Communication and Trust in Global Virtual Teams

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Abstract

This paper explores the challenges of creating and maintaining trust in a global virtual team whose members transcend time, space, and culture. The challenges are highlighted by integrating recent literature on work teams, computer-mediated communication groups, cross-cultural communication, and interpersonal and organizational trust. To explore these challenges empirically, we report on a series of descriptive case studies on global virtual teams whose members were separated by location and culture, were challenged by a common collaborative project, and for whom the only economically and practically viable communication medium was asynchronous and synchronous computer-mediated communication. The results suggest that global virtual teams may experience a form of "swift" trust, but such trust appears to be very fragile and temporal. The study raises a number of issues to be explored and debated by future research. Pragmatically, the study describes communication behaviors that might facilitate trust in global virtual teams.

(*Global Virtual Teams*; *Virtual Teams*; *Global Teams*; *Virtual Organizations*; *Trust*; *Swift Trust*; *Computer-Mediated Communication*; *Group Development*)

Introduction

> . . . you cannot build network organizations on electronic networks alone. . . . If so, . . . we will probably need an entirely new sociology of organizations.
>
> Nohria and Eccles, 1992, pp. 304–305.

Contrary to Nohria and Eccles's assertion, organizations are in fact forming virtual project teams that interact primarily via electronic networks (Grenier and Metes 1995, Lipnack and Stamps 1997). VeriFone, a multinational company, is reported to rely on teams that interact electronically to run its everyday business. Company management, including its top executives, are distributed geographically (Stoddard and Donnellon 1997). Microsoft uses virtual teams to support major global corporate customer sales and postsales services, as do other organizations that service global clients with interdependent customer needs crossing country boundaries (Jarvenpaa et al. 1995).

A virtual team is an evolutionary form of a network organization (Miles and Snow 1986) enabled by advances in information and communication technology (Davidow and Malone 1992, Jarvenpaa and Ives 1994). The concept of virtual implies permeable interfaces and boundaries; project teams that rapidly form, reorganize, and dissolve when the needs of a dynamic marketplace change; and individuals with differing competencies who are located across time, space, and cultures (Mowshowitz 1997, Kristof et al. 1995). As companies expand globally, face increasing time compression in product development, and use more foreign-based subcontracting labor, (Peters 1992, Stewart 1994), virtual teams promise the flexibility, responsiveness, lower costs, and improved resource utilization necessary to meet ever-changing task requirements in highly turbulent and dynamic global business environments (Mowshowitz 1997, Snow et al. 1996).

While the promises are laudable, a dark side to the new form also exists: such dysfunctions as low individual commitment, role overload, role ambiguity, absenteeism, and social loafing may be exaggerated in a virtual context (O'Hara-Devereaux and Johansen 1994). Moreover, customers might perceive a lack of permanency, reliability, and consistency in virtual forms (Mowshowitz 1997). Recommending only limited use of the virtual setting in global teams, some inculcate initial lengthy face-to-face gatherings with repeated same-time and same-place encounters interspersed throughout the project (De Meyer 1991). Handy (1995) questions whether virtual teams can even function effectively in the absence of frequent face-to-face interaction.

The heart of Handy's argument centers on trust and a belief that "trust needs touch" (p. 46). Paradoxically though, only trust can prevent the geographical and organizational distances of global team members from becoming psychological distances (O'Hara-Devereaux and

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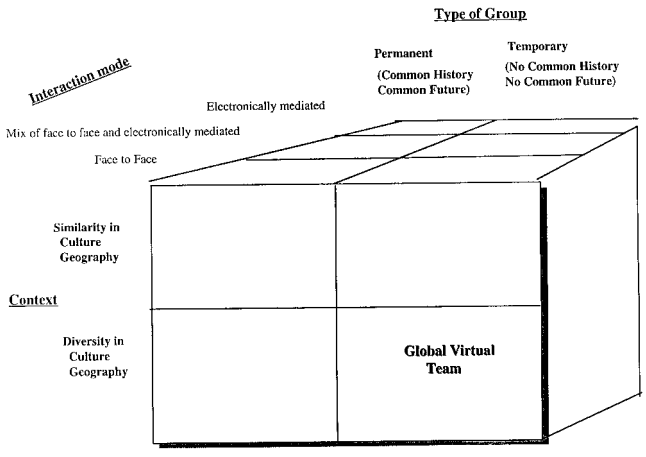
Johansen 1994): trust allows people to take part in risky activities that they cannot control or monitor and yet where they may be disappointed by the actions of others (Deutch 1958, Luhmann 1988, Lewis and Weigert 1985, Bradach and Eccles 1989, Gambetta 1988).

This paper reports an exploratory study that examined trust in teams that relied on virtual interaction only, unconfounded by any influences of face-to-face interaction. The study was guided by three questions. First, can trust exist in global virtual teams where the team members do not share any past, or have any expectation of future, interaction? Second, how might trust be developed in such teams? Third, what communication behaviors may facilitate the development of trust? The global virtual teams had members who (1) were physically located in different countries, (2) interacted through the use of computer-mediated communication technologies (electronic mail, chat rooms, etc.), and (3) had no prior history of working together. The next section of the paper will review relevant literature. The third section presents the methodology. The fourth section reports the analyses. The fifth section presents a discussion of the results, and the sixth section concludes the paper.

Conceptual Foundations

Following Kristof et al. (1995), we define a global virtual team to be a temporary, culturally diverse, geographically dispersed, electronically communicating work group (Figure 1). The notion of temporary in the definition describes teams whose members may have never worked together before and who may not expect to work together again as a group (Lipnack and Stamps 1997, Jarvenpaa and Ives 1994). The characterization of virtual teams as global implies culturally diverse and globally spanning members who can think and act in concert with the diversity of the global environment (Jackson et al. 1995, DeSanctis and Poole 1997). Finally, it is a heavy reliance on computer-mediated communication technology that allows members separated by time and space to engage in collaborative work.

Figure 1 Definition: Global Virtual Team



Trust in Teams

Can trust exist in global virtual teams? Noting the lack of shared social context in such teams, much of the theoretical and empirical literature on interpersonal and organizational trust would suggest a negative response to this question.

Cummings and Bromiley (1996) maintain that a person trusts a group when that person believes that the group "(a) makes a good-faith effort to behave in accordance with any commitments both explicit or implicit, (b) is honest in whatever negotiations preceded such commitments, and (c) does not take excessive advantage of another even when the opportunity is available" (p. 303). Several factors, such as shared social norms, repeated interactions, and shared experiences, have been suggested to facilitate the development of trust (Bradach and Eccles 1988, Mayer et al. 1995, Lewis and Weigert 1985). Another factor asserted to promote trust and cooperation is the anticipation of future association (Powell 1990). Such anticipation of future association is higher among group members who are collocated than among physically dispersed members. Colocation, or physical proximity more generally, is said to reinforce social similarity, shared values, and expectations, and to increase the immediacy of threats from failing to meet commitments (Latane et al. 1995). Furthermore, face-to-face encounters are considered irreplaceable for both building trust and repairing shattered trust (Nohria and Eccles 1992, O'Hara-Devereaux and Johansen 1994).

Developmental View

Yet, trust is pivotal in a global virtual team to reduce the high levels of uncertainty endemic to the global and technologically based environment. How might trust be developed in such teams?

The developmental views of trust are closely intertwined with the relationship development processes (Lewicki and Bunker 1995). McGrath's (1991) Time, Interaction, and Performance (TIP) theory describes work groups as time-based, multifunctional, and multimodal social systems. Effective groups are engaged simultaneously and continuously in three functions: (1) production (problem solving and task performance), (2) member support (member inclusion, participation, loyalty, commitment), and (3) group well-being (interaction, member

roles, power, politics). Member support and group well-being relate directly to relationship development. Teams carry out the three functions by means of activities that relate to four possible modes: (Mode 1) inception and acceptance of a project, (Mode 2) problem solving, (Mode 3) conflict resolution, and (Mode 4) project execution. The modes/functions are not a fixed sequence of phases, but rather are dependent on the team, tasks, technology, time, and other environmental contingencies (McGrath and Hollingshead 1994). McGrath's TIP theory (1991) suggests that a team with no past history that is working on a challenging problem with much technological and environmental uncertainty (such as a global virtual team) will have to engage in all four functions and modes to avoid detrimental effects on performance. Yet, at the same time, because the technological environment may constrain and limit the group's functions and modes (McGrath 1990, Warkentin et al. 1997), the development of trust may be inhibited.

The media richness (e.g., Daft et al. 1987) and social presence theories (e.g., Short et al. 1976) also question the possibility of relationship development, and subsequent trust development, in virtual teams. These theories suggest that computer-based communication media may eliminate the type of communication cues that individuals use to convey trust, warmth, attentiveness, and other interpersonal affections. However, contrary to the theories, empirical studies have found relational information sharing in computer-mediated teams (Walther 1992, 1994, 1995, 1997; Adler 1995; and Chidambaram 1996). According to Walther's social information processing theory (1996, 1997), computer-mediated communication does not differ from face-to-face communication in terms of the capability of social information exchange, but rather in terms of a slower rate of transfer. Others studies have concurred that communication is more a function of the context, setting, and timing than the characteristics of the media (Zack 1993, Markus 1994, Parks and Floyd 1996, Ngwenyama and Lee 1997).

Walther found that social discussion, depth, and intimacy were greater in computer-mediated communication groups than in face-to-face groups, even for groups with geographically dispersed and culturally diverse partners who had never met face-to-face (Walther 1995, 1997). Building on the Social Identification/Deindividuation theory (SIDE) (Lea and Spears 1992, Lea et al. 1992), Walther (1997) developed a hyperpersonal model to explain his results. The SIDE theory argues that people categorize themselves as either part of the in-group or out-group based on the characteristics of others in the group (Deaux 1996, Francis 1991, Turner et al. 1983). Similarity with others positively reinforces members' own identities and contributes to their willingness to cooperate. The SIDE theory suggests that in the absence of individuating cues about others, as is the case in computer-mediated communication, individuals build stereotypical impressions of others based on limited information (Lea and Spears 1992). Walther (1997) acknowledges this tendency to resort to categorical information processing, overattributions on minimal social cues, and idealization of the communication partners in computer-mediated communication groups, but also predicts that the effects from deindividualization should decrease in the face of information on individual differences, particularly if the team has diverse membership. Yet, the greater the team member diversity, the more time will be required for team members to form strong bonds (DeSanctis and Poole 1997). Moreover, some teams may develop strong bonds and trust despite heterogeneity and short time spans, whereas others may not (DeSanctis and Poole 1994, Poole and DeSanctis 1992). Thus, the third question we will explore is what communication behaviors enable trust to be established.

Cross-Cultural Communication

The global nature of virtual teams merits a discussion of possible cross-cultural differences in communication behaviors. While there is a wealth of research on computer-mediated communication and on cross-cultural communication, there is a paucity of research on cross-cultural computer-mediated communication. As part of the third research question, we will consider the possible influence of cultural differences on the communication behaviors of global virtual team members.

