

RUNNING HEAD: Out of sight

Out of sight, short of trust.

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### Abstract

This study examines trust toward local and distant co-workers in a geographically distributed unit of a Fortune 100 telecommunications company. The goal is to identify aspects of long distance relationships associated with increased trust. Trust is measured as openness toward others, or emotional trust, and as reliability of others, or cognitive trust. Analysis of survey data shows greater emotional trust of local workers compared to distant workers. Cognitive trust does not differ. Results indicate a positive association of familiarity, shared identity, and non-work communication with emotional trust in long distance relationships. In addition, interactive communication media has a positive relationship to non-work interaction compared to less interactive media, which were negatively related. The findings frame a set of recommended changes in communication tools and practices to enhance levels of emotional trust, particularly in geographically distributed work teams.

### Out of sight, short of trust

It is increasingly common for organizations to have 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 e-mail and other collaborative tools, has provided important infrastructure to support globalization. However, work practices have been slow to adapt to these transformations. While in the past a small number of workers were involved in site-spanning activities, 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. A main limitation regards the level of trustworthiness embedded in long distance relationships. Specifically, the *credo* is that individuals are reluctant to trust remote colleagues as much as they trust local ones (Handy, 1995; Jarvenpaa & Leidner, 1999). This insight suggests the need for organizations and workers to understand the reasons behind the decline of trust in long distance relationships and, eventually, which strategies could increase levels of trust. To address this need, we conducted a study of software development teams engaged in tightly coupled work within and between two sites.

The paper that follows represents a number of important theoretical and practical contributions. First, our results illuminate trust in the context of a key but previously under-examined setting: geographically distributed work. Second, the results offer general extensions to research on trust in terms of empirical data collected within authentic work groups, as opposed to experimental data. Third, the results suggest the role that different communication media play in trust formation. And finally, particularly in terms of cognitively complex tasks – such as software engineering – the results show that interpersonal factors, such as trust, play an important role even in highly structured work processes.

### Previous studies of long distance trust

If Handy's (1995) assertion that "trust needs touch" is true, then proximity increases trust through more opportunities for rich interaction, such as face-to-face conversations. As an illustration, Rocco's (1998, 1999) experimental work on social dilemmas found that people in simulated long distance relationships, who were not allowed to speak face-to-face, trusted each other less than people who did speak face-to-face. Similarly, field studies of student project groups have demonstrated barriers to trust formation in geographically distributed teams, where interaction was primarily via email, compared to co-located teams where members could talk in person (Iacono and Weisband 1997, Jarvenpaa and Leidner 1999, Warkentin, Sayeed, and Hightower 1997). While these findings are intriguing, they aren't definitive because experimental subjects and students in project teams are very different from people in authentic work situations.

In authentic work situations, working relationships persist over long periods, and the expectation of future interaction may motivate greater investment in building trustworthy relationships (Axelrod, 1984). Also, long term relationships offer more time to establish trustworthiness through routines and culture (Zack and McKenney, 1995). Third, in authentic work situations, workers have more communication options, which may affect trust to the extent that people have additional ways to clarify misunderstandings or to correct errors. Finally, in authentic work situations, workers confront higher stakes for successful performance, and trust formation may assume a higher priority. Because of these important differences, we chose to explore trust through a field study of work within a real multi-site organization. We felt this setting provided the best way to compare perceptions of trust in long distance and local relationships, while also examining the effects of demographic, organizational and communication factors.

### The problem of trust in geographically distributed software development

This field study took place within Lucent Technologies, a Fortune Global 100 telecommunication company headquartered in the United States. We focused on the Network Element Group (NEG), one of hundreds of departments within Lucent devoted to software engineering in support of telecommunications applications<sup>1</sup>. The NEG department had 117 employees at the time of our study, located mainly in Germany and the United Kingdom (UK). The next paragraph describes the centrality of trust in the software development process.

#### Need of trust in software development

Our starting point for understanding issues of trust within NEG was the software development process. Typically, the development process begins when a software production unit, like NEG, receives specifications for a particular release of the code for a particular program. From this point, the development process consists of six stages. The first stage, called functional specification, covers the decomposition and detailed definition of the software and interfaces to be developed. The second stage, called design, provides instructions about how units should work together when processing the scenarios given in the functional specification. In the third stage, engineers code the actual software modules. In the fourth stage, called unit test, engineers probe their modules for bugs, or errors. In the fifth stage, called integration, the individual modules are brought together into complete systems. And in the final stage, the unified system is tested and certified for release to customers.

In spite of the sequential nature of the process just described, in NEG high complexity and unforeseeable events characterize activities within and across sites. Pressure to bring products to market often meant that the same people are working on different stages of different releases in parallel. Further, individual engineers are under great pressure to find

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<sup>1</sup> All department names are pseudonyms. Our agreement with Lucent Technologies does not allow us to disclose the exact product supported by NEG.

bugs and get them corrected, which often involved extended communication with colleagues to negotiate solutions -- sometimes accompanied by very heated discussion. Sources of differences could include disputes over the importance of particular bugs, the urgency of fixing bugs in the current release, and the wisdom of postponing some bug fixes to a subsequent release.

