Interactional Influence in the Structuring of Media Use in Groups
Influence in Members' Perceptions of Group Decision Support System Use

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The aim of this study is to examine the ways in which individuals' perceptions of media use are influenced by others. Traditional theories of media use have proposed that perceptions of media use are shaped by individuals' demographic characteristics and the media's characteristics. However, three recent theories—critical mass theory, social influence model of media use, and adaptive structuration theory—suggest that individuals' perceptions of media emerge as a result of their interaction with others in their social network. Results from a longitudinal study of 30 group decision support system (GDSS) groups and 2.5 non-GDSS groups over a 3-week period indicate that interactional influence was a better predictor of individuals' perceptions of media use than were individuals' demographic characteristics or characteristics of the media.

The introduction of communication technologies in the workplace has spurred significant research activity (Johansen, 1988, 1989; Kling & Scacchi, 1982; Sproull & Kiesler, 1991). Although new communication technologies are heralded by proponents as helping

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to make individuals, groups, and organizations more effective and productive (Hiltz, 1988), reviews of the research on computer conferencing (Rice, 1984; Short, Williams, & Christie, 1976), videoconferencing (Johansen, 1977), electronic mail (Panko, 1984), and group decision support systems (GDSS; Hollingshead & McGrath, 1995; Seibold, Heller, & Contractor, 1994) have failed to find consistent support for these claims.

Malone (1985) points out that the majority of past research is based on the premise that the impact of a technology is consistent across adopting groups. However, many recent theories reject the view that perceptions and use of a new medium are shaped solely by its technological characteristics (Contractor & Eisenberg, 1990; Daft & Lengel, 1986; Daft, Lengel, & Trevino, 1987; DeSanctis & Poole, 1994; Fulk, Schmitz, & Steinfield, 1990; Hollingshead & McGrath, 1995; Markus, 1990; Poole & DeSanctis, 1990). Instead they propose that it is contingent on *individual characteristics* (such as gender and skills in using the new media), *group characteristics* (such as size and age of the group), *task characteristics* (e.g., brainstorming, planning, decision making, or conflict resolution), and *media characteristics* (such as its "richness" in providing multiple cues, or its ability to provide anonymous input and voting).

More recently, some researchers (Burkhardt & Brass, 1990; Contractor & Eisenberg, 1990; Fulk et al., 1990; Poole & DeSanctis, 1990; Rice & Aydin, 1991) have suggested that the uses and consequences of new media "emerge unpredictably from complex social interactions" (Markus & Rnbey, 1988, p. 588). That is, members' perceptions about the new media are not created in a vacuum. Instead, members influence and help shape each other's perceptions and use of media. According to this emergent perspective, it is possible that members with similar individual characteristics, working in groups with similar composition and on identical tasks, tnay perceive and use the same media differently (Barley, 1990). The differences can be explained by the manner in which members interactionally influence others' perceptions of the media and its use (cf. Kipnis, 1990).

This study examines the extent to which individuals influence each other's perceptions of a GDSS. The term GDSS is used to describe a large number of communication and decision-making tools that are made available to interacting group members by the use of computer and communication technologies (Johansen et al., 1991). Communication tools provide members the ability to augment face-to-face interaction in group meetings with text and graphics. Decision-support tools provide members with structures to evaluate members' ideas, develop decision trees, and use voting procedures. In some GDSSs, group members can make their contributions anonymously (DeSanctis & Gallupe, 1987; for a fuller treatment of variations in GDSS, see Seibold et al., 1994).

The GDSS used in the present study, SAGE (Software Aided Group Environment), was developed at the National University of Singapore (Wei, Tan, & Raman, 1992). It is functionally similar to SAMM (Software Aided Meeting Management), developed at the University of Minnesota (DeSanctis & Dickson, 1987) and used in many GDSS studies conducted by communication scholars (e.g., DeSanctis, D'Onofrio, Sambamurthy, & Poole, 1989; Poole & DeSanctis, 1992; Sambamurthy, Poole, & Kelly, 1993). Like SAMM, SAGE provides the following features: *brainstorming* tools, including the private input of ideas prior to sharing with other members; *voting schemes* such as preference weighting and ranking; *synchronous electronic communication* to one or more other members in the group; and *public display* of members' individual and collective contributions,

We begin the next section with a discussion of theories that take into account the influence of others in predicting an individual's perceptions of GDSS. We review past research that has examined the impact of social influence on members' perceptions of a new medium. Based on a critical evaluation of this research, we propose hypotheses aimed at furthering our understanding of how members influence each other's perceptions of GDSS use. Just as in research employing members' perception:; of influence patterns in group decision processes and outcomes (e.g., Green & Taber, 1980; see review by Seibold, Meyers, & Sunwolf, in press), this study focused on influences on members' *perceptions* of GDSS use, as distinct from effects on the patterns of actual use. This focus is consistent with the aims and methods of a plethora of recent GDSS studies investigating influences on members' perceptions of others' participation (Wheeler, Mennecke, & Scudder, 1993), their perceptions of features of groups' interaction (Hollingshead, McGrath, & O'Connor, 1993), members' perceptions of their task coordination (Farmer & Hyatt, 1994) and perceptions of that performance (Hollingshead et al., 1993), their perceptions of technology-related affect cohesiveness (Arrow & McGrath, 1993), perceptions of GDSS groups' affect levels (O'Connor, Gruenfeld, & McGrath, 1993), and members' perceptions of final recommendation quality and their perceived confidence in outcomes (Sambamurthy et al., *1993).*

THEORY AND HYPOTHESES

There are at least three theoretical frameworks that address how individuals' perceptions of technology media use are influenced by others: critical mass theory (Markus, 1992; Markus & Forman, 1990), social influence theory of rnedia use (Fulk et al., 1990; Rice, 1993; Schmitz & Fulk, 1991), and adaptive structuration theory (Poole & DeSanctis, 1990). All three frameworks are based on the prernise that perceptions and use of the new media are socially constituted (Markus, 1992).

Critical Mass Theory of Media Use

Traditional theories on the diffusion of innovations predict that the likelihood of an individual using a new product will depend, in part, on its perceived benefits to the individual (Rogers, 1983). However, as Markus and Forman (1990) point out, the diffusion of a new communication medium that requires the collective consent of two or more people is qualitatively different from the diffusion of commodities, such as soaps, that are used independently by each individual. Individuals can only benefit from the use of a new communication medium if others in their communication network also elect to use it. Hence critical mass theory predicts that the likelihood of an individual using a new medium will depend on its perceived benefits not just to the individual but to a "critical mass" of users.