Individuals from different cultures vary in terms of their communication and group behaviors, including the motivation to seek and disclose individuating information and the need to engage in self-categorization (Gudykunst 1997). One major dimension of cultural variability is individualism-collectivism (Hofstede 1980). In individualistic cultures, the needs, values, and goals of the individual take precedence over the needs, values, and goals of the in-group. In collectivist cultures, the needs, values, and goals of the in-group take precedence over the needs, values, and goals of the individual (Gudykunst 1997, Hofstede 1980). The research suggests that individuals from individualistic cultures tend to be less concerned with self-categorizing, are less influenced by group membership, have greater skills in entering and leaving new groups, and engage in more open and precise communication than individuals from collectivist cultures (Hofstede 1980, 1991; Hall 1976). In addition, the willingness to respond to ambiguous messages, interpreted

by Pearce (1974) to be a trusting behavior, has been shown to be higher among members of individualistic cultures than among members of collectivist cultures (Gudykunst et al. 1996). These findings suggest that individuals from individualistic cultures might be more ready to trust others than individuals from collectivist cultures in computer-mediated communication environments.

Finally, previous cultural exposure is an important factor influencing communication behavior (Wiseman et al. 1989). People with high confidence in their knowledge of other cultures tend to be more willing to explore cultural topics. This might suggest that people who are more culturally experienced might seek and disclose individuating information more than those who are less culturally experienced. The social dialog in turn might help develop trust on the team, at least in the eyes of the culturally experienced person.

Swift Trust in Temporary Teams

The theory of swift trust suggests that the research questions of whether trust is possible and how it might be developed via communication behavior may be the wrong questions to ask. The more appropriate questions might be: from where is trust imported to the global virtual team and how is trust maintained via electronic communication?

Meyerson et al. (1996) developed the concept of "swift" trust for temporary teams whose existence, like those of global virtual teams, is formed around a common task with a finite life span. Such teams consist of members with diverse skills, a limited history of working together, and little prospect of working together again in the future. The tight deadlines under which these teams work leave little time for relationship building. Because the time pressure hinders the ability of team members to develop expectations of others based on firsthand information, members import expectations of trust from other settings with which they are familiar. Analogous to the SIDE and hyperpersonal model, individuals in temporary groups make initial use of category-driven information processing to form stereotypical impressions of others.

After the team has begun to interact, trust is maintained by a "highly active, proactive, enthusiastic, generative style of action" (Meyerson et al. 1996, p. 180). High levels of action have also been shown to be associated with high-performing teams (Iacono and Weisband 1997). Action strengthens trust in a self-fulfilling fashion: action will maintain members' confidence that the team is able to manage the uncertainty, risk, and points of vulnerability, yet the conveyance of action has as a requisite the communication of individual activities. In summary, whereas traditional conceptualizations of trust are based strongly on interpersonal relationships, swift trust deemphasizes the interpersonal dimensions and is based initially on broad categorical social structures and later on action. Because members initially import trust rather than develop trust, trust might attain its zenith at the project's inception (Meyerson et al. 1996).

Developed to explain behavior in temporary teams such as film crews, theater and architectural groups, presidential commissions, senate select committees, and cockpit crews (Meyerson et al. 1996), the theory of swift trust assumes clear role divisions among members who have well-defined specialties. Inconsistent role behavior and "blurring" of roles erode trust. Moreover, the theory seems to presuppose that participants come from many different organizations, have periodic face-to-face meetings, and report to a single individual. By contrast, in global virtual teams, members remain in different locations and often are accountable to different individuals. Such teams are assembled less on the basis of members' specific roles and more on their knowledge differences, partially related to the geographic location of the individual who provides the team with greater knowledge of that environment. These differences may have significant implications for swift trust. In the temporary teams described by Meyerson et al. (1996), what is at stake are the professional reputations of members, the reputations of the persons to whom the team members report, impending threats from closely knit social and professional groups to which members and the supervisor belong, and perceived interdependence among the team members. In global virtual teams, the reputational and professional network effects may be weak because of less clearly defined and bounded professional networks and less emphasis on roles.

Methods

The case study method was chosen to enable us to capture the social context and dynamics of global virtual teams in order to explore what communication behaviors appeared to facilitate trust in global virtual teams. Data for the cases was generated from electronic mail archives and questionnaires.

The global virtual teams were organized via a collaboration of professors of information systems from graduate business programs around the world. Three hundred and fifty master's students from 28 universities participated in a global virtual collaboration organized over a period of six weeks during the spring semester of 1996. Every continent was involved except Antarctica. The students' learning objectives were to experience collaboration with

others in a virtual setting and to obtain international exposure by working with people from different countries. Participants were recruited through contacts with professors who had participated in previous collaborations (see Knoll and Jarvenpaa 1995). The letter soliciting participation explicitly stated that one of the conditions for participation included having the exercise comprise at least 20% of the students' course grade. To further motivate the students' participation, the professors were provided with reports on their students' levels of activity after the second and fourth weeks. Additionally, a monetary reward ($600) and industry publicity were promised for the highest performing team.

The students were assigned to teams of four to six people in such a manner that each member on a team resided in a different country. The students from a given university were assigned to teams based on the order that their names appeared on their professor's list. The teams were self-managing and were charged with completing three tasks: two voluntary assignments lasting one week each and a final project lasting four weeks. The students' course grade as well as the $600 reward were based solely on the successful completion of the final project. The students were also told that each team member would evaluate the others' contributions at the end of the final project and that this information would be shared with their professors.

Assignments

The first two voluntary assignments were designed to encourage the participants to exchange information about themselves and gain experience with the World Wide Web (WWW) technology platform. The first assignment asked the participants to send a description of themselves to their team members. The second required each team member to locate one website that they felt was relevant to business persons with information systems (IS) responsibilities and provide a paragraph explaining the relevance of the site.

The third assignment—the final project—required the teams to propose and develop a WWW site providing a new service or offering to IS World Net that would be of interest to IS practitioners in all the countries in which the members of a particular team resided. The proposal was to be a three- to five-page justification of the site. (IS World Net is an electronic community, comprised of IS practitioners and academicians around the world, that communicates and disseminates information via the Internet and newsgroups). The students were told that all team members were to submit the same final deliverable to their professors and the team deliverable was to represent the collective efforts of the group. The final assignment was expected to take about 20–30 hours of each student's time over the four-week period.

Technology

The host institution established a WWW site on the Internet (http://uts.cc.utexas.edu/~bgac313/index.html). The purpose of this central repository of information was to ensure that all students had access to the same information at the same time. Students communicated solely through electronic means. Electronic mail reached the individual team members via a "team address." Occasionally students used the reply function to respond to messages sent by individuals, thereby communicating with that individual alone.

Data Collection and Survey Analyses

Data for the research was provided by the team members' e-mail message archives, by the members' responses to the demographic questions in the first exercise, and by the members' responses to two questionnaires. Students were notified at the start of the exercise that all e-mail messages sent to the "team address" were archived. Team members were sent an electronic survey to complete immediately following the deadline for the second voluntary exercise (Time 1). The survey was designed to assess the level of trust in the team. The survey also contained questions designed to assess various antecedents of trust as described in Jarvenpaa et al. (1998). A second survey identical to the first, but with some additional questions related to outcomes of trust, was sent to the team members a day following the deadline for the completed final project (Time 2). The students were not required to complete the surveys and were not prodded to do so by their respective professors. Repeated questionnaire reminders were perceived to violate the goal of maintaining a realistic project atmosphere.

Measurement

Two separate measures were used to ascertain the level of trust on the team. One measure was a modified five-point scale version of Schoorman et al.'s instrument (1996) based on Mayer et al.'s (1995) overall conceptualization of trust; the other was a modified five-point scale measure of trustworthiness from Pearce et al. (1992). Both instruments were modified to reflect the team, rather than the original dyad, as the unit of analysis. These measures capture a general construct of trust. Since the purpose of the study was to explore the nature of trust in virtual teams, it was important to have an independently developed and validated measure of trust.

Data on culture was obtained from responses to the first team exercise. For all students who provided their birthplaces, the information was coded according to Hofstede's (1980) classification of countries as having individualistic or collectivist cultures as follows: students were considered as coming from an individualistic culture

if they were born and reared in Australia, Austria, Canada (excluding Quebec), Denmark, Finland, Germany, Great Britain, Ireland, New Zealand, Norway, Switzerland, or the United States. Individuals were coded as coming from a collectivist culture if they reported being born in Brazil, Catalonia, China, France, India, Indonesia, Italy, Macedonia, Pakistan, Philippines, Quebec, Singapore, Spain, or Vietnam.

Data on international experience was also obtained from the responses to the first exercise. Students who spoke only one language and reported not having traveled or lived in another country, and were not married to someone from another country, were coded as having no prior international experience. Students who reported speaking a second language or who had traveled to other countries were coded as having moderate international experience. Students who had lived in a foreign country for at least one year or who were married to someone from a country different from their own were coded as having extensive international experience.

Statistical Analyses

Before selecting teams for case analysis, a standard item reliability test was performed to determine the items that contributed to the reliability of the trust measures. Because, as mentioned, there were many questions on the surveys designed to assess variables other than the two trust measures of interest in the current paper, a factor analysis was performed before the reliability tests to ensure that the trust measures were unique constructs. The two trust measures did form two separate constructs, although a few items that did not have a loading of greater than 0.4 on the proper construct were eliminated. Following the factor analysis, the reliability analysis was conducted with the remaining items for the two measures of trust.

To determine if there were differences in perceptions of trust related to culture at Time 1 or Time 2, t-tests were conducted. Also, to determine if the individuals with little versus extreme prior international exposure perceived different levels of team trust at Time 1 or Time 2, t-tests were conducted. The above tests were conducted at the individual level of analysis.

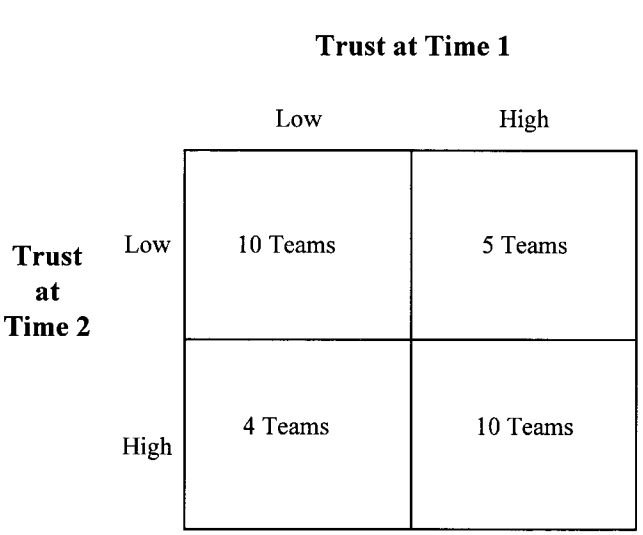
Next, the responses of the members of each team were averaged to form a team measure of trust. All remaining statistical tests were done at the team level. First, a test for nonresponse bias was performed. Then, after having selected only those teams with more than two respondents on both surveys, we performed a paired t-test to determine if trust changed significantly from Time 1 to Time 2. Lastly, after having selected the 12 teams for case analysis, we performed t-tests of trust at Time 1 and Time 2 on each team, computed within each team the interrater reliability of the team members' perceptions of trust, and computed the descriptive statistics for the 12 cases.

