The Social Construction Of Meaning: An Alternative Perspective On Information Sharing

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Research on information sharing has viewed this activity as essential for informing groups on content relevant to a decision. We propose and examine an alternate function of information sharing, i.e., the social construction of meaning. To accomplish this goal, we turn to social construction, social presence, and task closure theories. Drawing from these theories, we hypothesize relationships among the meeting environment, breadth and depth of information shared during a meeting, and decision quality. We explore these relationships in terms of the effects of both the media environment in which the group is situated and the medium that group members *choose* to utilize for their communication.

Our study of 32 five- and six-person groups supports our belief that interpretation underlies information sharing and is necessary for favorable decision outcomes. It also supports the proposed negative effect of low social presence media on interpretation in terms of depth of information sharing; a low social presence medium, however, promotes information sharing breadth. Finally, the findings indicate that when in multimedia environments and faced with a relatively complex task, *choosing* to utilize an electronic medium facilitates closure and, therefore, favorable outcomes.

(*Communication Media*; *Group Support Systems*; *Social Construction of Meaning*; *Intersubjective Interpretation*; *Social Presence*; *Information Sharing*; *Decision Quality*; *Task Closure*)

> All who joy would win must share it
> —happiness was born a twin.
> Lord Byron in *Don Juan*

1. Introduction

Acquiring, sharing, and processing information are critical activities for decision making. Recent research on information sharing typically regards this activity through an objective lens: Information sharing disseminates information that holds the same meaning to everyone. An alternate rationale for information sharing is the social construction of meaning. For example, saying that the weather forecast predicts rain could be to inform another of weather predictions or to invite a discussion on the accuracy of weather forecasts. Viewed through such a "subjective" lens, information sharing also facilitates interpretation in a social context.

Research findings about the effect of CT (collaborative technologies such as email and multimedia systems) on group information sharing activities are mixed. While the use of such technologies was found to enhance information sharing in some studies (i.e.,

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Dennis 1996, Dennis et al. 1997–98, Jarvenpaa et al. 1988), it had no effect in other studies (Mennecke and Valacich 1998, Warkentin et al. 1997). It even inhibited information sharing in some studies (Hightower and Sayeed 1996, Hollingshead 1996, McLeod 1997). Adopting a different view of information sharing, as well as operationalizing the construct more richly, may help illuminate research on information sharing.

The present research report offers an interpretive perspective of information sharing, operationalized in two dimensions: breadth and depth of information sharing. Previous research tended to view electronic media as replacing face-to-face communication. In reality, workgroups with access to electronic media also have access to other media. Consistent with the experimental research stream on CT at the University of Minnesota (Gallupe and DeSanctis 1988, Watson et al. 1988, Zigurs et al. 1988), we created experimental environments that were either face-to-face or multimedia (both face-to-face and electronic media). Paradoxically, while the availability of the electronic medium in multimedia environments may hamper information sharing, once available, using such media may be more effective than face-to-face communication.

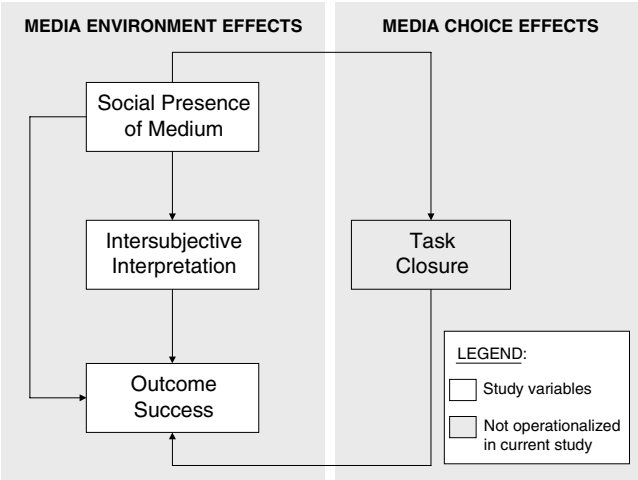
2. Literature Review

In developing information sharing as an interpretive activity, we draw from sociological theorists such as Berger and Luckmann (1966), Schutz (1967), Garfinkel (1967), and Ricoeur (1981). Social presence theory then helps us anticipate media effects on interpretation. Finally, task closure theory distinguishes between effects of the media environment versus effects of the medium chosen. The conceptual model that we develop is based on these theories and is presented in Figure 1. It is a two-part model encompassing (1) effects of the media environment in which the group is situated, and (2) effects of media that group members actually choose for a specific communication. We operationalize the model relationships in Section 3.

2.1. The Social Construction of Meaning: A Sociological View

"Social construction" derives from Berger and Luckmann's (1966) work on social institutions. Berger and Luckmann propose that institutions experienced as objective reality are in actuality social constructions. Once institutions are socially constructed, they assume an "objective" nature as "facts" in the social world. Similarly, meaning may be socially constructed. Schutz (1967), Garfinkel (1967), and Ricoeur (1981) emphasize the cognitive processes underlying such social constructions. Their perspectives suggest that we examine information, not as "objective" missives, but rather by recognizing that information is inextricably intertwined with the social settings in which it is encountered.

Figure 1 Conceptual Model



Schutz (1967) relinquishes any belief in an "objective" quality to information. He views information as possessing radically different meanings for different individuals, based on their biographies and positions in the social setting. The very social setting in which information is encountered contributes to its meaning. Schutz introduces the notion of intersubjectivity in describing the understanding that emerges from shared human experiences. In focusing on *intersubjective interpretation*, we adopt a narrower frame on intersubjectivity than Schutz. Intersubjectivity in this study argues that *meaning derives from interactive interpretation by multiple persons, not simply from the cognition of a single individual.*

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Garfinkel (1967) also stresses the subjective aspect of meaning. He sees interpretation as rooted in the situation in which it emerges, and proposes that shared meaning is essential to everyday interaction. This

shared meaning is not the same as agreement. Rather, it is referencing linguistic events, i.e., things that have been said in a particular context. Referencing linguistic events is analogous to referencing text in a document. The meaning of the text derives from its context. Ricoeur (1981) proposes that meaning is situational in spoken discourse. However, in most written discourse where there is no interaction, the reader individually imposes his or her subjective meaning on the text.

Information in such situations requires a subjective and social interpretation. In other words, meaning is socially constructed before information has value in decision making. Contrasting Ricoeur with Schutz and Garfinkel, we see that such social construction may be an individual subjective activity when using books, reports, or other noninteractive written media. However, in face-to-face interaction, interpretation is always collectively subjective, i.e., intersubjective. We suggest that intersubjective interpretation is inherent in information sharing and is affected by media availability and choice. The relationships between media availability and choice have been developed by Straub and Karahanna (1998).

2.2. Social Presence Theory

Intersubjectivity cannot be fully understood without seeing it in the context of a social presence. Social presence, which is "*the degree to which the medium facilitates awareness of the other person and interpersonal relationships during the interaction*" (Fulk et al. 1990, p. 118), is operationalized as low to high in most studies of social presence theory (Short et al. 1976). Electronic and paper-based communication media are typically viewed as low in social presence, while face-to-face communication is viewed as high in social presence.

Dennis and Kinney (1998) suggest that being aware of the social presence of a medium may be important to understanding "person-oriented" or social tasks. Social presence theory suggests that communicators' performance improves when media's ability to transmit social presence is matched to the social needs of a task (Christie 1985). Whereas task-oriented activities such as problem solving might be carried out equally well using any medium, person-oriented activities such as conflict resolution are thought to require media high in social presence.

