or “development”) and did not have an overarching NEG identity. These site specific identities often became the basis for mistaken conclusions about behavior by co-workers at other sites.

The German site, for instance, was populated by experienced workers, many of whom were inherited by NEG through Lucent’s acquisition of a smaller company. By contrast, the UK site was new, and most of the workers were fresh hires. As a result of their inexperience, the British workers directed frequent email queries to their German colleagues. Rather than seeing the British workers

as members of the same team who should be helped in the interest of increasing overall team performance – many of the Germans viewed the barrage of emails as a nuisance and complained about distractions from their jobs. Similarly, adversarial relationships emerged between functional groups, such as software developers versus testers. In this case, testers complained that developers did not aggressively probe their code for errors – leaving the test team with too many problems to resolve. Developers, for their part, felt that the testers were over eager, and posed unrealistically challenging tests for finished code.

Communication. Communication refers to work and non-work related interactions. In general, communication is related to trust formation both as a means to set and transmit mutual obligations in relationships and as a mechanism to assess the trustworthiness of others [22, 8]. Non-work related communication, in particular, because of its discretionary nature, provides occasions to develop emotional ties that can lead to greater openness and sharing. Within NEG, communication breakdowns often reduced trust across sites.

Simple differences in communication expectations, for example, led to negative feelings early in NEG’s history. Workers at the UK site were accustomed to using voice mail and had the norm of responding to messages the same day they were received. By contrast, the German workers, who had no experience with voice mail, responded to messages once or twice a week. The response lag from the German site was initially attributed to neglect or arrogance, until the British workers discovered the different styles of voice mail use. Informal communication, in most cases, helped build trust, by creating a stronger sense of common goals. As one worker reported “I realized we [my distant colleague and I] were part of the same team when I heard him saying I care about the company as much as you do, and I try to do my best to protect the company from dark shadows threatening the future of our project.”

## **METHODS**

In order to complement the understanding we achieved from our extensive interviews and time spent in the field, we administered a web-based survey. The survey provided a way for us to focus specifically on trust, to compare levels of trust toward local and distant workers, and to obtain a better understanding about the role of communication and tool use in establishing trust across sites. It also fit the practical constraint of minimizing our demands on the time and attention of NEG workers.

While we recognized the liabilities of survey methodology, we took a number of precautions to ensure that we collected valid and relevant data. Our previous interviewing, as well as careful pilot testing of the questionnaire with NEG workers, assured us that the questionnaire items tapped into relevant issues, were phrased in a way that workers could easily and unambiguously interpret, and did not offend cultural sensitivities. We offered a German language

version of the questionnaire, back translated from the English version (and pilot tested with German NEG workers), as an option to German-speaking workers. Finally, we built our questions on well-understood measures from the trust literature.

We collected the questionnaire data in November, 1998. All NEG workers in Germany ( $n=75$ ) and the UK ( $n=42$ ) were invited to complete the questionnaire. We did not offer an incentive for participation. The questionnaire consisted of 68 questions covering demographics, size and shape of social networks, trust, communication and coordination, information exchange, and language. The respondents provided two answers per question: one with regard to local co-workers and the other with regard to distant co-workers. Overall, 98 NEG employees completed the questionnaire, for a response rate of 83%. Respondents were 86% male, and ranged in age from 22 to 53 years old. For purposes of analyzing long distance trust, individuals who did not report any relationship with distant co-workers were eliminated, resulting in a usable sample of 73 employees (41 from the German site and 32 from the UK site).

#### *Measures*

We based our measures of trust on modifications of items from McAllister's questionnaire [21, p. 37]. Specifically, McAllister's interest was in dyadic relationships, while we were interested in collective trust. By collective trust, we mean the degree to which an individual feels that members of a group or organization are: a) receptive to expression of personal thoughts and concerns (e.g., emotional trust); and b) dependable and reliable (e.g., cognitive trust). Therefore, emotional trust was measured by a single 7 point Likert scale, anchored by 1 = Strongly disagree to 7 = Strongly agree: "I feel comfortable sharing ideas and feelings about work with my co-workers." Cognitive trust was measured by two 7 point Likert items, anchored by 1 = Strongly disagree to 7 = Strongly agree ( $\alpha = .77$ ): "If I do not closely monitor my co-workers' progress, our tasks will not be completed." [reverse scored]; and "I cannot rely on my co-workers to fulfill their commitments. (e.g., meet deadlines, complete tasks)" [reverse scored].