Case Selection and Analysis

Case analysis was used to answer the original research questions. First, can trust exist in global virtual teams? Second, how might trust be developed in such teams? And third, what are the communication behaviors that might facilitate the development of trust? Only teams with more than two respondents on both surveys were included in the sample to be considered for the case analysis. Of the 75 teams, 29 teams had two or more members who completed both the first and the second surveys. The 29 teams were assigned to one of the following categories: (1) lower than the mean trust of the sample at Time 1 and Time 2 (LoLo); (2) lower than the mean trust at Time 1, but higher than the mean trust at Time 2 (LoHi); (3) higher than the mean trust at Time 1, but lower at Time 2 (HiLo); and (4) higher than the mean at Time 1 and Time 2 (HiHi). Of the 29 teams, ten teams fell into the LoLo category, four into the LoHi category, five into the HiLo category, and ten into the HiHi category (see Figure 2). The three most extreme teams in each category were chosen for the in-depth case analyses.

Many different approaches to case research have been advocated, some recommending that researchers go to the field without preconceived notions of research questions, concepts, variables, etc., (Glaser and Strauss 1967) and others recommending predetermined research questions, themes, and data collection plans (Eisenhardt 1989, Miles

Figure 2 **The Change in Team Trust over Time**



and Huberman 1984). We began our analysis with broad research questions, but did not have a set of a priori constructs or a data-coding theme. Because the literature contained no rich descriptions of the form trust might be expected to take in the virtual team context, we felt that it was premature to develop a coding scheme. In summary, our case descriptions were based on naturally occurring communication, and the analysis procedures attempted to preserve the situated context of the teams' communication.

The following process was used in analyzing the data for the cases: first, each team's mail archives were analyzed message by message, noting the date, time, message initiator, and message content in a table. Second, a three- to five-page case write-up was prepared for each team. Next, the cases were condensed into one page each with only the essential facts of each case included. These one-page cases form the basis of the next section. The cases were compared and contrasted with the other cases in their category, resulting in the summaries of each category. Lastly, a comparison of cases across categories was undertaken.

Table 1 **t-Tests of Trust by Degree of International Experience**

	None			Moderate			Extensive		
Level of International Experience	Mean	St. Dev	N	Mean	St. Dev	N	Mean	St. Dev	N
Trust Time 1	3.9	0.43	15	4.1	0.537	23	3.87	0.67	75
Trust Time 2	3.87	0.94	13	4.32	0.685	20	4.04	0.712	67

	t-Tests					
	None vs. Moderate		None vs. Extensive		Moderate vs. Extensive	
Experience	t	p	t	p	t	p
Trust Time 1	−1.16	0.236	0.16	0.831	1.42	0.116
Trust Time 2	−1.52	0.15	−0.76	0.533	1.43	0.157

Results

Preliminary Results of the Statistical Tests

The first survey had a response rate of 47%, and the second a response rate of 61%. Given that most teams had several inactive members, the response rates are reasonable. Inactive members were not expelled from participation as it was felt that coping with them was an important part of the team's experience. The two measures of trust were correlated ($p = 0.019$ at Time 1 and $p = 0.003$ at Time 2) although the Pearce et al. scale had the higher reliability of 0.92, compared to 0.66 for the Mayer scale. We hence used the Pearce et al. modified measure of trust in all further tests. Table 1A in Appendix 1 shows the final items used to measure trust.

There was no significant difference in perceived trust at Time 1 or Time 2 for individuals for individualistic versus collectivist cultures ($t = -0.68$, $p = 0.5$ at Time 1; $t = 0.07$, $p = 0.9$ at Time 2). Nor were there significant differences in perceived trust at Time 1 or Time 2 between any of the levels of international experience (see Table 1). Because of insignificant results on culture and international experience, we did not consider these issues in selecting teams for the case analysis.

To test for nonresponse bias in the whole sample, a t-test was conducted comparing the perceived trust at Time 1 of those teams with at least two respondents at Time 1 but without two respondents at Time 2 ($\bar{X} = 3.93$), versus those teams with at least two respondents at Time 1 and Time 2 ($\bar{X} = 3.76$). Likewise, a t-test was conducted comparing the perceived trust at Time 2 of those teams with at least two respondents at Time 2 but not Time 1 ($\bar{X} = 4.02$), versus those teams with at least two respondents at both time periods ($\bar{X} = 4.03$). There were no significant differences ($t = -1.12$, $p < 0.236$ for the first test; $t = 0.42$, $p < 0.674$ for the second test). Hence, it does not appear that the level of trust biased respondents into responding, or not responding, to the surveys.

A paired-comparison t-test was conducted on the sample of 29 teams to determine if there was an overall significant difference in trust from Time 1 ($\bar{X} = 3.95$) to Time 2 ($\bar{X} = 4.04$). The test was insignificant ($t = -1.35$, $p < 0.188$).

Case Analyses

Of the 12 teams selected for in-depth analysis, only two had less than three respondents to the first survey, and only two had less than three respondents to the second questionnaire (see Table 1). In addition, as seen in Table 2, there was a small variance among the members' ratings of trust, with the exception of Team LoLo2 at Time 1 and Team HiLo1 at Time 2. The interrater reliabilities for each team were computed for trust at Time 1 and Time 2. As seen in Table 2, in 20 of the 24 instances, the reliability is above 0.8.

To verify that there was a significant difference in perceived trust among the teams chosen for the case analyses, t-tests were conducted. The differences in the mean levels of perceived trust varied significantly ($t = -7.78$, $p = 0.000$) for those teams reporting low trust at Time 1 ($\bar{X} = 3.36$) versus those perceiving high trust at Time 1

Table 2 Number of Respondents in the 12 Teams

Team	Trust Time 1 Responses	Mean	St. Dev	Interrater Reliability	Trust Time 2 Responses	Mean	St. Dev	Interrater Reliability
LoLo1	2	3.00	0.57	0.84	2	3.00	0.62	0.81
LoLo2	3	3.33	1.10	0.40	4	3.48	0.88	0.61
LoLo3	3	3.67	0.46	0.89	4	3.75	0.50	0.88
LoHi1	3	3.43	0.42	0.90	3	4.15	0.44	0.90
LoHi2	2	3.40	0.85	0.64	4	4.40	0.49	0.88
LoHi3	3	3.87	0.55	0.85	2	4.10	0.14	0.99
HiLo1	3	4.07	0.12	0.99	4	3.67	1.33	0.12
HiLo2	5	4.25	0.44	0.90	3	3.60	0.57	0.80
HiLo3	4	4.30	0.46	0.90	3	3.93	0.42	0.90
HiHi1	5	4.44	0.55	0.85	4	4.60	0.42	0.91
HiHi2	4	4.56	0.46	0.80	4	4.60	0.40	0.92
HiHi3	5	4.47	0.20	0.99	4	4.60	0.46	0.90

($\bar{X} = 4.34$). The differences in the mean levels of perceived trust also varied significantly ($t = -5.19$, $p = 0.001$) for those teams with low trust at Time 2 ($X = 3.57$) versus those with high trust at Time 2 ($X = 4.4$).

Within-Case Analyses

Twelve cases were written from the transcripts, three per category. Table 3 reports background information on each case study team: the number and home country of team members, the total number of messages in the first two weeks and the following four weeks, and who, using fictitious names, sent the messages. We next provide brief synopses of the 12 cases.

Category 1: Low Initial Trust and Low Final Trust (LoLo)

Team LoLo1. Team LoLo1's first message was, "Hi! Anybody there?" sent by Chao, the member who would send 41 of the 81 total messages. Six days later a response arrived from Paulo, asking if his message made it through, and from Richard. A fourth member, Pierre, sent a total of two messages in six weeks. The fifth member, Martin, was not heard from until after the first assignment. Chao took the role of the team coordinator and suggested that they assign roles. She asked for volunteers for various roles but received no response.

She submitted her contribution to the second assignment before the other members and after a four-day lapse in communication, reminded the other members of the deadline and wrote: "Are you not in the GVT assignment anymore?" Two of the other members, Richard and Pierre, sent their parts to the second assignment on time. Chao again asked if Paulo and Martin were still in the group. There was no response.

Only three of the five members contributed to the final project for which Chao developed a schedule of tasks and deadlines, solicited comments, and wrote, "I have observed that effective groups are those who communicate constantly and are committed to all datelines set." A day later, Paulo asked the team to continue "on the next step" but did not comment on Chao's message. Chao gave an idea for the final project and asserted that she was "seriously and eagerly looking forward to communicate with you." Paulo provided brief feedback on Chao's idea, but disappeared for several days. Martin apologized for his lack of participation and reasserted his desire to "be a part of the team" and volunteered to complete a part of the project. Richard volunteered to write code for their Web page. Paulo contributed links for their Web page as did Martin, but Chao responded with an explanation of why they were not relevant for the project. After writing a draft of their proposal, Chao requested feedback but received none. Team LoLo1 completed the final project. Martin thanked Chao and Richard, "without whom there would not have been any team." None of the other members sent final greetings.

Team LoLo2. As a result of technical difficulties, the first few messages sent by various team members of Team LoLo2 were not received until a week after they were sent. The first message received was from Kathy, who would be the most active of the members, sending 47 of the 109 total messages. As early as the first week, she sent a schedule with tasks and deadlines for the team. Becky was uncertain about the functioning of the server and asked for confirmation of her message. She volunteered to send the team's first exercise to the project coordinator. The members all submitted their first and second exercises on time although the exercises were terse,

Table 3 Information About the 12 Teams

Team	Total Messages Sent	Messages Before Survey 1	Messages After Survey 1	Trust Time 1	Trust Time 2	Country	Number Messages by Member Before Survey 1	After Survey I
LoLo1	81	20	61	3.00	3.00	Australia	Chao: 11	30
						Denmark	Martin: 1	13
						France	Pierre: 2	0
						Philippines	Paulo: 2	8
						U.S.A.	Richard: 4	9
LoLo2	109	34	75	3.33	3.48	Australia	Kathy: 9	38
						Canada	Becky: 12	17
						Finland	Matti: 4	3
						France	Mireille: 5	4
						Ireland	John: 4	13
LoLo3	169	39	130	3.67	3.75	Australia	James: 16	30
						Austria	Heike: 4	27
						Denmark	Cecilie: 6	29
						Finland	Liisa: 8	11
						Philippines	Leo: 5	33
LoHi1	122	48	74	3.43	4.15	Australia	Lawrence: 8	11
						W. Australia	Olivia: 23	35
						Brazil	Alejandro: 2	2
						France	Vanessa: 5	9
						Ireland	Kelly: 4	11
						Netherlands	Lars: 6	6
LoHi2	57	16	41	3.40	4.40	Australia	Moti: 4	15
						Austria	Andreas: 3	7
						Canada	Shelli: 4	11
						Denmark	Mans: 2	0
						Finland	Magnus: 3	8
LoHi3	58	28	30	3.87	4.10	Australia	Huan: 8	9
						Austria	Franz: 4	9
						Brazil	Javier: 9	4
						U.S.A.	Dan: 7	8
HiLo1	97	39	58	4.07	3.67	Australia	Jun: 8	16
						Brazil	Carlos: 10	11
						Denmark	Rune: 3	3
						Netherlands	Henrik: 9	16
						U.S.A.	Michael: 9	12
HiLo2	71	21	50	4.25	3.60	Australia	Howe: 4	17
						Brazil	Andre: 4	11
						Canada	Thomas: 7	8
						Denmark	Marj: 2	7
						Ireland	Stephen: 4	7
HiLo3	103	36	67	4.30	3.93	Australia	Jenny: 6	12
						Austria	Leike: 7	4
						Canada	Vern: 14	33
						Denmark	Flemming: 2	1
						Finland	Paivi: 7	7
						Thailand	Jasmine: 0	10