Implicit in social presence theory is the belief that the presence of the sender influences the recipients' understanding of the message. But this concept has not been fully worked out in the literature. For this reason, we seek to broaden social presence theory by acknowledging that the presence of others, including (but not limited to) the message sender, influences the nature and success of intersubjective interpretation.

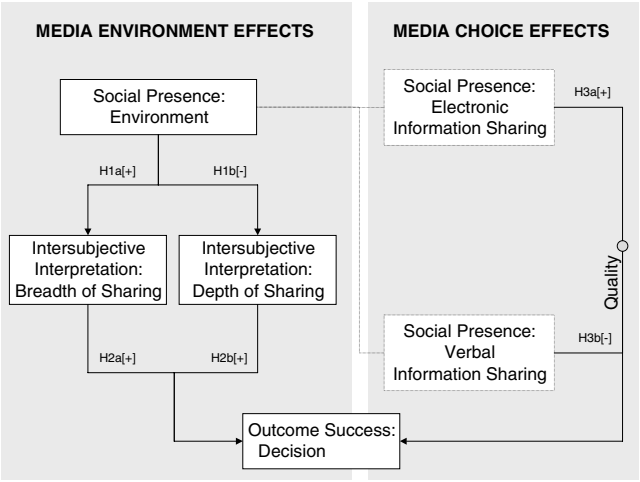
Intersubjective interpretation is a social activity ill-suited to media low in social presence. Intersubjective construction of meaning necessitates reciprocity. Media low in social presence tend to impede such reciprocity or interactivity. Even in "synchronous" settings such as an electronic meeting, because group members contribute information simultaneously, they attend to specific pieces of information asynchronously. Therefore, immediate reciprocity is difficult to accomplish. Low social presence makes it more likely that specific comments are entirely ignored as individuals are unable to perceive others' urgency and consequential emotional reactions.

2.3. The Paradox of Closure

There are circumstances, however, when the context may require using media not as well suited to the activity, for example when the recipient is not immediately available. Intended recipients of a message are available when they are physically able to receive it from the medium and then attend to it. When recipients are "unavailable" via alternate media, using media low in social presence may paradoxically enable more efficient communication by allowing individuals to achieve closure. This premise underlies task closure theory (Straub and Karahanna 1998). Closure is defined as *"the completion of a communication transmission segment"* (Straub and Karahanna, 1998, p. 171).

Electronic media permit a heightened experience of closure because transmission is within the sender's control. "Communicators sending an [electronic message] sense they have brought closure to the task when the message has been transmitted" (Straub and Karahanna 1998, p. 171). This experience of closure occurs even though the message may not be received. Face-to-face communication, by comparison, typically requires the recipient's availability and attention in order for the sender to experience complete closure.

Figure 2 Research Model



Electronic media may overload people with information when they use features such as anonymity and simultaneity. Anonymity permits individuals to share information and opinions that they would otherwise be uncomfortable sharing. Simultaneity maximizes "floor time" available to each individual and makes it easier to experience information overload (Thorngate 1997). Thus, both simultaneity and anonymity increase the number of ideas conveyed in a group discussion. This may create a situation described by Herbert Simon: "A wealth of information creates a poverty of attention" (cited by Shapiro and Varian 1999, p. 6). Additional information competes for the attention of those receiving it and challenges their ability to process it (Gopal and Prasad 2000). An inability to cope with information overload leads to organizational and individual dysfunction (Davenport and Beck 2001). Schultze and Vandenbosch (1998) found that individuals cope with potential overload by being selective about the information to which they attend. Individuals are therefore unlikely to fully attend to communications when overloaded. Thus, because electronic media facilitate information acquisition, their use may create situations where more information is acquired than can be processed (Davenport and Beck 2001). This overload is compounded by the presence of multiple media. Such overload situations inhibit intersubjective interpretation.

With the addition of electronic media individuals are socially unavailable, even if physically present. As noted earlier, when a recipient is potentially unavailable for communication via a medium higher in social presence, communicators may resort to media lower in social presence to achieve closure. Lee (1994; also Gopal and Prasad 2000) suggested that media attributes might not be absolutes. Rather, they might be socially constructed by individuals. Individuals may reconstruct media properties to achieve closure in intersubjective interpretation. When recipients become "unavailable" for communication because of heavy demands placed on their attention, the use of media low in social presence may paradoxically enable more efficient communication and allow groups to achieve closure.

3. Research Model, Hypotheses, and Method Preview

Figure 2 describes our research model. For purposes of building hypotheses, the variables used to operationalize these constructs are introduced in this section and detailed further in Section 4. Some components of the conceptual model are either not explicitly tested or are tested using surrogates. Specifically, task closure, which is depicted in gray in Figure 1, is not explicitly tested in our research, though we use task closure theory to build hypotheses about differences in sharing information electronically and verbally by groups in multimedia environments. Variables in white in Figure 1 are assessed using surrogate measures.

Information refers to all task-related content discussed by groups. *Information sharing* refers to *oral and written discussion of information among group members*. Information sharing is used as a surrogate for intersubjective interpretation since it is an essential and most visible part of intersubjective interpretation. In conceptualizing information sharing, we introduce two dimensions: (1) *breadth* of interpretation, i.e., *the number of discussions initiated by group members* and, (2) *depth* of interpretation, i.e., *extensiveness of group members' responses to the initiated discussions*. Table 1 displays the relationships between constructs in the conceptual and research models and the measures.

Past research on information sharing relied exclusively on hidden-profile tasks, i.e., tasks where group

Table 1 Mapping Constructs and Their Operationalization

Constructs		
Conceptual Model	Research Model	Operationalization
Social presence of media	Environment	Face-to-face medium vs. multi-media (electronic and face-to-face media)
Intersubjective interpretation	Breadth of information shared	Count of discussion sequences initiated
	Depth of information shared	Average number of comments or threads in discussion sequences
Outcome success	Decision quality	Expert rating of decision quality
Task closure	Implied by effects of choice of electronic vs. verbal information sharing on decision quality	

members each possess different elements of information, and the knowledge of this information is essential to a good solution (e.g., Dennis 1996, Hollingshead 1996, McLeod 1997). The premise of such research is that information sharing is necessary because no single individual possesses all the requisite information to make an informed decision. In this case, information sharing is necessary only because it allows a group of decision makers to fit together pieces of a preconstructed puzzle. However, there is an alternative to this metaphor of a preconstructed puzzle. The alternative is that puzzle pieces are imbued with meaning during the decision-making process, and the decision emerges from this meaning.

Our research is premised on the belief that information sharing is essential to the social construction of meaning, rather than being simply the completion of a puzzle. To this end, we use a task in which all group members have equal access to every piece of information instead of hidden-profile tasks. This study is concerned with the extent to which information and ideas surface and are subsequently discussed.

We employ a fuzzy task in this experiment. Fuzzy tasks are highly complex and tend to have high levels of information load, information diversity, conflict, and uncertainty; they are characterized by multiple solutions and multiple approaches to solving the problem (Zigurs and Buckland 1998).

3.1. Media Environment Effects

This study, like several of its precursors (e.g., Gallupe and DeSanctis 1988, Watson et al. 1988, Zigurs et al. 1988), operationalizes the experimental treatment as the addition of an electronic medium to the face-to-face (FTF) medium. Consequently, groups in this treatment had the advantages and challenges of using both electronic and FTF media. We do not hypothesize a direct relationship between environment and decision quality. Prior reviews argued that this relationship is typically mediated/moderated by other variables (e.g., Benbasat and Lim 1993, Lim and Benbasat 1996–1997).