Factors that we believed were associated with trust, based on our interview responses, were measured as follows. Familiarity was captured by whether a worker had visited a remote site at least once during the six months prior to the survey administration (scored 1 for those who had visited, and 0 otherwise). Shared group identity was measured by a single 7 point Likert item, anchored by 1 = Strongly disagree to 7 = Strongly agree: "I feel like I'm part of the same team as my co-workers." Finally, communication was measured in terms of the self-reported frequency of work-related interaction via face-to-face, email, phone, conference call, voice mail, fax, web, and video conference. The importance of non-work communication was measured

by a single 7 point Likert item, anchored by 1 = Strongly disagree to 7 = Strongly agree: "I discuss non-work related matters with my co-worker."

Because of the numerous differences observed in the two sites included in this study, we included site location as a control variable (scored 1 for the German site and 0 for the UK site). Site location summarized the compound effects of different factors, including social and demographic characteristics of the workers; physical characteristics of the sites (such as office layout); departmental and organizational culture; and national culture. Characteristics that differed significantly between the two sites were: a) age (German  $M = 36.5$  years vs. UK  $M = 34.0$  years); b) organizational tenure (German  $M = 8.5$  years vs. UK  $M = 3.5$  years); and c) office layout (German 100% personal offices vs. UK 83 % cubicles). Departmental and organizational culture of the two sites also differed, such as different norms regulating work and different work styles [13].

#### *Analysis*

Differences in perceptions of trust toward local versus distant workers were analyzed with paired t-tests, a technique for determining whether the mean difference score between two measures is statistically different from zero. In this case, the pair-wise differences were levels of trust toward local co-workers versus levels of trust toward distant co-workers, for each survey respondent. A significant t-test result would indicate a non-zero difference score, and therefore, a meaningful difference between levels of trust toward local versus distant co-workers.

Descriptive models for trust in long distance relationships were analyzed using multiple regression techniques. Multiple regression is an extension of ordinary least squares analysis where a fit line to a set of data is minimized, such that the sum of the squared vertical differences between the y-axis values of the data points and the fit line is as small as possible. The resulting least squares estimates are used to determine coefficients that fix the position of the fit line through the data. For example, in the case of two variables, the coefficients give the slope of the fit line as well as the point at which the line crosses the y-axis. For the NEG data, our goal was to find the smallest number of explanatory factors that produced the best fit to our criterion variable, trust.

## **RESULTS**

### *Local versus remote trust*

Summary. Our analysis showed that NEG workers reported higher levels of emotional trust toward local co-workers than toward distant co-workers, but the results concerning local versus distant differences in cognitive trust were inconclusive. Overall, levels of cognitive trust were lower than for emotional trust.

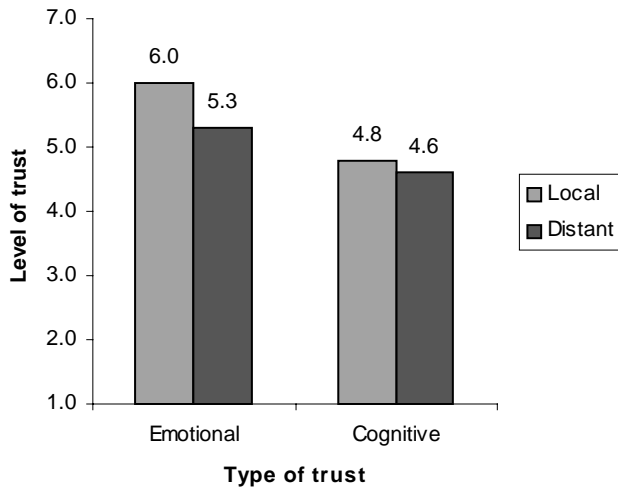


Figure 1. Perceived emotional and cognitive trust toward local and distant co-workers

**Statistical details.** The chart in Figure 1 summarizes these results. The first two bars of the chart represent a statistically significant difference for emotional trust ( $t = 6.14, p < .01$ ), but the next two bars for cognitive trust do not. In addition, the bars for local trust represent a statistical difference ( $t = 7.67, p < .01$ ), as do the bars for distant trust ( $t = 3.30, p < .01$ ).

#### Factors related to trust

**Summary.** Our analysis showed that greater familiarity with distant sites, greater sense of shared group identity with distant workers, and greater importance of non-work communication with distant workers were associated with higher levels of emotional trust toward distant workers. Results concerning cognitive trust toward distant workers were inconclusive for the same measures. Primary site affiliation was not associated with levels of trust.

