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## How do media expand?

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### Abstract

We conducted an in-depth, micro-level process analysis of 36 experimental groups working on a decision-making task in either desktop videoconferencing, audio conferencing or face-to-face environments. Using the framework of Giddens's structuration theory, we observed social structures producing behaviors and social structures reproducing behaviors that participants exhibited during the experimental task and then examined how these behaviors are related to their perceptions of media. Our study found that both ad hoc and established groups spent about 40% of their time performing structuring behaviors. We also found that members of established groups exhibited more social structures reproducing behaviors and less social structures producing behaviors than members of ad hoc groups. Members's structuring behaviors directly influence their perceptions of media. Our results suggest that future research on teams communicating via electronic media should focus more on group behaviors than on environmental variables such as media condition or group history.

**Keywords:** Computer-mediated communication, structuration theory, process analysis

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## How Do Media Expand?

Past research on computer-mediated communication has revealed that the “richness” of electronic media is not fixed by its mechanical characteristics (Burke and Chidambaram 1999; Carlson and Zmud 1999; Chidambaram 1996; Walther 2002; Yoo and Alavi 2001). This “media-expanding” line of research has demonstrated that group history can expand the perceived richness of electronic media, which would be otherwise classified as “lean” media according to media richness theory (Daft and Lengel 1984; 1986). It has been demonstrated that established groups can effectively conduct equivocal and complex tasks through lean media (Carlson and Zmud 1999; Yoo and Alavi 2001). What is not known in the literature is how media perception expands. What types of group behaviors lead to the expansion of media perception? Do group behaviors explain the changes in the media perception above and beyond technical characteristics and group history? In the literature, group history was treated as a “black box” that affects the media perception. However, precisely how and why group history *expands* media perception has not been well understood. In this paper, we attempt to open up the black box of group history by examining the differences in the group processes between established and ad hoc groups, and examine how these differences affect media perceptions. We use structuration theory (Giddens 1984) in analyzing group behaviors. Specifically, we attempt to answer the following questions.

1. What structuring behaviors distinguish ad hoc and established groups from one another?
2. Do different structuring behaviors affect media perception above and beyond technical characteristics of the media and group history?
3. Do technology characteristics affect the structuring behaviors?

The paper is organized as follows. After this introduction, a theoretical background is presented along with hypotheses. We then present the study design and offer detailed discussions on the methods and analytical approaches. The results of qualitative and quantitative analyses are presented. Finally, we conclude the paper by discussing implications for future research and practice.

### Theory and Hypotheses

#### Media Perception and Group History

Early theories on computer mediated communication take the position that media’s inherent characteristics will determine the effectiveness of the media for the task performance. Social presence theory and media richness theory are two prominent theories that reflect such a perspective. Social presence theory (Short et al. 1976) regards social presence as a quality inherent to a communication medium. It suggests that communication media that convey more cues would lead to a higher degree of social presence, thus creating more personal, sensitive and social communication environments. Similarly, media richness theory suggests that communication media vary in their ability to process rich information due to their inherent capacity for “immediate feedback, the number of cues and channels utilized, personalization and language variety” (Daft and Lengel 1986, p.560). The theory further argues that media with high information richness will be more effective in dealing with equivocal tasks.

Among many criticisms of these early media-dependent perspectives, one important stream of research suggests that the perception of so-called “lean” media sometimes can be

expanded among individuals who know each other. For example, McGrath et al. (1993) found that established group norms and relationships among members enable them to exchange equivocal messages through lean media. Walther (1995) argues that lean media can support the exchange of rich social information, if they are used over time by the same people. He found that the exchange of social information through lean media became as effective as an exchange through richer media over a period of time. Similarly, Chidambaram (1996) found that the perceived social presence of group support systems increased as group members spent more time with their team members. Carlson and Zmud (1999) made more forceful arguments in their channel expansion theory. They identified four experiential factors as the channel, the topic, the organizational context and the communication partners that expand the perceived richness of e-mail. Finally, Yoo and Alavi (2001) found that group cohesion influences the social presence of media above and beyond the media characteristics. They found that for ad hoc groups, media characteristics were influential in determining social presence and task performance, as predicted by media richness theory. However, for established groups, group cohesion was a much stronger predictor of social presence than media condition.

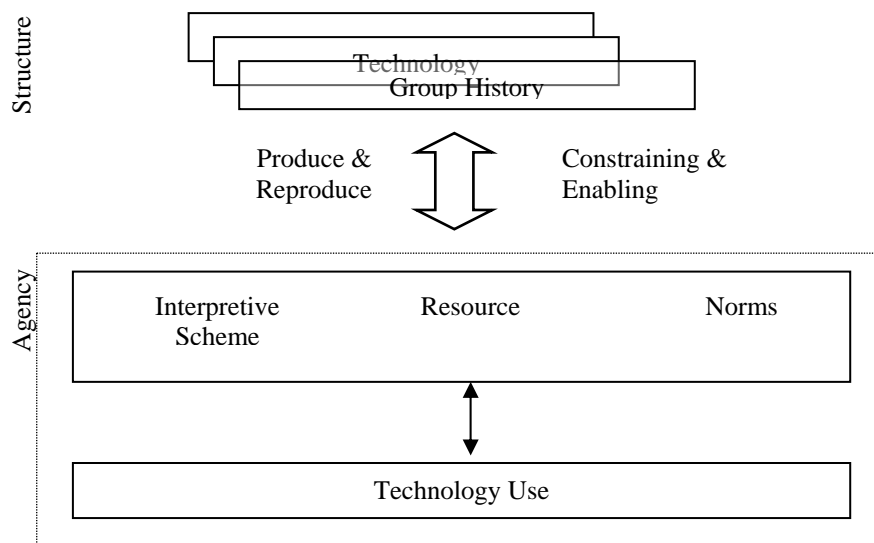
What is striking in this line of research that draws on a media-expanding perspective is that these studies treat group history as a black box that affects the media perception. Just as early IS research found that simply having technology would not produce the intended outcomes (DeSanctis and Poole 1994; Orlikowski 1992), we contend that group history itself would not automatically expand media perceptions. We argue that it is through specific group behaviors and appropriate group history that media perception expands. Understanding these behaviors can lead to a specific management strategy for both ad hoc and established groups that accelerates the expansion of media in teams that must use electronic media to perform their tasks. In this study, we focus on group members' behaviors that produce and reproduce social structures of the group that enable and constrain the group's activities.