These features of simultaneity and anonymity in the electronic media encourage a greater number of discussions, or breadth of information sharing. While it was possible for groups to communicate face-to-face rather than via the electronic medium alone, the availability of the electronic medium increases breadth of information sharing by expediting concurrent information sharing and encouraging frank communication. The availability of both media enables exchange of an even wider set of ideas since the FTF medium augments the electronic one.

However, electronic media may not be good for exploring ideas, especially complex ones. The availability of media low in social presence impedes the depth of information sharing for four reasons. First, as noted before, electronic media inundate individuals with information making it difficult for them to attend to the information (Gopal and Prasad 2000, Thorngate 1997). Second, since depth of information sharing entails responsiveness to the comments of others, it necessitates reciprocity in communication. Individuals must be able to interact and seek feedback to reconcile their

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Table 2 Summary of Effects of Media on Breadth and Depth of Information Sharing

	Effects of Media on			
Multimedia Features	Information Overload	Reciprocity	Breadth of Information Sharing	Depth of Information Sharing
Electronic: Anonymity	+	No effect	+	+
Electronic: Simultaneity	+	−	+	−
Electronic: Written content	−	−	No effect	−
FTF: Addition	+	+	+	+

positions with others based on differences in experiences, values, and even facets of individuals' cognitions. Media high in social presence facilitate such reciprocity, while electronic media tend to inhibit reciprocity. Effective FTF interaction typically involves turn-taking in which individuals respond to others' comments, and complete discussion on one issue (to an extent) before moving on to another. By contrast, in electronic interactions, individuals "speak" simultaneously, though not necessarily concurrently, on a specific issue. Resorting to FTF communication while other group members are communicating electronically may not elicit the necessary attention. Thus, addition of an electronic medium tends to impede reciprocity and therefore depth of information sharing.

Third, electronic media transmit written communication (Short et al. 1967). As noted previously, a text's meaning is derived *subjectively* by the reader, while the meaning of speech is derived *intersubjectively* and references a social situation. The additional availability of the electronic medium will, thus, prompt individually subjective interpretations rather than recourse to the social situation, thereby limiting both breadth and depth of information sharing. Fourth, when using electronic media, individuals still have recourse to and are accessible via more conventional media, that is, they still need to attend to spoken communications. This necessity to attend to multiple media further attenuates individuals' ability to respond to the communications of others.

In sum, electronic media features of anonymity and simultaneity increase breadth of information sharing. The availability of the FTF medium also enhances group ability to share information. On the other hand, anonymity and simultaneity contribute to information overload. Further, when communications are written, recipients attempt to reduce information overload by saving written messages until they are better able to attend to them (Schultze and Vandenbosch 1998, Kock 1998). Simultaneity and written content negatively impact reciprocity because it is difficult when using these features to respond to a comment immediately after it is made. Anonymity may have a positive effect on both breadth and depth of information sharing because members may safely respond to others' comments even when these comments may be construed as contentious or offensive. However, written content and simultaneity may serve as greater impediments to depth of information sharing and may overwhelm gains derived from anonymity. Finally, when FTF augments electronic media, reciprocity is possible with the FTF comments, but not the written ones. Gains in depth of information sharing via reciprocity are offset by cognitive demands stemming from information overload due to messages being delivered via multiple media. The effects just discussed are summarized in Table 2.

Au: Short 1976 in refs. If not same ref. please add to list

Based on these posited relationships, we hypothesize that:

Hypothesis 1a. *The addition of the electronic medium to FTF will have a positive effect on breadth of information sharing.*

Hypothesis 1b. *The addition of the electronic medium to FTF will have a negative impact on depth of information sharing.*

Intersubjective interpretation enables groups to construct a richer interpretation of task-related information and devise more complex solutions. Further,

while intersubjective interpretation does not in itself imply the formulation of a shared social reality, it certainly facilitates it. Hence, groups are able to cover a larger number of viewpoints, discuss these viewpoints more fully, and construct a joint decision in a more orderly fashion. This is particularly important for complex tasks such as fuzzy tasks in which intersubjectively derived meaning enriches group perspectives. Since information sharing provides the means for intersubjective interpretation, we propose that both depth and breadth of information sharing has a beneficial impact on the quality of groups' decisions.

Hypothesis 2a. *Breadth of information sharing will have a direct positive impact on decision quality.*

Hypothesis 2b. *Depth of information sharing will have a direct positive impact on decision quality.*

3.2. Medium Choice Effects

Communicators' inclinations toward task closure is important for understanding media choice. As previously noted, the availability of electronic media creates information overload. Since fuzzy tasks impose relatively high levels of cognitive demands (Zigurs and Buckland 1998), the information overload imposed by the addition of the electronic medium is likely to be exacerbated. Faced with information overload, group members become less "available" for communication. In such situations, the use of a low social presence medium facilitates closure in groups' communication. Group members wishing to communicate may send out a message. The message is transmitted via the electronic medium and is available for future attention if the targeted recipients are unable to attend to it immediately. On the other hand, a message transmitted using a high social presence medium is lost if the targeted recipients do not attend to it immediately. Having messages lost because of overload limits the benefit of verbal information sharing on decision quality. We therefore propose that:

Hypothesis 3a. *In environments with both face-to-face and electronic media, electronic information sharing will have a positive impact on decision quality.*

Hypothesis 3b. *In environments with both face-to-face and electronic media, verbal information sharing will have a negative impact on decision quality.*

4. Methodology

As noted above, we chose an experiment to examine these posited effects. The study examined information sharing in decision making under time constraints. Groups were required to make a decision within a limited amount of time (i.e., two hours). This scenario is typical of organizational decision making characterized by deadlines.

Thirty-two five- and six-member groups[1] were used in this study. These groups were drawn from undergraduate introductory information systems classes at a southeastern university. Students received course credit for participating in the study. They were also motivated to actively participate with the promise of an award for the team that made the best decision. Students were randomly assigned to groups, subject to their time constraints. While these were ad hoc groups, most study participants knew each other from their classes.

Prior to the study, participants received about an hour of training on the electronic medium by using the technology to work through a university parking problem. This experiment reports on 16 FTF and 16 electronic sessions in which groups developed a solution to an Ethical Dilemma (fuzzy) task.

4.1. Treatment Variable: Environment

Group decision-making environments were either FTF only—or multimedia (FTF *and* electronic). In multimedia meetings, groups used the VisionQuest software (version 2.11). The multimedia environment was a relatively nonrestrictive one, where groups were provided with guidelines on technology use, but were neither required to use all recommended tools, nor to use them in a fixed sequence. The electronic agenda is provided in Appendix A. Groups were encouraged to interact verbally, in addition to using the technology provided. A high level of communication support was provided via parallel inputs, group display, input feedback, access to external information, and group members' typed inputs. A high level of information processing support was provided via the VisionQuest

[1]Past studies of groups using GSS and computer-mediated communications tend to range from three to seven. In Hollingshead and McGrath's (1995) review of 50 such studies, 15 included groups with five or six members.

multicriteria rating tool and a link to Lotus 1–2-3. Process-structuring support was also available through a flexible electronic agenda. Groups in the FTF treatment used traditional paper and pencil techniques. They followed the same agenda as those used in the multimedia treatment. The agenda items and sequencing were not strictly enforced in either environment. That is, subjects in both treatments had the option of deviating from the recommended agenda, consistent with the Minnesota CT experiments.