There has been some empirical evidence in support of critical mass theory. Rice, Grant, Schmitz, and Torobin (1990) found that coworkers who were closely connected to each other prior to the implementation of an electronic mail system had similar patterns of electronic mail adoption. Wohlert and Grant (1992) studied the use of a network-based groupware product in the R&D division of a computer manufacturer. They found that organizational members were more likely to adopt the product if others in their communication network also adopted the product. Markus and Forman (1990) studied how four teams decided on adopting a package of information technologies-hardware, software, and telecommunications–for the support of group tasks. They found that the teams' choices were not based on individuals' independent choices. Instead, the choices were heavily influenced by the informal team leaders. Their findings suggest that a group's collective perceptions of a new medium cannot be predicted by simply aggregating the perceptions of group members. Instead, one must weight the perceptions of members by their relative influence on other members. These findings serve as a bridge between traditional predictions of critical mass theory and the social influence theory of media use (Fulk et al., 1990) discussed in the next section.

Critical mass theory and its extensions provide an explanation for how group members influence each other in making a collective decision about the *adoption* of a particular medium. However, members continue to influence others' perceptions about the medium even after it is adopted. In doing so, members often "reinvent" or redefine the use and appropriateness of the medium (Johnson & Rice, 1984). Further, the membrrs may use the new medium itself to influence others' perceptions of it (Markus, 1992; Steinfield, 1986). The socialinfluence theory of media use, discussed next, focuses attention on how members who have adopted a new medium influence others' perceptions of its use.

Social Influence Theory of Media Use

The social influence theory of media use (Fulk et al., 1990) deals with the effects of social influence on perceptions of many aspect!: of a medium's use-including the richness of the medium. It was developed in part as a response to media richness theory, which proposed that individuals' perceptions and use of a medium are determined by certain objective characteristics of the medium (Daft & Lengel, 1984, 1986). According to media richness theory, individuals choose a medium that is most appropriate for a task. A task that entails a high degree of equivocality is best accomplished by using "rich" media that are capable of reducing equivocality. Traditionally, face-to-face communication has been considered the richest medium. By comparison, it is considered richer than the telephone, which in turn is considered richer than electronic mail or formal memos. However, as Culnan and Markus (1987) note, emerging communication technologies such as GDSS bring into question the validity of using face-to-face communication as a benchmark for comparison. Because technologies such as GDSS offer computer-augmented face-to-face communication, they could be considered even richer than traditional face-to-face meetings. The argument that GDSS is richer than face-to-face interaction represents an extension to traditional notions of media richness. It is important that GDSS, which represents computer-augmented communication, is not equa ted with the leaner computer-mediated communication (CMC), which is typically bereft of face-to-face interaction.

There is some evidence questioning the validity of an objective media richness scale. After studying 375 managers in a risk-management organization, Markus (1992) observed that "managers may have socially defined their communication media in terms different from those of information richness theory" (p. 41). Steinfield and Fulk (1989) found no systematic association between individuals' use of electronic mail and the perceived task equivocality in a large office products firm.

Fulk et al. (1990) argue that media are not inherently rich or lean. Rather, individuals socially influence each other's perceptions of a medium's richness. Schmitz and Fulk (1991) draw upon social learning theory (Bandura, 1978), social information processing (Salancik & Pfeffer, 1978), and self-perception theory (Bem, 1972) to identify individuals' influence on others perceptions. Specifically, individuals can exert influence by (a) explicitly stating their own assessment of a medium, (b) serving as a behavioral role model by their own use of the medium, and (c) providing feedback to others on their use of the medium.

There is growing evidence in support of the social influence model. Fulk, Schmitz, Ryu, and Steinfield (1989) found that those individuals who were closely connected with coworkers who perceived electronic mail to

be useful were more likely to use electronic mail themselves. Further, Schmitz and Fulk (1991) report that individuals whose supervisors perceived electronic mail to be useful were more likely to perceive electronic mail as useful. Wohlert and Grant (1992), while basing their arguments in a "critical mass perspective," report that organizational members' use of a groupware product was predicted by the amount it was used by other members with whom they had direct contact.

Schmitz and Fulk (1.991) note that their research did not take into account differences in members' ability to influence each other. Their study assumed that individuals were equally likely to be influenced by all members in their respective communication networks. They suggest that future research must address the following questions: "How can we assess and incorporate differences in importance of the sources of social influence? Also, what is the appropriate weighting scheme to apply to alters? Are some sources more influential than others?" (p. 518). Rice (1993) responds to this call for greater precision in articulating the social influence process by offering three contingencies: (a) the equivocality in the situation, (b) the extent to which members are exposed to each other, and (c) the importance members place on each other's perceptions.

First, members are more likely to be socially influenced in equivocal situations (Moscovici, 1976; Thomas & Griffin, 1983; Woelfel & Haller, 1972). A situation is equivocal when individuals do not have any prior exposure to, or experience with, the phenomenon. Clearly, the introduction of new media to a group is potentially an equivocal situation. Hence one would expect social influence processes to be more prevalent in groups using new media than in groups that are not exposed to new media. Further, as Moscovici notes, the social influence processes in equivocal situations may lead, at least in the short term, to more divergent views. Thus one would expect that, even in cases where group members' perceptions of a new medium's use converge, the convergence may take longer than among group members not exposed to a new medium.

Second, Rice (1993) notes that the social influence process is moderated by members' exposure to each other. That is, members are more likely to influence each other when they are socially proximate. Rice defines social proximity as the extent to which one is exposed to others in their communication and spatial network. Hence members' perceptions of a new medium's use are more likely to be influenced by those who are socially proximate to them. This must, by definition, primarily include others with whom they communicate using the new medium.

Third, members are not equally influenced by all who are socially proximate to them. Using computer models, Krassa (1988) showed that the rate at which individuals influence each other in a social network is significantly influenced by the importance they place on others' opinions.

Hence members' perceptions of media use will be more heavily influenced by those whom they perceive as influential. However, in cases where the new medium permits anonymous communication (as in GDSS technologies like those in the present study), members will not know if the information came from a source they consider as influential. Hence members' perceptions of the new medium are less prone to social influence when the medium permits anonymous communication.