### **Social Structures and Communication Technology**

Rooted in structuration theory (Giddens 1979; 1984), our study begins with the assumption that communication technology is a social technology that possesses technical features whose meanings are recreated through social interactions among the individuals who use it. Through the use of technology, individuals enact social structures – defined as a set of rules and resources people use in interaction – in group interactions. Before the initial use of a technology, the technical features of the tool represent the *structural potentials* of the technology (Orlikowski 2000). Structural potentials of a technology include the general objectives of the system, the intended capabilities and resources offered by the tool and the procedures by which the designers of the tool intended it to be used (DeSanctis and Poole 1994).

It is well documented in the literature, however, that in the use of technology, users often find idiosyncratic ways of using technology, thus circumventing the original designers' intentions (Barley 1986; DeSanctis and Poole 1994; Orlikowski 1992; Orlikowski 1993; Orlikowski 2000). Such gaps between the designers' intentions and actual usage practices arise primarily due to the separation between the two in time and space. As users attempt to interpret and use technology, they enact social structures from other sources such as group history, organizational culture and formal company policies and also produce and reproduce social structures (Barley 1986; Poole et al. 1985). In this study, we focus on how individuals produce and reproduce social structures that are pertinent to group history in their computer-mediated decision-making environments and examine how such enactments influence individuals' media perceptions. As noted by Orlikowski (2000), in any structural analysis, one must background some structures in order to examine others. Hence, in this

paper, we will foreground group history as a source of social structures in computer-mediated communication environments and background other factors such as media condition (see Figure 1).



**Figure 1.** Three modalities of social structures (Adopted from Orlikowski, 2000)

**Group History and Structuring Behaviors.** Group history is the past that the members of a particular group have shared (or not shared) within the context of that group's existence (Mennecke et al. 1992). Like other social structures, group history is produced and reproduced by the interactions among group members. According to Giddens (1984), social structures provide the "taken-for-granted" knowledge that enables social interactions. Therefore, ad hoc members do not have a taken-for-granted knowledge of group norms, roles and expectations (Giddens 1984), although some teams might be able to import certain routines from other contexts (Gersick and Hackman 1990). Since such taken-for-granted knowledge is integral to smooth social interactions, a lack of such shared knowledge can make communication problematic (Clark 1996).

We contend that members of ad hoc groups overcome this void by negotiating and agreeing upon – either explicitly or implicitly – the social structures of the team as they perform the task (Poole et al. 1985). In this study, we define the group behaviors through which members negotiate and develop new roles, norms of the group process and social relationships as *social structures producing* (SSP) behaviors. Our definition is informed by past research in group development that suggests groups not only produce task-related outcomes such as actual task outputs, role differentiation (Bales 1970; Bales and Strodtbeck 1951; Liang et al. 1995; Moreland et al. 1996) and preferred approaches to tasks (Bavelas 1950; Freeman 1977; Guetzkow and Simon 1955), but also socio-emotional outcomes such as attraction to the group (Evans and Dion 1991; Keyton and Springston 1990; Tschuschke and MacKenzie 1989) and trust (Korsgaard et al. 1995; O'Reilly et al. 1989). In computer-mediated contexts, Valacich, Mennecke, Watcher and Wheeler (1994) found that members of ad hoc groups negotiated the norms and rules of the group as they performed the experimental task, thus influencing task outcomes. Valacich et al. suggested that the unexpected outcome of their study might in part be due to the structuration process. Majchrzak et al. (2000) and Malhotra et al. (2001) found that the virtual team they studied had to negotiate various social structures governing the group, the organization and

technology. They found that social structures evolve over time through such negotiation processes. Maznevski & Chudoba (2000) observed two established and one new virtual teams. They found that the new virtual team struggled to establish social structures that governed the temporal dynamics of the team, while the more established teams showed clear repeated patterns of temporal dynamics. These outcomes of group development can be viewed as structural potentials that can later be enacted by the group in their subsequent interactions (Poole et al. 1985).

On the other hand, once group history is established, group members can possibly draw upon the existing social structures in order to carry out their task (McGrath et al. 1993). In this study, we define group behaviors through which members draw on existing role expectations, group norms and social relationships as *social structures reproducing* (SSR) behaviors. McGrath et al. (1993, p. 408) observed that group history tends to reduce the level of intra-group coordination and information exchange required by decreasing the uncertainty and ambiguity associated with the distribution of ability and motivation within the group and by increasing predictability. Weick and Roberts (1993) noted that team members who share experiences could coordinate their actions for mission-critical tasks in a heedful way without explicit coordination and communication. Recently, Berman et al. (2002) found that shared experiences among players in National Basketball Association teams facilitated the development of the team's tacit knowledge, thus improving their performance. These studies, along with the growing body of social cognition literature (Hutchins 1995; Levine et al. 1993; Liang et al. 1995; Moreland 1999; Moreland et al. 1996; Resnick et al. 1991), suggest that group history provides a stock of shared knowledge, shared norms and rules and the ability to anticipate others' moves.

While structuration theory argues that single actions simultaneously produce and reproduce social structures (Giddens 1984; Orlikowski 2000), Barley and Tolbert (1997) proposed a diachronic approach to fully understanding the processes by which social structures and actions are reciprocally related. Giddens' original portrayal of the enactment process is essentially static, making only implicit temporal assumptions. Therefore, we need a more dynamic approach that links actions to the production and reproduction of social structures. Thus, we analytically separate SSP and SSR. Our approach is consistent with DeSanctis and Poole (1994), who also proposed to separately analyze technology appropriation behaviors that produce and reproduce social structures.

Therefore, while both established and ad hoc groups will show SSP and SSR behaviors in their enactment processes, we expect that ad hoc groups will show more SSP behaviors as they try to develop new roles, rules and relationships, while established groups will show more SSR behaviors as they enact existing social structures as they appropriate technology in performing the task. Thus, we hypothesize:

- H1a:** Established groups will show SSR behaviors more frequently than ad hoc groups.
- H1b:** Ad hoc groups will show SSP behaviors more frequently than established groups.