4.2. Measures

4.2.1. Information Shared. Information shared during group meetings was determined by coding videotaped discussions of all groups and electronic transcripts of groups in the multimedia treatment. The coding involved a simple count of each statement made, electronic or verbal. The focus of this coding was the social construction of the task content, not the meeting process or technology. Therefore, only task-related comments were counted—social, procedural, and technological comments were not. Breadth of information sharing was a count of the number of distinct discussion sequences initiated during a session. Depth of information sharing was the average number of comments or threads in the discussion sequences. For groups in the electronic treatment, verbal and electronic scores were aggregated to yield composite breadth and depth scores. A sample coding sheet with explanations is provided in Appendix B.

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Following the technique adopted by Dennis (1996), two raters in this study coded the videotapes for 10 (of 32) sessions. To assess the inter-rater reliability of breadth and depth of information-sharing measures, we adopted the technique of intraclass correlations recommended by Shrout and Fleiss (1979). This technique is effective in determining the extent to which raters are "interchangeable" (James et al. 1984). This is particularly important since only a third of the tapes were coded by two raters. The intraclass correlations were significant at 0.86 ($F_{(9,9)} = 13.09$, $p = 0.0004$) for breadth of information sharing and 0.93 ($F_{(9,9)} = 26.05$, $p = 0.0000$) for depth of information sharing. Thereafter, a single rater coded the remaining 22 sessions. To adjust for group size, group scores on the information sharing measures were divided by the number of members in the group.

4.2.2. Decision Quality. The task used in this experiment required groups to make an assessment of a moral situation, resolve conflicting perspectives, and propose a solution—the Ethical Dilemma Problem (see Appendix C). Multiple outcomes and solution schemes were possible, and outcome uncertainty was high. This task was a modification of a problem developed by Weiss (1990). Subjects analyzed the problem of faulty software and proposed legislation that might remedy the situation. They were not provided with an a priori set of criteria on this task. Groups needed to develop a list of solutions, identify evaluation criteria, evaluate the solutions, and plan for their implementation.

Groups were required to report their decision in writing. Each decision was evaluated by two raters using a 7-point scale (a "7" representing an excellent decision, a "1" a poor decision). Chosen on the basis of their familiarity with task content, raters were a lawyer and an information systems professor who taught an ethics course.

After rating each decision individually, the raters met to discuss their ratings and reconcile major differences. The judges distinguished among group responses based upon the number of issues addressed and depth of analysis. Inter-rater reliability was assessed as intraclass correlations. This was found to be significant at 0.73 ($F_{(31,31)} = 6.46$, $p = 0.0000$). Thus, inter-rater reliability was acceptable. The ratings of the two judges were then aggregated for statistical analysis.

4.3. Controls

Attempts were made to control for facilitation provided to the groups, gender composition, group size, and the problem-solving model. Task type was controlled by having all groups solve the Ethical Dilemma task described above.

4.3.1. Facilitation. One of the two researchers was present at each meeting. This researcher distributed the task and instructions, verbally instructed the group about the task, environment, and time limits, and offered help with the technology or in recording the group ideas. Instructions to the groups in both treatments were scripted and consistent with the meeting agenda. As such, the researcher's role was more of

an administrator than a conventional meeting facilitator. Nevertheless, each researcher was present for an equal number of meetings in each treatment to avoid the potential for contamination of treatment effects by systematic variation due to facilitation.

4.3.2. Gender Composition. While efforts were made to control for group composition, the demographics of the underlying population and exigencies surrounding the study foiled these efforts. Consequently, a greater number of study sessions (22 out of 32, or 69%) were male-dominated. However, *t*-tests of gender composition revealed that gender did not significantly impact any study variable (breadth of information shared: $t = 0.1345$, $p = 0.8939$; depth of information shared: $t = 0.3501$, $p = 0.7287$; decision quality: $t = 0.3037$, $p = 0.7635$). We therefore eliminated the possibility of gender composition as a systematic source of variance in this study.

4.3.3. Group Size. We attempted to set group size at six members per group. However, nonparticipation and attrition frequently resulted in five-member groups and one four-member group. Variables directly related to group size were adjusted for the differences in the number of people in the group. Thereafter, group size did not correlate significantly with the variables of interest in this study (breadth of information shared: $r = 0.0317$, $p = 0.4294$; depth of information shared: $r = 0.0353$, $p = 0.4214$; decision quality: $r = 0.0065$, $p = 0.4854$). These tests allowed us to rule out group size as a systematic source of variance.

4.3.4. Problem-Solving. Since study participants were undergraduate students with limited experience in group problem-solving, a brief overview of problem-solving was provided during the training session prior to the hands-on technology training. The researcher-recommended problem-solving model was reinforced via the meeting agenda at the top of each task sheet provided to study participants. This agenda suggested the following procedures for both treatments: (1) read the problem; (2) identify and discuss alternatives; (3) identify relevant criteria; (4) evaluate alternatives against criteria; (5) discuss alternatives and reevaluate until a consensus is reached; and (6) record the decision and provide an explanation for it.

4.4. Overload Manipulation Check: Information Acquisition

In addition to the basic information provided to the groups on the task sheet, group members could access eight additional pieces of information. This information is presented in Appendix D. The amount of information acquired by groups, while not central to our research model, is critical for testing the appropriateness of our experimental treatment. Specifically, we believe that the information acquired by the group was responsible, in part, for the information overload experienced by the electronic groups.

At the start of the meeting, the experimenter informed groups that additional information was available to assist them. The experimenter provided the groups with a list of topics available and information on how subjects could access this information. A menu system, accessible from the VisionQuest agenda, allowed subjects to access eight different information screens with task-specific information. The same additional information was available in the FTF treatment via a resource person who was employed by the researcher. This person had a notebook containing two copies of each of eight different information sheets, any of which could be requested by subjects.

Individuals in the multimedia treatment accessed information an average of 6.75 times. By comparison, individuals in the FTF treatment accessed information 3.46 times. The difference in groups' acquisition of information was nearly significant ($t = 1.5289$; $p = 0.0684$). This sets up the possibility that individuals in the electronic environment could have been more subject to information overload based on the additional amount of information that they acquired.

5. Results

Descriptive statistics for the research variables appear in Table 3. A total of 181 subjects, 74 (41%) of whom were females, 103 (57%) males and 4 (2%) undeclared gender, participated in the study. Participants had an average age of 23.82 years. Ninety-eight participants (54%) indicated that they were juniors, 78 (43%) were seniors, 3 (2%) were sophomores, and 2 (1%) did not indicate their year in school. Participants represented nine different majors in the College of Business.

Table 3 Descriptive Statistics

	All Groups ($n = 32$)				Multimedia Treatment Split-Out ($n = 16$)			
	Face-to-Face Treatment ($n = 16$)		Multimedia Treatment ($n = 16$)		Verbal Information Sharing		Electronic Information Sharing	
Variable	Mean SD	Min Max	Mean SD	Min Max	Mean SD	Min Max	Mean SD	Min Max
Breadth of Information Shared	66.50 20.35	26 108	103.69 27.80	56 172	81.31 22.79	47 142	22.38 8.88	9 44
Depth of Information Shared	4.47 1.36	2.31 7.66	3.02 0.85	1.75 4.63	3.63 1.23	1.95 6.43	1.05 0.15	1.00 1.56
Decision Quality	5.76 2.08	3 11	7.61 2.15	3 11	[Same as multimedia treatment statistics]			

Subjects reported an average full-time work experience of 3.34 years. On a 7-point scale (1 = never, 7 = always), they indicated an average experience with group work of 4.32, and an average experience with computers of 4.85. The reported average typing skill was approximately 28 words per minute. On an average, groups in the FTF treatment made 301.81 total comments during the meeting. Groups in the multimedia treatment made an average of 313.31 total comments.