In summary, the social influence theory of media use is based on the assumption that members influence each other's perceptions of new media. Unlike media richness theory, the social influence theory of media use focuses attention on the sources and mechanisms by which members influence others' perceptions of media use. However, like media richness theory, Fulk et al.'s (1990) social influence model proposes that individuals: perceptions and use of a medium are mediated by its perceived richness. That is, individuals influence each other's use and perceptions of the medium by first influencing their perceptions of the medium's richness. However, coworkers' and supervisors' influences on individuals' perceptions of a medium's use are not always mediated by the individuals' perceived richness of the medium (Rice, 1992; Schmitz & Fulk, 1991). Hence these findings cast doubts on the significance of media richness-actual or perceived-as a central construct in members' perceptions of media use. It must be noted that there is nothing in the core formulation of the social influence model that privileges the concept of media richness. In its most generalized formulation, Fulk et al. propose a social influence model for perceptions of media use. However, in empirical studies elucidating the social influence model (e.g., Schmitz & Fulk, 1991), their emphasis has been on the ways in which individuals socially influence each other's perceptions of media richness. Adaptive structuration theory, discussed next, suggests that the rules and resources accompanying the use of new media, rather than media richness, are more directly associated with members' perceptions of media use.

Adaptive Structuration Theory

Adaptive structuration theory (DeSanctis & Poole, 1994; Poole & DeSanctis, 1990; Poole & Holmes, 1995) proceeds from the assumption that interactions among individuals are organized around a variety of practices that are task related and social in character. The effects of new media on any of these practices is best understood in terms of the *structures* they promote among members. Poole and DeSanctis (1990) define structures as the rules and resources that individuals use to generate and sustain these practices. Three examples of structures during group meetings that will be examined in this study are (a) the ease with which members

differed significantly from those among groups not using GDSS. Further, the groups' structures-in-use were significantly associated with members' overall perceptions of the GDSS.

Adaptive structuration theory, like critical mass theory and social influence theory, rejects the notion that individuals' perceptions of media use arc technologically determined. Like the social influence theory of media use, adaptive structuration theory is based on the premise that individuals' perceptions of media use are socially constructed. Unlike the social influence theory of media use, adaptive structuration theory does not consider a medium's perceived richness as a central construct in shaping individuals' perceptions of media use. Instead, adaptive structuration theory proposes that individuals' perceptions of media use are characterized by group members' structures-in-use associated with the media.

As mentioned earlier, Poole and his colleagues studied the structures-in-use by analyzing the microlevel interaction among individuals. However, their analysis of microlevel interaction has two limitations. First, the structures-in-use identified by an external observer's coding of the microlevel interaction may be at variance with those perceived by individuals in the group. Individuals' perceptions of the structures-in-use serve a consensus-building role in the appropriation process. Poole and DeSanctis (1990) note that "only when there is a fairly high level of consensus among a substantial proportion of group members does appropriation on the global or normative levels develop" (p. 185). Their argument underscores the importance of identifying individuals' perceptions of the structures-in-use associated with new media. Second, the analysis of the microlevel interaction does not explicitly articulate a mechanism by which individuals influence each other's perceptions of the structures-in-use. The social influence model described earlier provides a network framework that can be used to explicate the manner in which group members may influence others perceptions of the structures-in-use.

Summary of the Theoretical Perspectives and Hypotheses

The aim of this study is to examine the ways in which individuals' perceptions of media use are influenced by others. Traditional theories of media use have proposed that perceptions of media use are shaped by individuals' demographic characteristics and the media's characteristics. However, three recent theories suggest that individuals' perceptinns of media use are shaped by the perceptions of others in their network Critical mass theory suggests that the likelihood of individuals adopting a new medium depends on the number of current and potential users of that medium in those individuals' communication network. Social influence theory of media use proposes that individuals' perceptions of media

communicate their ideas to the group, (b) the extent to which members are stimulated by each other's contributions, and (c) the extent to which members do not feel hesitant about presenting their ideas to the group.

Central to adaptive structuration theory is the analysis of interaction among individuals, for it is through the variety of social processes that occur in interaction that individuals produce and reproduce their own "structures-in-use" (Poole & DeSanctis, 1990, p. 180). As Poole and DeSanctis point out, these structures have no reality independent of the interactions they constitute and in which they are constituted. Poole and DeSanctis (1992) provide a clearer and more detailed explication of the concept of structures-in-use in the context of GDSSs:

> Structures are appropriated from relevant social institutions, systems traditions, and material artifacts such as GDSSs. The rules and resources embodied in social institutions, which actors learn as second nature, are "sedimented" structures, the result of repeated structuration over longer periods. GDSSs and other technologies typically base their structures on these institutions, whether designers acknowledge this or not. We will term this array of structures available to a system its *structural potential* and we will refer to the specific structures that are appropriated as *structures-in-use*. (pp. 10-11)

GDSSs offer groups a wide variety of potential structures to deal with tasks, including procedures that guide deliberations, menus of decision stages, databases aggregating group memory, and the like. Any GDSS group appropriates some of the technology's structural potential while eschewing (consciously or not) other potential structures. As Poole and DeSanctis (1992) summarily note, "The group may draw upon some parts of the structural potential and leave other parts unrealized. In doing so, the group is producing and reproducing a particular version of the structure as part of its *structures-in-use* [italics added]" (pp. 11-12). In the present study, we examine GDSS group members' perceptions of their structures-in-use associated with the technology's structural potential to (a) facilitate intragroup communication, (b) facilitate process gains associated with the ways members' contributions can stimulate each other, and (c) facilitate individuals' contributions of ideas through reduction of inhibition-producing forces associated with group discussion.

Appropriation can be studied in terms of the microlevel interaction among a group of individuals, and at the network level in terms of the patterns of interaction among individuals. Studies conducted by Poole and his colleagues (e.g., DeSanctis et al., 1989; Poole & DeSanctis, 1992) have focused on the relationship between microlevel interaction among group members and their appropriation of GDSS. They coded members' interactions and used them to compute indicators of the group's structures-in-use, such as their critical examination of ideas and depth of analysis. They found that the struchnrcs-in-use among groups using GDSS

use are influenced by the perceptions of other proximate individuals in their network. Further, Fulk et al. (1990) suggest that perceptions of media use are characterized by individuals' perceptions of the medium's richness. Adaptive structuration theory contends that individuals' perceptions of media use are more usefully characterized by their perceptions of the structures-in-use, rather than the perceived richness of the medium.