**Structuring Behaviors and Social Presence.** In the context of computer-mediated environments, the features of the enabling communication media are interpreted and appropriated in light of on-going structuring behaviors. Thus, if the communication media that support the group do not consider these on-going structuring behaviors, there will be an incongruence between the activities and the communication media, even if the media meet the communication needs of the task characteristics proposed by media richness theory (Daft and Lengel 1986; Daft and Weick 1984). Furthermore, while more deterministic theories

(Daft and Lengel 1984; 1986; Short et al. 1976) suggest that a medium's inherent technical bandwidth is the only source of equivocality reduction or sociability in communication, we argue that existing social structures can be an equally powerful means of reduction and sociability. Established groups can reduce uncertainties and simplify their task performance by drawing upon the existing social structures when possible. Gersick and Hackman (1990) noted that groups can import routines of the past and reduce the cognitive load. Understanding the background and the contexts simplifies the communication needs. Citurs and Yoo (1999) found that e-mail communication became shorter and more implicit over time as team members gained more experiences together. Lee (1994) demonstrated that readers who understand the context can extract complex interpretations from simple e-mail exchanges. Thus, we believe that groups who can draw on existing social structures through more frequent SSR behaviors would perceive the given medium richer.

To the contrary, we submit that SSP behaviors are more complex and cause more ambiguity among group members than SSR behaviors. This is because, while SSR behaviors are routine and repeated behaviors, SSP behaviors are typically new and thus equivocal. In performing SSP behaviors, people often seek other members' confirmations and agreements. Valacich et al. (1994) observed that new group members communicated significantly to determine how to perform even a simple, experimental task. In addition, SSP behaviors are often ironic, conflicting and ambiguous (Giddens 1984). Participants were reluctant and hesitant when showing SSP behaviors. Therefore, for a given communication environment, we expect that the more often group members exhibit SSP behaviors, the more they feel constrained in their communications, which would lower their perceptions of social presence in communication interactions. Finally, we expect that the impact of group history will be fully mediated through SSP and SSR behaviors and group history will have no direct impact on social presence. Thus, we hypothesize:

- H2a:** Groups who show more frequent SSR behaviors will perceive their communication medium as having a higher degree of social presence than groups who showed less frequent SSR behaviors.
- H2b:** Groups who show more frequent SSP behaviors will perceive their communication medium as having a lower degree of social presence than groups who showed less frequent SSP behaviors.
- H2c:** When SSP and SSR behaviors are considered, group history will not have a direct impact on social presence.

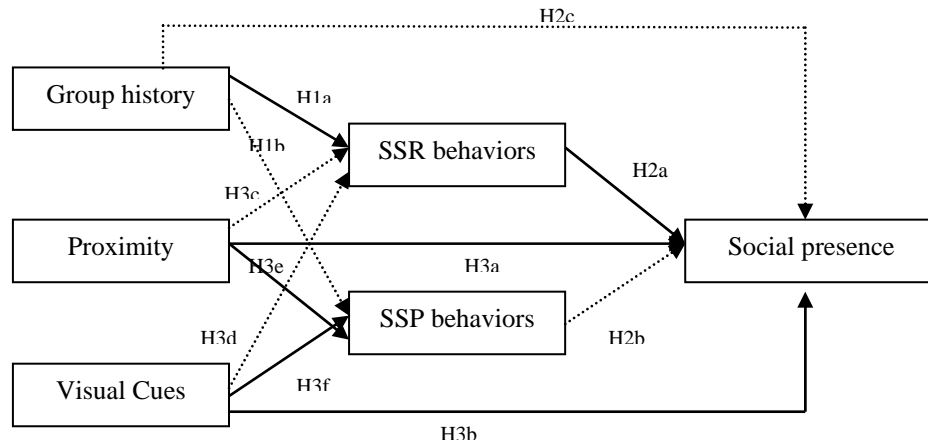
Finally, we expect that the technical features of a medium would influence the social presence of media (Daft and Lengel 1984; Short et al. 1976). Media richness theory suggests that rich media will allow more equivocal communications, while lean media will make such communications more difficult. Therefore, in the lean communication environment, it is more likely that group members will resort to a simplified communication strategy that draws on existing rules and expectations. Therefore, we argue that the impact of the technical features of a medium on the social presence of interaction is in part mediated by SSP and SSR behaviors.

Thus, we hypothesize that:

- H3a:** Face-to-face groups will perceive their communication medium as having a higher degree of social presence than distributed groups.
- H3b:** Distributed groups with visual cues will perceive their communication medium as having a higher degree of social presence than distributed groups without visual cues.

- H3c:** Face-to-face groups will show fewer SSR behaviors than distributed groups.
- H3d:** Distributed groups with visual cues will show fewer SSR behaviors than distributed groups without visual cues.
- H3e:** Face-to-face groups will show more SSP behaviors than distributed groups.
- H3f:** Distributed groups with visual cues will show more SSP behaviors than distributed groups without visual cues.

Our research model is summarized in Figure 2.



Note: Straight lines denote positive relationships and dotted lines denote negative or non-significant relationships.

**Figure 2.** Research model

### Study Design

#### Data Set

We used a subset of a data set collected from a controlled laboratory experiment, manipulating group history (ad hoc and established groups) and communication environments (face-to-face, audio conferencing and desktop videoconferencing). Both group history and communication environments were between-participant manipulations that created six different experimental conditions. The participants of the study were undergraduate students taking an introductory business school computer literacy course at a large state university in the United States. A total of seventy-two triads (forty ad hoc and thirty-two established) participated in the experiments. All sessions were videotaped. A random sample of thirty-six sessions (six triads in each experimental condition) was drawn for the in-depth process analysis reported in this paper.

#### Task

All groups received the same task, "Van Management," (Mennecke and Wheeler 1993) and instructions for the session. In this task, the participants were instructed that they needed to select one recipient of a new van. The recipient was to be selected from a group of five sales managers whose biographic information and reasons for needing a new van were provided to the group members. All participants were given the same information and the same task of deciding as a group who should receive the new van.



### Manipulation of Group History

Ad hoc and established groups were recruited from different sections of the same course. Participants in the ad hoc group treatment were scheduled individually and first met their teammates when they began the experiment. To minimize possible in-class contact among the participants, all the experiments with ad hoc groups were completed before the mid-point of the semester.

Participants in the established group treatment were asked to form a group of three at the beginning of the term for a semester-long project. In addition, they were required to complete two computer program projects as a group before participating in the experiment. Experiments for the established groups started after the mid-point of the semester so that, by the time they participated in the experiment, these groups could be characterized as established groups with a significant history of working together (McGrath 1984). To check the group history manipulation, participants were asked at the end of the experiment how many hours group members had worked together prior to the experiment. On average, established group members had spent 32.6 hours, while ad-hoc group members had spent less than 0.05 hours ( $p < 0.0001$ ). Furthermore, in order to examine if established groups indeed developed a sense of shared history significantly more than ad hoc groups, we measured group cohesion using the Group Attitude Scale (Evans and Jarvis 1986). The results clearly demonstrated that established groups developed a much stronger sense of group cohesion than ad hoc groups ( $p < 0.001$ ).