5.1. Testing the Proposed Models

We tested our hypotheses using PLS or partial least squares (Lohmöller 1989). PLS makes no assumptions regarding distributional normality, and was chosen over other structural modeling techniques for its lack of sensitivity to sample size (Lohmöller 1989, Wold 1982). It permits testing of structural models with as few as 10 observations (Chin et al. 1996). While it is unusual to use PLS in a lab experiment, it is appropriate in this case because we are more interested in relationships among study variables than in differences across treatments (Gefen et al. 2000). We assessed the effects of media environment in one structural model and the effects of medium choice in a second model. We present these two structural models below.

Blindfolding was conducted to validate the structural model. This is a resampling technique that involves recalculating each path coefficient using several subsamples, in each of which a specified number of observations are withheld (Lohmöller 1989). The resampling size adopted was nine,[2] implying that every ninth observation was withheld from each of nine subsamples. The averages of the path coefficients computed across the resamples were then subjected to *t*-tests (with nine degrees of freedom), to determine if they were significantly different from zero. A family-wise significance level of 0.05 was adopted. For a total of five tests on the first structural model, an individual significance level of 0.01 (0.05/5) for each path was yielded (see Keppel 1982). On the second structural model, the four paths tested set the significance level to 0.0125 (0.05/4) for each path.

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5.2. Media Environment Effects

The structural model for media environment effects is presented in Figure 3. Numbers in the model represent beta weights, and are comparable to standardized regression coefficients in multiple regression. The multiple R^2 values for each endogenous variable in the model are also presented in Figure 3, along with the significance of the coefficient. Multiple R^2 values in PLS may be interpreted in the same fashion as they are in traditional regression analysis. They indicate the

[2]This resampling size represents a trade-off between sample size and number of samples. Too large a resampling size would limit the total number of samples; too small a resampling size would make sample statistics problematic.

proportion of variance in an outcome variable explained by other variables in the structural model presumed to impact it.

As expected, the multimedia treatment promoted breadth of information sharing (H1A), while suppressing deep discussions (H1B). However, the hypothesized effects of these two aspects of information sharing on decision quality were only partially supported by the data: While breadth of sharing did have the anticipated positive effect on decision quality (H2A), depth of sharing did not (H2B). In fact, the sizable negative effect of depth of sharing on decision quality was quite unexpected.

5.3. Medium Choice Effects

While all groups made extensive use of the technology to interact with each other, they also interacted verbally. In fact, 93% of total comments and 78% of discussions initiated in the multimedia treatment were done so verbally. This is consistent with other studies that report a larger number of total characters and average characters per unique idea exchanged verbally when subjects had the option of responding either verbally or electronically (e.g., Valacich et al. 1993).

Given the high cognitive demands imposed by the fuzzy task, we proposed that electronic information sharing would achieve closure and thereby result in more favorable outcomes. We tested this proposition via separate PLS analyses for the multimedia treatment alone. The resulting model is presented in Figure 4.

As expected, breadth and depth of electronic information sharing improved decision quality significantly (H3A). Contrary to our expectations, however, verbal information sharing did not have a negative effect on decision quality (H3B).

6. Discussion

In this study, we attempted three tasks. First, we argued that information sharing is about interpretation, not just informing, and that interpretation is an intersubjective process. Second, we demonstrated that the social presence of communication media affects intersubjective interpretation. Specifically, we posited that while the availability of electronic media enhances breadth of discussions, it constricts deep discussions. Third, we proposed that when both FTF and electronic media are available, choosing the electronic medium facilitates closure. The results of our hypothesis testing, summarized in Table 4, provide partial support for these premises.

6.1. Media Environment Effects

While our results provide unequivocal support for our hypothesized effects of media environments on depth and breadth of information sharing, subsequent effects of these aspects of intersubjective interpretation on decision quality are somewhat unexpected. The data did

Figure 3 Results for Media Environment Effects (Hypotheses 1A, 1B, 2A, and 2B)

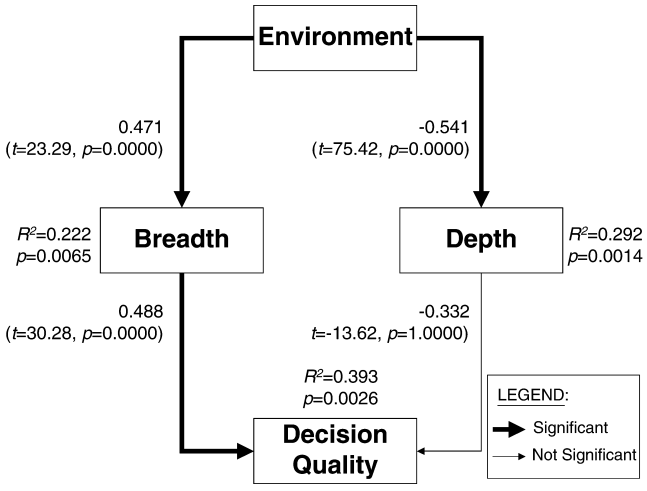

Figure 4 Results for Media Choice Effects (Hypotheses 3A, and 3B)

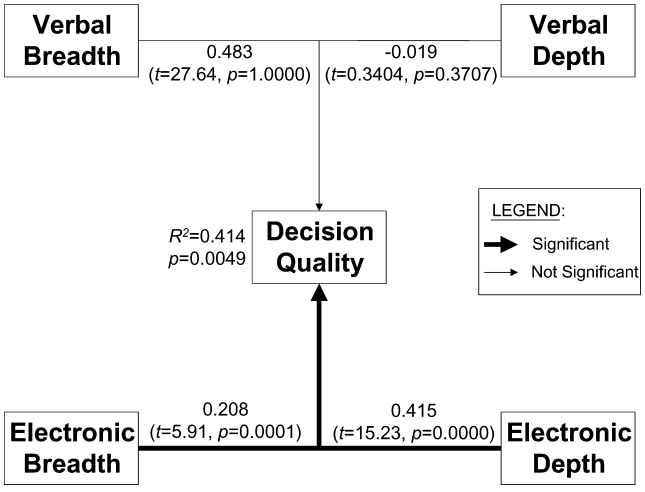

Table 4 Summary of Research Findings

	Hypothesis	Finding
1A.	The addition of the electronic medium to FTF will have a positive effect on breadth of information sharing.	Supported
1B.	The addition of the electronic medium to FTF will have a negative impact on depth of information sharing.	Supported
2A.	Breadth of information sharing will have a direct positive impact on decision quality.	Supported
2B.	Depth of information sharing will have a direct positive impact on decision quality.	Not supported
3A.	In environments with both FTF and electronic media, electronic information sharing will have a positive impact on decision quality.	Supported
3B.	In environments with both FTF and electronic media, verbal information sharing will have a negative impact on decision quality.	Not supported

not support our predictions about the link between depth of information sharing and decision quality. Intuitively, it seems that groups need to do more than merely refer to various issues. They must discuss these issues in depth to ensure a common reference point and to reach a shared meaning. This is essential to making good decisions. So why did our data not support our hypothesis regarding the effect of information sharing depth on decision quality?

To answer this question, we consider the interactions of Group 29. This was a FTF six-person group. Their depth of information sharing exceeded the average depth for groups in the FTF treatment. By contrast, they were below the average decision quality for groups in their treatment. A sample of their discussion is presented in Figure 5.