Based on the preceding review, we next propose six hypotheses concerning the determinants of members' perceptions of the structures-in-use during group meetings. Although we have focused attention (in H3 through H6) on the interactional influence endemic to all three theoretical perspectives surveyed, for purposes of comparison we have included two hypotheses (H1 and H2) proposed by the individual characteristics and media characteristics perspectives.

Individual Characteristics Hypothesis

H1: Members' perceptions of the structures-in-use during group meetings will be significantly associated with their individual characteristics, specifically gender, age, and, in the case of technologically supported meetings, typing skills and computer experience.

Media Characteristics Hypothesis

H2: Members' perceptions of the structures-in-use during group meetings will be significantly associated with the media characteristics of the specific communication and decision support tools used in the meeting.

Interactional Influence Hypotheses

H3: Members' perceptions of the structures-in-use during group meetings will be predicted by other members' perceptions of the structures-in-usr, weighted by the extent to which the other members are perceived as influential.

H4: Members' perceptions of structures-in-use will be influenced by other members to a significantly greater degree in GDSS meetings (where members will encounter uncertainty resulting from the introduction of the new medium) than in traditional face-to-face meetings.

H5: Members' perceptions of structures-in-use will be significantly less influenced by other group members in GDSS meetings where members have the opportunity to make anonymous contributions than in meetings where the GDSS contributions are identified.

H6: Members' perceptions of structures-in-use will be significantly more influenced by other group members in the first meeting, where there is a higher level of uncertainty, than in subsequent meetings.

METHOD

Participants

Data were collected from 55 four-person groups of undergraduate students (N = 220) enrolled in speech communication courses at the University of Illinois. Each of the groups met once a week over a 3-week period. There was no change in the composition of the groups, and all four members attended each of the three sessions. Fifty-six percent (n = 123) of the students were female. All of the 55 groups were mixed sex. Members' ages ranged from 17 to 22 years, with the average age being 19.4 years. All groups had a prior history of working together on class projects. The groups' prior histories ranged from less than a week to a maximum of 7 weeks, and averaged 2.8 weeks. The absence of history has been a severe threat to the validity of previous studies of group behavior (Michaelson, Watson, & Black, 1989), group decision making (Hall & Williams, 1966), and group communication (Fisher & Ellis, 1990). This study seeks to obviate that threat and is consistent with other GDSS studies that have incorporated group history into the design of the study (e.g., McGrath, 1993; Mennecke, Hoffer, & Wayne, 1992). These improvements to conventional GDSS designs notwithstanding, and despite the fact that the ad hoc groups in this study had a greater history of working together than typical laboratory groups in GDSS studies, these concocted groups of minimally interdependent students cannot be considered bona fide groups by the naturalistic, open-system criteria outlined by Putnam and Stohl (1990). Indeed, judged against those standards, very few GDSS studies have been conducted with hona fide groups with established histories (for a notable exception, see Poole, DeSanctis, Kirsch, & Jackson, 1995).

Task

Groups discussed a different decision dilemma task at each of their three meetings (Siegel, Dubrovsky, Kiesler, & McGuire, 1986). All groups were instructed to confer on the dilemma until consensus had been reached on a final group decision. This procedure has been found to enhance the emergence of solutions as a result of member composition and interactional dynamics similar to those of interest in this research (Meyers, Scibold, & Brashers, 1991; Stasson, Kameda, Parks, Zimmerman, & Davis, 1991).

First task. The group was to advise a man having severe stomach pains. The man had to decide whether he should cancel his trip and go to the hospital, or board the plane and forgo medical treatment. The group

was asked to recommend the level of risk the man should take in deciding to travel.

Second task. The group was to advise a man who had a severe heart condition. The man had to decide whether he should drastically change his lifestyle or undergo a particularly risky surgical operation. The group was asked to recommend the level of risk the man should take in deciding to undergo surgery.

Third task. The group was to advise a man who had been accepted by two Ph.D. programs in chemistry. The man had to decide whether he should go to the higher prestige university where only a few students graduate, or to the lower prestige university where most students graduate. The group was asked to recommend the level of risk the man should take in accepting the offer from the higher prestige university.

Design and Procedures

The experiment used a repeated measures (three points in time) between-group design for fixed effects. The 55 groups were randomly assigned to four conditions. The four conditions-baseline, manual, GDSS identified, and GDSS anonymous-represented different levels of communication and decision support provided to the groups. Groups remained in their assigned condition for all three meetings. For a full discussion of design and procedures, see Heller (1992).

In the GDSS identified condition, 15 groups were provided with SAGE to augment their face-to-face interaction. All contributions made by members were identified. In the GDSS anonymous condition, 15 groups were provided with SAGE to augment their face-to-face interaction. However, all contributions made by members using SAGE were anonymous. A manipulation check was performed by asking members at the end of each session to assess the extent to which they could identify the contributors on a scale of 1 (*not at all*) to 7 (*always*). The mean scores were 2.11, 2.46, and 3.13, respectively, for the three sessions. In the manual condition, face-to-face interactions in the 14 groups were augmented with a noncomputer version of the support tools provided by SAGE. These included detailed descriptions and pen-and-paper versions of the brainstorming, voting, and private messaging procedures available in SAGE. Groups also were provided with a white-board for public display. Finally, in the baseline condition, 11 groups were given no support to augment their face-to-face interactions concerning each decision dilemma task.

Groups in the GDSS identified and anonymous conditions met in the University of Illinois Collaboratory. The Collaboratory is similar to a traditional conference room but has a network of Macintosh computers that are housed within a specially designed conference table. Participants were able to view their computer screens through a glass window on their table top. Because the computers were recessed into the table top, they did not obstruct face-to-face interaction among the participants. The network of computers also were connected to a public projection display. Groups in the baseline and manual condition met in a conference room of the same size and similar furnishings.

Before the start of the experiment, members in the two GDSS conditions and the manual condition received approximately 30 minutes of training in the use of their support tools. An abbreviated version of the training was repeated at the start of the second and third meetings. This extended training reduced the possibility of "cognitive overload" found associated with single training sessions (Siegel et al., 1986). Before the start of the first meeting, participants completed a preliminary survey that included questions on demographic information and computer experience. At the end of each meeting, participants completed a longer survey eliciting their opinions about the meeting process, other members, and the group decision.