Table 3 (continued) Information About the 12 Teams

Team	Total Messages Sent	Messages Before Survey 1	Messages After Survey 1	Trust Time 1	Trust Time 2	Country	Number Messages by Member Before Survey 1	After Survey I
HiHi1	216	40	176	4.44	4.60	Australia	Linda: 5	22
						Denmark	Anders: 7	44
						Finland	Riikka: 10	35
						Ireland	Emma: 11	51
						U.S.A.	Donna: 7	24
HiHi2	168	44	124	4.47	4.60	Australia	Janet: 1	31
						Canada	Pattie: 20	18
						France	Anne: 4	14
						Netherlands	Machtelt: 11	27
						Philippines	Randy: 8	34
HiHi3	114	35	79	4.56	4.60	Australia	Julian: 5	31
						Canada	Melissa: 8	18
						Denmark	Karl: 6	14
						Netherlands	Boris: 11	27
						Philippines	Hirod: 5	34
MEAN				3.95	4.04			
ST DEV				0.42	0.40			

with little social content. Becky encouraged the team to think about the final project early but stated that she found "the subject hard to find." John volunteered to be responsible for developing the Web page and sent an idea for the final project.

Team LoLo2 had a lapse in communication of five days following completion of the second exercise. During the following seven-day period, John, Kathy, and Becky were the only members to contribute. They agreed on the idea suggested by John and decided upon roles: one individual doing research (Kathy), two working on the Web page (John and Matti), and two working on the written document (Becky and Mireille). Mireille's response to the role assignments was to say that she was "kind of confused, still, about all that. I am not sure I can be very helpful." She subsequently announced on April 17 that she would be leaving town April 25, so any contribution from her would have to be made before then. Kathy devised a schedule for the final project with tasks, members, and deadlines. She began researching their topic and sent the text of ten articles she found in the library. However, she did not provide ideas about how to incorporate the articles.

Only one individual assigned to the document, Becky, contributed. (Mireille's only contribution was to say it "looks great" and that she had nothing to add.) Likewise, John developed the prototype of the Web page with Matti's sole contribution being to congratulate John. Kathy aggregated her work with Becky's and reminded the team that "This is OUR PRODUCT." The feedback was again "Great job." Kathy then enclosed a revised file for review and Becky erupted: "What's going on!!! First, we had decided on a schedule, nobody follows it. Second, we decided on who would do what, nobody cares. . . . Is this a team project or what?" She was upset because Kathy had not included some additions she had made to an earlier draft. Kathy apologized—she had "accidentally overlooked" one of Becky's messages with the new information. The remaining four days of the project were spent finalizing the Web page. The team completed the assignment on time but no pleasantries were exchanged at the end.

Team LoLo3. Team LoLo3 exchanged a large number—169—of messages among all five members and conducted chat sessions. James, the most active member for whom this was a "first ever group project," expressed concern early on over "the lack of control that a group project entails" and "what should I do when there is no communication." James volunteered to submit the first assignment and summarized what should be done. The

day of the deadline coincided with technical difficulties, and James failed to receive some of the contributions. He wrote, "So far we have only had really easy things to do, and we still have failed to meet the deadline properly." The group finished the second assignment on time.

Heike, who had not contributed to the first assignment, was the first to provide ideas for the final project. Leo provided two ideas and, like Heike, provided brief explanations. James gave an idea with substantial explanation. Heike proposed to combine the ideas, and Liisa and Leo responded agreeably, to which James responded, "Heike ranks technology transfer highest, but does anyone know anything about this? Please can EVERYONE provide DETAILS about the idea they like most. I am scared because I can't see how to proceed." He then went into great detail (over five pages) on his idea. Leo thanked James "for his more rational thinking." Leo, Heike, and Liisa agreed to go with James's idea.

James maintained responsibility and control for the Web page development, Leo took responsibility for the written proposal, and Heike, Cecilie, and Liisa promised to contribute links for the Web page. In a period of 48 hours, Cecilie, Liisa, and Heike each sent James a large number of URL addresses, but without any written explanation about the sites. James wrote, "Whoah!!! hang on a minute . . ." and "Please please please please do not send me any more links . . . I must have written about 10 times about the reason why links to technical manuals are not appropriate for our page." With one week left, James became concerned that someone would turn in the incorrect version of the proposal to their professor. He had "put way too many hours into this project" to risk receiving a poor mark. As a practice assignment, he wanted each member to try to decode a copy of the paper sent by Leo as an enclosure in a message. Heike stated that she could not decode it, and Cecilie and Liisa did not respond. Leo and James completed the project. Heike stated in her closing message that "although some things didn't work well it was a good experience to see IF it is possible to work in such a virtual environment. In my opinion, it's much more complicated to communicate in such a way without face-to-face contact." The team did not exchange departing messages.

Summary of LoLo Teams. Besides having technical problems, LoLo teams lacked optimism, excitement, and initiative. LoLo3 had members with initiative and willingness to complete their role assignments, but the negative or distrustful leader suppressed excitement over the project. The teams also suffered from major lapses in communication or, as in case of LoLo3, a fear of communication lapses. None of the teams had messages with much social content.

Category 2: Low Initial Trust and High Final Trust (LoHi)

Team LoHi1. Team LoHi1 consisted of six members (three active members) and exchanged a total of 122 messages. The initiator of team activity, Olivia, described herself as "very reliable—if I say I will do something, I do it." Olivia asked for a volunteer to collate the first assignment but did not volunteer herself. Lars volunteered and asked if anyone objected. When only two members replied that they did not objects, he responded, "not everyone has responded to my 'vote' for me collecting" the information. Olivia responded, "just do it" and proposed a rule that "silence indicates consent." This triggered discussion on rules such as respecting others' ideas, checking e-mail regularly, and avoiding the flaming of other members.

The team had technical problems early on: one member contributed to the first assignment on time, but several did not receive the contribution; the member, in turn, did not receive others' contributions. Another member stated that he did not understand what to do for the second assignment even though two members had already submitted their parts of the assignment to the group. Two members explained what to do, but he still submitted his part two weeks late with the excuse that he had been busy.

Several messages were exchanged on the final project idea. Lawrence sent an idea which Olivia was not sure "really fit" the objective of the project, but she gave no alternative. Vanessa returned from vacation and expressed discomfort with the idea but also gave no alternative. Kelly gave an alternative idea, which was accepted. Afterwards, the team focused solely on the project. There were no references to rules of any kind, and the nonparticipating members, Alejandro and Lars, were not assigned any tasks.

Lawrence, Kelly, and Olivia communicated frequently during the final weeks. The members had assigned tasks, but they overlapped. Lawrence and Kelly worked simultaneously on coding two separate sets of Web pages. Kelly asked why there was duplication of effort. Lawrence suggested that the pages were not "in competition" but that he intended to take the best from both pages. Well before the project deadline, Olivia produced a lengthy written proposal; likewise, Lawrence and Kelly produced the html code with sufficient time for comments. After the drafts had received feedback and were revised, Lars reemerged from what he said was an illness, expressed surprise that the deadline was in two days, but then gave extensive comments and suggestions on the proposal draft which were incorporated. The active members expressed satisfaction with their project as well as their team.

Team LoHi2. Of all twelve teams, Team LoHi2's five members exchanged the smallest number of messages in the first two weeks. The members engaged in very little social introduction; they did, however, reflect about the challenges of virtual work in their opening messages. Said one, "Quickly establishing a mutual understanding is not an easy task." Said another, "Everyone makes an introduction, but the impression you get is like via a letter." A third member echoed the potential paradox of virtual work: the "virtual environment can either allow a person to be more honest than they may be face-to-face or the exact opposite, they can hide behind a facade so you may not be getting truth."

Even before completion of the second assignment, Shelli asked the other members to think about the final project and proposed an idea to which the others responded and gave optional ideas. The team agreed to go with Shelli's initial idea. Andreas developed a home page listing the days and hours he would be available to work on the project, and upon his request, the other members sent their schedules for posting on the page. Moti proposed a framework to discuss ideas—he set up a Web page with initial ideas and asked others to respond; he continually updated the page according to submitted ideas. The members did not hesitate to commit, evident in such statements as "I promise to do a paragraph or two as Moti suggested." Each member also followed through with the work they promised to do. At one point, Moti wrote, "Dear Virtual Teammembers: now you are almost becoming real to me." Shelli stated that she "was worried after assignment 2 but this was quickly alleviated by everyone's enthusiasms." Each member expressed satisfaction with the final outcome as well as with the teamwork achieved. Wrote one, "I think it is great the way we could build upon each others' ideas." And another, "I enjoyed very much working with you. You all did what you promised to do. In teamwork, it's the most important thing." The name of the fifth team member who had only sent two messages was not included on the final project or the website.

Team LoHi3. Like Team LoHi2, Team LoHi3 sent relatively few messages—60 in total. The first member to send a message, Huan, wrote that he had never used "this technology" before and that he hoped "my mail could reach you." He sent a second message three hours later saying the same thing. Javier responded, but did not introduce himself. Huan sent a third and fourth message with the earlier message content. A third member, Franz, wrote that he received a "terrible lot of mail day after day" and requested them to identify the project in the subject of each message. A fourth member, Dan, gave a long introduction and compared working in a virtual environment to "playing chess with one move made every 24 hours." Dan initiated the first two team assignments. Huan expressed his gratefulness for Dan's initiatives but also wrote that he was "a bit jealous of the other group" who had "a lot of conversation." He suggested that Dan or Franz serve as the team leaders, Franz announced that he would be unavailable until May 6 (the project was due on April 31).

The concept of a leader was never mentioned again although Dan remained the initiator; he did not assign tasks to others, but reminded others of what needed to be done and by when, Franz reemerged on April 5 and offered to "take care of coordinating and giving a final touch to the website." Franz set up a background for a website before the team actually chose a topic and a day later commented that "If I am not mistaken—at least that's what I learn from the log files, then Huan is the only one who has found the time to at least look at what is going at the yet to be filled GVT51 Web page." The other members visited the site and one wrote, "I finally visited our home page. I got really happy with this. . . . Friends, I am very happy today (as I see our home this evening)." Huan checked the page regularly and commented on Pete's changes. On April 28, Dan sent a lengthy (six page) document describing the page, its design, its contents, and the justification. Wrote Franz in response, "I believe, you will understand, that I would have been much happier if only you had managed to confront me with any new/summarising material by Friday as indicated a week ago. Nonetheless, it is nice to see that you did invest more time to bring our project to an end before long." Dan politely explained how his changes implied only minor coding changes. Huan and Dan both maintained an upbeat and friendly tone in the final messages and sent goodbyes as well.