Despite Group 29's prolonged discussion of the problem, it did not culminate in shared meaning. Rather, it was abruptly ended, as were several other discussion sequences initiated during the meeting. While intersubjectivity does not necessitate agreement, it does require a common reference point. In the discussion in Figure 5, while Beth and Lisa saw the problem as two-sided, Alex did not. The rest of the group did not help Alex, Beth, and Lisa reconcile their diverse perspectives. Instead, Nathan moved the discussion forward by focusing on their recommendations, with no acknowledgment that they lacked a shared perspective on the problem. Lisa attempted to revisit their divergent perspectives on the problem, but evidently got frustrated with the group's lack of responsiveness, and changed to a procedural comment. Shared meaning was not attained, even at this critical juncture of the meeting. This group's subsequent discussions also highlight their inability to attain shared meaning. In subsequent discussions, Alex, recalling that his uncle was a software consultant, began to insist that any legislation they considered exclude custom software and focus exclusively on off-the-shelf software. Each of these discussions was extensive, but reached no conclusion.

To the extent that extensive discussions do not produce a common reference point, they are unlikely to be effective. In fact, one could argue that groups who lack the facility to seek such a common reference point are doomed to prolonged discussions because they are unable to resolve their differing perspectives efficiently. Hence, prolonged discussions relate negatively to decision quality, not because they are ineffective in themselves, but because they are symptomatic of failure to achieve a shared understanding.

6.2. Medium Choice Effects

We theorized that electronic media impose greater demands on group attention because of anonymity and simultaneity. We believed that these demands, coupled with the heightened cognitive demands of having to attend to communication via two media in multimedia environments, tend to diminish a group member's attention to others' interpretive overtures. The combination of the multimedia environment and fuzzy task prevents closure in communication. Therefore, when in a multimedia environment, and faced with a fuzzy task, recourse to the electronic medium for information sharing enables task closure. Our data supports this position: Both breadth and depth of electronic information sharing enhanced decision quality (H3A). However, we were unable to find support for a negative effect of verbal information sharing (H3B). This may be attributable to the fact that while groups

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Figure 5 Sample Discussion from Group 29

NATHAN:	So, the problem is that . . . ?
LISA:	It's right here. . . To what extent should legislation be passed to protect software developers . . . That's the problem right here.
ALEX:	These guys [the developers] are the one's making money if it's successful, and taking risks.
VICTOR:	They're just trying to get more money.
ALEX:	They are trying to increase their profit share.
NATHAN:	They should definitely be liable for anything that dealt with the IRS or the radiation case.
ALEX:	If they sell you something, it should work, you know.
BETH:	There's two sides to it. There's that. But then if you're too strict, every one will sue for every little thing and the company will not be able to be innovative. . . It will hurt both the developers and the consumers of software.
ALEX:	How would you feel if you bought a tax package from someone and it didn't work?
BETH:	Oh—I agree with you, but it's a two-sided problem.
LISA:	I agree. That's what I was going to say. It's a two-sided issue.
ALEX:	I don't think so. The consumer is the one that gets the most risk. The companies are taking their money. They're making their profit. They should be responsible for how the software works.
LISA:	If they're not going to be able to sell their software, they're going to be held back. If they have to keep checking it to make sure its safe, they won't be able to put it out.
JENNIFER:	They didn't test it. They just wanted to be the first person on the market. They really didn't test it. They didn't make an effort to work out all the bugs.
NATHAN:	Whether you test it or not, it's still going to have bugs.
VICTOR:	There definitely needs to be steps they have to go through.
BETH:	Usually with a drug, you have to wait seven years before you get it approved. If you make them wait 7 years before they put out the product, there will be . . .
ALEX:	If you tell them that they are going to be liable for what they put on the market, I'm sure they will work it out themselves. I don't think you have to set regulations for the testing. Just let them know that they will be responsible for what they sell.
JENNIFER:	There is a strict liability law. This hasn't fixed the problem.
NATHAN:	You can't regulate software.
BETH:	They realize that the amount of profits they make from selling the software will be more than the liability they incur from any problem. They'd rather make more profits even though these people have died. They'll still put it out on the market.
LISA:	There's nothing else we can do though.
NATHAN:	The problem is that there should be an ethical standard for both parties.
	-----x-----
LISA:	I think they should limit the number of claims—so that every little thing that happens doesn't penalize the developers.
	-----x-----
NATHAN:	Should we decide then? Is that it? What should we recommend?
	-----x-----
LISA:	The problem is to what extent should legislation be passed to protect the software developers?
VICTOR:	Not consumers?
LISA:	And then the consumers. I think software is going to have bugs. Anytime you do anything for the first time. . .
NATHAN:	That's what testing is for. More strict testing?
	-----x-----
LISA:	We have to do this here? [*Changing to a procedural discussion*]

-----x----- Indicates start of new discussion sequence

in the multimedia treatment did, in fact, switch back and forth across media, they tended to do so relatively synchronously. While media choices were sometimes individual, they were frequently the result of group negotiations at each stage of the meeting agenda. Members were therefore able to focus on each other's contributions during verbal interchanges. Providing limited support for task closure theory, the medium changes likely impeded reciprocity and depth of information sharing,

While the overall effect of depth on decision quality was not positive, in the multimedia environment, depth of electronic information sharing did have a strong, positive effect on decision quality. A look at a segment of the electronic discussion from Group 22 and a portion of their decision sheds some light on this finding (Figure 6).

Group 22 used the threaded discussion capability more extensively than any other group in the multimedia treatment. Consequently, it was considerably above the mean for the multimedia treatment on depth of electronic information sharing. It was also above the treatment mean for decision quality. While depth of verbal information sharing was extremely high in some cases, depth of electronic information sharing was moderate, at best. While some *verbal* discussions ran over 50 rounds, the deepest *electronic* discussion was five rounds. This leads us to wonder whether the relationship between depth and decision quality is indeed linear, as hypothesized, or whether it perhaps is more complex. It may be an inverted-U relationship, where initially an increasing depth of discussion enhances decision quality, but beyond a certain point, depth of discussion diminishes decision quality.

Further, when responding to comments electronically, members of Group 22 elaborated or refined initial comments or suggestions. Notably, they managed to translate these refinements directly into the details of their recommendation. Thus, this group had a more detailed recommendation than did most groups. Furthermore, their interactions via the electronic medium suggest a convergence of perspective that is not apparent in the verbal discussions of less effective groups.

7. Conclusions

The findings of our study provide considerable support for our perspective of information sharing as a vehicle for intersubjective interpretation, our model in Figure 1, and the theories from which the model is derived. The positive effect of breadth of information sharing in circumstances where group members all had equal access to information supports the social constructionist perspective, i.e., meaning is socially constructed during information sharing. The media effects on depth and breadth of information sharing strongly support social presence theory. Finally, the positive effects of breadth and depth of electronically shared information provide some support for task closure theory. (Total support for task closure theory is

Figure 6 Electronic Interactions from Group 22

Discussion	Decision
. . . 2.5. Allow software to be under UCC regulations. . . 2.5.1. when software doesn't deal w/ physical liability (Therac 25) . . . . 2.13. add a legislative clause to the bill. 2.13.1. allow s/w to be under UCC regulation 2.13.1.1. if program meets universal product testing codes, minimize responsibility 2.13.2. minimum liability for customized software . . .	. . . 1. allow software that does not affect physical well-being to be covered under UCC regulation; 2. establish minimum levels of damage before developers may be held liable; 3. minimize liability for customized software (the receiver of the customized software becomes the test bed for the software). . . .

mitigated by our findings that breadth of verbal information sharing appeared to positively affect decision quality while depth of verbal information sharing did not have the anticipated negative effect.)