Instrumentation

Members' individual characteristics. Before the start of the first meeting, members were asked to provide demographic information on gender and year in school. They were also asked to report their level of typing skills and experience with computers on a 7-point Likert-type scale.

Structures-in-use. At the end of each of the three meetings, members were asked their perceptions of the structures-in-use during the meeting. Specifically, they were asked to report their level of agreement on a 7-point Likert-type scale to the following statements:

1. It was easy for members to communicate their ideas to the group.
2. Members were stimulated by each other's contributions (i.e., they led each other to generate more comments).
3. Members did not feel hesitant about presenting their ideas to the group.

These three measures were based on results from a pilot study that attempted to validate an operational definition for perceived structures-in-use. Specifically there was no compelling evidence that the three items were measuring a unitary concept. The intcritem correlations were 0.06, 0.10, and 0.09 (for items 1-2, 2-3, and 1-3, respectively) in the pilot study,

and 0.04, 0.08, and 0.10 (for items 1-2, 2-3, and 1-3, respectively) in the present study.

Interactional influence. At the end of each meeting, members were asked to report, on a 7-point Likert-type scale, the extent to which they were influenced by each of the other three members in the group. The use of self-reports of influence is potentially problematic because self-report measures can be subject to bias due to social desirability, comprehension, and selective memory. However, in view of the facts that behavioral measures are no less prone to sources of variance that can invalidate them (Howard, Maxwell, Wiener, Boynton, & Rooney, 1980) and that self-report measures of constructs like those in this study have been found to be as valid as other measurement approaches (Howard, 1994), the use of self-reports was deemed appropriate in this study. Furthermore, research has demonstrated that when people's experience with an object enhances their clarity, confidence, certainty, accessibility, and strength of attitudes concerning it-the case in this study—self-reports are veridical with behavioral measures (Eagly & Chaiken, 1993). Finally, consistent with the social constructivist orientation of this research, research conducted by Fulk, Schmitz, and Ryu (1995) and rooted in social learning theory suggests that perceptions of influence are potentially more important for assessing media effects than are objective measures.

Analyses

H1 proposed that there would be significant differences in members' perceptions of structures-in-use on the basis of gender, age-and in the case of the two GDSS conditions-typing skills and computer experience. A *t* test was conducted to test for differences between males' and females' perceptions of the three structures-in-use. Further, zero-order correlations were computed between each of the three structures-in-use variables and members' ages. Finally, for the groups in the two GDSS conditions, correlations were computed between each of the three structures-in-use and members' typing skills and computer experience.

H2 proposed that members in the four communication and decision support conditions-baseline, manual, GDSS anonymous,. and GDSS identified-would differ significantly in their perceptions of the structures-in-use. Because, as discussed above, the three structures-in-use were not correlated, a multivariate analysis of variance was not deemed appropriate, Instead, a one-way analysis of variance was conducted to test for differences in means for each of the three structures-in-use across the four conditions.

H3 proposed that members' perceptions of the structures-in-uxc can be predicted by other members' perceptions of the structures-in-use, weighted by the extent to which the other group members were perceived as being influential. A network influence model was used to test this hypothesis (Burt, 1989; Dow, Burton, & White, 1982). For instance, Member A's perceived structures-in-use were predicted using the following model:

$$S_A^* = I_{AB}S_B + I_{AC}S_C + I_{AD}S_D,$$

where S_B, Sc, and S_D are the perceived structures-in-use by Members B, C and D, respectively; I_{AB}, I_{AC}, and I_{AD} represent the extent to which Member A reports being influenced by Members B, C, and D, respectively; and S_A^* is Member A's perceived structures-in-use as predicted by the model.

Correlations between members'reported perceptions of the structures-in-use and those predicted by the network influence model were computed. A total of 36 correlation coefficients were estimated to gauge the extent to which group members in each of the four experimental conditions influenced one another's perceptions of the three structures-in-use at the three meetings. However, as Burt (1987) notes, the data used in a network influence model are not independently distributed, and therefore the significance of ordinary least squares estimates cannot be assessed using routine statistical tests. Instead, the significance of the correlations between reported values of structures-in-use for each member and those predicted by the network influence model were determined by using the jackknife Fisher's Z-transformed correlation, estimated using techniques in the network analysis program STRUCTURE (Burt, 1989).

H4 proposed that the extent to which members influence others' perceptions of the structures-in-use will be higher for the two GDSS conditions than the baseline and manual conditions. H5 proposed that the extent to which members influence each other's perceptions of the structures-in-use will be higher in the GDSS identified condition than in the GDSS anonymous condition. Finally, H6 ***proposed*** that the extent to which members influence each other's perceptions of the structures-in-use will diminish over time. H4, H5, and H6 were tested by assessing the significance of the z-scores representing pairwise differences between the relevant jackknife Fisher's Z-transformed correlations.

RESULTS

Table 1 reports the results of the *f* tests comparing males' and females' perceptions of the three structures-in-use collapsed across the three sessions. The results indicate that differences in all three cases are not

TABLE 1

Mean Gender Differences Among Individuals' Perceptions of Structures-In-Use

	Males (N = 279)	*Females* (N = 381)	*t Value*[a]
Easy to communicate	5.90	5.91	-.06
Stimulate each other	5.37	5.52	-.82
Hesitate presenting ideas	5.95	6.21	-1.46

a. None of the t values reported were significant at the $p < .05$ level.

TABLE 2

Zero-Order Correlations of Age, Typing Skills, and Computer Experience With Individuals'l'erceptions of Structures-In-Use

	Age (N = 660)	*Typing Skills* (N = 360)	*Computer Experience* (N = 360)
Easy to communicate	-.03	.06	.13
Stimulate each other	-.05	.03	.00
I-Jesitnte presenting ideas	-.01	.12	.02

NOTE: None of the correlation coefficients were significant at the $p < .05$ level.

statistically significant. Table 2 reports the zero-order correlations, collapsed across the three sessions, between members' ages and their perceptions of the three structures-in-use. Members' ages were not associated with their perceptions of the three structures-in-use. Table 2 also reports (only for the GDSS groups) the extent to which members' typing skills and computer experience were correlated with their perceptions of the structures-in-use. Members' perceptions of the structures-in-use were not associated with their typing skills or their experience with computers. Hence the results indicate no support for the individual characteristics H1, employed in this study as a contrast for the interactional influence hypotheses (H3 through H6) of interest.