Summary of LoHi Teams. The LoHi trust teams appeared to differ from the LoLo trust teams in that they had predictable, though infrequent, communication, more equal participation across members, and a focus on the task after the initial assignments. Like LoLo teams, LoHi team members did not exert an effort to get to know each other, and hence the members' relationships were purely professional or task focused. These teams seemed to be initially preoccupied with the establishment of rules to manage the uncertainty they felt. The teams appeared to have increased their trust by successfully overcoming (or simply learning to ignore) the initial uncertainties they felt, focusing on the task, and resisting distractions that did not contribute to the task.

Category 3: High Initial Trust and Low Final Trust (HiLo)

Team HiLo1. Team HiLo1 exchanged a total of 99 messages, a little under half of which were exchanged during the first two weeks. The group began by exchanging many social messages. One wrote, "How hard is it to carry out an entire project without having those boring professional meetings." Rune volunteered to compile the first assignment but did not follow through because he did not receive confirmation of the role. Another member, Henrik, submitted the assignment and received praise from the others: "Well done, buddy." After the first assignment, the members were exuberant: "I had very good impressions of you, and I think we'll have a great time working together. Success for Team 60!!!" Another wrote, "Hey guys, I think we've done it." And another, "I think we've started this collaboration in a good way. It's nice working with you guys." And the fourth, "Congratulations everybody! We did complete our first assignment on time!" When one of the members failed to complete the second assignment on time, the coordinating member added one of his own ideas under the absent member's name before turning in the assignment.

After the second assignment, Michael announced that he "would love to just do it and get it over." Carlos complained of technical problems at his university, stating that "it seems every time I go to school to surf on the Net, the only room with direct Internet access is closed." Rune failed to communicate for over a week, and others sent messages: "Where is Rune?" He reemerged after two weeks but contributed only two messages thereafter. With three weeks remaining before the final project deadline, one member suggested the need for rules although he did not suggest any particular ones. The others also agreed on the need for rules but proposed none. Likewise, the members were aware of the need to provide ideas for the final project—"I think it would be nice for us to brainstorm a little before we decide the subject"—but only one member, Jun, actually proposed any ideas. Jun sent a long task-oriented message with ideas for the project. The message was received enthusiastically—"Great Hurray for the Jun, Excellent initiative my friend, I applaud your idea"—but there was no discussion over the content of the proposal. Michael stated that he had no experience in the proposed area but made no other suggestion. Another wrote: "If you send me a topic that I can research, I'll be happy to do so." Wrote a third, "But plz plz plz mail me in what way I can contribute. . . . I still am a little confused. Just tell me what I need to contribute." Jun then suggested that the final project be a compilation of one topic per member, and asked each member to send their topics to him. Two members contributed brief paragraphs of content for the project. Jun was left to finalize the project. No greetings were exchanged at the end.

Team HiLo2. Team HiLo2 had 73 messages in total. Thomas was the first to communicate: "To move things along, I'm starting the ball rolling with a personal description." One member subsequently suggested that Thomas take on "the role of a team coordinator" because of his "technical experience and ambitions to go into management." Thomas did not acknowledge the role in writing, but did take initiative in moving the second assignment and final project along. All members contributed to the first two assignments on time, except for one member, Andre, who sent his part for the first assignment late with the excuse that he was having technical problems.

A long lapse in communication occurred after the second assignment. Between April 3 and April 15, only Thomas sent messages, one on April 11 and the following on April 14. On April 14, Thomas wrote, "I've just spent a very dull few hours looking through the ISWorld site in preparation for Part III. The next and final assignment is due on April 29 and, as is the custom of most students, we're leaving it rather late." He offered an idea for the project. He received no immediate response and sent a second message asking if his message was received. The following day, Howe wrote that he had been having technical difficulties and would respond shortly. A day later, Stephen gave no idea of his own for the project but asked, "Can we agree on a topic . . .? Also, I would like to hear from someone apart from Thomas."

One member, assumed by the others to be Thomas, sent a message to the project administrator complaining that none of the other members were contributing. The message was forwarded to the professors of each member on the team. One of the members responded, "That sort of behavior does nothing for the spirit of the team." Another member agreed: "In my humble opinion, things are somewhat out of order in this exercise." Thomas sent just three more messages in a ten-day period, one with his contribution to the project, one thanking a member for coding the page, and a third stating that he was unavailable to do any more work on the project.

Stephen and Howe were left to complete the project. Stephen sent a series of links and suggested someone else should "take on the job of organising them." The only response was from Howe who wrote that he was working on the proposal and "would have expected more from Andre and Samal." On April 25 Stephen sent another message to the members to "just have a look at our page and try to give me your feedback as to how to make it look better." The following day, he sent a message stating

that he had "just checked my mail . . . and I was disappointed to see that there have been no replies about the project." Howe submitted a proposal draft for review containing several sections where he had inserted "need help here," but the only feedback received was that it "looked fine" and was actually "more than I expected." The team submitted a final project with several sections containing asterisks next to the words "need help here."

Team HiLo3. Team HiLo3 exchanged a total of 107 messages of which almost half, 46, were from a single member, Vern, who was elected to be team leader. Team HiLo3's communication began with lengthy personal introductions and claims such as, "I am looking forward to working with you all." A few members experienced problems in receiving mail, but Vern reassured them that this was common so not to worry. Vern proposed procedures for the group to follow, and the group agreed upon them. All members contributed to the first and second assignments on time except for one individual, Flemming. Vern wrote, "It would have been nice to get his opinion on the numerous points raised."

After the second assignment, Paivi summarized the ideas expressed for the final project to that point and proposed additional team rules. On April 10, Vern wrote that "judging from the pace we have demonstrated so far, we should be done by Christmas," and he did not want "to sound cranky." Even though the team had exchanged 53 messages at this point, many more than some other teams, he stated that "they need to start interacting more often as a team." Paivi thanked Vern for stimulating the group, again summarized the ideas submitted to that point, and noted which idea she preferred.

Without any prior warning, Paivi withdrew herself from the project on April 15 and stated that "the actual teamwork could have anyhow been more intensive." The members reacted strongly. Jenny explained that she had "no ability to work without their help" and begged them to "please do our work together!!!" Vern asked the remaining members to identify a role for themselves. Ten hours later, Vern sent another message stating that "this will continue to be a frustrating experience for many unless everyone participates fully . . ." and that if "anyone is in for a free ride, get out." He counted the number of task-related messages in the past week and described the situation as "extremely frustrating." Jenny thanked Vern for "trying to wake them up" and defined her role. Vern then listed tasks to be done and "appointed" volunteers. He requested confirmation of the message containing negative remarks: "The situation is not very encouraging. UNLESS ALL TEAM MEMBERS START CONTRIBUTING SERIOUSLY NOW, WE WILL NOT GET A SATISFYING RESULT." Vern continued to work on his own tasks and prodded for feedback. Leike and Jasmine offered excuses relating to technical problems and a lack of a clear understanding of their tasks. Vern completed the project and wrote, "I would have expected this exercise to be a real collaborative effort which, unfortunately, it has not really been."

Summary of HiLo Teams. The teams that shifted from high trust to low trust exhibited initial enthusiasm and excitement. Ironically, their optimism coincided with a lack of serious reflection on the challenges of working in a virtual environment. This optimism and excitement waned gradually in one case, but rather abruptly in two cases. In one case, the trust seemed to fall as the members exhibited a pattern of desultory followers looking for a leader who did not emerge. The other two teams explicitly chose leaders only to be abandoned by them. The very choice of a single leader appears quixotic: the existence of a stated leader seemed to lessen the felt need to contribute among the other members. Since the members had betrayed their leaders, it was no surprise that the leaders betrayed their teams.

Category 4: High Initial Trust and High Final Trust (HiHi)

Team HiHi1. Team HiHi1 was characterized by many messages—222, 142 of which came during the last five days of the project. The members' initial messages expressed enthusiasm about the project—"I'm really enthusiastic and committed to this project"; "I'm waiting forward to hearing from you!"; "This project is really exciting to me." The members were also curious about the potential of the virtual environment—"Can we trust the things we see, read, or hear?" All but one member, Emma, submitted the first assignment, but the members asked Emma to complete her assignment even after the deadline so they could get to know her. There were many social exchanges during the first two weeks. When the members returned after Easter, the first few messages were also social—describing their weekends, what they ate, and what they drank.

This team did not establish team rules nor spend time deciding upon procedures. A member proposed a schedule for the final project with four milestones, each with a deadline. The other members agreed to the schedule with some minor modifications. Anders, Linda, and Riikka provided ideas for the project with thorough explanations as did Donna, who summarized all the ideas received. The team agreed on a topic and divided into roles. After finding a link that accomplished what her team had planned to do, Donna sent a message with the subject heading "URGENT!!! Idea taken?" and suggested they change the topic. Linda, Anders, and Emma all responded that they

should just differentiate the site. The team wavered for days. Donna maintained her position and persuaded Emma. The team was divided and a sense of urgency developed as they were "running out of time!" Donna then suggested that they stick to the original idea. At this point, the members were well behind their own schedule but seemed to maintain a confidence—"Don't worry I am sure we will get it done with a little concentration some hard work and keeping in touch," wrote Linda. With four days left, 91 messages had been exchanged. In the remaining four days, 111 more messages were exchanged. Emma and Anders coordinated their working times, as did Riikka and Linda because of overlap in their work. The team managed near real-time communication: when a member asked, "p.s. is anybody there?", she meant "right now"—as opposed to a larger time frame within the project. The members exchanged and edited several versions of the paper and the html code before completing the final version. They each thanked the others for their great work, expressed satisfaction with having worked on such a team ("Super much thanks to everyone!!! I loved working with you!"; "You are great!!!"), and exchanged personal e-mail addresses.

Team HiHi2. The first two weeks of the five-member HiHi2 team's communication was dominated by Pattie, a 50-year old former nurse. As early as her third message, Pattie expressed a desire to keep in touch with the other members after the project. Randy claimed to be "equally enthusiastic" to work with the team. One member, Hans, never sent a single message, and the members concluded that Hans was not part of the team. Team HiHi2 missed the deadline for the first and second assignments. Wrote Pattie, "One of the frustrations I have with this virtual team process is that there seems to be no way of knowing what has been sent or received." The team developed a system of numbering messages and agreed to confirm receipt of messages by referring to the number. The members continued to express enthusiasm: "This is fun isn't it! I came home tonight looking forward to reading mail from my team." Janet suggested a schedule with tasks and deadlines. Randy followed up with three pages of discussion on what their project page should look like and what the target should be. Pattie took on mostly a social and process role, such as sending greetings and recounting daily events.

