Argument and Decision Making in Computer-Mediated Groups

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Following Gouran (1994), the authors proposed four hypotheses that predict the probability of computer-mediated groups (CMGs) endorsing proposals based on (a) the number of reasons offered for them, (b) the number of members advancing these reasons, (c) the net number of positive reactions to the reasons advanced, and (d) the development of support for the reasons. Results from 11 groups that had long collaborated exclusively through computer-mediated means indicated that members in support of a proposal relative to those in opposition as well as the development of their arguments were significant predictors of decision outcomes. Moreover, the number of responses for/against a proposal and the difference in the positive and negative reactions to decision proposals were good independent predictors of decision outcomes.

Organizations increasingly have adopted advanced communication technologies in efforts to improve collaboration within and across work groups (Warkentin, Sayeed, & Hightower, 1997). For instance, organizations have utilized computer-based meeting support technology (e.g., group decision support systems) with the aim of increasing efficiency and effectiveness in group decision-making processes (DeSanctis & Poole, 1994). Researchers have sought to document and explain individual members' and groups' methods of appropriating these new tools, as well as the effects of appropriation on changes in the technologies and in users' group processes and outcomes (Contractor & Seibold, 1993). Because decision making is a key process in groups' work (Hirokawa & Poole, 1996), and in view of the increased use of collaborative technologies in group work, communication researchers have studied many dynamics of group decision-making processes in "group support" electronic environments. Representative studies include investigations of communication technologies and teamwork (Scott, 1999), influence equalization (Siegel, Dubrovsky, Kiesler, & McGuire, 1986), relational effects (Walther, 1992), and social cues in collaborative environments (Lea & Spears, 1991).

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Communication researchers also have studied group argument[1] in decision-making groups (Brashers, Adkins, & Meyers, 1994), largely because interpersonal influence processes are key aspects of decision-making deliberations and patterns of argument are central to communicative influence (Seibold, Meyers, & Sunwolf, 1996). Research with face-to-face (FtF) groups suggests that argument mediates members' prediscussion decision preferences and final group decisions (Meyers, 1989). Similarly, Meyers and Brashers (1998) found an argument-outcome link beyond the valence (positivity/negativity) of statements underlying argumentative reason giving. For the most part, scholars have examined group argument in FtF groups. As a consequence, research on argument in groups supported by new media has lagged the increase in computer-mediated groups (CMGs). This study fills this gap by examining the influence of members' arguments on group outcomes in CMGs.

Communication and Computer-Mediated Groups (CMGs)

Organizations concerned with facilitating communication among geographically distributed members have implemented electronically mediated groups (Hiltz, Johnson, & Turoff, 1986; Warkentin et al., 1997). Relatedly, researchers have studied an array of collaborative technologies that affect decision making (Scott, 1999).[2] These media enable individuals to communicate remotely, and they provide rapid information transfer, convenience, and increased accessibility to co-workers, information, and decision support tools (Straus, 1996). Although some researchers have used student groups, and hence have limited the scope of their findings, this research provides important knowledge regarding group communication in general.[3]

Important differences exist between the structural dimensions of the two communication modes that differentiate FtF groups from CMGs—spoken and written language. "Most of the linguistic differences between speech and writing may be traced to the interactiveness, evanescence, 'on-the-fly' production and the use of prosody in speech that differ from the solidarity, permanent, planned nature of writing" (Jahandarie, 1999, p.149). Specific differences in CMC and FtF contexts also reflect the visual and textual nature of each mode. Whereas FtF groups' spoken interactions are affected by observable cues such as nonverbal gestures

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[1] We use the term "group argument" to refer to the corpus of literature on task group members' argumentation concerning decision making. This focus, and our study, are distinct from the research on members' trait argumentativeness and interpersonal/relational arguing.

[2] Our focus is on CMGs found in more general groupware and not on programs such as group decision support systems (GDSSs). General groupware is not designed to moderate group interaction and serves the group more as a background than as a support system. GDSSs are programs that both provide the tools for group work and structure group communication.