The second hypothesis proposed that members' perceptions of the structures-in-use would be influenced by the media characteristics of the communication and decision support tools provided to the group members. Table 3 indicates no significant differences in the members' perceptions of the three structures-in-use across the four conditions. Further, *t* tests based on pairwise comparison of the four conditions were not significant. Hence the results indicate no support for the media characteristics H2 used in contrast to H3 through H6. Post hoc analyses were conducted to examine if media characteristics had a transirnt impact on members' perceptions of the structures-in-use. The results indicated no

TABLE 3

Comparison of Individuals' Perceptions of Structures-In-Use Across Communication and Decision Support Conditions

	Baseline (N = 132)	*Manual* (N = 168)	*GDSS Identified* (N = 180)	*GDSS Anonymous* (N = 180)	*F Ratio*[a]
Easy to communicate	5.79	6.08	6.02	5.87	1.67
Stimulate each other	5.79	5.42	5.59	5.59	2.14
Hesitate presenting ideas	6.26	6.10	6.21	6.13	2.46

a. None of the *F* ratios were significant at the $p < .05$ level.

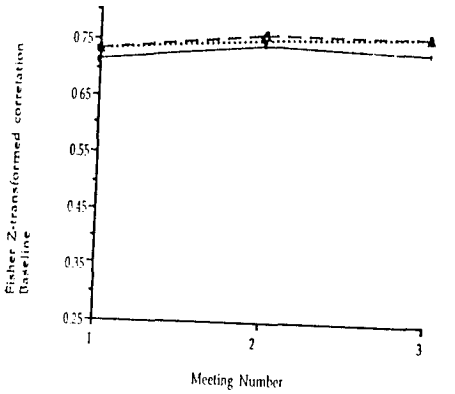

Figure 1: Fisher's Z-Transformed Correlation Coefficients for Structures-In-Use in the Baseline Condition Across the Three Meetings

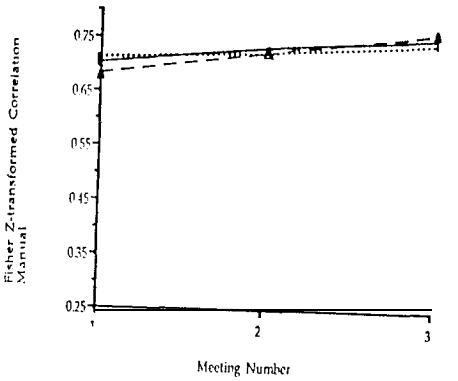

Figure 2: Fisher's Z-Transformed Correlation Coefficients for Structures-In-Use in the Manual Condition Across the Three Meetings

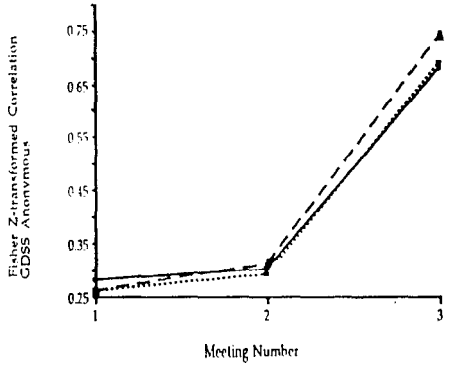

Figure 3: Fisher's Z-Transformed Correlation Coefficients for Structures-In-Use in the GDSS Anonymous Condition Across the Three Meetings

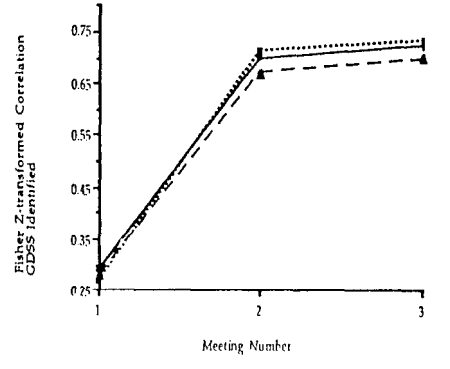

Figure 4: Fisher's Z-Transformed Correlation Coefficients for Structures-In-Use in the GDSS Identified Condition Across the Three Meetings

significant differences in the members' perceptions of the three structures-in-use across the four conditions, for each of the three sessions. Further, a post hoc two-way analysis of variance was also conducted to examine if there were any interaction effects between individual and media characteristics. The results indicated no significant interaction effects.

The results to test H3 are reported in Table 4 and are displayed in Figures 1 through 4. Table 4 lists jackknife Fisher's Z-transformed correlations between members' perceptions of the three structures-in-use and those predicted by the network influence model. The 36 correlations reported in Table 4 refer to results obtained for the three structures-in-use for each of the three sessions and for each of the four experimental

TABLE 4
Jackknife Fisher's Z-Transformed Correlations Between Individuals' Perceived Structures-In-Use and Those Predicted by the Network Influence Model

	Baseline		*Manual*			*GDSS Anonymous*			*GDSS Identified*		
	Time 1 (N = 44)	*Time 2* (N = 44)	*Time 3* (N = 44)	*Time 1* (N = 56)	*Time 2* (N = 56)	*Time 3* (N = 56)	*Time 1* (N = 60)	*Time 2* (N = 60)	*Time 3* (N = 60)	*Time 1* (N = 60)	*Time 2* (N = 60)	*Time 3* (N = 60)
Easy to communicate	.73	.75	.76	.71	.72	.74	.26	.29	.69	.27	.71	.73
Stimulate each other	.71	.74	.73	.70	.73	.75	.28	.30	.68	.29	.70	.72
Hesitate presenting ideas	.73	.76	.76	.68	.72	.76	.26	.31	.74	.28	.67	.70

NOTE: Correlations significant at the $p < .05$ level; the standard errors are 0.16, 0.14, and 0.13 for coefficients in the baseline, manual, and both GDSS conditions, respectively.

conditions (baseline, manual, GDSS anonymous, and GSSS identified). For instance, in the baseline condition at Time 1, there was a .73 correlation between group members' response to the statement "It was easy for members to communicate their ideas to the group" and their response as predicted by the network influence model. The *t* values reported in the tables indicate that in each case there was a statistically significant correlation between levels reported and those predicted by the network influence model. That is, as proposed in H3, members' perceptions of structures-in-use were indeed predicted by other members' perceptions of structures-in-use weighted by the extent to which the other members were considered as influential.