Only two ideas for the final project were proposed. Janet wrote that Randy's idea received the most support so they should go with it. When there were no comments to her message, she asked, "Can you all PLEASE allocate time to this exercise." Pattie apologized for a seven-day absence, thanked Randy and Janet for their leadership, and informed the team that she would be busy for two more days. Machtelt expressed confusion over the topic, saying that she was "not quite sure what to do, and what to write" and asked them to describe to her "in short clear terms." Randy said that he felt "that we are stagnating."

Janet wrote an introduction for Randy's idea and asked each member to contribute a section. Randy and Janet began to develop a draft of the paper and kept the team apprised of their progress. Janet then realized that she and Randy had had a misunderstanding over the nature of the topic. She decided they must go with Randy's interpretation. Pattie then reemerged after four days with a nine-page summary of what she found on Janet's original interpretation of the topic. This exasperated Janet, who felt "like I have just wasted my whole weekend on this assignment . . . we've gone backwards. It is very depressing." Randy and Pattie sent "calming e-mails" to encourage Janet.

Seventy-two messages were sent during the final week of the project. Pattie, Randy, and Janet did the majority of the work. Machtelt and Anne sent positive feedback. Pattie wrote that she was "eating, sleeping, and dreaming" the project, and Machtelt was "very impressed, and much heartened" by the results. Pattie praised the other members with phrases such as "good thinking lady!" to Janet and "You said it perfectly well!" Randy was likewise enthusiastic ("Heaps of Mails! Excellent!"), as was Janet ("It's fun isn't it.")

Team HiHi3. Team HiHi3 exchanged 131 messages. Julian, a 39-year-old former doctor, initiated the communication, stating that "the first couple of weeks . . . will be largely about sorting out what the project even is." The members did not exchange social messages although they expressed commitment and excitement. The first assignment was completed by all members on time. The team agreed upon procedures at the start of the second week—they would read all messages before responding to any, use meaningful subject headings, code their messages for easy reference, and divide into roles. Julian was nominated as a leader. The second assignment was completed on time by all members except Melissa.

After the second assignment, the team arranged for numerous chat sessions and always summarized the session for one member who was unable to attend because of technical or time problems. Julian, since "someone called me the LEADER," even developed a list of tips on how to chat properly—with upwards of 15 tips included. The members discussed the proper way to exchange versions of the paper well before anything had been written. After a week of synchronous and asynchronous discussions about procedural issues, the group focused on task content. Responding to an idea from Boris that he considered too complex, Julian suggested that he preferred the simple

"Melissa and Julian approach." Melissa was annoyed and suggested that no one "speak on behalf of anyone else." She proceeded to expand on Boris's idea. A lapse in communication ensued, leading Melissa to state, "I hate to be the one to bring this up, but it has been 97 hours since our chat, and I have not received anyone's contribution." Responded Julian, "The ongoing contribution is coming from members who support Boris's idea—where are you Boris?" Julian volunteered himself for a portion of the work and made suggestions on which members would do the other tasks.

The team's work progressed smoothly from this point on, and the communication was focused on the task content. Julian continued to play the leadership role and encouraged the team with such statements as, "Everyone just keep pulling together and we can do this." The pace began to intensify well before the deadline, and the members often wrote portions of the paper synchronously during chat sessions. The biggest spurt of messages occurred the week before the project deadline. The members were excited—"This is great!"—with the way they were working together and finished the project several days early. The members congratulated each other on their contributions, exchanged personal addresses, and departed with warm greetings.

Summary of HiHi Teams. The HiHi teams engaged in social introductions that allowed the team members to get to know each other. Periods of intense online communication further strengthened the group identity. The HiHi teams experienced difficulties, but were able to overcome them. For example, two of the HiHi teams failed to fully complete the first two exercises on time, but this was not viewed as a setback by the members; rather, they kept prodding the members who did not complete the exercises to complete them after the deadline, not because the completion was needed but because they were generally interested in the other members' responses. The team members all or nearly all showed initiative, and roles emerged for each member. In the HiHi teams, the members engaged in frequent communication, gave substantive feedback on fellow members' work, and notified each other of forthcoming absences.

Analysis Across the Categories of Cases

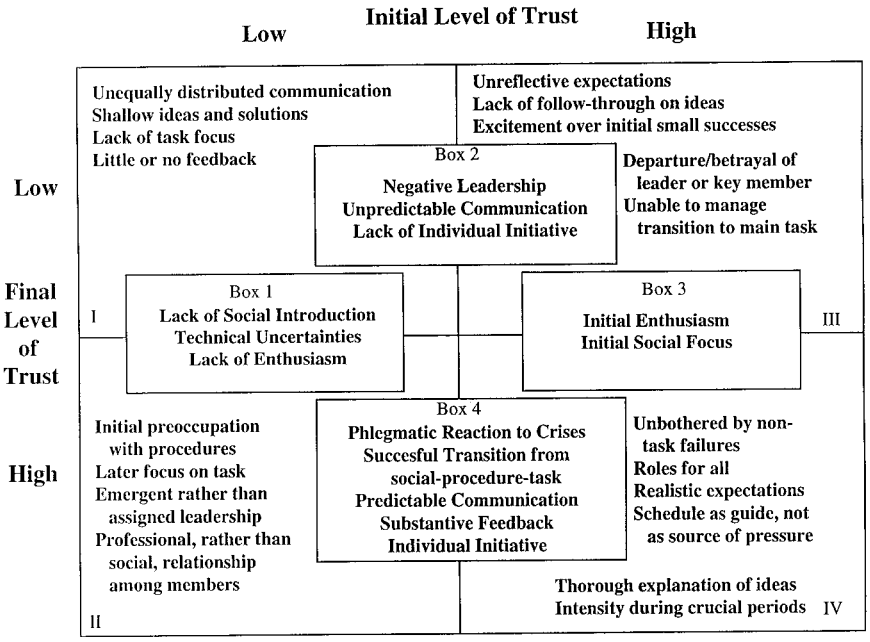
The case descriptions reveal sources of vulnerability, uncertainty, and expectations in all teams. The LoLo and HiLo teams appeared to be less equipped to deal with them than the HiHi and LoHi teams. Figure 3 captures the behaviors that surfaced in the case analyses by each category (the major quadrants) as well as the behaviors that were common across categories (the four boxes transversing the quadrants). The teams that began and finished the project with low trust (Quadrant I) were marked by unequally distributed communication, shallow ideas, a lack of task focus, and little feedback, as contrasted with the teams that began with low trust but finished with high trust (Quadrant II), who managed a shift from a procedural focus to a task focus, were able to resolve technical difficulties, and established a predictable communication pattern as the project progressed. The teams that began with high trust but finished with low trust (Quadrant III) began enthusiastically but were unable to manage a successful shift to a task focus, failed to develop capabilities to deal with the unreliable technology, appointed a leader who had no followers, or had followers with no leader. By contrast, the teams that began and finished the project with high trust (Quadrant IV) began with high enthusiasm but were also able to address technical problems, were able to dynamically address issues of who would do what, when and with whom, provided detailed explanations of content contributions, quickly responded to others' initiatives, and were immersed in the task.

Several commonalities were observed in teams that began the project with low levels of trust (the LoLo and LoHi teams): a lack of social introduction, concern with technical uncertainties, and a lack of enthusiasm (see Box 1 of Figure 3). The teams that began with high trust (the HiLo and HiHi teams) exhibited roughly the inverse pattern of high initial enthusiasm and extensive social dialog (see Box 3 of Figure 3). Those teams that finished the project with low trust (LoLo and HiLo) displayed a common problem of negative leadership, lack of individual initiative, and unpredictable communication (see Box 2 of Figure 3), whereas those teams that finished the project with high trust (the LoHi and HiHi teams) benefitted from a successful transition to the task following the initial communications, predictable communication, substantive feedback, strong individual initiative, and calm reaction to problems (see Box 4 of Figure 3). As is noticeable, the behaviors observed in teams with low levels of early trust are the inverse of those behaviors observed in teams with high levels of early trust; likewise, the behaviors observed in teams with low levels of trust at the end are the inverse of those associated with teams with high levels of trust at the end. Table 4 categorizes these major characteristics in terms of communication behaviors and member actions that appear to facilitate the existence of trust early on and communication behaviors and actions that might help maintain trust in the later stages. Following the table, we describe these in more depth.

Communication Behaviors Facilitating Trust Early On

1. Social Communication. Social exchanges appeared to facilitate trust early on in the team's existence. Whereas

Figure 3 Within and Cross-Category Case Analysis



the teams with low initial trust exchanged few social messages in the first two weeks, the initial communication among members of teams beginning with high trust was largely social. For instance, almost half of all messages exchanged for two of the HiLo teams were done so during the first two weeks of participation and contained social (nontask) comments: they discussed their hobbies, their weekend activities, and their families at length. This extensive social discussion appeared to foster trust in the beginning of the project but was insufficient in maintaining trust over the longer term. Two of the HiHi teams developed an amicable social rapport early on and continued to exchange social information until the final week, but this information was always integrated into otherwise task-oriented messages. These team members appeared to be careful not to use social dialog as a substitute for progress on the task.

Table 4 Trust-Facilitating Communication Behaviors and Member Actions

Communication Behaviors that Facilitated Trust Early in a Group's Life	Communication Behaviors that Helped Maintain Trust Later in a Group's Life
• Social communication • Communication of enthusiasm	• Predictable communication • Substantial and timely responses
Member Actions that Facilitated Trust Early in a Group's Life	**Member Actions that Helped Maintain Trust Later in a Group's Life**
• Coping with technical uncertainty • Individual initiative	• Successful transition from social to procedural to task focus • Positive leadership • Phlegmatic response to crises

2. Communication Conveying Enthusiasm. In teams with low initial trust, the messages revealed markedly little enthusiasm or optimism. Whether the low-trust team members actually had little enthusiasm, or simply failed to express it, is not clear. In HiHi teams there was a great deal of excitement about the project: the members referred to their teams as their "virtual family" and as a "virtual party," claimed that "we are beginning to feel like friends, not just teammates," and encouraged each other with such statements as "This is getting exciting!" and "great work everyone!!!" The HiHi teams encouraged each other on the task, with such statements as, "Everyone just keep pulling together and we can do this" and with references to working together "on producing the best IS page ever." The teams that moved from low to high trust expressed enthusiasm and optimism as the project progressed. For example, it was after the first two weeks that the members of LoHi2 began encouraging one another.

Member Actions Facilitating Trust Early On

3. Coping with Technical and Task Uncertainty. The teams that reported low initial trust were unable to develop a system of coping with technical uncertainty and the unstructured task. Although the leader of LoLo3, for example, gave his work and home telephone numbers for the other members if they were experiencing prolonged technical problems beyond their control, this was not a realistic solution because of time zone differences and the expense of telephone calls. The low-trust teams also fuelled the feeling of an uncertain technological environment by blaming their problems and tardiness on the technology. The excuses given were rarely challenged beyond statements such as, "I find it very hard when there is no communication . . . I don't know if it is because of technology failing, or people not coming in to work or what." Members of low-trust teams also expressed uncertainty over the task goals—"I find the subject hard to find" and "I am kind of confused . . . not sure I can be very helpful"—but failed clarify the task among all the team members.