**Statistical details.** We ran multiple regression models of the three explanatory factors (familiarity, shared identity, communication) and the control for site location against both emotional and cognitive trust – in long distance relationships. We obtained significant results for emotional trust, but not for cognitive trust. Table 1 shows the results for regression models of increasing completeness against emotional trust toward distant co-workers. Models 1 through 3 show the increasing improvement in fit (indicated by rising values for *Adjusted R*<sup>2</sup>) produced by the addition of new explanatory factors. Model 4 shows the fit of the full model (i.e., with all explanatory factors plus the control factor for site location). Model 5 represents the “best fit” model – where non-significant explanatory factors were eliminated in the interest of parsimony.

In Model 5, emotional trust toward distant co-workers was best described in terms of all three explanatory factors, while site location and frequency of work communication

were not significant. From Model 5, positive coefficients can be interpreted as evidence of a positive correlation between trust and a particular explanatory factor. That is, according to the NEG respondents, their trust in distant co-workers increased as familiarity with distant sites increased and as they reported higher levels of shared group identity with distant co-workers. These results were consistent with our expectations. More interesting was the positive relationship between the importance of non-work communication and trust. Specifically, in relative terms, while shared group identity had the most influence in determining the fit of Model 5, non-work communication was more influential than familiarity – based on comparison of standardized coefficients.

Measures	Models				
	1	2	3	4	5
German site	-.48	-.24	-.10	-.22	--
Familiarity	--	.81**	.43	.45	.49*
Work communication	--	--	.028	-.05	--
Non work communication	--	--	.280**	.19*	.19**
Group identity	--	--	--	.36**	.36*
Intercept	5.53**	4.50**	3.95**	2.69**	2.53**
<i>Adjusted R</i> <sup>2</sup>	.027	.12**	.36**	.40**	.42**

**Note.** \* denotes  $p < .05$ ; \*\* denotes  $p < .01$

Table 1. Regression models for emotional trust toward distant co-workers (n=73)

#### Channels for non-work communication

**Summary.** The association between non-work communication and trust led us to explore the relationship between use of different communication media and the importance of non-work communication. Our analysis showed that greater use of phone-based channels was significantly associated with increased importance of non-work communication, beyond effects associated with familiarity. Results for use of computer-based channels showed a negative, but not significant relationship with non-work communication.

**Statistical details.** The influence of non work-related communication on emotional trust piqued our interest. Therefore, we regressed non work-related communication against the frequency of work-related communication occurring, respectively, by phone-based and computer-based channels as reported in the social network portion of the survey. The usable sample dropped in this case, because we only used responses that were complete for all

communication types. We controlled for familiarity with the remote site.

Table 2 presents the results of this analysis. Model 1 shows the impact of familiarity on non-work communication, without including the communication frequency factors. Model 2 shows the full model, with the communication frequency factors, and a significant increase in the fit from Model 1 (based on the increase in *Adjusted R*<sup>2</sup>). Model 2 also shows a positive relationship between phone-based communication (measured as the combined frequency of work-related dyadic and conference calls) and importance of non-work communication, and a negative (but not significant) relationship between computer-based communication and non-work communication. Also, Model 2 indicates a positive relationship between familiarity and non work-related communication.

Measures	Models	
	1	2
Familiarity	1.34**	.92
Computer-based communication	--	-.09
Phone-based communication	--	.54*
Intercept	3.03	1.35
<i>Adjusted R</i> <sup>2</sup>	.12**	.22**

Note. \* denotes  $p < .05$ ; \*\* denotes  $p < .01$

Table 2. Regression models for non-work communication and communication channel use (n=54)

According to NEG respondents, then, their judgement of the importance of non-work communication with distant co-workers increased as they reported increased frequency of phone-based communication with distant co-workers and as they reported increased familiarity with distant sites. Interestingly, the importance of non-work communication decreased with increased frequency of computer-based communication, although this result was not significant. In relative terms, phone-based communication had greater influence than computer-based communication on non-work communication, based on comparison of standardized coefficients.

### ENHANCING TRUST

In the next sections we use the characteristics associated with trust, as found in our study of NEG workers, to identify trust-enhancing features found in past CSCW applications and to define requirements for new features. Our strategy will be to either find technologies that enhance group identity, familiarity, and non-work communication -- or that act as proxies for these factors.

### Shared group identity

Our findings suggest that geographically distributed workers benefit from the creation of shared group identities that extend beyond local boundaries. Creating shared identities that span multiple sites is a particular challenge since local identities are so salient. For example, individual sites have their own leaders, culture, and history – all of which are experienced more vibrantly than people and places known only through text on a screen, via voices on a conference call, or through sporadic visits. Key features in overcoming the bias toward local identities might include mechanisms for knowing more about what is happening at distant sites.