The results in Table 4 further suggest that the extent to which members were socially influenced by others differed across the four conditions (H4 and H5) and over time (H6). The z-scores representing pairwise differences across conditions are reported in Table 5. For instance, the difference in correlations (computed as a z-score) between individuals' perceived structures-in-use and those predicted by the network influence model for participants in the baseline and GDSS anonymous conditions was 2.31). Contrary to H4, members in the GDSS anonymous and identified conditions did not influence each other more than members in the baseline and manual conditions. Specifically, in Meetings 1 and 2, members in the GDSS anonymous condition were significantly less likely to influence one another than were members in the baseline and manual conditions. Further, in Meeting 1, members in the GDSS identified condition were significantly less likely to influence one another than were members in the baseline and manual conditions.

The results in Table 5 also provide a comparison of the extent to which group members in the GDSS anonymous and identified conditions influenced each other. H5 predicted that group members would influence each other significantly less in the GDSS anonymous condition than in the GDSS identified condition. The results indicate that the differences were only statistically significant for the second meeting. Hence the results provide partial support for H5.

Finally, H6 posited that the extent to which members were socially influenced by others would diminish over time. Table 6 provides the z-scores representing differences between the first and second meetings and between the second and third meetings. For instance, in the baseline condition, the difference in correlations (computed as a z-score) between individuals' perceived structures-in-use and those predicted by the network influence model for Sessions 1 and 2 was .09. Contrary to H6, members did not influence each other more in the first meeting than they did in subsequent meetings. In the baseline and manual conditions, there were no significant temporal differences. In the GDSS anonymous condition, members influenced each other significantly more in the third

TABLE 5
Pairwise Comparisons (*z*-Scores) Between Conditions of the Fisher's *Z*-Transformed Correlations Between Individuals' Perceived Structures-In-Use and Those Predicted by the Network Influence Model

	Easy to Communicate			*Stimulate Each Other*			*Hesitate Presenting Ideas*		
	Time 1	*Time 2*	*Time 3*	*Time 1*	*Time 2*	*Time 3*	*Time 1*	*Time 2*	*Time 3*
Baseline vs. GDSS anonymous	2.30*	2.25*	0.34	2.10*	2.15*	0.24	2.30*	2.20*	0.10
Manual vs. GDSS anonymous	2.36*	2.25*	0.26	2.20*	2.25*	0.37	2.20*	2.15*	0.10
Baseline vs. GDSS identified	2.25*	0.20	0.15	2.05*	0.20	0.05	2.20*	0.44	0.29
Manual vs. GDSS identified	2.31*	0.05	0.05	2.15*	0.16	0.16	2.10*	0.26	0.31
GDSS identified vs. GDSS anonymous	0.05	2.30*	0.22	0.05	2.19*	0.22	0.11	1.99*	–0.18

*$p < .05$.

TABLE 6
Pairwise Comparison (z-Scores) Between Sessions of the Fisher's Z-Transformed Correlations Between Individuals' Perceived Structures-In-Use and Those Predicted by the Network Influence Model

	Easy to Communicate		*Stimulate Each Other*		*Hesitate Presenting Ideas*	
	Time 2 vs. Time 1	*Time 3 vs. Time 2*	*Time 2 vs. Time 1*	*Time 3 vs. Time 2*	*Time 2 vs. Time 1*	*Time 3 vs. Time 2*
Baseline	0.09	0.05	0.14	–0.05	0.14	0.00
Manual	0.05	0.10	0.15	0.10	0.21	0.21
GDSS anonymous	0.16	2.14*	0.11	2.03*	0.27	2.30*
GDSS identified	2.35*	0.11	2.19*	0.11	2.08*	0.16

*$p < .05$.

meeting than they did in the second meeting. In the GDSS identified condition, members influenced each other significantly more in the second meeting than they did in the first meeting.

DISCUSSION

This study attempted to further our understanding of the factors that shape individuals' perceptions of group technology use. Specifically, we examined the extent to which individual characteristics, media characteristics, and interactional influence contributed to individuals' perceptions of three structures-in-use in group meetings. Our results indicate that there were no systematic differences in individuals' perceptions of the structures-in-use on the basis of individual characteristics (such as gender, age, typing skills, and computer experience) or media characteristics. Further, our results indicate that individuals influence each other's perceptions of the structures-in-use during group meetings. These findings reinforce the argument that individuals do not form their opinions about media use in a vacuum. Rather, differences in individuals' perceptions of media use are better explained by the extent to which they interactionally influence one another (e.g., Contractor & Eisenberg, 1990; Poole & DeSanctis, 1990; Seibold et al., 1994).

Our findings also offer some intriguing insights into the social influence process. Social influence theory suggests that members influence each other most in cases of high uncertainty (Moscovici, 1976). We had hypothesized that groups using GDSS would experience higher uncertainty and were therefore more likely to influence each other. However, our findings indicate that members in the non-GDSS conditions influenced each other more than did members in the GDSS conditions. There is a plausible explanation for this apparent contradiction. Traditionally, social influence theorists have conceptualized uncertainty in terms of task or environmental dimensions. However, in the present case, we are examining the uncertainty associated with media use-the very same channels through which members influence each other. It therefore seems plausible that the social influence process is inhibited when the uncertainty is caused by the introduction of a new communication medium, especially when members' contributions are anonymous. Hence, as expected, the social influence process was somewhat stronger among individuals in the GDSS identified condition than among individuals in the GDSS anonymous condition.

The results of this study provide some useful insights into the temporal evolution of the social influence process. We had hypothesized that as individuals worked together in the same groups on similar tasks, they would encounter less uncertainty and hence be less socially influenced by

each other. Our findings indicate that there were no significant changes in the social influence patterns of individuals in the baseline and manual conditions. These results suggest that individuals in groups that have some prior history and are not exposed to the uncertainty associated with a new medium tend to stabilize, rather than reduce, their social influence patterns (i.e., develop stable "operating conditions"; see Shaw, 1981).