The HiHi trust teams developed schemes to deal with the technological and task uncertainty. One such scheme was the use of numbering systems so that all members would be aware if they had missed a message. Another scheme was simply informing the other members in advance of the times they would be working or would be unavailable to work. The HiHi teams also exchanged many messages purporting to clarify and develop consensus on the requirements of the task.

4. Individual Initiative. The teams with low initial trust, and those that remained at low trust, had members who did not take initiative: several members on each LoLo team revealed a desire to be told what to do and simply waited for others to make the important decisions. The members would state that a topic needed to be decided upon without making a suggestion. Similarly, teams that shifted from high to low trust exhibited a lack of initiative in pushing the project forward. For example, a member of HiLo trust team asked, "Can we agree on a topic or on what we are going to do?" but did not take initiative in suggesting an idea. A member on HiLo2 stated that she was waiting for someone "to give the signal" on the topic. Likewise, a member suggested the need to be proactive—"The only way to make the experience enjoyable and valuable was for all members to be as proactive as possible."—without actually proactively initiating a task. The teams reporting low trust at the end were hesitant to commit, evident in such statements as "I think (not a promise) I'll be able to have the page (at least the skeleton of it) done early next week." Furthermore, the teams ending with low trust revealed simple task ideas and solutions with little explanation. One cannot blame the medium for the lack of richness in their ideas; rather, the members simply failed to provide details with their ideas. In this sense, the medium was more of a shield against having to explain themselves than a factor that limited their ability to fully explicate their ideas. By contrast, the HiHi teams were characterized by initiative: members would make topic suggestions instead of asking for suggestions, and would volunteer instead of asking for volunteers. In HiHi teams, even though a leader emerged, the majority of the members took initiative at different times.

Communication Behaviors Maintaining Trust Later On

5. Predictable Communication. Unequitable, irregular, and unpredictable communication hindered trust. Teams ending with low trust were characterized less by the overall level of communication than by unpredictable communication patterns, with one or two members responsible for the majority of the communication. Members would express concern over where the other members were, such as a member from LoLo3 wondering, "What is happening to the rest of the team apart from James?" A member from LoHi1 wrote during the first two weeks that "I was away for a few days and everybody thinks I died or something." However, without forewarning of communication absences, it proved difficult for these members to maintain confidence in their teams. What appeared to reestablish confidence in LoHi teams was explicitly setting an expectation of how regularly messages would be sent. Thus, even though they did not necessarily communicate frequently, they had a regular pattern of communication established, which assuaged uncertainties over team members' commitments. Likewise, the members of all HiHi trust teams forewarned one another about upcoming absences. The members of two of the HiHi trust teams managed a near real-time environment during the crucial periods of the final project.

6. Substantive and Timely Response. A key difference between HiLo and HiHi teams was that HiHi team, members received explicit and prompt responses verifying that their messages, and their contributions to the assignments, were thoroughly read and evaluated. Even though all three HiHi teams divided the work, each member contributed to the work of the others. Even less adept members (either due to language or technical challenges) managed to contribute positively. By contrast, the feedback in HiLo trust teams might have been positive, but the failure to elaborate reflected a cursory perusal rather than a perspicacious evaluation of others' contributions. Often, the low trust teams received no feedback and were left,

as stated a member from LoLo3, to "just . . . use my own creativity as I haven't had any real comments."

Member Actions Facilitating Trust Later On

7. Leadership. A problem that was common for the HiLo and LoLo teams was ineffective and/or negative leadership. Team HiLo1 exhibited a desire for leadership although no leader emerged. The other two HiLo teams experienced negative posturing from their elected leaders and other key team members. The leaders of these teams were chosen not based on their greater level of experience but apparently because they were the first to communicate or they had sent the largest number of initial messages. The appointed leaders of the HiLo teams engaged in negative rather than positive reinforcement—complaining about other members' lack of participation, complaining about too little communication, comparing the team unfavorably to other teams, or sending messages of complaint to the project coordinator. They described the work as "extremely frustrating" and as a "frustrating experience." These actions were viewed as betrayals by the other team members and did little to reinforce commitment among the team.

By contrast, the leadership role of the high trust teams emerged after an individual had produced something or exhibited skills, ability, or interest critical for the role. Moreover, the leadership role was not static but rather rotated among members, depending on the task to be accomplished. Those taking leadership roles maintained a positive tone, such as in HiHi2 where Pattie prodded a member for one of the assignments but explained that she was "not complaining, just letting you know" and where Julian of HiHi3 sent a private message to a member who failed to complete an assignment, rather than singling her out with a message to the entire team.

8. Transition from Procedural to Task Focus. HiLo trust teams exchanged many messages on rules, or procedures. The emphasis on procedures, such as on how often to check e-mail, helped to provide an illusion of certainty, but in the absence of any mechanism to enforce the rules or even monitor the other members' compliance, any member could reemerge and blame his absence on technological problems. The HiLo teams were unable to move beyond setting rules. In contrast, all LoHi teams demonstrated an ability to move from a procedural orientation to a task orientation. Once they began focusing on the task, they were undisturbed by negative comments or by missing team members. The HiHi teams were also able to make a successful transition from a social and/or procedural focus to a task orientation.

9. Phlegmatic Reaction to Crisis. All three HiHi teams experienced some turbulence that could have permanently disrupted the teams. Yet these teams were marked by an ability to remain phlegmatic during crises. All three teams experienced difficulties related to the choice of a topic for the final project—two teams discovered after they had chosen a topic that other websites existed covering the same idea; one team had difficulty reaching an agreement over an idea. Another temporary source of turbulence for one team coincided with a sudden change in the communication regularity of the key member and disagreement over the division of work. Even in the early stages, the HiHi trust teams, unlike the LoLo trust teams, were unconcerned over failing to fully complete the first two exercises on time; rather, they kept prodding the members who did not complete the exercises to complete them after the deadline, not because the completion was needed but because they were generally interested in the other members.

Discussion

The objective of this study was to explore via an analysis of communication behaviors whether and how trust exists and/or develops in global virtual teams comprised of individuals who communicate electronically across time, space, and culture on a short-term basis without any prior common history or anticipated future. The research was directed by three questions. We will next discuss the results for those three questions.

Trust in Global Virtual Teams

The first question explored whether trust can exist in global virtual teams. The global virtual team was defined by three dimensions: (1) no common past or future, (2) culturally diverse and geographically dispersed, and (3) communicating electronically (see Figure 1). The traditional conceptualization of trust assumes that trust resides in personal relationships and past or future memberships in common social networks that define the shared norms of obligation and responsibility (Bradach and Eccles 1988; Powell 1990). The lack of past and future association decreases the potential existence of trust. The diversity in cultural and geographic backgrounds should similarly challenge the potential existence of trust (Bradach and Eccles 1989, Mayer et al. 1995). Finally, Handy (1995) argues that trust needs physical touch, which the current technological context also eliminated.

The 12 case studies portray many challenges that the global virtual teams had. But did the teams exhibit trusting behavior? The current study explored this question by examining electronic mail archives (case studies) of teams with various levels of self-reported trust obtained via questionnaire data. On one hand, the teams that reported high levels of trust in the beginning and at the end appeared to be more capable of managing the uncertainty,

complexity, and expectations of the virtual environment than the teams that reported low levels of trust in the beginning and/or at the end. On the other hand, the communication archives contained little evidence of the depth of socialization, courtship, and social identification that is traditionally associated with interpersonal or socially based trust (Lewicki and Bunker 1995, 1996; Sheppard and Tuchinsky 1996). Trust in the HiHi and possibly in LoHi teams may have taken the form of swift, depersonalized, action-based trust. Trusting behavior may itself have provided the cognitive and emotional basis for the trust that was then captured by self-reports on trust.

Developmental View

Question two explored how trust might be developed in a team. In swift trust (Meyerson et al. 1996, p. 192), "unless one trusts quickly, one may never trust at all." The survey data suggest that out of the 29 teams, only four teams shifted to a high trust condition from a low initial trust condition. The first messages on the team appeared to set the tone for how the team interrelated. The adage "you can never give a second first impression" seems to apply to electronic impressions as well.

Consistent with the SIDE model, members of the HiHi and HiLo teams appeared to enter the team collaboration with confidence and optimism although they had no information on which to assume the trustworthiness of the other members. In the LoLo and LoHi teams, the members appeared to be more skeptical in their early communication about what the team would be able to accomplish. Meyerson et al. (1996) maintain that in swift trust, members make categorical judgments of others based on positive stereotypes. Given that the members in our global virtual teams were not identifiable by their roles nor necessarily by their national origin (many members were located in countries other than their home country), it is unclear what stereotypes might have been evoked. Hence, it might be that trust was created swiftly based on the members' imported propensity to initiate or to respond to the first electronic communication stimuli rather than based on any particular stereotypes.

The findings are consistent with other research on the temporal aspects of group development (Gersick 1988, Gersick and Hackman 1990). In her study of naturally occurring groups, Gersick (1988) was struck by how the behavioral patterns that emerged in the first meeting persisted through the first half of the group's life. According to Gersick (1988), the patterns appeared "as early as the first few seconds of a group's life" (p. 33). Gersick and Hackman (1990) maintain that these early and lasting patterns occur either (1) by importation or (2) by creation. Importation happens when an outsider prespecifies the pattern of behavior, or alternatively, when a homogeneous team shares the same a priori expectations of appropriate behavior. Creation occurs when the team is new, heterogenous, and self-managing. In such cases, team members bring in propensities for initiating and responding to communication stimuli and interaction processes rather than transporting ready-made patterns from other contexts. The way members respond to particular stimuli in the first communication event will generate patterns that will last persistently in the team. Under the creation scenario, we would expect to see very widely diverse communication behaviors across different groups as we did across the 12 case studies. Interestingly, Gersick's (1988) finding of midpoint transitions in project teams was not evident in the current teams' communication archives: only one of the 12 global virtual teams appeared to go through a clear midpoint transition that allowed a dramatic change in communication behaviors. This might suggest that in global virtual teams, it is particularly challenging to encourage groups to reflect upon, learn from, and redirect, as appropriate, their communication behaviors.

Communication Behaviors

The third research question, intertwined with the second question, explored what communication behaviors might facilitate trust in global virtual teams. McGrath's (1991, 1994) TIP model suggests that new teams that work on a complex and unfamiliar task and face technological uncertainty will have to engage in all four production modes: inception, problem solving, conflict resolution, and execution. Such teams must also devote time to the various modes of group well-being and member support to be able to progress through problems and conflict. Our case results suggest that when faced with technical/task uncertainty early in the group's life, teams high on trust were able to solve problems and resolve conflicts in an environment where they were limited to electronic communication. The study also found that teams communicate both task and social information.

The theory of swift trust discounts member-support and group well-being functions as unnecessary (Meyerson et al. 1996). By contrast, the TIP theory maintains that the relational links between the members and between the member and the rest of the group are of paramount importance for new teams with no common past. Our results suggest complementarity between these two theories: those teams that did not become strongly focused in their communication on the task reported low levels of trust at the end, yet the task focus in communication could coexist in parallel with the social focus. Two of the HiHi teams continued to exchange social messages throughout

the project although they were clearly task focused. These results are consistent with findings that social exchanges can make computer mediated groups "thicker" as long as the social exchange is not at the expense of a task focus (Adler 1995, Walther and Burgoon 1992, Chidambaram 1996).