### Manipulation of Media Condition

For the face-to-face treatment, group members worked together in a small room via three networked computers with application-sharing capabilities so that all three members could see and manipulate the same applications. For the audio conferencing treatment, group members were located in three separate rooms with a three-way conference call and application-sharing capability. Finally, for the desktop videoconferencing treatment, group members in three separate rooms were connected via desktop videoconferencing systems that provided full motion video, audio and application-sharing. Since the communication environment manipulation has face validity, no explicit manipulation check was performed.

**Measurement of Group Process.** To measure the structuring behaviors exhibited by group members during the experimental task, we content analyzed the behaviors of the group members into thematic categories. Although there are several coding systems available for content analyses of group members' interaction behaviors (e.g. Bales 1950; Futoran et al. 1989; Hirokawa 1982), these systems were not developed in the context of the structuration process. The coding system developed by DeSanctis and Poole (1994) focuses primarily on the social structures instantiated in the use of information technology, not other sources of social structures. Thus, we decided to develop our own coding system by adopting and modifying existing coding systems for the purpose of our study. The approach that we took was a mixed method (Boyatzis 1998; Glasser and Strauss 1967; Strauss and Corbin 1990). To begin with, we sought to identify the structuring behaviors. Thus, the theory provided us a high level category of behaviors to look for, namely SSP and SSR behaviors. However, we could not specify what behaviors we would expect to see. Thus, we had to inductively develop a list of behaviors within the SSP and SSR categories.

The process we used drew upon the recommendations of Boyatzis (1998), Eisenhardt (1989), and Strauss and Corbin (1990). The authors each took a random sample of six videotapes (three ad hoc teams and three established groups not included in the actual data analysis) with the goal of independently content analyzing the behavior of the group members into categories of group behavior that might represent the production and

reproduction of social structures for ad hoc and established groups. In particular, guided by our definition of SSP and SSR behaviors, we focused on the behaviors that create, negotiate or draw on role expectations, group norms and social relationships. We also coded mundane task performance and clarification activities.

Each tape was subjected to a within-case analysis that involved repeatedly watching the tape and taking thorough notes on behaviors exhibited by the group members. After individual tapes had been analyzed, we began cross-case comparisons that involved listing similarities and differences across the sample. This led to a search for patterns and finally the grouping of related behaviors into themes or categories (Boyatzis 1998; Strauss and Corbin 1990). The end result for each of us was a list of categories of team behavior and examples that fit within each category.

Categories	Codes	Definition of Codes
New role development	Volunteering	This is a participant's explicit statement about his or her own skill or role. This can be either a positive volunteering or negative one.
	Asking for volunteer	This is an explicit attempt to reduce the uncertainty in role specification. This indicates lack of agreements among group members in terms of role specification structure.
Demonstration of existing role separation	Jumping in	Someone starts typing or using mouse to find the place to type without explicitly asking affirmation from other members. Other members do not challenge this behavior. This indicates that other members acknowledge the person who jumps in is capable of performing the task.
	Giving direction	This is an opposite of volunteering. In this case, one participant explicitly direct another member what to do. This does not include dictation. This indicates that members know other members' skill and resources quite well. This is an indication of existing role differentiation structure among group members.
	Dictation	This captures the moments when one person of the group dictates what needs to be typed or written more than one sentence in a row. Typically, <i>but not necessarily</i> , followed by a confirmation question by the typing person.
New social relationship development	Inappropriate Laughter	Laughing when no humor was expressed. This captures participants' uneasy feeling with other members. This behavior is expressed when a participant is trying to hide their nervous and uncomfortable feeling about his/her group members or comments made by others or himself/herself.
	Asking name or spelling	This includes both explicitly asking spelling of other members or spelling out his/her name to other members during the task.
	Ambiguous statement on task	This includes suggestions, supporting arguments, and factual comments regarding the task that were made in a manner that the tone of the statement or the phrases used in the comments show uneasy feeling of the speaker in making his/her point explicitly. Includes statements such as "Um, well, I guess we can give the van to Erica."
	Ambiguous statement on technology	This includes suggestions, supporting arguments, and factual comments regarding the technology that were made in a manner that the tone of the statement or the phrases used in the comments show uneasy feeling of the speaker in making his/her point explicitly.
	Ambiguous statement on process	This includes suggestions, supporting arguments, and factual comments regarding the process that were made in a manner that the tone of the statement or the phrases used in the comments show uneasy feeling of the speaker in making his/her point explicitly.

*Table continues next page*

*Table 1 continues from the prior page*

Categories	Codes	Definition of Codes
Demonstration of existing social relationship	Playfulness	This code captures the level of relationship maturation among group members. This captures the expressed degree of comfort among group members during the task performance. This includes expressions of humor and relaxation, including both verbal expressions and behaviors, typically building on their prior shared experiences and knowledge. This excludes nervous laughter or laughter <i>without</i> provocation.
	Use of profanity	This includes use of profanity in both a humorous and irritated context, which shows a high level comfort with the other group members.
	Interruption	This includes interruption of other members' comments by interjecting his/her own comments or other sudden disturbance, such as making intentionally loud noise. Typically this is coded with another category. If the person who got interrupted continues to talk, his/her comment should not be treated as two incidents.
	Explicit contradiction	This captures direct, uninhibited, and explicit disagreements. This also includes making alternative suggestions to directly express the disagreement on the comments made by the previous speaker, and includes sarcastic comments.
Clarification	Task clarification	This code captures clarification questions regarding the task itself. Typically, it's about the goal or objective of the task. It also includes factual questions.
	Process clarification	This code captures clarification questions regarding process itself and other things. This includes asking spelling of other person's name after it is typed without asking the spelling initially. It also includes simple questions like "What did you say?"
	Technology clarification	This code captures clarification questions regarding the way they use technology.
Explicit task discussion	Explicit statement on task	This captures uninhibited and explicit comments and statements related to the task. This includes suggestions, supporting arguments, and factual comments, and answers to clarifying questions.
	Explicit statement on technology	This captures uninhibited and explicit comments and statements related to the technology. This includes suggestions, supporting arguments, and factual comments, and answers to clarifying questions.
	Explicit statement on process	This captures uninhibited and explicit comments and statements related to the process. This includes suggestions, supporting arguments, and factual comments, and answers to clarifying questions.
	Explicit agreement	This captures participants' clear and unequivocal agreements toward a suggestion.
	Asking for agreement	This captures participants' attempts to solicit agreements or explicitly confirm agreements.