[3] We recognize that the studies we review might have limitations (e.g., zero-history, limited time frame of interaction). For a comprehensive review on group communication methodology, see Poole, Keyton, & Frey (1999); for a comparison between research using laboratory CMGs and CMGs embedded in organizations, see Scott (1999).

and signs of status, many CMG members take advantage of full or partial anonymity to counteract the influence of observable cues and to emphasize their message. Hence, the importance of linguistic content, including argument, is augmented in this electronic environment.

Comparing FtF and CMG Communication

In FtF groups, nonverbal behaviors punctuate and shape social interaction, whereas verbal communication is the primary means of expressing opinions, formulating arguments, and exchanging information during group discussion (Stasser & Taylor, 1991). By implication, in CMGs the information conveyed in words should be more salient than the physical or social aspects of the group or individuals with whom members communicate FtF (Siegel, et al., 1986). Accordingly, Straus (1996) suggests that in CMGs explicit disagreements and superlatives probably reflect the need to compensate linguistically for a lack of nonverbal cues (e.g., shaking one's head) or paraverbal cues (e.g., speaking louder).

Group member status is another contextual factor found to influence FtF group communication. According to social role theory (Eagly & Karau, 1991), group members use observable status characteristics as a basis for establishing the initial leadership and influence hierarchy. Failure to share information in groups and lack of participation have been attributed to a number of factors related to these status characteristics (e.g., age, sex, and position in the communication network) and to physical aspects (e.g., seating, position in the group meeting, and floor time) of FtF group interaction (Straus, 1996). These status characteristics and physical aspects of groups are less evident in CMGs. Moreover, group interaction in computer-mediated channels may avoid some of these pitfalls of FtF interaction by capitalizing on anonymity (Connolly, Jessup, & Valacich, 1990) and by appropriating structures enabling group processes such as decision making without emphasizing status differences (Reynolds, 1994). Studies have found that media that support anonymity promote the possibility of more egalitarian participation (Siegel et al., 1986), allow greater idea generation (Gallupe, Bastianutti, & Cooper, 1991), enable strategic identification of individual traits (Flanagin, Tiyaamornwong, O'Connor, & Seibold, 2002), and potentially increase overall participation levels (Kiesler, Siegel, & McGuire, 1984). Each of these factors directs attention to additional means of influence during groups' decision making, including text-based argument processes (Brashers et al., 1994).

Anonymity or partial anonymity (e.g., fully concealing members' real identity or limiting identifiability by using pseudonyms) within computer-mediated interaction reduces observable status differences found in FtF groups and promotes the potential for a "more level playing field" for group members (Brashers et al., 1994). Individuals who may be reluctant to speak in FtF discussions because of status differences might feel more comfortable making contributions in CMGs (Straus, 1996), a phenomenon that Siegel et al. (1986) termed the "equalization effect."[4] Zigurs, Poole, and DeSanctis (1988) reported that member influence was

[4] The equalization effect in this study is viewed as a possible effect that is promoted by features of CMC as compared to the features in the FtF group context. In other words, it is the absence of the features

distributed more evenly in CMGs compared to FtF groups. However, Straus (1996) suggested that individual-level participation is not necessarily equal across members of CMGs, just less unequal than among FtF group members.

Because computer-mediated communication (CMC) makes possible simultaneous and equal information exchange without some of the inefficiencies found in FtF discussions (e.g., waiting for everyone's attention, taking turns in speaking, and giving social support), task information exchange may be greater in CMGs (Siegel et al., 1986). Walther (1992) observed that CMC participants were more task-oriented, offered more opinions and evaluations of proposals, and advanced fewer statements of agreement in computer-conferencing groups than in FtF settings. Computer-mediated and FtF groups generated equally correct solutions in a problem-solving task, but CMGs were less likely to express agreement than were FtF groups (Hiltz et al., 1986). As noted above, this finding might be related to the fact that any tendencies toward idea generation and the consideration of all potential alternatives are facilitated more in CMGs (Connolly et al., 1990). Relatedly, CMG members may attempt to gain support from other group members by advancing more complex arguments both for and against decision proposals.

A contextual factor extremely salient in CMGs is the importance of the written interaction among members because most CMC is text-based (Brashers et al., 1994). Absent the social cues provided in FtF interaction, CMG members may rely more heavily on the message texts advanced to satisfy their informational, emotional, and identity needs (Walther, 1992), and thus might be more influenced by the content of the messages presented. This includes argumentative communication that advances and defends members' proposals concerning task processes and performance.