The current study also extends the theory of swift trust. Meyerson et al. (1996) deemphasized commitment ("There is less emphasis on . . . commitment . . .") because of the long-term reputational effects and clear role clarity. In the teams with high trust, there were explicit verbal statements about commitment, support, and excitement. Although prior research has found that members in computer mediated groups tend to express less excitement and support (Rice and Love 1987), the expression of such enthusiasm, if achieved, increases the attraction to the group, tendency for agreement, and cooperation (Fulk 1993).

Another finding of the study that might be endemic to virtually communicating temporal teams was the role of response. Our data supports the view of Meyerson et al. (1996) that initiatives (e.g., volunteering to complete tasks) appear to strengthen and unify the team, but the case data also suggest that the responses to the initiatives might be even more important. Because computer mediated communication entails greater uncertainty than face-to-face communication, there tends to be an "intense need for response" (Hawisher and Moran 1993). A response is an endorsement that another person is willing to take the risk of interpreting the first person's message and, if necessary, supplying the missing elements to make it understandable. Interpreted by Pearce (1974) to be a trusting behavior, a response also suggests involvement, and involvement conveys attraction, intimacy, attachment, and affection (Manusov et al. 1997).

Finally, one might be surprised by the lack of cultural effects in the study. The insignificance of culture in predicting perceived levels of trust as well as the lack of individuating information exchange may be related to the fact that the respondents were of similar ages, functional backgrounds, and educational levels. Additionally, electronically facilitated communication may make cultural differences insalient: the lack of nonverbal cues eliminates evidence of cultural differences, such as different ways of dressing, gesticulating, and greeting. Likewise, the written media eliminates the effect of accents which would again reduce the saliency of differences in cultural background. In addition, because the asynchronous mode gives individuals more time to process messages and respond, there might be fewer language errors, particularly among nonnative speakers of the language being used by the group, which would in turn reduce the saliency of differences in cultural background. Hence, by making cultural differences less noticeable, the medium may thereby increase the perceived similarity among members.

In summary, the results of the study suggest that in global virtual teams, trust might take on a form of swift trust with some variations. Trust might be imported, but is more likely created via a communication behavior established in the first few keystrokes. Communication that rallies around the project and tasks appears to be necessary to maintain trust. Social communication that complements rather than substitutes for task communication may strengthen trust. Finally, responding behaviors are as critical as initiating behaviors, and members have to explicitly verbalize their commitment, excitement, and optimism.

Limitations

There are several limitations that warrant mention before discussing implications. Although we observed naturally occurring teams, these teams were student teams where risks and rewards were grade based. The team members used primarily asynchronous electronic mail technology, and, on occasion, chat room technology; videoconferencing was not possible. The characteristics of the communication medium influence the communication behaviors (Straus and McGrath 1994). On the one hand, one might argue that the context was inordinately contrived by limiting teams to electronic communication. On the other hand, the context provides a rare opportunity to examine pure virtual interaction free from the influences of face-to-face interaction. Such research will, in the long run, not only afford us instruction as to the extent to which teams are able to work virtually, but also provide insight into the appropriate design of technology and group processes that facilitate virtual interaction.

The study can be criticized in several ways from the way trust was operationalized. Trust assumes that risk is present (Deutch 1958) and that members have alternatives (Luhmann 1988). The final project was designed to be a collaborative task, and the students were graded on their contributions to the task by their team members. This information was shared with their professors. All professors whose students were invited to participate were informed that the collaboration should count between 20% to 40% toward a grade in a course a student was taking at a time. Nevertheless, there were discrepancies in course credit and reputational effects, and hence in the participants' risk level. As an alternative to team cooperation, the project could conceivably have been completed by one person, although the workload was immense. The students could also have colluded with members of other teams who resided in the same university.

What is unknown is the extent to which participants were aware of these alternatives. Also, the study did not have any self-report measures of swift trust, only traditional conceptualizations of trust. Finally, the members were not assigned to teams to serve well-defined roles as the theory of swift trust assumes.

Another methodological weakness relates to the response rates of the surveys. It is possible that many of the least effective teams (and perhaps, least trusting) were not considered for analysis since the failure to receive at least two responses to the survey may have indicated a low level of participation on the team. Additionally, the lack of an objective measure of effectiveness renders conjectures about the implications of trust on objective team effectiveness impossible.

The external validity of the results might be faulted on having used students as participants. One should note, however, that the students were in master's programs and that most had significant work experience. Finally, the group size of all the teams was between four and six members. Such large-sized groups might face greater difficulties in the computer-mediated communication environments (Valacich et al. 1992). Perhaps the most serious concern of external validity is that the exercise represented many students' first experience in virtual teams (Hollingshead et al. 1993).

Implications

Theoretical Implications

Integrating research on trust and temporary organizational forms with group development literature as well as with computer-mediated and cross-cultural communication research, this study suggests implications for the specific theories. The boundaries for the traditional conceptualizations of trust may need to be reexamined and possibly reopened: trust in virtual teams appears to be somewhat depersonalized, but perhaps not as depersonalized as described in Meyerson et al.'s swift trust (1996). Also, trust might be initially created, rather than imported, via communication behaviors in global virtual teams. The case studies portray marked variations in the levels of communication richness across teams, suggesting that the information richness is an interaction between the people, tasks, the organizational context, and perhaps familiarity with the technology in use. The study also raises questions about how technology might obliterate, reduce, or delay the effects of culture and cultural diversity on communication behaviors when the setting is totally virtual.

The above theoretical implications must take into consideration that this study cannot provide any definite answers as to the existence and nature of trust in global virtual teams. Nevertheless, the case studies provide a rich basis for proceeding with such questions. In our case studies, the types of problems (unreliable technology, agreeing on ideas, dealing with nonparticipating members) were common in low and high trust teams; hence, the LoLo teams and HiHi teams were not distinct in terms of the circumstances they faced, but rather in the individual members' and teams' reactions to these circumstances. We therefore proffer, in contradiction to the opening quote of this paper, that it is viable to build upon and extend theories from the traditional communication contexts rather than assume that an entirely new sociology of group communication and interaction behavior is needed.

Implications for Practice

Some practical implications can be drawn from the study. For the manager of a virtual team, one of the factors that might contribute to smooth coordination early in the existence of the team is a clear definition of responsibilities, as a lack of clarity may lead to confusion, frustration, and disincentive. Particularly if the work is only part of the team members' organizational responsibilities, which is likely to be the case, providing guidelines on how often to communicate and, more importantly, inculcating a regular pattern of communication, will increase the predictability, and reduce the uncertainty, of the team's coordination. Furthermore, ensuring that the team members have a sense of complementary objectives and share in the overall aim of the team will help prevent the occurrence of desultory participation.

Another critical factor will be the effective handling of conflict. One strategy is to address perceived discontent as early as noticed: emotions left unchecked in the virtual environment might erupt into sequences of negative comments which will be difficult to resolve asynchronously. Another strategy in handling conflict will be to address as much as possible only the concerned individual and to avoid sending the entire team those messages dealing with the potentially conflict. Finally, not all individuals may be equally adept at handling the uncertainty and responsibilities inherent in virtual work. Managers should carefully choose individuals for virtual teamwork; such qualities as responsibility, dependability, independence, and self-sufficiency, while desirable even in face-to-face settings, are crucial to the viability of virtual teamwork.

For the participants on virtual teams, there are some observations derived from our study which may be relevant to practice. Although it is not necessarily critical to meet in person, it is critical to engage in an open and thoughtful exchange of messages at the beginning of the

team's existence. Cavalier attitudes that the virtual environment is no more challenging than a face-to-face environment prove to have ephemeral effects on participant enthusiasm, and once difficulties arise, the team lacks a substantive foundation upon which to overcome the real challenges imposed by the virtual context. Participants should also be aware of the importance of providing the others with timely and detailed accounts of the work they are doing. Likewise, participants must be aware of the need to provide thorough feedback on the contributions of the other members. Finally, participants should be aware that it is not the quantity, but the quality and predictability, of their communication that is most critical to the effective functioning of the team.

Suggestions for Future Research

Future research is encouraged to continue to address the three research questions that guided this work. Does trust exist in virtual teams and on what is it based? It is qualitatively different in terms of its antecedents, development, and decline from the traditional conceptualizations of trust as well as from swift trust as described in Meyerson et al. (1996)? Why are some groups capable of addressing problems and conflicts early on in the group's life, whereas others are not? What are the necessary conditions for virtual teams to learn dynamically and engage in team processes that allow the teams to redirect their activities at a halfway point or at a similar logical point of their life? What are the most effective ways of communicating social information in virtual teams? Additionally, systematic research is needed on the virtual team member profile, task requirements, technology capabilities, and other environmental circumstances that allow the team members to react in such a manner as to thicken rather than enervate the team in the face of the inevitable crises that occur in global settings. We need to understand the effective leadership styles and contrast virtual teams with and without initial face-to-face contact. The issues of member diversity also await exploration. Finally, from an organizational standpoint, how is knowledge and learning best transferred from one globally dispersed virtual team to another?

Conclusion

The virtual environment environment is bespeckled with uncertainty: Are other individuals reading the messages, and if not, why not? Are they having technical problems, or are they not committed? Such uncertainties militate against the development of trust and challenge the viability and longevity of global virtual teams. This has led to the argument that trust may not be possible in global virtual teams (Handy 1995). Yet, our exploratory study suggests that trust can exist in teams built purely on electronic networks. The study describes a number of communication behaviors and member actions that distinguished global virtual teams with high trust from global virtual teams with low trust. Encouraging such behaviors and actions on the part of members of global virtual teams might help to foster a climate condusive to the existence of trust.

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Appendix 1

Measures of Trust

Trust (adapted from Mayer et al. 1995)

If I had my way, I wouldn't let the other team members have any influence over issues that are important to the project.

I would be comfortable giving the other team members complete responsibility for the completion of this project.

I really wish I had a good way to oversee the work of the other team members on the project.

I would be comfortable giving the other team members a task or problem which was critical to the project, even if I could not monitor them.

Trust (adapted from Pierce et al. 1992)

Members of my work group show a great deal of integrity.

I can rely on those with whom I work in this group.

Overall, the people in my group are very trustworthy.

We are usually considerate of one another's feelings in this work group.

The people in my group are friendly.

There is no "team spirit" in my group.

There is a noticeable lack of confidence among those with whom I work.

We have confidence in one another in this group.

These questions were responded to on a five-point scale of 1 = strongly disagree, 2 = disagree, 3 = neither disagree nor agree, 4 = agree, 5 = strongly agree.

Table 1A Final Items and Reliability of the Trust Measure

	Alpha if item deleted
Overall, the people in my group were very trustworthy.	0.88
We were usually considerate of one another's feelings on this team.	0.91
The people in my group were friendly.	0.91
I could rely on those with whom I worked in my group.	0.90
Overall, the people in my group were very trustworthy.	0.88
Overall Alpha:	0.92

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