**Table 1.** Coding systems

At this point, we compared and contrasted the two lists we had separately developed while watching the tapes and searching for the listed behaviors. We then integrated the lists, making clarifications and additions, and settled upon a final list of 23 behaviors clustered into the following six clearly separated, conceptual categories: new role development; drawing on existing role separation; new social relationship development; drawing on existing social relationship; clarification; and explicit task discussion. Table 1 presents the list of behaviors,

their specific definitions and sample quotes or examples of how they were exhibited by the members. Among these six categories, the first four categories were directly related to structuring behaviors and the other two were mundane task performance and clarification. We included new role development and new social relationship development in the list of SSP behaviors and included drawing on existing role separation and drawing on existing social relationship in the list of SSR behaviors. This was turned into a codebook that would be used to code each group's behavior and thus help determine how frequently each behavior was exhibited by each group in the study.

In order to establish reliability, we then hired a coder who was blind to the research questions and experimental conditions. The coder underwent a training process that included iteratively coding clips of the six tapes that were used to develop the coding systems and then meeting with us to clarify code definitions and applications. Once we felt that this individual had a clear understanding of the code, the coder and the second author, who was also blind to the experimental conditions of each group, coded four random 10-minute clips of tapes that were part of neither the coding system development nor the actual data analysis. The clips were selected to occur in the middle 10 minutes of the experimental sessions, which did not include the early warm-up phase of the group projects or the winding down phase.

Frequency counts of each behavior were made and coding reliabilities were calculated for each separate code as the percent agreement across all clips between both coders (Boyatzis 1998). The coder and the second author achieved an average inter-rater reliability of 71%. Coding involved marking a scoring sheet with the specific code and the time on the tape when a behavior listed in the codebook was observed. The group members' verbal statements were the unit of analysis and the number of times a code could be applied was unlimited. Once reliability was established between the coder and the second author, the second author coded the 36 tapes. The end result was a frequency of the number of times a code was applied in each group<sup>1</sup>.

**Measurement of Media Perception.** Individuals' media perceptions were measured using the original social presence measure that was developed and tested by Short et al. (1976) as a single dimension that represents a cognitive synthesis of several factors of communication interaction. A higher score represents a communication medium with a higher degree of social presence. Four items were measured immediately after the session, using a seven-point semantic anchoring scale. An inter-rater reliability coefficient (James coefficient) was used to examine the intra-group reliability of responses (James et al. 1984). The intra-group reliability measure for social presence was .78. Thus, group members' assessments of social presence were aggregated to the group level. To measure groups' performance in the negotiation task, we measured the time taken to reach consensus.

## Results

We conducted the data analyses in three steps. First, we performed a descriptive analysis of the content coding results. Second, we examined the reliability and validity of the variables used in our study. Finally, we tested our hypotheses using a structural equation modeling technique called Partial Least Squares (PLS)<sup>2</sup>. PLS generates estimates of standardized regression coefficients (i.e., beta coefficients) for the model paths, which can then be used to measure the relationship between latent variables (Wold 1985). Among the

<sup>1</sup> Examples of the coding are available from the authors upon request.

<sup>2</sup> We used PLS-GRAPH version 2.19 for our study to run PLS.

many benefits of structural equation modeling tools, as compared to traditional multivariate statistical methods such as MANOVA or multiple regression combined with exploratory factor analysis, is their capacity to simultaneously estimate both the structural (i.e., path model) and the measurement components (i.e., factor model) (Fornell and Bookstein 1982; Fornell and Larcker 1981; Hayduck 1987; Loehlin 1992). We chose PLS among several structural equation modeling tools, including EQS, AMOS, and LISREL because, unlike other tools, PLS does not require a large sample size (Barclay et al. 1995; Fornell and Bookstein 1982). Furthermore, PLS is more suitable when the objective is causal-predictive testing rather than complete theory testing (Barclay et al. 1995; Chin 1998a; b).

Given that the model presented in the previous section has not been tested in its entirety and that our sample size was 36 groups, we opted to use PLS. Generally, the ratio between the number of observations and the number of independent variables needs to be within the range of 5-30 (Guadagnoli and Velicer 1988). In the case of PLS, we should apply this rule for the most complex portion of the model (Chin 1998b), which here has 5 independent variables with a sample size of 36. Thus the ratio is 7.6, which is within the recommended range.

### Descriptive Results of Content Coding

A total of 6,413 behaviors were observed and coded. An average of 178.14 behaviors (S.D. = 64.06) were observed for each group. There were no differences in terms of the total number of behaviors observed among conditions (group history and media conditions). The frequencies of individual behaviors were aggregated for the corresponding category. Then, given that certain groups could have talked more and spent more time on the task, we decided to analyze the process based on proportions rather than on the actual number of behaviors in each category. Table 2 shows the descriptive statistics of these categories.

Category		Mean (%)	S. D.	F-values of differences between ad hoc and established groups.
New role development	Ad hoc	1.78	1.26	
	Established	0.94	0.80	5.58*
Demonstration of existing role separation	Ad hoc	0.89	0.76	
	Established	3.56	2.53	18.41**
New social relationship development	Ad hoc	17.67	6.57	
	Established	0.61	4.61	37.29**
Demonstration of existing social relationship	Ad hoc	17.89	6.76	
	Established	26.61	7.09	14.26**
Clarification	Ad hoc	17.28	4.35	
	Established	19.06	3.77	1.72
Explicit task discussion	Ad hoc	44.39	4.94	
	Established	44.06	5.77	0.04

• p < 0.05; \*\* p < 0.01

**Table 2.** Descriptive statistics of eight categories

To examine differences among experimental conditions in these six categories, we performed a multivariate analysis of variance (MANOVA) followed by a series of variance analyses (ANOVA). MANOVA detected the significant main effect of group history (Wilks' Lamda = 0.27;  $F(7, 24) = 9.395, p < 0.001$ ), without the significant main effect of media condition (Wilks' Lamda = 0.43;  $F(14, 48) = 1.802, p = 0.065$ ) or significant interaction effect (Wilks' Lamda = 0.490;  $F(14, 48) = 1.468, p = 0.160$ ). Thus, we focused on group history for the subsequent ANOVA analyses.