Houde, Bellamy, and Leahy [14] describe a web-based “online newspaper” developed by Apple’s Advanced Technology Group that represents a candidate application for increasing knowledge about distant sites. The newspaper consists of a front page, summarizing events and news of general interest, and back pages for posting specific queries, akin to want ads. A unique feature is the ability of readers to submit copy for the newspaper via email. At Apple, the newspaper was used primarily in a local setting where images of the front page were projected in a common area. Users responded very enthusiastically to the public display because they could see, at a glance, what was going on while getting coffee, coming in to work and so forth. In particular, Houde et al. note that “...the newspaper was an important element in forming a sense of community...announcing that [the newspaper users] were members of a community who shared common interests and activities” (p. 117). An extrapolation from the Apple experience would be simultaneous projection of a front page at multiple sites. Such a distributed newspaper might be expected to create the same sense of community among distant users that it did among co-located users at Apple. Alternatively, shared text-based chat tools, such as MUD rooms, offer a simpler approach to creating community at a distance (e.g., [24]). Indeed, users of a laptop-based version of the Apple newspaper reported a strong desire for additional tools to organize conversational threads.

### Familiarity

Our findings suggest that geographically distributed workers benefit from personal exposure to distant sites. An obvious remedy for this problem is more travel. A more practical approach, however, is to focus on elements of CSCW tools that act as proxies for travel. For instance, one benefit of visiting distant co-workers is that it breaks down the invisible colleague syndrome, or the tendency for people at other locations to be out of sight and therefore out of mind. This suggests a potentially important role for tools, such as continuous video links between sites, that can provide cues and reminders about distant co-workers.

CSCW researchers have pursued two strategies with respect to video-based awareness applications. One approach, based on virtual glances from office-to-office has met only

limited success due, in part, to privacy concerns (e.g., [10]). An alternative strategy has explored linking public spaces via video, which overcomes many privacy issues. Prototype systems, like Bellcore's VideoWindow [9], were reasonably successful in supporting spontaneous encounters at a distance. For example, in a comparison of VideoWindow with a shared physical space, Fish et al. [9] found that VideoWindow was about half as effective as the shared physical space. While this level of performance would appear to be quite strong, experiments with continuous video connections across distributed public areas have not been extended. It might be time to re-examine the conclusions of early work with linked public spaces. For example, video and audio capture technologies have improved a great deal since the early 1990s, as has access to high bandwidth via Internet 2 and other advanced Internet testbeds. These improvements might allow more realistic video-mediated interactions. More important, new systems can address problems identified from earlier research, such as poor support for: a) seamless transitions from public interactions to private interactions; and b) for escalation from casual encounters to more formal meetings (i.e., with supporting tools and materials).

Another benefit of visiting distant sites is increased exposure to other ways of thinking and acting, which contributes to cultural sensitivity and tolerance. Mechanisms for achieving this outcome might be as simple as coordinated web pages or, on a more elaborate level, creation of special tools for organizing cross-site information about national and religious holidays. For example, based in part on findings from this study, researchers at Bell Labs have produced a web-based application that allows NEG workers to view individual and organizational calendars with appropriate embedded local holidays – or any combination of holidays across all NEG sites. From links within the tool it is possible to view explanations and descriptions of the various holidays.

#### *Non-work communication*

Our findings suggest that geographically distributed workers benefit from placing greater emphasis on non-work related interactions with distant co-workers. In particular, absence of opportunities for non-work communication in long distance relationships may impede formation of emotional trust. That is, non work-related communication may serve a number of important functions. First, people reveal aspects of their non-work lives through non-work communication. This facilitates the disclosure of feelings, ideas or personal problems beyond the façade of the job role, supporting the establishment of emotional bonds. Second, people discover common interests through non-work communication. Sharing common interests can become the pretext to interact more frequently, engage in activities outside work together, and to establish friendships. Finally, people can use non-work

communication to gather information to assess the trustworthiness of others.

CSCW research has focused largely on support for work-related communication and in many cases, only on support for formal interactions, such as meetings. The importance of non-work communication suggests greater attention to tools for casual conversation. For example, Boyer et al. [2] describe a “virtual jazz club” where individuals can meet on-line and talk while listening to music (and even singing together, karaoke-style). Alternatively, shared web browsing may provide a focus for joint non-work activity (e.g., [11]). However, such efforts to produce virtual spaces or virtual synchronous activities must accommodate impediments to virtual socialization. For instance, when distance implies different time zones, people ready to socialize at one site might have distant colleagues who are just beginning or ending their day. A significant larger challenge remains to determine how tools for non-work interaction should be integrated, if at all, with tools for work interaction. For example, a concern in adoption of instant messaging applications is that employees will use them predominantly for non-work communication – at the expense of pending work-related tasks.