Finally, Ang, Cummings, Straub, and Earley (1993) found that when face-loss costs or the risks involved in feedback seeking were reduced, subjects sought more feedback in computer-mediated environments than in face-to-face communication. Because mediated environments may allow equal participation and de-emphasize the physical features of group members, individuals both provide more information and seek more feedback. This proactiveness increases the potential for reason giving and other forms of argumentation concerning substantive aspects of the group's work.

In sum, the relative lack of nonverbal and status cues in CMC compared with FtF group communication—together with the heightened potential in CMGs for more equal member participation, anonymity of contribution, task information exchange and idea generation, feedback seeking, and written interaction—suggests that the search for sources of influence in CMG processes and outcomes should be more focused on features of the interaction than on characteristics of the interactants. Thus, researchers interested in interpersonal influence in CMGs and scholars concerned with CMG decision making should address the role of argument in CMG influence processes of decision outcomes. We take up that challenge next.

of FtF interaction that potentially increases the equality of participation and heightens the possibility for a more equalized CMC context.

The Structuration of Group Argument

Communication scholars have acknowledged the importance of argument in group decision-making (Gouran, 2000), especially the links between group members' processes of reason giving and decision outcomes. Gouran noted that argumentative reason-giving functions help groups resolve questions of value by highlighting evidence as a key factor in the group decision-making process. Empirical research has explicated some of these complexities. Meyers, Brashers, and Hanner (2000) examined minority-majority influence in argument patterns and found that although majorities tended to win more often, consistency in argument was a strong predictor of subgroup success. Meyers and Brashers (1998) also examined argument-outcome links by comparing the group valence model (GVM; Hoffman, 1979) with the distributed valence model (DVM; McPhee, Poole, & Seibold, 1982; Poole, McPhee, & Seibold, 1982). The GVM proposes that group discussion functions to intensify the magnitude of the group valence for a solution regardless of the distribution of the sources of preference statements (Hoffman, 1979), whereas the DVM proposes that the distribution of individual expressions of preferences, or valences, more powerfully advances groups toward decisions (McPhee, 1994). For example, in a group of 10 people, if 3 group members raise 15 favorable comments and 7 group members raise 10 unfavorable comments regarding a solution, the GVM would suggest that the positive valence associated with the difference in the number of favorable (15) relative to unfavorable (10) comments is influential to the decision-making process. Conversely, the DVM would suggest that the group's decision process is influenced by the outnumbering of members in favor of the solution (3 members) by those against the solution (7 members). Prior research found that the DVM was a better predictor than the GVM among five argument features studied (arguables, convergence-seeking activities, disagreement-relevant intrusions, delimitors, and nonarguables), and all but one argument act (disagreement-relevant intrusions) proved to be good predictors of group decision choices (Meyers & Brashers, 1998).

Drawing upon Giddens's (1984) structuration theory, Meyers, Seibold, and Brashers (1991) conceived of group argument as both structure and system. Viewed as systems, or observable patterns of relations, argument may be seen as communicative patterns of disagreement, reason giving and reason defending, and convergence production (Seibold & Meyers, 1996). Viewing argument as underlying structures that enable the production of the system implies that group argument is "constructed and maintained in interaction, and guided perhaps by different rules and norms than those that govern the practice of ideal or rational argument" (Brashers et al., 1994, p. 267). Conceptualizing argument as both structure and system allows the understanding of the components and functions of argument in a systematic way that also facilitates group research on communicative processes and message-outcome linkages.

Meyers and Seibold (1987) proposed that argument is a communicative behavior at the group level and not merely reasoning at the individual level. Unlike cognitive perspectives such as social decision scheme (Davis, 1973) and persua-

sive arguments theory (Burnstein, 1982), interaction—including group argument—is key to group decision processes. For example, Meyers (1989) found that the interaction among group members significantly influenced the number and novelty of arguments advanced during FtF discussion compared with those members' prediscussion cognitive arguments.