The pressure to produce finished code and the unpredictable nature of code integration produced constant need within NEG for frequent informal communication with both local and distant workers. In these circumstances, the flow of communication needed to be clear, smooth and unambiguous to avoid risks of misinterpretation among collaborating team members. In practice, communication failures were common -- leading in one case to false attributions about co-workers' willingness to share information. Communication difficulties led to correspondingly low levels of trust. Consequences of low trust were annoying, and occasionally severe. For example, in the course of testing code, engineers produced modification requests (called "MRs") which were indications to engineers responsible for an offending module to clean up bugs that generated the MR. However, a flood of MRs can overwhelm engineers attempting to complete other tasks. Therefore, people assigning MRs needed to show consideration, such that sufficient goodwill was preserved to ensure that the MRs would be resolved. Trust was a critical component of achieving the appropriate balance between resolving MRs and maintaining a reasonable workload. When this trust broke down, engineers frustrated with too many MRs would defensively isolate their code, which was counter-productive since this isolated code might later require more attention to integrate with other modules (i.e., particularly when unresolved bugs involved the interface between one module and another).

#### Need of shared identity

A factor complicating trust formation was the different identities of the sites forming NEG. While Lucent itself is a well-established company, NEG was a recently formed unit. The creation occurred through acquisition and through construction of new facilities. The English site was founded in early 1997, and as a result, most employees were recent hires, and many were also recent university graduates. By contrast, the German site had been part of an independent company which, prior to its purchase by Lucent in 1996, was on the brink of bankruptcy. At the time of this study (November 1997) workers had 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”). There was not an overarching NEG identity. These site-specific identities often became the basis for mistaken conclusions about behavior by co-workers at other sites. For instance, most of the German workers were very experienced. By contrast, the British site was new, and most of the workers were fresh hires. As a result of their inexperience, the British workers used to direct frequent email queries to their German colleagues. The Germans viewed the barrage of emails as a nuisance and complained about distractions from their jobs. On the other site, the British employees started complaining about the lack of cooperation. Both site reacted by a strong problem escalation within their local chain-of-command that, according to the NEG management, could have been avoided with sufficient trust between members of the cross-site teams. That is, workers did not feel comfortable discussing problems with co-workers at distant sites, and as a result, preferred to let their managers solve problems.

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 solve. Developers, for their part, felt that the testers were over eager, and posed unrealistically challenging tests for finished code.

### Need of familiarity

In addition to the lack of common identity, linguistic and cultural differences amplified the trust issues between distant workers. The corporate language within Lucent is English, and everybody spoke fluent English within NEG. However, as the following anecdote illustrates, linguistic fluency did not equal cultural fluency. For example, during a face to face meeting with his British colleagues a German manager proposed a course of action. The manager framed his suggestion as follows: “You should do...”. The British employees were perturbed by the form of this recommendation, which they interpreted as a command from the German manager. In fact, the manager used “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. Therefore, an innocent suggestion by the German manager provoked an antagonistic reaction from his British subordinates.

In general, it is much easier to build trust when behavioral norms are mutually understood, than when these norms must be explained, or worse, are incomprehensible. The point is supported by observations of the importance of face-to-face meetings for trust building in virtual teams (Grudin & Poltrock, 1999). In the context of NEG, personal exposure came when workers traveled and spent time at other sites. In particular, visits to the other sites helped managers to realize critical situations and behaviors that risked giving rise to misinterpretations by workers at other locations. For example, they soon came to realize the impasse due to different accents and lack of personal knowledge during teleconference meetings among team members spread out in different location. The solution became sending a representative from each participating site to opposite site in advance of critical cross-site teleconferences —the “hostage taking” practice. The representatives could help translate and interpret both literally and culturally. A similar solution explains the role of the “liaison engineer”. In this case, every three months a representative from the distant site left his site

and worked in the remote site as facilitator. The liaison engineer took the dual advantage of keeping the two sites tuned while learning skills, rules and procedures of the remote site.

#### Need of communication

The different sites experienced large communication problems. On the one hand, structured communication used to follow different procedures. In fact, each site tended to inherit pre-existing communication procedure (e.g., the German site inherited the previous German owner's procedures), or adopt the local ones. Managers undertook a big effort to homogenize communication protocols and documentation, as well as create a common culture to make information available on the intranet (e.g., results of recent tests, information about new members joining the team). Workers were asked to attend training course to learn standard communication procedures. But other subtler customs would have been harder to diffuse. For instance, different communication expectations led to negative feelings in the NEG's early 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, Germans, who had no experience with voice mail in the workplace, responded to messages once or twice a week. The response lag from the German site was initially attributed to neglect or arrogance, until the different style of voice mail use came to light.

Besides formal communication, workers complained for the lack of informal, spontaneous communication with remote colleagues. For instance, engineers often complained that co-presence would have helped to get strategic information just in time (e.g., changes to official plans before starting a task). In many cases, distance equaled delay because important decisions were made in informal circumstances (e.g., in the corridor or in front of the coffee machine), leaving remote colleagues in the dark.

Moreover, spontaneous communication carries an important social role. Non work-related communication, in particular, because of its discretionary role, provided occasions to

develop social and emotional bonds among people. Co-located colleagues used to share non work-related activities, such as going to the pub on Fridays or play games together. Even talking about personal problems or family events enhances solidarity among people. The friendship bonds existing among sets of co-located individuals helps to explain why the latter were more receptive to each other's needs than to remote colleagues' needs. Remote colleagues did not have occasions to share regularly non work-related activities or engage in non work-related communication with each other. Therefore, they were losing the important organizational by-product of social communication, i.e., solidarity and sensitivity for each other's needs.