7.1. Limitations

A central premise of this research is that depth of information sharing is critical to decision quality. Our data failed to support this anticipated positive effect of information sharing depth on decision quality. We suggest that this is because the depth of information sharing may not always culminate in shared meaning. Clearly then, shared meaning is an intermediate construct that ought to be measured. Another possible explanation for our unexpected finding lies in the fact that the relationship between depth and decision quality is not a simple, linear relationship as hypothesized. Our limited data set did not allow us to test for a nonlinear relationship. Future research needs to investigate depth of information sharing more thoroughly to ascertain the nature of its relationship to outcome success and possible mitigators of this effect.

Our research failed to determine to what extent the subjects felt that they had shared (or even wanted to share) in interpreting and solving the group's problem. Since we believe that intersubjective interpretation is emergent rather than purposive, assessing an individual's participation in group interpretation via self-report techniques is difficult since it would require a great deal of reflection by subjects. Individual participation would need to be assessed by a qualitative analysis of the group interaction process. This may also reveal subject perceptions, understandings, and meaning associated with the research situation and uncover systematic differences between student and nonstudent samples, and thus permit sensible inferences from their responses (Gordon et al. 1986).

As was the case with the majority of the prior studies on electronic communication, the subjects in this study were students—relatively older students with work experience, but students nonetheless. Student samples may be useful sources of information about processes underlying organizational phenomenon (Greenberg, 1987). However, the validity of research results based on the use of student subjects has frequently been questioned (Gordon et al. 1986, 1987). The differences between managerial and student samples could be attributed to differences in experience, rather than psychological factors. This finding is consistent with Remus (1986), i.e., that no differences exist between MBA student and managerial samples when controlling for experience.

In our study, we attempted to reduce the effect of limited experience by using topics that students had covered in the class. Further, we sought to motivate students with participation points added to their grades, and with prizes for the best decisions. We attempted to employ a realistic business decision situation and simulate business decision-making stress by implementing time limits. Nevertheless, we acknowledge that managers, because of their experience or motivation, may have responded differently in making the group decisions.

A side effect of our manipulation check may have been that group members in the multimedia environment did not have the time or necessity to exchange information in depth of discussion because they instead had acquired information through their increased exposure to the hold-out material. That is, they relied on the hold-out information instead of creating intersubjective knowledge by discussion, as was typically done in the FTF groups. Hence, groups in the multimedia treatment may have engaged in subjective interpretation, resulting in enhanced decision quality. Such individually subjective interpretation was not measured in this study.

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The layout of the electronic meeting room may have inhibited the process of intersubjective interpretation in electronic groups. A layout in which the computers were less prominent may have been more conducive to FTF interactions.

Finally, task closure theory was tested indirectly, and partial support was found. A direct test of the theory should be pursued, however, because we were not able to do this in this study. There is every reason to believe that communicators are influenced by the need to draw an end to their tasks, and the choice of a medium lower in social presence may prove to be a viable option, even though interactivity is not a characteristic of the exchange. Intersubjective interpretations may be forfeited or may come about through other means in

such a case, and this possibility needs to be further investigated.

7.2. Suggestions for Future Research and Implications for Practice

Future research on alternate communication media needs to acknowledge and further study intersubjective interpretation. Social construction of content has been largely ignored in media research. Since intersubjective interpretation had not been measured previously in information systems research, we assessed it in this study by coding breadth and depth of information sharing in the group discussions. An alternate technique that may be appropriate in future research is to focus on the thinking that individuals apply to specific decision scenarios. This would involve having subjects individually solve a problem and identify the reasoning that they used in arriving at a solution. They would then convene to solve the problem in groups. Intersubjective interpretation could be assessed at the end of the group session on the extent to which members of the group were aware of others' interpretations at the end of the group decision process.

Moreover, as noted above, while our study serves to highlight group intersubjective interpretation via information sharing, we were unable to satisfactorily tease out the effects of depth of information sharing on decision quality. Future research needs to pay more attention to this aspect of intersubjectivity, specifically with regard to nonlinear or moderated effects.

Carlson and Zmud (1999) point to three factors that may facilitate, or mitigate the need for intersubjectivity. First, familiarity with the technology can enable groups to communicate in a fashion that elicits and ascribes the necessary attention to intersubjective construction of meaning. Second, familiarity with the task may permit sufficient complexity in individual cognition so that intersubjective interpretation is unnecessary. Alternatively, familiarity with the task or technology may mitigate the attentional challenge imposed by either the task or technology. Third, familiarity with one's social group may enable anticipation of the comments of others, thereby providing the necessary complexity in interpretation. Since groups were relatively unfamiliar with the technology and with each other, our study findings may be exaggerated. The possible mitigating effects of experience needs further investigation. Groups should be familiar with the technology, and research should contrast ongoing and ad hoc groups.

Future research also needs to investigate media choice in groups embedded in an organizational or social context. Such a context may influence group success in intersubjective interpretation via alternate media. For example, Markus (1994) suggests that media choice may be an institutionalized one. She found that organizations socialize their members into using certain media. Further, the manner in which different media are used for different types of communication is also part of the institutional environment. While such a social context may limit the media choices of individuals, it can also provide information that assists in the social construction of meaning.

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Group size may also mitigate a group's ability to intersubjectively interpret their task and information. While group size varied little in our study, we anticipate that intersubjective intepretation may be more difficult in larger groups. The increased number of communications and their conflicting interpretations make meaningful information sharing more difficult. Further, as the group size increases, and so too do the attentional demands, the value added by the electronic medium may increase. Members in larger groups are likely to be less available for communication and intersubjective interpretation. Intersubjective interpretation that would be difficult to accomplish in large FTF groups may then be facilitated by the electronic medium.

Two critical implications for practice emerge from our research. First, information sharing entails not only objective information dissemination, but also intersubjective interpretation. This view of information sharing suggests a departure from the conventional view of decision making as the product of assimilating objective pieces of information to a new view of decision making, which implies that managers may improve organizational decisions through group discussions designed to imbue information with meaning. Second, using electronic media facilitates closure on complex tasks. Thus, electronic media may be very useful in

helping managers cope with information overload. The implications of this study for research and practice warrant further tests of our research model.

Acknowledgments

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Appendix A. Electronic Agenda

	Agenda Item	Tool	Instructions [Notes]
I	Read problem	Topic	
II	Discuss Alternatives	Topic	
A	Identify possible legislation	Commenting	At this point, try to list all ideas you have regarding legislation to protect either software developers or consumers. To add an idea about possible legislation regarding either interest group, use your arrow keys to move the highlight bar to the interest group you wish to comment on. Hit "ALT-A" to append comments under that category. Hit the ESC key to move to a different category. [Subjects were also verbally instructed that the same technique would enable them to comment on each others' suggestions.]
B	Discuss pros and cons of the legislation	Noncomputer-based activity	Verbally discuss the legislations suggested by your group.
III	Evaluate options against criteria	Topic	
A	Identify important criteria	Noncomputer-based activity	Identify the criteria against which you will evaluate alternatives generated by your group. Discuss these criteria and their relative importance. [The researcher entered the criteria called out by the group.]
B	Evaluate alternatives against criteria	Multi-rating	Evaluate each alternative against each criteria on a 5-point scale. A "5" would indicate a very favorable perception of an alternative against that particular criteria. A "1" would indicate a very unfavorable perception. When you are done rating the solutions, hit F4 and ENTER to submit your votes.
IV	Record your group's decision	Topic	
A	Discuss your decision	Noncomputer-based activity	Discuss the decision that your group would like to recommend on this problem.
B	Record your decision	Other software	Have a member of your group or the facilitator record your decision. [Decision was recorded in a text editor by a group member or by the researcher—usually by the researcher.]
	Access external information	Other software	View additional information about this task. [This menu item invoked DOS-based scripts displayed menus of information to group members.]