Argument in Computer-Mediated Groups
With notable exceptions (see Brashers et al., 1994), the role of argument has been largely overlooked in studies of CMG communication (Scott, 1999). As observed in the survey of research on communication and CMGs reported earlier, given the key function of textual exchanges in CMGs and the tendency for elaborated reason-giving, more evaluation of proposals, and fewer statements of agreement than in FtF groups, group members' argument via CMC should have effects on decision making at least as important as in FtF groups, if not more so. Investigators can discern such effects by tracing patterns of argument and predicting argument-outcome links in CMGs, as has been done in FtF groups.

Drawing a parallel to earlier structurational research on valence and group decision-making (McPhee et al., 1982; Poole et al., 1982), Gouran (1994) offered a set of four argument propositions predicting the probability of a group endorsing a proposal based on (a) the number of reasons offered for the proposal, (b) the number of members advancing these reasons, (c) the quality of the support for the reasons, and (d) the proportion of favorable to unfavorable reactions to the reasons advanced. The first two propositions are the argument analog to the GVM and the DVM, the latter of which was found to be a better predictor of decisions in FtF groups than message valence alone (Poole et al., 1982). More recently, Meyers and Brashers (1998) invoked Gouran's propositions in studying argument in FtF groups and examined argument-outcome links by comparing the GVM with the DVM. They found the DVM to be a better predictor than the GVM. They also found most argument acts (i.e., reasoning activities, convergence seeking, and a combination of all possible acts) to be good predictors of group decision choices in FtF groups. The empirical support for Gouran's propositions in the work of Meyers and Brashers (1998) in FtF groups, and the emphasis on linguistic influence of the written exchanges in CMGs, suggest the utility of Gouran's four propositions as hypotheses for testing group argument effects in CMGs.

Gouran (1994) first drew upon research reported by proponents of the GVM (Hoffman, 1979) theorizing that the "valence" of decision proposals (favorable relative to unfavorable reasons about each) accumulates until the proposal with the highest valence is endorsed by the group majority. Studying communicative manifestations of decision valence in group discussants' message exchanges concerning specific proposals, McPhee et al. (1982) found some support for the GVM. Meyers and Brashers (1998) found support for an argument analog to the GVM, but again in FtF groups. Given the contextual features that might amplify the effect of argument in CMGs, Hypothesis 1 predicts support for the argument analogue to the GVM found in FtF groups, but in CMGs:

H1: In CMGs, the difference between the number of initial reasons in support of proposals and the number of initial reasons offered in their opposition is positively related to the likelihood of the endorsement of decision proposals.

Poole et al. (1982) found that the "distribution" of accumulated valence for decision proposals was a better predictor of decision acceptance than total accumulated valence alone. Gouran (1994) challenged researchers to test an argument analogue to the DVM reported by Poole et al. (1982). Meyers and Brashers (1998) found support for just such an argument version of the DVM when taking into account the number of group members who participated in forwarding each group argument. However, they studied the distribution of argument across members in FtF groups, in which observable status cues and physical features might have been conflated with group discussion to influence decision making (Lucas & Novaglia, 1998). Because these cues are absent in CMGs, computer-mediated group argument allows for a clearer test of Gouran's second proposition than reported in Meyers and Brashers (1998):

H2: In CMGs, the difference in the number of group members who offer supporting rather than opposing arguments for proposals is positively related to the likelihood of endorsement of decision proposals.

Although findings from FtF groups reveal that group arguments supported consistently by a majority of members win (Meyers et al., 2000), members' reactions to others' argument statements concerning a decision proposal are also important in group decision making. Since exposure to arguments can influence group members to endorse a decision proposal (Gouran, 1994) and because CMGs promote the possibility of egalitarianism, it is likely that the exposure to the reactions of multiple group members is necessary for some members to agree on a proposal because status cues and other characteristics of single influences in FtF groups are less likely in CMGs. Bonner (2000) found evidence that a single person, regardless of individual characteristics, is not able to control the group decision-making outcome in a judgmental task when a majority is present. In addition, conformity increases with the size of the group majority (Shaw & Webb, 1982). Hence, the larger the proportion of members offering favorable reactions to a proposal, relative to those who offer unfavorable reactions, the more likely members will be to find those reactions compelling, suggesting a third hypothesis that parallels Gouran's (1994) third group argument proposition:

H3: In CMGs, the greater the difference between favorable and unfavorable reactions to reasons offered in support of decision proposals, the greater the likelihood of acceptance of those proposals.