The description of NEG, its organization, history, culture and the nature of the working processes illustrate the critical role of trust and highlight the difficulty of developing trust, particularly in long distance relationships. The next section presents the framework we used to explore issues of trust within NEG.

#### Emotional and cognitive trust in long distance relationships

Trust and trust formation assume special significance in long distance relationships. For instance, in many geographically-distributed collaborations workers must achieve trust quickly and then maintain trust without frequent face-to-face interaction. In many ways, this situation resembles the conditions Meyerson, Weick, and Kramer (1996) describe as "swift trust" (Mishra 1996, Jarvenpaa and Leidner, in press). With swift trust, co-workers must often assume that others are trustworthy, and then learn to read the cues that emerge early in a relationship that indicate whether such assumptions are justified.

In the organizational literature, trust is presented as both a single and as a multi-faceted construct. There is compelling research evidence to support the idea that trust is multi-faceted (e.g., Jennings 1967, 1971, Gabarro 1987, Mishra 1996, Nahapiet and Ghoshal

1998). Specifically, McAllister (1995) has proposed two critical dimensions: emotional trust and cognitive trust. Therefore, in thinking about trust formation at a distance, we've focused on cues that reflect both of these underlying dimensions.

Emotional trust. We describe emotional trust as the development of non-calculative and spontaneous emotional bonds and affect among two or more people. Emotional trust is demonstrated through confidence and openness in sharing ideas, feelings and concerns. In work settings emotional trust is important to the extent that it elicits "communal relationships" (Clark, Mills and Corcoran 1989, Clark, Mills and Powell 1986), or relationships characterized by sensitivity to personal and work-related needs of colleagues, oriented to support these needs with no demand for reciprocation. Also, the existence of emotional trust provides reinforcement in the face of adversity. For instance, if the organization faces a temporary lack of critical resources (i.e., human, technological, or financial) the existence of emotional bonds can be a source of strength or solidarity that helps to overcome temporary setbacks (Mishra 1996, Krackhardt and Stern 1988).

In local relationships it is easier to read the cues to evaluate emotional trust than it is in long distance relationships. Therefore, we expected that in NEG's geographically distributed teams, perceptions of the level of emotional trust with co-workers would be lower than in local teams. That is, local workers can see each other every day, can have meals together, can engage in unplanned discussions -- all of which contribute to a level of mutual understanding, or even friendship, that enables the formation of emotional trust. By contrast, distant workers have many fewer opportunities for the kinds of interaction that develop and maintain emotional trust.

**Hypothesis 1:** Within NEG, perceptions of emotional trust toward local workers would be higher than perceptions of emotional trust toward distant workers.

Cognitive trust. The second dimension of trust we were interested in exploring was cognitive trust. In this research, cognitive trust refers both to judgements of competence and reliability about the other members of a team (Jonhson-George and Swap 1982, Lewis and Wiegert 1985). Judgments of competence are based upon verifying instances of predictably professional behavior (i.e., correct task execution), while reliability refers to the congruence between words and actions (i.e., respect for deadlines). 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 (1979, 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 (Williamson 1985). An informal but equally costly form of defensive behavior is placing multiple requests to multiple colleagues to increase that likelihood that a particular need gets satisfied (e.g., asking for the same service from different people).

There is not as great a difference between local and long distance relationships in reading cues associated with cognitive trust, as there is with emotional trust. That is, distant workers are not as disadvantaged in terms of communicating their reliability and competence as they are in terms of communicating emotional openness. For example, attributions about reliability may be reinforced as easily by a prompt email reply or telephone call (i.e., as in a geographically distributed team) as by a prompt visit in response to a note left on an office door (i.e., as in a local team). In a similar vein, judgements of competence are based on the correct execution of tasks depending on the worker’s skills and not on his or her location.

**Hypothesis 2:** Within NEG, perceptions of cognitive trust toward local workers would not differ from perceptions of cognitive trust toward distant workers.

#### Predictors of trust in long distance relationships

The goals of this study include: a) exploration of the hypotheses described in the previous section; and b) identification of factors positively associated with perceptions of trust, particularly in long distance relationships. We believe that perceptions of trust in long distance relationships are driven by the three factors: shared identity, familiarity, and communication. The following section elaborates our theoretical framework and presents hypotheses about the expected influence of each of the three factors on emotional and cognitive trust.

#### Shared identity

The importance of shared identity emerges from the observation that the feeling of belonging to a group is positively associated with many desirable social outcomes. Specifically, in accordance to social identity theory, people begin to like those people with whom they identify. Liking leads to increased trust (Kramer and Brewer 1984, Brewer and Kramer 1986), as well as greater cooperation (Dutton, Dukerich, and Harquail 1994), preferential treatment (Tajfel and Turner 1985), and more helpful behavior (Dutton et al. 1994, Ashforth and Mael 1989). In addition, a sense of common purpose, particularly in the face of adversity, can create circumstances that build strong emotional bonds necessary to support openness and expression of feelings (Scott 1997).

**Hypothesis 3:** Within NEG, shared identity would be positively associated with perceptions of trust in long distance relationships.