The results of ANOVA (see Table 2) showed that there were no differences in terms of the frequency of clarification and explicit task discussions between ad hoc and established groups as had been expected. However, as expected, our results show that among four groups of behaviors, ad hoc groups showed significantly more new role development and social relationship development behaviors compared to established groups.

**Test of Measurement Model**

Since PLS uses simple and multiple regressions using ordinary least squares, experimental conditions were treated as nominal scales in multiple regression (Cohen and Cohen 1983; Sosik et al. 1997). The group history condition was a dummy variable coded as 0 for ad hoc groups and 1 for established groups. Since there were three different media environments, we used two dummy variables for the media condition. The first variable captured the proximity condition and was coded as 0 for distributed groups (audio conferencing and desktop videoconferencing groups) and 1 for face-to-face groups. The second variable captured the visual cue conditions in distributed groups and was coded as -1 for audio conferencing groups, +1 for desktop videoconferencing groups and 0 for face-to-face groups. This approach makes it possible to contrast audio conferencing and videoconferencing groups while minimizing the effects of face-to-face groups (Cohen and Cohen 1983, pp. 198-204). For SSP behavior, we specified a latent variable for social structures producing behaviors using new role specification and new social relationship development categories as indicators. Likewise, for SSR behaviors, we specified other latent variables using demonstration of existing role separation and demonstration of existing social relationship categories as indicators.

	Social presence	SSP Behaviors	SSR Behaviors
<b>Social presence</b>			
1	<b>.75</b>	-.39	.22
2	<b>.90</b>	-.44	.26
3	<b>.86</b>	-.44	.33
4	<b>.83</b>	-.34	.30
<b>SSP Behaviors</b>			
1	-.51	<b>.84</b>	-.29
2	-.26	<b>.77</b>	-.73
<b>SSR Behaviors</b>			
1	.21	-.34	<b>.84</b>
2	.34	-.68	<b>.78</b>

Note: Largest factor loadings for each item are boldfaced and underlined.

SSP1: New role development

• SSP2: New social relationship development

SSR1: Demonstration of existing role separation

SSR2: Demonstration of existing social relationship

**Table 3.** Factor and cross-factor loadings

We estimated the measurement model by examining the following: (a) individual item reliability; (b) internal consistency; and (c) discriminant validity. We assessed individual item reliability by examining the loadings of the measures in their corresponding construct.

Table 3 shows the factor and cross-factor loadings of constructs with more than one item. A common rule of thumb is that the factor loadings should exceed .7 because this implies that less than half of the item’s variance is due to error. All constructs met the above criterion.

Internal consistency was examined using the composite scale reliability index developed by Fornell and Larcker (1981), a measure similar to Cronbach’s alpha. Fornell and Larcker (1981) recommended using a criterion cut-off of .7 or more. The internal consistency of each scale used in the study is shown in Table 4. All constructs met the recommended criterion.

	Ad hoc Groups						Established Groups						Correlation of constructs <sup>b</sup>			Reliability
	Face-to-Face (n = 6)		Audio (n = 6)		Video (n = 6)		Face-to-Face (n = 6)		Audio (n = 6)		Video (n = 6)		1	2	3	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
1. Social presence	4.8	0.6	5.9	0.5	6.1	0.6	5.3	0.5	6.0	0.8	6.5	0.3	<b>.83</b>			.90
2. SSP behaviors	23.0	7.3	19.0	7.8	16.3	3.1	8.3	5.9	5.0	3.8	7.8	4.9	-.46	<b>.81</b>		.79
3. SSR behaviors	17.3	7.8	17.5	7.9	21.5	4.6	26.3	8.2	30.2	7.5	34.0	5.5	.34	-.68	<b>.81</b>	.79

Note:

a. For partial least square (PLS) analysis, these variables were measured with one indicator. Therefore, the internal consistency and average variance extracted for time could not be calculated with PLS.

b. Boldfaced elements on the diagonal represent the square root of the average variance extracted. Off-diagonal elements are correlations between constructs. For adequate discriminant validity, the elements in each row and column should be smaller than the boldfaced element in that row or column.

**Table 4.** Means, standard deviations, internal consistencies, correlation of constructs

In PLS, the discriminant validity of items is assessed using criteria similar to those of a multitrait/multimethod analysis (Barclay et al. 1995). One criterion is that the construct represented should share more variance with its measures than it shares with other constructs in a model. To assess discriminant validity, Fornell and Larcker (1981) suggest the use of the measure Average Variance Extracted, which is the average variance shared between a construct and its measures. This measure should be greater than the variance shared between the construct and other constructs in the model. Table 4 shows the correlation matrix for the constructs. The diagonal of this matrix is the square root of the Average Variance Extracted. For adequate discriminant validity, the diagonal elements should be greater than the off-diagonal elements in the corresponding rows and columns. Results shown in Table 4 indicate that this criterion was met. Another criterion is that no measurement item should load more highly on another construct than it does on the constructs it intends to measure. An examination of factor and cross-factor loadings (Table 3) showed that all items passed this criterion.

**Tests of Hypotheses**

The results of the hypothesis testing are shown in table 5. The statistical significance of the path coefficients was assessed using a bootstrapping procedure (Barclay et al. 1995).

We expected that established groups would show SSR behaviors more frequently than ad hoc groups (H1a), while ad hoc groups would show SSP behaviors more frequently than established groups (H1b). Both of these hypotheses were supported.

We hypothesized that frequent SSR behaviors would lead to a higher degree of social presence (H2a), while frequent SSP behaviors would decrease social presence (H2b). Furthermore, we expected that the impact of group history would be fully mediated through

SSR and SSP behaviors. Thus, we hypothesized that group history would have no significant direct impact on social presence (H2c). As expected, the SSP behaviors led to a lower degree of social presence and group history did not affect the social presence once the impact of SSR and SSP behaviors was considered. Thus, H2b and H2c were supported. However, SSR behaviors did not improve the degree of social presence. Therefore, H2a was not supported.