In contrast, groups using GDSS changed their social influence patterns across the three meetings. There was a significant increase in the social influence among individuals in the GDSS identified condition between the first and second meetings. There was a similar change among individuals in the GDSS anonymous condition between the second and third meetings. Consistent with our structurational predictions, these results suggest that individuals in the GDSS condition were increasingly influenced hy each other's perceptions of structures-in-use over time. However, the social influence process took longer to emerge in the GDSS anonymous condition, perhaps due to the difficulty in identifying the source of the contributions during the meetings.

Although this study did not find support for the received view that media characteristics affect members' perceptions of structures-in-use, it can be construed as supporting a more sophisticated "media effects" perspective. That is, although media do not affect members' perceptions of the structures-in-use, they affect the extent to whichmembers influence each other's perceptions of the structures-in-use. In particular, our results suggest that there are substantial initial media differences in members' ability to socially influence one another. These differences appear to dissipate over time. This finding is homomorphic with Walthcr and Burgoon's (1992) argument that media differences are transient and dissipate over time. Whereas Walthcr and Burgoon were positing media rffccts on the form and rate of interpersonal information exchange, this study focused on media effects on the social influence process. However, our results are not consistent with Walther's (1994) more recent argument that media differences are primarily an artifact of increased anticipation of future interaction in the face-to-face condition. Our study, in which groups in all conditions anticipated future interaction, found initial media differences in the social influence process.

The results of this study must be interpreted with caution for several reasons. First, this study represents an early attempt at operationalizing the concept of members' perceived structures-in-use. It is possible, and even probable, that the three structures used in this study are not consistently salient in group decision making. Hence the findings of this study do not preclude the possibility of finding evidence of individual and media characteristics significantly affecting other structures-in-use. We believe that the structurational arguments reviewed earlier in this study—together with the findings here-are sufficiently compelling to warrant

continued empirical research, but with more systematic attempts at operationalizing the key concept of structures-in-use.

Second, as with some of the contrived trappings of much experimental research, this study can be indicted as being less than adequate in gauging social influence processes. Even though the study did not use zero-history groups, they had a relatively small range in group history It could be argued that, because the groups had a relatively short history, members were still getting to know each other over the three sessions. If this were the case, members may socially influence each other more in later sessions simply due to their increased familiarity, Further, it could be argued that groups communicating with richer media would get to know each other more rapidly and hence their social influence would stabilize more quickly. However, the results indicate that whereas social influence was stable over time for- the baseline and manual groups, it increased for groups using the richest medium, GDSS identified, where computers were used to augment face-to-face communication. Further, the study used small groups (only four members) of undergraduate students (who did not vary much in age), working on an artificial task. In particular, the truncated range associated with ages of participants in this study, as well as the potential ceiling effect manifested in the participants' high mean and low variance scores on the three 7-point structures-in-use scales (presumably a result of their positive affect for the task), limited the test of the hypotheses somewhat and warrants replication with a more heterogeneous population. The substantive significance of our findings encourages extension of this line of research to nonexperimental settings. Four examples serve to illustrate potential extensions. First, in field settings, individual characteristics not used in the present study, such as task competence and hierarchical status, may prove to be better predictors of members' perceptions of structures-in-use than age, sex, typing skills, and computer experiencc. Second, the greater variation in ages in organizational settings may make it a more powerful predictor of structures-in-use than was the case in the present study. Third, the emergence of social influence may be slower in larger groups, especially those using an anonymous GDSS. Last, it is possible that in field settings, differences in the emergence of social influence will be less marked between GDSS and non-GDSS groups. This is because organizationally "embedded" (Putnam & Stohl, 1990) members of both GDSS and non-GDSS groups may continue to influence each other in face-to-face interactions outside the context of the decision-making sessions.

Third, the network influence model employed in this study has been used by researchers to study a variety of behaviors such as the adoption of innovations (Burkhardt & Brass, 1990; Burt, 1987), and attitudes such as organizational commitment and role ambiguity (Hartman & Johnson, 1989). More recently, researchers have discussed the utility of the network

influence model to clarify our understanding of the social influence process (Friedkin & Cook, 1990; Friedkin & Johnsen, 1990). However, there has only been a modest amount of empirical research applying this technique to the social influence process in general, and more specifically in the context of new media in general and technologies in particular. Although the empirical support in this study for the model's predictions are encouraging, continued refinement of the model's application to media use is essential.

Fourth, the study reported here did not consider different task types (McGrath, 1984) as influencing individuals' perceptions of media use. The study reported here was carried out using only one type of decision-making task-the choice shift decision dilemma task-thereby experimentally controlling for the effect of different task types on the social influence process. Future research could examine, for instance, if individuals socially influence each other's perceptions of media use differently in creative tasks than in decision-making tasks. There is emerging evidence that, because the cognitive mechanisms underlying idea generation in such creative tasks as brainstorming are different from those in problem-solving tasks, the social processes in such groups also differ--especially when the tasks are computer supported (see Connolly, Routhieaux, & Schneider, 1993; Nagasundaram & Dennis, 1993). In addition, if creative tasks are employed, research should incorporate larger sized groups in order to study how members' structuring of interactions are related to their exploiting the technology (e.g., Gallupe et al., 1992).

Finally, studying the social influence process over three meetings was, in retrospect, inadequate. Unlike in the groups in the baseline and manual conditions, the social influence processes in the groups using GDSS did not demonstrate unequivocally any enduring patterns. Our results suggest, but do not prove conclusively, that by the third meeting, the social influence process among members in the GDSS anonymous and identified conditions were similar to those in the baseline and manual conditions. Future studies carried out over a larger number of meetings should improve our understanding of the mechanisms by which groups of individuals "self-organize" their perceptions and use of GDSS (Contractor, 1994; Contractor & Seibold, 1993). Such over-time designs would be consistent with recent trends in the study of group decision making in general (Corfmnn & Sterkel, 1990; Little, 1986), as well as of group communication in particular (Poole & Roth, 1988). Given the logistical challenges associated with longitudinal research, it may be useful for researchers to use simulation techniques as a precursor to data collection (Contractor, 1994). Computer simulations can help researchers gain richer insights into the relationship between social influence processes and individuals' perceptions of media use over an extended period of time (Zeggelink, 1092). The results of these simulations can assist researchers

in developing more specific hypotheses to be tested in longitudinal empirical studies.

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