Finally, it is instructive to consider the combination of argument acts in support or against a proposal to examine the argument structures related to decision making. Meyers and Brashers (1998) found that a "total argument model" that included assertions, propositions, elaborations, responses, amplifications, justifications, agreements, acknowledgments, objections, and challenges was a strong predictor of

final group decisions in FtF groups. Consistent with Gouran's (1994) fourth proposition, for which Meyers and Brashers (1998) found support in FtF groups, we therefore predict:

> H4: In CMGs, the better developed the arguments offered in support of decision proposals relative to the development of arguments opposing them, the greater the likelihood of acceptance of those proposals.[5]

Method

Participants, Collaborative Technology, and Task
Participants were advanced college students enrolled in an undergraduate course focusing on collaborative technologies in contemporary organizations. Subjects used a custom-made, text-based software application delivered via the Internet for all group communication and group work. Eleven groups were formed by random assignment, ranging from 5 to 6 members each ($N = 63$), in which participants worked for 10 continuous weeks. The lack of anticipation of future interaction beyond the length of the course may be a limitation in that it is unusual. That said, many groups in organizations are structured around temporary tasks (e.g., ad hoc committees, task forces) that have definite deadlines and exist only for set periods of time. Hence, the lack of anticipation of future interaction is not uncommon in many organizational groups.

Group members were identified to one another only by pseudonyms. Tasks completed by group members required wide-scale participation across members over extended periods of time and were the sole basis for evaluation in the course. Thus, tasks were interdependent, purposeful, and the basis for meaningful rewards, and they substantially resembled organizational work tasks. Prior to using the system for group work, users were trained and were allotted time to experiment with the technology.

The task utilized in this study occurred in the seventh week of group interaction and required each group to produce a report involving a theoretical analysis of the impact of advanced communication and information technology on organizational goals, structures, and collaboration. The nature of the task was judgmental in that it did not possess an objective, correct answer. In a judgment task, reaching a final collective decision—not discovering the objectively correct answer—is the goal of the group (Bonner, 2000). All participants' interactions were stored electronically and were the basis for a content analysis of CMG members' arguments in this study.

Content Analysis
Unitizing discussion content. Two judges working independently unitized discussion content in the 11 CMGs. Any statement that functioned as a complete thought

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[5] Although we have predicted our hypotheses in the positive direction, we implicitly predicted the opposite relationship in the negative direction and therefore tested both directions.

or change of thought was a unit. In view of the focus on argument and in light of past research in this area (Meyers et al., 1991), it seemed appropriate to unitize transcripts into complete thoughts, rather than individual "words" or broad "turns" (see Meyers & Brashers, 1998; Meyers et al., 2000). The data were partitioned through an iterative procedure that identified lines of argument by first examining the topical foci of members' messages concerning the task, a customary procedure in this line of research. By analyzing specific argument acts in terms of the topical foci of messages, the links between argument patterns and final group decision outcomes were clear.

Coding procedures and measures. The structuration argument coding scheme developed by Canary, Seibold, and colleagues was used to code specific argument acts in this investigation (see Canary, Brossman, & Seibold, 1987; Canary, Ratledge, & Seibold, 1982). Meyers et al. (1991) offered a modification of the original coding scheme by adding three categories, a revision used in this study as well. The revised scheme contained 17 categories reflecting five argument-related structures: arguables, reinforcers, promptors, delimitors, and nonarguables (see see appendix). There were three principal coding tasks that required coders to make several passes through the data. First, they parceled the data within each group into the lines of argument so as to identify each line and each member's contribution(s) to each proposal. Once the lines were separated, coders were trained to apply the structuration argument coding scheme to every member's contribution in each group for every line of argument. Finally, the valence of each argument-related act within each line of argument was coded for use in tasks involving the number of reasons, group member endorsements, reactions, and development of the arguments for and against the proposals.

Dichotomous outcomes. After all of the argument-related statements were coded using the structuration argument coding scheme, the success of a proposal was determined by examining the transcripts for statements that indicated whether the group members followed the course of action argued for in decision proposals. All proposals were coded as successful or unsuccessful.