Hypotheses	Paths	Predicted direction	Standard path coefficient (t-value)	Result
1a	Group history → SSR behaviors	+	-.70** (9.67)	Supported
1b	Group history → SSP behaviors	-	-.66** (10.69)	Supported
2a	SSR behaviors → Social presence	+	-.06 (0.79)	Not supported
2b	SSP behaviors → Social presence	-	-.37* (1.83)	Supported
2c	Group history → Social presence	n.s.	-.23 (0.60)	Supported
3a	Proximity → Social presence	+	.47** (4.49)	Supported
3b	Visual cues → Social presence	+	.41** (3.07)	Supported
3c	Proximity → SSR behaviors	-	-.31** (3.08)	Supported
3d	Visual cues → SSR behaviors	-	-.05 (0.43)	Not supported
3e	Proximity → SSP behaviors	+	.13 (1.58)	Not supported
3f	Visual cues → SSP behaviors	+	.23 (1.61)	Not supported
<b>R<sup>2</sup></b>				
	SSR behaviors		.49	
	SSP behaviors		.44	
	Social presence		.60	

• p < 0.05; \*\* p < 0.01

**Table 5.** Tests of hypotheses

Finally, drawing on media richness theory and social presence theory, we hypothesized that media with technically “rich” characteristics would lead to a higher degree of social presence (H3a and H3b). As expected, proximity and visual cues enhanced social presence. Thus, H3a and H3b were supported. We further hypothesized that rich media would encourage more SSR behaviors, while lean media environment would lead to more SSP behaviors (H3c through H3f). Face-to-face groups showed fewer SSR behaviors than distributed groups, thus supporting H3c. However, proximity did not affect SSP behaviors. Also, visual cues affected neither SSR nor SSP behaviors. Therefore, H3d through H3f were rejected.

### Discussion and Conclusion

The fundamental question that we ask in this study is how group history *expands* the perception of media? Our study shows that it is through structuring behaviors of the group that group history expands the perception of media. Our study was directed by three research questions. We will discuss the results of those three questions next.

#### Group History and Structuring Behaviors

The first question explores the differences between established and ad hoc groups in their structuring behaviors. We found about 40% of groups’ activities (both ad hoc and established) were structuring behaviors. In particular, ad hoc groups in our study performed social structures producing behaviors significantly more frequently than established groups. Often such social structures producing behaviors involved ambiguous statements, lukewarm



agreements and ambiguous disagreements in an effort to avoid breaking newly born fragile social structures. Giddens (1993, p130) notes that the “rule-following” in the constitution of interaction is “to know how to apply it to novel circumstances, which include knowing about the *contexts* of its application” (italics original). In the absence of such rules and the stock of mutual knowledge, as in the case of ad hoc groups in this study, individuals make ambiguous statements in attempts to “test the water” and find out what is acceptable in the context. Once such attempts are successfully accepted or rejected by other members, new rules become part of the group’s repertoire of social structures that enable and constrain their future actions.

On the other hand, established group members showed much more frequent social structures reproducing behaviors, which often involved the use of humor and , direct confrontation, and much uninhibited behaviors. Such behaviors provide a sharp contrast to those of ad hoc group members, who were much more cautious and hesitant in their interactions. According to Giddens (1984), the reproduction of social structures through routinization is primarily found in the realm of *practical* consciousness, which involves skillful and tacit applications of mutual knowledge in the course of social interactions. The spontaneous and uninhibited interactions among established group members that we observed are consistent with Giddens’ argument.

Our results challenge one of the perceived advantages of electronic media often mentioned in the literature – the belief that the use of electronic media will allow organizations to bring individuals around the world in order to quickly solve a specific problem. Our results suggest that all groups, whether they are face-to-face or computer-mediated, are inherently social and spend about 40% of their time producing and reproducing social structures. They negotiate rules and norms, establish boundaries and roles and develop a shared stock of knowledge. They use such social structures, when possible, to make the processes more efficient and effective. Thus, organizations deploying computer-mediated teams for “quick” problem solving will be disappointed. Just like other teams, these teams need to be nurtured, developed and properly managed.

At the same time, our results suggest that the management of ad hoc teams communicating via electronic media needs to be different from that of established teams. We found that most structuring behaviors in ad hoc groups were social structures producing behaviors while those in established groups were social structures reproducing behaviors. Given the stark contrast between these two behaviors, the leadership skills and managerial interventions required by each context are inherently different.

Our content analyses also showed that social structures producing behaviors occurred as groups moved from one activity to another. The experimental task used in our study required that the groups type in their response to the case. Most groups approached the task by first discussing the case and then typing their response, although many of them went on to discuss the case once they started typing their response (McGrath 1991). As such, there was a typical moment of transition from a phase dominated by discussion to another phase wherein typing was the primary activity. Such transitions were evidenced by participants’ remarks, such as “Let’s type,” or “What should we do now?” These transitions created a novel situation for ad hoc groups who had never worked together and consequently revealed a lack of established social structures in the group. Giddens (1984) argues that such “critical situations” occur “when there is radical disjuncture of an unpredictable kind which affects substantial numbers of individuals” (p. 61). Anxieties, uncertainties and contradictions arise in such critical situations. The participants in our study reacted to these uncertainties and contradictions by trying to produce new social structures, as shown in the above excerpts. This suggests that a breakdown in teams is not necessarily something to be avoided. Rather, it is an opportunity to build social structures.

### Structuring Behaviors and Media Perception

The second question explores the relationship between media perception and group behaviors. Our study shows that the group's structuring behavior, particularly social structures producing behavior, has a significant impact on social presence. We also found that when the impact of group behaviors is considered, group history does not have a direct impact on media perception. Instead, its influence on media perception was fully mediated through group behaviors.

In particular, we found that social structure producing behaviors have a significant impact on media perceptions. Our results indicate that groups' initial attempts to negotiate and establish new rules and norms seem to require more communication "bandwidth" than social structure reproducing behaviors, thus making the given media less accommodating.

Past media-expanding line of research has focused on how shared group history expands media perception (Carlson and Zmud 1999; Chidambaram 1996; Yoo and Alavi 1996). We found that group history does not expand media perception. Rather, media perception of ad hoc groups *contracts* due to the lack of existing social structures within the group and in response to members' efforts to produce new ones. As Clark (1996) has pointed out, developing *common ground* enables communications among group members. When such common ground does not exist, group members attempt to build it through social structures producing behaviors. Yet, such social structures producing behaviors seem to contract the perceptions of a given media because these behaviors demand more social cues.

Our study also shows that group history itself does not automatically affect media perceptions. It is group behaviors that affect media perceptions. This suggests that if ad hoc groups need fewer social structures producing behaviors because they have alternative mechanisms to rapidly establish necessary social structures, they may perceive their communication media as being richer. This would enable them to perform more complex and equivocal tasks with the given media. Gersick and Hackman (1990) argue that groups can import certain routines to perform the task. For example, flight crewmembers of commercial airlines often fly with new members. However, they manage to perform their task by importing well-established routines that are common among all team members. On the contrary, even if a group has worked in the past together and thus has a shared history, they may find the given communication media to be less rich if they need to establish and agree on new social structures because of the changes in the context or task. Even an addition of a single member to an existing team was found to be disruptive (Arrow and McGrath 1993).