#### Familiarity

The construct of familiarity includes preconditions that must be satisfied before trust can emerge. For example, by Blakar's (1985) description, trust depends on the ability to

negotiate and endorse contracts of behavior -- such as norms of participation and mechanisms for conflict management. It is much easier to build trust when contracts of behavior are mutually understood, than when these contracts must be explained, or worse, are incomprehensible. We believe familiarity is enhanced when people have personal exposure to other ways of thinking and acting. For example, in the context of this study, such exposure came when workers traveled and spent time at other sites (e.g., British workers to Germany and vice versa). Spending time at other sites increases acquaintance with strangers, and with different cultures and their implicit norms, and creates a common frame of reference for building relationships. This common frame may be essential in learning to interpret the actions of others, that in context make sense, but out of context may seem malicious or foolish.

**Hypothesis 4:** Within NEG, familiarity would be positively associated with perceptions of trust in long distance relationships.

#### Communication

One of the main mechanisms that enhances trust is communication (Sally 1995, March and Simon 1958). The importance of communication reflects the observation that interaction with others provides the opportunity to gauge their beliefs and attitudes, which is critical to accurate assessments of trustworthiness (Messick and Brewer 1983, Dawes, McTavish and Shaklee 1977). Communication also permits individuals to socialize, establish commitments and exchange promises (Messick and Brewer 1983, Dawes et al. 1977). Finally, at least for emotional trust, the frequency of interaction is an important positive factor (McAllister 1995). Organizational communication is usually work-related. However, beyond work-related communication, non work-related communication also plays an important role in the formation of trust. Non work-related communication responds to the general desire individuals have to derive pleasure from the social interactions that accompany their daily

work (Granovetter 1985). Non-work communication in particular, because of its discretionary nature, provides occasions to develop emotional ties that can lead to greater openness and sharing.

**Hypothesis 5:** Within NEG, the frequency of communication would be positively associated with trust in long distance relationships.

#### Additional influences on trust

Because of the numerous differences observed in the two sites included in this study, we included site location as a control variable. Site location summarizes the compound effects of different factors, including<sup>2</sup>: social and demographic characteristics of the respondents; 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  $\underline{M}$  = 36.5 years vs. British  $\underline{M}$  = 34.0 years); b) organizational tenure (German  $\underline{M}$  = 8.5 years vs. British  $\underline{M}$  = 3.5 years); and c) office layout (German 100% personal offices vs. British 83 % cubicles). Departmental and organizational culture of the two sites also differed, such as different norms regulating work and different work styles (Herbsleb and Grinter 1999). Finally, national culture was a potential influence on trust formation. Based on Hofstede's (1997) categories, Doney, Cannon, and Mullen (1998) found that people from different national cultures will vary in terms of preferred trust formation processes depending on their relative degree of risk aversion, individualism, masculinity, and power distance.

### Methodology

In November, 1998, 117 NEG employees located in Germany (n=75) and the UK (n=42) were invited to complete a Web-based questionnaire. Most of the workers were

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<sup>2</sup> In this study, the site location mainly coincided with the national culture of employees at a site, as only a few individuals were expatriates.

software engineers, with some managers and some administrative support personnel. This was the first administration of a planned twice yearly administration over the next four years. The questionnaire consisted of 68 items covering demographics, patterns of communication, working relationships, communication and coordination, information exchange, and language. However, administrative constraints posed a severe limit the number of questions we could ask to measure each framework's item. The respondents provided two answers per question: one with regard to local co-workers and the other with regard to distant co-workers. The Web-based administration of the survey provided several technical and organizational advantages, particularly in a setting where workers were frequently away from their primary office locations. A German language version was produced using back translation techniques, and was available for non-English speakers. 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. Respondents received no incentives for completing the questionnaire, but were provided with aggregate summaries of the results. To test the hypotheses, individuals that did not report any relationship with remote co-workers were eliminated from the sample, resulting in a usable sample of 73 employees (41 from the German site and 32 from the English site).

### Specific measures

Trust. We based our measures of trust on modifications of items from McAllister's questionnaire (1995, pg. 37). 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]. 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.”<sup>3</sup>

Shared identity. We measured shared identity using two measures. The first refers to common identity. It was measured by a single 7 point Likert scale, anchored by 1 = Strongly disagree to 7 = Strongly agree: “I feel like I’m part of the same team as my co-workers.” The second measure was common vision. It was the mean of three 7 point Likert items, anchored by 1 = Strongly disagree to 7 = Strongly agree ( $\alpha = .77$ ): “Plans for future action are clearly formed;” “There is disagreement about task priorities” [reverse scored]; and “When work is assigned, everyone is clear about his or her task.”

Familiarity. We used a dummy variable (1=once or more, 0=never) to indicate the frequency of travel to the opposite site during the six month period prior to the questionnaire administration.

Communication. We measured work-related communication as the mean frequency of interaction with co-workers, as reported via a ten person name generator (anchored by 1 = once a year or less to 7 = more than daily). We measured non-work communication with a 7 point Likert scale, anchored by 1 = Strongly disagree to 7 = Strongly agree: “I discuss non-work related matters with my co-worker.”

Location. To control for unmeasured variation due to differences between the two sites (e.g., national culture, founding history) we created a dummy variable coded 1 = Germany, and 0 = UK.