To test H1, assertion and response acts were used to operationalize the initial reasons in support versus the initial reasons against the decision proposal. To test H2, messages of only those group members who produced the original reasons in H1 were utilized. These members' supporting versus opposing statements were operationalized as agreement or objection acts, which in turn were assessed in terms of agreement, agreement-plus, objection, objection-plus, and challenge statements. H3 investigated members' favorable and unfavorable reactions embedded in arguments concerning a decision proposal. Whereas responses are arguables in support or against the initial decision proposal, reactions are the arguables in support or against the responses. Favorable reactions were coded as the combination of reinforcers and related delimitors. Unfavorable reactions were coded as the combination of prompters and related delimitors. These statements were tracked across the entire argument sequence for each specific decision proposal. To test whether better developed arguments led to endorsing a specific proposal (H4), argument development was coded as the combination of statements reflecting codes in the arguable, reinforcer, promptor, and delimitor

categories in the Structuration Argument Coding Scheme. In turn, each combination was weighted based on the type of statements and used to create a Development of Argument Index (see Table 1).[6]

Coder training and reliability. Five coders were trained for the initial coding and parceling of the data, and three were retained for the remaining coding tasks. For each main coding task, coders were trained during a 5-week period using one of the group's transcripts (used for training purposes only). Each week, differences were discussed and clarified among all coders. Two coders, working independently, coded each transcript. Cohen's kappa estimates of reliability were .81 for the lines of argument, .86 for the argument codes in the coding scheme, and .88 for the valence of each proposal.

Results

Because preliminary ANOVAs revealed that the CMGs did not differ significantly across any of the variables measured, data within each category were collapsed across the 11 groups and tests of all hypotheses were performed on these aggregated data.[7] A total of 188 proposals were identified in the transcripts of the CMGs; 132 (70.2 %) were successful and 56 (29.8 %) were unsuccessful.

Because the hypotheses state that the success of a proposal is a function of the variation (difference) of two independent variables together, we calculated the difference between each set of independent variables and conducted analyses

[6] As we describe fully elsewhere (Seibold & Lemus, 2003) and consistent with our structurational approach, although reason-giving and reason-using arguables are necessary for group argument, they are not viewed as sufficient for arguments of high quality. Rather, as systems of disagreement repair and convergence production, group argument also may embody higher order efforts at reinforcement, prompting, and delimiting. Hence, reinforcers, promptors, and delimitors receive progressively higher weights in the aggregate measure of quality evidenced in the development of the argument (see Column 2 of Table 1). The resultant argument development quality index yields a measure of the degree of development embodied in the argument structure, with higher weighted arguments reflecting more discursive development during decision-making deliberations.

As Seibold and Lemus (2003) discuss, the argument development quality index does not address the particular logical form or force of argument reflected in a structure captured by the coding scheme. Nor does the "argument development" index of argument quality we propose in column 2 of Table 1 reflect, necessarily, the psychological force of the combined argument acts. However, the "force" aspects of argument quality could be indexed with the structuration argument coding scheme (see Seibold & Lemus, 2003, for a description and weightings). To assay the merits of such a force measure relative to the development measure we utilize to test H4, we examined whether assigning highest weights to reason-giving and reason-using arguables, and lower weights to the features we weight most highly in the development of argument quality index (Table 1), would predict the likelihood of successful or unsuccessful decision proposals. The results of the logistic regression (Wald χ^2 = .030, β = .995, p = .861) indicated that argument force was not a significant predictor of decision outcomes. This stands in sharp contrast to the results we report, in which argument development is a significant predictor of group outcomes (Table 2).

[7] The results of the ANOVAs revealed that across the eleven groups, there were no significant differences in groups' endorsement of the decision proposals, $F_{(10, 177)}$ = 1.148, p = .329; groups' positive responses, $F_{(10, 177)}$ = 1.705, p = .083; groups' negative responses, $F_{(10, 177)}$ = .779, p = .649; number of members in support, $F_{(10, 177)}$ = 1.318, p = .224; number of members in opposition, $F_{(10, 177)}$ = 1.128,

Table 1. Development of Argument Index

Categories	Codes	Values of codes in index* (weights)
Delimitors	12, 13, 14	5
Promptors	9, 10, 11	4
Reinforcers	7, 8	3
Arguables	3, 4, 5, 6	2
Potential arguables	1, 2	1

*The higher the weight, the greater the development.

using these difference scores. Multivariate logistic regression analysis was conducted to simultaneously test the effects of all four predictor variables on the likelihood of a successful or unsuccessful decision proposal. In addition, we performed chi square analyses to probe the data further.