Appendix B. Coding for Depth and Breadth of Information Sharing

Sample Intersubjectivity Coding Sheet

Group:____1____ Coder:____1____

Depth	Number of Rounds	Total
1	𝍸 𝍸 𝍸 𝍸 𝍸 |	26
2	𝍸 𝍸 𝍸 𝍸 |	21
3	𝍸 𝍸 𝍸 ||||	14
4	𝍸 𝍸	10
5	𝍸 |||	8
6	𝍸 ||	6
7	𝍸 |	6
8	𝍸	5
9	𝍸	5
10	|||	3
11	||	2
12	||	2

Au: should this be 19? check hashes.

13	
14	
15	

Comments: 108 Breadth: 26 Depth: 4.15

Computations

Comments is the total number of content-related speech acts during the meeting.

Breadth is the total number of tallies in the first row. This indicates the number of discussion sequences initiated.

Depth is *comments* divided by *breadth*. (It is also the average of the number of discussion sequences stopping at each round, weighted for the depth of that round). This indicates, on an average, how many rounds each initiated discussion sequence lasted.

Appendix C. Task Description

The Ethical Dilemma Problem

TaxCo, a software development company produced a new software package that incorporates the new tax laws and figures taxes for both individuals and small businesses. TaxCo's president, Mr. Wilfred, knew that the program probably had a number of bugs. He also believed that the first firm to put this kind of software on the market was likely to capture the largest market share. The company widely advertised the program. When TaxCo actually ships a disk, it includes a disclaimer of responsibility for errors resulting from use of the program. The company expected to receive a certain number of complaints, queries, and suggestions for modification. They planned to use these to make changes and eventually issue updated, improved, and debugged versions. Because of bugs, a number of users filed incorrect tax returns and were penalized by the IRS.

You are a member of ACM's committee on Ethical Standards. The committee is to provide testimony to a Senate subcommittee of fair trade practices, chaired by Senator Hollings. The subcommittee is holding hearings on the feasibility of legislation designed to provide greater protection for software developers. The legislation would effectively decrease the extent of consumer protection from economic and physical harm directly caused by "bugs" in computer software, such as those in TaxCo's. To what extent should legislation be passed to protect software developers? To what extent should it protect consumers?

Appendix D. Additional Task Information

1. Software Background Information

Computers are used in every walk of life today. Software applications can be found in a number of areas: in business, in product design, in scientific research, in publishing, in education, and in medicine.

Software applications are available in various forms. Standard application packages such as wordprocessors, spreadsheets, and databases are available in stores. Customized software may be developed at the request of a user. Such software is developed when users do not find off-the-shelf software that meets their specific needs.

2. The Software Testing Process

Major software producers, such as Microsoft, are usually fairly conscientious about testing software. The software testing process typically involves a number of steps.

The firm usually starts with extensive testing of the product in-house. This testing begins with members of the development team who test each of the product modules. Once the product modules are put together, the software product is tested some more. It is then distributed to in-house users for further testing.

The software is then given to knowledgeable users outside the firm, with the stipulation that they report all problems back to the company. This is the alpha-test phase. At the next phase, the firm distributes the software to a wider clientele, perhaps at a discounted price, or with other inducements to participate in the product testing. This is the beta-test phase. User reports of software problems are used for further updates of the product. Following product modifications after this stage, the firm begins commercial distribution of the product.

3. Overview of Law

The legal system is divided into Criminal Law and Civil Law.

Criminal Law: This area of the law relates to public wrongs that are prohibited by the state. Criminal prosecution is initiated by an agent of the state (the prosecutor). In such cases, the defendant's guilt needs to be proved beyond a reasonable doubt. In addition to formal punishment, criminal convictions carry the penalty of social stigma. Crimes are categorized as felonies, serious crimes, or misdemeanors, lesser crimes.

Civil Law: Civil law is applied when one party sues another party because of the other's failure to meet some legal duty owed to the first party. In civil proceedings, the burden of proof rests with the plaintiff, who must demonstrate that the preponderance of the evidence favors him.

Civil law includes an area of the law called TORTS, and contract law.

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4. Torts And Contract Law

Torts: These are private or civil wrongs against a person or their property. They represent a breach of duty resulting in loss or harm to another person. If there is a such a breach of duty, it could be intentional, or the result of unintentional but negligent actions.

Contract Law: Contracts are agreements that are voluntarily created by persons with the capacity to contract. Contracts consist of an offer, made and accepted. The agreement must be supported by some consideration (e.g. an agreement to buy a house for a certain dollar amount).

5. Strict Products Liability

Strict Products Liability holds a "seller liable for negligence in the manufacture or sale of a product which may reasonably be expected to cause harm if it is defective. The rule applies to all products, which if negligently [designed or] manufactured, could cause physical harm or property damage" (Birnbaum, 1988).

The plaintiff does not have to prove negligence under this provision of the law. Strict products liability requires that the plaintiff demonstrate that:

1. the product was defective when it was bought,

2. the product was used in an intended or reasonably foreseeable manner,
3. and the product was the proximate (immediate) cause of injury.

Under strict products liability, product disclaimers do not free the manufacturer or seller from responsibility for the consequences of a faulty product.

6. Uniform Commercial Code

The UCC applies to anything characterized as a good, rather than a service. The code defines a good as "all things (including specially manufactured goods) which are movable."

The Uniform Commercial Code provides for explicit and implicit warranties. The following are the two types of implicit warranties.

1. Warranty of merchantability—product should work as it is supposed to.
2. Warranty for particular purpose—customer imparts information to sales person about needs. Sales person is liable to ensure needs are met.

These warranties can be disclaimed.

7. Therac 25

Therac 25 is a computerized therapeutic radiation machine. During 1985 and 1986, three people were administered a higher dosage of radiation than was intended. This resulted in the deaths of two of the three victims, and the disfigurement and injury of the third.

Closer examination of the equipment revealed a bug in the software that ran the radiation machine. This bug resulted in the administration of higher intensity radiation if the administering technicians edited their input in a particular fashion.

Atomic Energy of Canada Ltd., the company that manufactured Therac 25, settled claims in all three cases out of court. All parties involved were prohibited from discussing the terms of the settlement.

8. RRX Industries, Inc. VS. Lab-Con, Inc.

Thomas E. Kelly Associates (TEKA) contracted with RRX laboratories to supply RRX with a software system for use in its laboratories. The contract obligated TEKA to correct any malfunctions or "bugs" in the system, but limited TEKA's liability to the contract price. TEKA then formed Lab-Con to market the software system, and assigned the RRX contract to Lab-Con.

Bugs appeared in the system soon after installation. TEKA attempted to fix the bugs. However, the system remained unreliable because bugs continued to exist. RRX sued TEKA and Lab-Con for breach of contract. The court concluded that since TEKA and Lab-Con were either unwilling or unable to provide a system that worked as represented, the court found that TEKA and Lab-Con had breached the contract, and awarded RRX damages.

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