### Media Characteristics and Structuring Behaviors

Finally, our third question explores the relationship between the mechanical characteristics of media, specifically proximity and visual cues, as well as groups' structuring behaviors and media perceptions. We found that media characteristics affect the media perceptions as predicted in media richness theory. However, they did not affect groups' structuring behaviors. This suggests that media condition does not affect the group's need to produce and reproduce social structures. Therefore, our findings are consistent with those of previous studies that found both media conditions and social factors are important and complementary in influencing users' perceptions and use of communication media (Carlson and Zmud 1999; Chidambaram et al. 1991; Trevino et al. 2000; Walther 1995; Webster and Trevino 1995).

In the IS literature, individuals are often depicted as impotent communicators whose ability to communicate is determined by either the existing social structures or the technical capabilities of the given technology. On the contrary, our results indicate individuals are capable and creative users of various means of communication who employ communication

media and other sources of social structures in order to achieve their goals. We argue that individuals faced with relatively limited means of communication in terms of media richness can and do overcome limitations imposed by the technical features of the tool by drawing on other possible sources of social structures (such as group history). In doing so, we argue that individuals produce and reproduce social structures provided by these other sources of social structures. Furthermore, we argue that this structuration process (i.e., the process of production and reproduction of social structures) in part influences individuals' perceptions of communication interactions and their task outcomes.

### **Limitations**

This paper has several limitations. First, the influence of structuration processes on group outcomes was observed within a single session. Therefore, we should not attempt to generalize our findings beyond the context of a single meeting. What would happen if ad hoc groups were brought back to the laboratory to perform a similar task? Would group processes exhibited by group members during a session influence the group processes and outcomes of subsequent sessions? The answer to the second question would presumably be yes. But we do not know how the former would influence the latter.

Second, the four behavior categories used for PLS analysis (role specification, demonstration of existing role separation, socialization and demonstration of existing social relationship) cover about 40% of the total coded behaviors. This is in part due to our efforts to focus on participants' explicit attempts to enact or produce social structures pertaining to group history. However, we feel that this ratio could have been improved by further refinements of the coding system.

Third, a relatively small sample size in phase 2 should be noted as a significant limitation of the current study. Although PLS is forgiving of small sample sizes, any attempts to generalize our results should be completed with acknowledgment of the small sample size.

Finally, we did not code the structuration process related to the use of technology. One could have coded users' behaviors in relation to their use of technical features (e.g., the size and position of the video screen, their use of application-sharing capability, etc.). We originally hoped to code such behaviors with respect to technology use. However, the quality of our videotapes made it impossible to examine these behaviors. Furthermore, since we recorded only one participant in the distributed condition, we were not able to reliably code the group's technology usage pattern. Coding systems for such behaviors already exist (DeSanctis and Poole 1994) and future research that will examine structuration processes related to both technology and group history will undoubtedly enrich our understanding in this area.

### **Implications for Studying of Electronic Media**

Despite these limitations, the current study provides several implications for future research in electronic media. First, we suggest that teams using electronic media cannot come together as a unit as quickly as many organizations might hope. If this is in fact the case, we must ask under what conditions can electronic teams be quickly established? Can these teams import social structures developed in other contexts into computer-mediated environments? Under what circumstances can teams draw on social structures established in different contexts? Can teams enhance media perception and thus their performance of complex and equivocal tasks by reducing the needs of social structure producing behaviors? All of these are important questions. Despite their importance, there are not enough theoretical and empirical works clarifying how group history and norms are developed and how they influence group performance and task outcomes in computer-mediated

environments (Dennis et al. 2001). Furthermore, we call for more careful analysis of laboratory studies using student subjects, not so much because they are not “real” decision-makers, but because they too operate under the influence of social structures.

Second, we found that communication breakdowns are important events in structuration processes. It is apparent that not all communication breakdowns will result in positive outcomes. Future research should identify the types of communication breakdowns that exist in computer-mediated communications and determine the conditions under which they lead to positive outcomes.

Our study also challenges the assumptions of some of the past computer-mediated communication studies. Much past computer-mediated communication research implicitly assumes that by studying ad hoc student teams in a controlled laboratory, we could “objectively” study the fit between technology and the task without the influence of social factors. Recently, scholars have pointed out that, unlike the assumptions made in these laboratory studies, most groups in organizations have existing social structures that influence group dynamics (Carlson and Zmud 1999; Chidambaram 1996; Lyytinen et al. 1993; Walther 1995). Based on our findings, however, we argue that even participants of controlled laboratory studies have their own social context and in the same manner that the social context of established groups influence their interactions, newly developing fragile social structures of ad hoc groups in a controlled laboratory also influence interactions among the members. The question here is not if groups operate in a social context; all groups are inherently social. On the contrary, what we need to identify what are the types of social contexts in which groups operate and conclude how they might have influenced the results of the study. In this regard, our results challenge future IS researchers using ad hoc groups to carefully consider the group members’ attempts to produce new social structures as they work in the laboratory environments and how these social structures might influence results. The work by Valacich et al. (1994) is a good example of such careful consideration.

### **Implications for the Use of Electronic Communication Technology**

This study suggests a crucial need for managers to consider group history and process among group members when they deploy various technologies to support groups. They need to understand that the same technology will be perceived and utilized differently by different groups, which will in turn result in potentially different outcomes.

Our results call for more attention to be paid to the group process in computer-mediated small group communications. Managers working with people in virtual team environments need to be trained to promote and exhibit certain behaviors that have been found to be positively linked to group outcomes. For example, in our study, we found that ad hoc group members frequently showed role development behaviors. Such behaviors are linked to low social presence. Thus, managers can develop an intervention mechanism that allows role development to take place in an expedited manner, particularly early on in the group development process. Similar suggestions can be made for other social structures producing behaviors. Such intervention will make the individuals feel that their communication is richer and more social. We also suggest that managers need to pay special attention to communication breakdowns, not to avoid them, but to use them to build social structures.

Finally, managers need to understand that it is the whole experience of communication interaction, not the “richness” of the technical features of the medium deployed, that matters. In other words, even in the case of a medium with limited technical features, one might still be able to meet complex communication needs through other social structures. As such, to enhance organizational communication effectiveness, managers need to focus not only on the deployment of electronic communication technology itself, but also

on the surrounding social and organizational environments that have an impact on communication effectiveness.

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