As shown in Table 2, the regression results indicate that the difference in the number of members supporting or opposing the argument (DVM) and the development of the argument are significant predictors of the decision outcomes in CMGs. These results support H2 and H4. In the case of H2, the findings were consistent with the DVM model (Poole et al., 1982) and replicated Meyers and Brashers's (1998) findings concerning the superiority of the DVM over GVM. In light of the results of the multivariate logistic regression analysis, we conducted secondary analyses to probe Gouran's four propositions further.

Related to H1, a chi-square analysis assessed the degree to which (a) decision proposals in CMGs that are endorsed by the group are more likely to be associated with positive than negative responses to them throughout the groups' deliberations, and (b) unsuccessful proposals are associated with negative responses more than positive responses during members' discussions. Of the 447 positive responses to the 188 proposals, 364 (81.4%) were responses to decision proposals that were successful, and 83 (18.5%) were responses to decision proposals that were unsuccessful. Of the 180 negative responses, 73 (40.5%) were responses to proposals that were successful and 107 (59.4%) were responses to proposals that were not successful. Chi-square tests confirmed that positive responses were more frequent for the successful proposals and negative responses were more frequent for the unsuccessful proposals, $\chi^2(1) = 101.52$, $p < .01$, consistent with H1.

Concerning H2, a chi-square analysis probed the distribution of the number of members who supported relative to those who opposed successful decision pro-

$p = .344$; groups' positive reactions, $F(10, 177) = 1.644$, $p = .098$; groups' negative reactions, $F(10, 177) = 5.30$, $p = .868$; groups' argument development in support, $F(10, 177) = 1.143$, $p = .333$; and groups' argument development in opposition, $F(10, 177) = .766$, $p = .661$.

Table 2. Summary of Multivariate Logistic Regression for the Differences Between Variables Predicting Successful or Unsuccessful Decision Proposals (*N* = 188)

Variable	β (SE)	Exp (B)/Odds ratio
Response difference	-.205 (.185)	.814
Distribution of member endorsement diff.	1.176 (.387)**	3.240
Reaction difference	-0.019 (.175)	.981
Development difference	.189 (.071)**	1.208

Note. **$p < .01$.

posals, and the distribution of members who opposed relative to those who supported unsuccessful decision proposals. Of the 447 positive responses from the group members to all decision proposals, a total of 186 (41.6%) responses were from members who supported decision proposals that were ultimately endorsed, and 27 (26%) were from members who supported decision proposals that were not endorsed. Of the 180 negative responses advanced, a total of 27 (15%) were from group members who were against proposals that were ultimately endorsed and 47 (26%) were from group members who were against proposals that were not endorsed. Chi-square tests revealed that more members advanced positive responses for the successful proposals and more members advanced negative responses for the unsuccessful proposals, $\chi^2(1) = 74.17$, $p < .01$. Interestingly, the distribution of the members who supported decision proposals ranged from 1 to 4 members, whereas the distribution of members who opposed decision proposals ranged from 1 to 2 members. That is, supporting responses were distributed across as many as twice the number of members who opposed the proposal. Results of both the primary and secondary analyses supported H2.

With regard to H3, a chi-square analysis tested the difference between the number of positive and negative reactions to the number of successful and unsuccessful proposals. Of the 412 reactions in support of a proposal, 343 (83.2%) were in support of a decision proposal that was endorsed and 69 (16.7%) were in support of a decision proposal that was not endorsed. Of the 127 reactions opposed to a decision proposal, 41 (32.3%) were reactions to successful decision outcomes, and 86 (67.7%) were reactions to decisions that were not successful. A chi-square test supported the prediction that positive reactions were more frequent for the successful proposals and negative reactions were more frequent for the unsuccessful proposals, $\chi^2(1) = 123.09$, $p < .01$, as proposed in H3.