Communication media. We measured the frequency of e-mail, phone, voice mail, and conference call communication using four measures. Each measure was a self report of the

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<sup>3</sup> At the beginning of the study we intended to measure emotional trust by a 2-item scale. The second item was “I cannot freely talk with my co-workers about difficulties I’m having at work” [reverse scored] (McAllister 1995). The unexpected response pattern led to some post-survey interviews revealing that a large proportion of the respondents interpreted the question as lack of free speech within the organization. Thus, we decided to drop the item.

frequency of media use, measured on a 7 point Likert scale (anchored by 1 = once a year or less to 7 = more than daily). The phone, voice mail, and conference call measures were averaged to generate a measure for frequency of phone-based communication.

#### Data analysis

Differences in perceptions of trust toward local versus distant workers were analyzed with two sample t-tests. Predictive models for trust in long distance relationships were analyzed using multiple regression techniques.

### Results

#### A comparison of local versus long distance trust

While we recognize 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 that the questionnaire items tapped into relevant issues. In particular, pilot testing helped to phrase questions in a way that workers could easily and unambiguously interpret them. Figure 1 indicates the mean levels of trust, comparing trust toward local workers with trust toward distant workers. In terms of emotional trust, respondents reported higher levels of trust toward local workers ( $M_L = 6.04$  vs.  $M_D = 5.26$ ,  $t(72) = 6.13$ ,  $p < .01$ ). This result supported Hypothesis 1. In terms of cognitive trust, there was no difference in reported levels of trust ( $M_L = 4.80$  vs.  $M_D = 4.63$ ,  $t(72) = 1.39$ ,  $p = .17$ ). This result supported Hypothesis 2. These findings reinforce the idea that emotional trust is at greater risk in long distance relationships and justifies further exploration of factors that encourage and discourage emotional trust in long distance relationships.

#### Predictors of emotional trust in long distance relationships

Table 1 summarizes the Pearson correlation coefficients for the bivariate relationships among the hypothesized predictors, controls, and dependent variables. Specifically, note that

reports of emotional trust in long distance relationships were positively related to: a) visiting the opposite site ( $r = .37, p < .01$ ); b) group identity ( $r = .54, p < .01$ ); and c) non-work related communication ( $r = .51, p < .01$ ). Based on these results we proceeded to explore the simultaneous effect of these variables on emotional trust.

Table 2 presents the results of the regression analysis for emotional trust in long distance relationships. Moving across the table, the columns represent increasingly complete models, concluding with the best-fit model. In the full model (model 4, adjusted  $R^2 = .40$ ,  $F(6, 72) = 9.05, p < .01$ ), each of the predicted factors made a significant contribution. First, there was a positive relationship between visiting the opposite site and emotional trust ( $\beta_{VISIT} = .45, t(72) = 1.83, p = .07$ ). Second, there was a positive relationship between group identity and emotional trust ( $\beta_{IDENTITY} = .36, t(72) = 3.80, p < .01$ ). And finally, there was a positive relationship between non-work communication and emotional trust ( $\beta_{NON-WORK} = .19, t(72) = 2.56, p = .01$ ). In addition, results suggested that non work-related communication mediated the effect of familiarity on emotional trust. In fact, the impact of familiarity on trust was reduced to one half when non work-related communication was introduced in the model (model 2 vs. model 5). Familiarity was highly correlated with non work-related communication (see Table 1). Thus, non work-related communication satisfied the criteria for a variable that statistically mediates the effect of an independent variable on a dependent variable (Baron and Kenney 1986). The same relationship did not hold for the relationship between familiarity and shared identity (see Figure 2).

#### Non-work communication in long distance relationships

The influence of non-work communication on emotional trust in long distance relationships piqued our interest. Therefore, we ran further analyses to identify what factors were associated with non-work communication with distant workers. We regressed non work-related communication against work-related communication occurring, respectively, by

e-mail and by phone-based media<sup>4</sup>. We controlled for familiarity with the remote site. Table 3 presents the results of this analysis. The model (Adjusted R<sup>2</sup> = .219, F (3, 54) = 6.05, p < .01), shows a strong positive relationship between phone-based communication —although this was communication for work-related purposes— and non-work communication ( $\beta_{\text{VOICE}} = .54$ ,  $t(53) = 2.37$ ,  $p < .05$ ). Also, results indicated a positive relationship between familiarity and non work-related communication ( $\beta_{\text{VISIT}} = .92$ ,  $t(53) = 1.99$ ,  $p = .052$ ). Familiarity was positively associated with phone-based communication ( $r = .291$ ,  $p < .05$ ). When phone-based communication was added to the regression, it reduced the effect of familiarity. Hence, phone-based communication could be a mediating factor, essential for the maintenance of non work-related communication (see Figure 3).

#### Discussion

This study offers a number of contributions to our understanding of trust, both in the case of geographically distributed work and more generally. 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. Third, with respect to non-work communication, we found that phone-based interaction had a significant positive relationship, while email-based interaction was not significantly related. Finally, we showed that interpersonal factors, such as trust, played a role in the performance of complex cognitive tasks – such as software development – even when these tasks were governed by a highly structured work process. The discussion that follows focuses on specific implications of these results in terms of understanding the role of trust in cognitively intensive group work, general recommendations

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<sup>4</sup> Phone-based work-related communication is measured as the average use of phone, voice-mail and teleconference for work-related purposes. The sample size is smaller than in the previous regression ( $n = 53$ ) because of missing data on communication media. To guarantee the comparability of results between regression models we repeated the regression of table 2 on the sub-sample. Results did not change.

for enhancing trust in geographically distributed teams, and prospects for improving trust formation and maintenance via specific interventions.