#### *Reasonably interactive communication*

Our findings suggest that for geographically distributed workers, the importance of non-work communication is positively related to the frequency of work-related phone-based communication, and may be negatively related to the frequency of computer-based communication. One interpretation of this result is a preference for richer media over leaner media, in this case voice vs. email, as the importance of non-work interaction increases [7]. If media richness plays a role, the more critical dimension might be immediacy of feedback separate from the number of available channels for expressing meaning. For example, Churchill and Bly [4] document non-work communication in a work-related MUD, indicating that the ability to get prompt replies is critical, even though these exchanges are all text-based.

More broadly the popularity of instant messaging tools, like ICQ, suggests the suitability of lightweight chat applications for supporting what we term “reasonably interactive communication” at a distance. That is, under conditions of dubious or expensive voice communication alternative communication media that approximate the interactivity of spoken conversation may be useful. Suitable interactivity might mean response latencies from minutes up to an hour, depending on urgency. Again, based on the findings from this study, Bell Labs researchers have produced a tool called *rvm* (*rear view mirror*) to support reasonably interactive communication within NEG [3]. The *rvm* tool combines features of awareness within distributed work groups with group-specific chat rooms. In practice, these chat rooms provide occasions for non-work interactions that in many cases become opportunities for

important work-related interaction. Herbsleb and Grinter [13] offer several illustrations of the value of informal communication in the performance of cognitively complex group work, such as software engineering. At a general level, Whittaker, Frohlich, and Daly-Jones [31] have argued that encounters are a key element of interaction in a shared space exactly because encounters stimulate informal communication. In fact, Whittaker [30] suggests that support for virtual encounters may be the most important reason to pursue video-based awareness applications. Text-based encounters, as in *rvm*, may accomplish similar goals at much lower cost.

## CONCLUSION

This study offers a number of contributions to our understanding of trust in the case of geographically distributed work. First, our results showed higher levels of emotional trust toward local workers than toward distant workers, but no difference in terms of cognitive trust. Second, we identified three factors associated with higher levels of emotional trust toward distant workers: familiarity with remote sites; shared group identity; and non-work communication. Finally, with respect to non-work communication, we found that phone-based interaction had a significant positive relationship, while computer-based interaction was not significantly related.

### *Future empirical work*

This study highlights a number of ways that subsequent empirical efforts could be tuned to improve the usefulness of results for CSCW tool development. First, future studies should continue to include trust measures. We would recommend the use of at least our measures of emotional and cognitive trust, or related concepts of benevolence and ability [15]. These trust measures could also be expanded to include other constructs, such as integrity – or the degree to which others adhere to principles that increase dependability and reliability [20]. Second, replications in other contexts should include additional variables shown to have a relationship with levels of trust, such as degree of risk associated with projects, incentive systems, reputation of team members, and monitoring systems. Third, future studies should examine links between trust and team or organizational performance (e.g., productivity, innovation, employee morale). In related work based on the data collected at NEG, for example, we are exploring the relationship between trust, behavioral and attitudinal measures associated with trust, and critical delays. Critical delays include lags in completion of expected tasks, latency in obtaining needed information, and down time produced while awaiting important decisions. Finally, future research should investigate how different blends of face-to-face and electronic communication influence trust. For instance, in a geographically distributed group, what is the optimal sequence of face-to-face and electronic communication to initiate and maintain trust?

### *Future tool development*

We've identified a number of past and current CSCW tools that align with the factors positively associated with trust in this study. These include the use of: a) continuous video and on-line newspaper links between distributed public areas to enhance shared identity and familiarity; b) calendar tools with culturally-specific information to enhance familiarity ; c) support for awareness in virtual settings to increase opportunities for encounters that lead to both work and non-work communication; and d) support for reasonably interactive communication media to increase levels of work and non-work communication. Future tools, particularly when targeted at geographically distributed workers, should incorporate all of these features. In particular, this suggests a research style where a set of tools, oriented to a common set of goals (e.g., improvement of trust, higher performance, ease of use), should be developed in concert and then deployed in an authentic work context. Once in use, tools should continue to be examined to confirm expected effects on critical outcomes. Too often, CSCW tools emerge in isolation, fail to address specific real world needs, and are not evaluated outside the laboratory. The larger project that encompasses this study, for example, is a five year effort to understand the combination of tools and practices that will improve the performance of the NEG organization.

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