Trust in cognitively intense group work. Software development is a good proxy for a broader class of group activities that share high levels of complexity and correspondingly high demands for coordination (other tasks with these characteristics might be automobile design and manufacturing, aircraft design and manufacture and so forth). Within such activities, the final product is often the combination of outputs from multiple sub-processes, which are brought together through an overarching integration plan. For example, these plans can specify actions to a very fine level. In practice, such plans are more like idealized conceptions of how things should work rather than precise descriptions of the way work is actually accomplished. In particular, uncontrolled contingencies, such as delays in the delivery of critical parts, staff turnover, or changing customer requirements can cause alterations. These deviations from the expected flow of events are occasions for potential conflicts and breakdowns.

Yet the number of actual breakdowns is much less than it could be, largely because workers elaborate workarounds to successfully resolve differences, and therefore keep their efforts directed toward achievement of the larger goal (e.g., completing the software system, the car design, or the aircraft design). In particular, studies of software developers point to the enormous significance of informal and spontaneous communication as a mechanism for identifying and resolving problems (e.g., Herbsleb and Grinter 1999). Underlying the success of these informal interactions, we believe, is the establishment and maintenance of sufficient levels of trust, such that workers are comfortable raising problems to colleagues and soliciting help to resolve these problems. Specifically, high levels of trust can produce more charitable interpretations of others' behavior, which in turn provides a vital opening for building collaborative solutions – rather than an opportunity for antagonistic attributions. Yet, despite

the apparent importance of trust formation and maintenance in ensuring successful performance of cognitively complex group tasks, much of the thinking about the performance of these kinds of tasks continues to emphasize formal plans and procedures. For instance, we feel that efforts to optimize software development through greater attention to process (e.g., Brooks 1974, Curtis, Krasner and Iscoe 1988) underestimate the importance of more organic factors, such as trust, in effective code production.

Recommendations for enhancing trust in geographically distributed teams. This study identifies a number of ways for managers to enhance trust in geographically distributed teams. A first critical focus should be on the role of shared identity. Specifically, in geographically distributed work there should be an attempt to establish super-ordinate identities that extend beyond local boundaries. In particular, working in different locations makes subordinate identities more salient than super-ordinate identities (Alderfer 1987, Friedlander 1987). Each site has its own managers, and develops its own culture, tacit rules, heroes 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. However, super-ordinate identities can emerge, such as one NEG engineer noted in an interview: "I realized we [my remote colleague and I] were part of the same team when, during a meeting, 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'". That is, the discovery that distant workers shared the same level of concern for and commitment to a common destiny created a shared reference, and perhaps generated latitude for more tolerant interpretation of any future site-specific or culturally-specific behaviors. As this story illustrates, however, the realization of mutual goals occurred only after these goals were explicitly identified through a face-to-face conversation.

A second critical focus should be on the role of familiarity. It is interesting to note that in our study it was the simple fact of visiting the opposite site that mattered -- not the frequency or duration of visits. This suggests a powerful effect for seeing counterparts at distant sites. It may be that these visits helped breakdown the invisible co-worker syndrome in long distance collaborations. That is, the tendency for distant colleagues to be out of sight, and therefore out of mind. Anecdotally, NEG workers reported another significant by product of travel. Those who had been to the opposite site became unofficial guides to resources there. As guides, they could interpret behavior at the opposite site as well. A variation of this benefit is the practice in some parts of NEG of sending local representatives (i.e., liaison managers) to distant sites in advance of conference calls or videoconference meetings. In this way, the travelling local person can translate (both literally in some cases, and metaphorically) what is going on back at the home site for the local audience.

A third critical focus should be on the role of non-work communication (see also Kraut et al., 1990). Non work- communication presumably encompasses a broad range of interactions, from simple greetings to deep conversations. The present study did not distinguish between these extremes. But, the results show the general importance of non-work communication for building emotional trust, and suggest that barriers to non work-related communication may impede emotional trust in long distance relationships. 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.

Interventions to improve trust formation and maintenance at a distance. A common thread across each of the managerial recommendations in the previous section is the heavy dependence on opportunities for face-to-face interaction. Technical and non-technical solutions could potentially reduce this dependence. On the technical side, the positive correlation between phone use and frequency of long distance non-work communication suggests that technologies that incorporate features of phone conversations, or are generally richer media in terms of immediacy of feedback and available channels for interpreting communication cues (Daft and Lengel 1984, 1986), may perform more effectively in terms of fostering emotional trust. In terms of generating super-ordinate identity, organizations could exploit Web-based solutions -- such as the Web “newspaper” application used at Apple’s Advanced Technology Group, where people could post news items to a group Web page viewable from desktops and from various public locations, such as lounges (Houde, Bellamy and Leahy 1998). On the non-technical side, this study provides a clear argument for the benefits associated with visiting distant sites. Despite the expense, managers should allocate resources to let their employees travel to relevant distant sites early in the history of joint projects. This travel provides the face to face contact necessary to establish common ground, or “meetings of the mind,” that might otherwise be diminished by distance.

#### Future research

While the present study makes contributions to our understanding of trust in geographically distributed teams, there are important limitations, which should be addressed in future work. Most significantly, the idiosyncratic nature of NEG may diminish the external validity of this study. That is, perceptions of trust might have been confounded by the differences between the two focal sites in England and in Germany. While we made an

attempt to control for these differences, particularly with the dummy variable for location, the possibility exists that something unique to the NEG situation explains the trust findings. To dispel this concern we are continuing to collect data within NEG (which may have the benefit of counteracting maturation effects associated with the different founding times of the two sites). However, even further data collection at NEG does not resolve the possible confounding effects of Lucent-specific issues. The only way to counteract these factors would be via data collection in other organizations. Replications of this study should include richer measures of trust (e.g., more extensive scales) that could not be used in the study due to concerns about demands on respondents' time and attention. Also, 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, reputation of team members, incentives and monitoring systems (Kollock 1998). Another important addition in future studies should be linking measures of trust with measures of team or organizational performance (e.g., productivity, innovation, employee morale).

Ethnographic studies would complement findings of the survey addressing questions about the behavior of geographically distributed teams. For instance, it would be important to untangle the specific aspects of non work-related communication that are supportive of trust. What kind of non work-communication matters? How often? When does it occur? It would also be important to explore the extent to which these functions can or cannot occur in distributed settings. For example, the development of tools for richer social interactions at a distance (e.g., the virtual jazz club, Boyer, Cortes, Vernick, Wilbur, Khan and Balfour 1999) is another topic for further work. However, such efforts to produce virtual spaces must clarify the impediments to virtual socialization. For instance, when distance implies different time zones, people in one site might be more likely to socialize (for instance after lunch) but their

remote colleagues could be almost ready to leave to go home or may have just arrived in the office.

Another topic for future research regards the investigation of different blends of face-to-face and electronic communication to enforce trust. The present research provides evidence that phone-based communication was more strongly associated with non-work communication than text-based communication. Given the wide availability of communication technologies, future experiments should test hypotheses about the following issues. How do different mixes of face-to-face and mediated communication (e.g., videoconferencing, telephone) support trust? What is the optimal sequence of face-to-face and electronic communication to maintain trust? Should communication occur in a one to one or in a group context? For example, in a recent study of e-mail based negotiation, the possibility to build rapport and positive affect through a social conversation by email prior to the negotiation led to lower levels of impasse (Moore, Kurtzberg, Thompson and Morris 1999). Addressing these questions will help in the management of geographically distributed teams as well as in the definition of communication principles for such teams.

A final comment about future avenues for research regards the research methodology. This study used a Web-based questionnaire. The high response rate we achieved endorses the use of the Web for collecting data in future research involving geographically distributed environments. However, it should be noted that the respondents were software engineers with a potentially higher facility and higher interest in Web applications than might be typical in non-engineering settings. An elaboration on Web-based surveying might be Web-based interviewing (either guided or self-guided), or Web-based experiments.

### Conclusion

This study highlighted a number of findings that improve our understanding of trust in geographically distributed teams. The first conclusion is that emotional trust was significantly

lower in long distance working relationships compared with local relationships. By contrast, cognitive trust was not as affected by the lack of physical proximity. The implication of this finding is that long distance working relationships cannot benefit as easily from “by-products” of emotional trust, such as sensitivity and support for personal and work-related needs, as well as reinforcement in face of adversity. The second conclusion of the study is that familiarity with remote sites, group identity and non work-related communication were positively related to emotional trust of distant co-workers. These results should inform the definition of practical recommendations for enhancing trust in geographically distributed teams, such as increased travel early in the history of projects. The third conclusion regards the role of different communication media on non work-related communication. Phone-based communication turned out to have a strong positive relation with non work-related communication. If non work-related interaction is a critical component of trust, communication tools based on voice rather than text are more likely to allow individuals to perceive higher trustworthiness.

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TABLE 1  
Correlation coefficients for independent, control, and dependent variables (n=73)

	Mean	S.D.	N	1a.	1b.	2a.	2b.	3.	4
1a. Emotional trust – Local	6.04	.73	73						
1b. Emotional trust – Distant	5.26	1.20	73	.460**					
2a. Cognitive trust – Local	4.80	1.29	73	.169	.060				
2b. Cognitive trust – Distant	4.63	1.36	73	.210	.187	.666**			
3. National Location	.53	.50	73	-.218	-.200	-.177	-.283*		
4. Visit the other site	.52	.50	73	.170	.370**	-.087	.084	-.295*	
5a. Work-related communication –Local	5.08	1.09	73	.092	.201	.150	.153	-.055	.121
5b. Work-related communication – Distant	4.40	1.57	73	.167	.202	.180	.288*	-.395**	.176
6a. Non-work related communication – Local	5.56	1.19	73	.591**	.322**	.260*	.288*	-.446**	.200
6b. Non-work related communication – Distant	3.78	1.77	73	.193	.506**	.000	.036	-.222	.417**
7a. Group identity – Local	6.12	.72	73	.329**	.074	.063	.075	-.155	.050
7b. Group identity – Distant	4.97	1.42	73	.082	.541**	-.067	.130	-.038	.117
8a. Common Vision – Local	4.40	1.10	73	.260*	.085	.109	-.043	+.090	-.102
8b. Common Vision – Distant	4.15	1.05	73	.045	.250*	-.028	.129	-.004	.004

Note. \* denotes  $p < .05$

\*\* denotes  $p < .01$

	5a.	5b.	6a.	6b.	7a.	7b.	8a.	8b.
1a. Emotional trust – Local								
1b. Emotional trust – Distant								
2a. Cognitive trust – Local								
2b. Cognitive trust – Distant								
3. National Location								
4. Visit the other site								
5a. Work-related communication –Local								
5b. Work-related communication – Distant	.272*							
6a. Non-work related communication – Local	.131	.351**						
6b. Non-work related communication– Distant	.116	.292*	.291*					
7a. Group identity – Local	.013	.155	.170	-.075				
7b. Group identity – Distant	.150	.260*	.162	.083	.193			
8a. Common Vision – Local	.352**	-.004	.131	.122	.274*	.267*		
8b. Common Vision – Distant	.011	.343**	-.030	.108	.087	.457**	.633**	

Note. \* denotes  $p < .05$

\*\* denotes  $p < .01$

TABLE 2  
Regression models for emotional trust in long distance relationships (n=73)

Measures	Models				
	1	2	3	4	5
National location	-481 (-.200)	-240 (-.100)	-.103 (-.043)	-.218 (-.091)	
Visit the remote site		.813** (.340)	.429 (.179)	.450 (.188)	.490* (.205)
Work-related communication			.028 (.033)	-.052 (-.060)	
Non work-related communication			.279** (.412)	.188* (.277)	.187** (.275)
Group identity				.356** (.422)	.357* (.422)
Common vision				.035 (.031)	
Constant	5.531**	4.497**	3.946**	2.692**	2.527**
$R^2$	.040	.146	.405	.451	.444
Adjusted $R^2$	.027	.121	.360	.402	.419
F	2.962	5.966**	9.115**	9.054**	18.333**
Df	1,72	2,72	4,72	6,72	3,72

Note. Non-standardized and standardized regression (in parenthesis) coefficients.

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

TABLE 3

Regression models for non-work communication in long distance relationships (n=54)

Measures	Models	
	1	2
Visit the remote site	1.340** (.365)	.924 (.252)
Frequency of work-related e-mail communication		-.086 (-.058)
Frequency of work-related phone-based communication		.544 * (.415)
Constant	3.026	1.354
<u>R</u> <sup>2</sup>	.133	.263
Adjusted <u>R</u> <sup>2</sup>	.117	.219
<u>F</u>	8.165**	6.053**
<u>Df</u>	1,54	3,54

Note. Non-standardized and standardized regression (in parenthesis) coefficients.

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

FIGURE 1

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

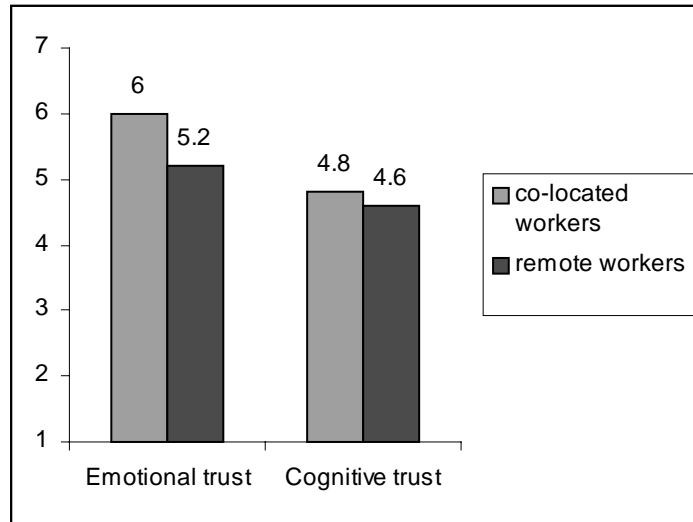


FIGURE 2

A model of emotional trust in distant working relationships.

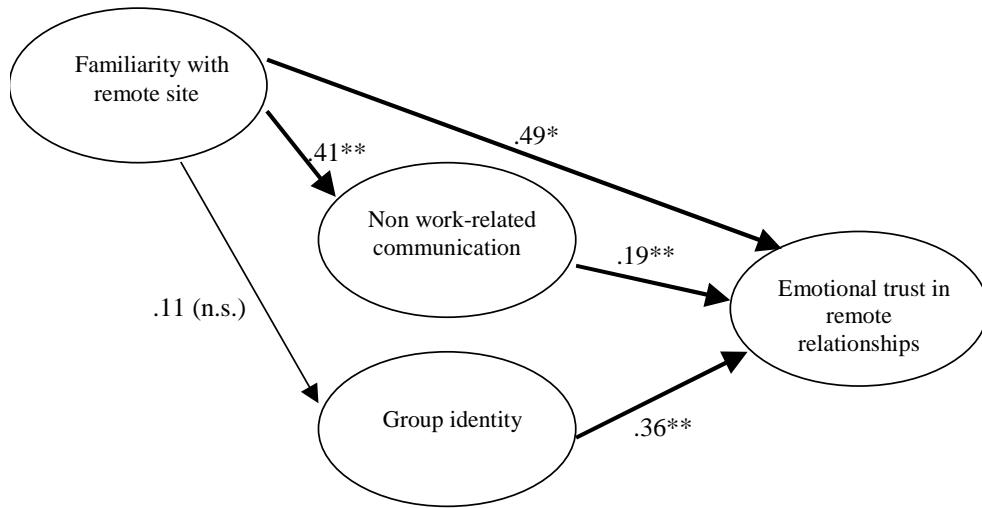


FIGURE 3

Impact of media on non work-related communication.