We used the development of argument index (see Table 1) to test H4. The development in arguments supportive of decision proposals was higher on average than the development in arguments opposing proposals. Consistent with H4 and the multivariate analyses, 25% of the arguments in support of proposals had weights greater than 16, whereas 75% of the arguments in opposition to proposals had weights of 5 or less.

Discussion

Results of this study indicate that in CMGs, the number of members in support of a proposal relative to those in opposition, as well as the development of the arguments in support of a proposal, are both significant predictors of decision outcomes. Moreover, based on the chi-square results, the number of responses in support of or against a proposal and the difference in the positive and negative reactions to decision proposals, when analyzed independently of the other variables, were good predictors of decision outcomes. These findings extend research on Hoffman's (1979) Valence Model and the communication-based group valence research of FtF groups (McPhee et al., 1982; Meyers & Brashers, 1998) to the computer-mediated context.

Findings of this study are consistent with Meyers and Brashers (1998) and supportive of the DVM (McPhee et al., 1982): The more members who support decision proposals (relative to those opposed), the more likely the successful endorsement by the group. In addition, this study confirms this dynamic in CMGs, in which the possibility that status and physical cues might affect these relations is greatly reduced. Although members openly expressed opposition, fewer members opposed than supported decision proposals in these CMGs—a pattern similar to the influence found in FtF groups where majorities tend to win (Meyers et al., 2000). This seems to indicate that group members might not only be paying attention to the arguments advanced but also to the proportion of members offering endorsements or objections to the proposals.

In this study, the difference between the positive and negative responses and the difference between the number of positive and negative reactions advanced for a decision proposal were good predictors of decision outcomes, but only when considered independent of each of the other predictors. This is consonant with Gouran's (1994) view that group members exposed to other group members' comments are more likely to form favorable reactions that endorse a decision proposal. However, analyses indicated that such influence is attributable more to the number of members and the development of the reasons they advance in support or opposition of the decision proposals than to the valence of the members' responses or reactions.

In the CMGs in this study, the development of arguments in support of decision proposals was higher on average than the development of arguments opposing them. Furthermore, the difference in the development of the arguments between those who supported and those who opposed successful decision proposals was a significant predictor of the decision outcome. It should be noted that the conceptualization of development is the combination of arguables, reinforcers, promptors, and delimitors, rather than the depth of evidence advanced in support of an assertion.

Implications
This study supports previous structurational models of influence in FtF groups (i.e., DVM and GVM) and both replicates and extends recent research on FtF group argument in the new context of computer-mediated groups. Despite the

similarity of the influence patterns found in FtF groups (e.g., majority-minority influence), this new context evidently influences group members' argument patterns in a different way than does FtF interaction. Perhaps, because of the textual nature of the CMC context and consistent with a structurational perspective (DeSanctis & Poole, 1994; Poole, Seibold, & McPhee, 1996), CMG members seem to compensate for the lack of physical and perceptual cues available in FtF contact by utilizing the text-based nature of the medium to influence others through more highly developed arguments.

Studies of interaction and task performance in computer-assisted groups reviewed earlier reveal that CMGs are characterized by more idea generation, higher task information exchange, and greater consideration of potential alternatives than FtF groups. This study certainly supports that view of CMGs considering the very large number of proposals (188), task-related argument exchanges (2,798), and reactions and responses (859) observed here. As also noted, research by Walther (1992) suggested that CMG members offer more opinions/evaluations of proposals and advance fewer statements of agreement than in FtF groups. Relatedly, communication among CMG members who are anonymous (or partially anonymous) has been found to be characterized by greater direct advocacy, more criticisms of ideas or propositions, and more questioning (Guzzo & Dickson, 1996). The findings from this investigation of anonymous CMG members corroborate these perspectives of CMG interaction: the relative absence of direct agreements reflected in negative responses (180; 29%), negative reactions (127; 24%), and the high amounts of direct advocacy (815 assertions and propositions; 24%). These findings, together with research on anonymity (Guzzo & Dickson, 1996), type of task (Shaw, 1981), and the potential equality offered by this context (Straus, 1996), imply that perhaps there is an interaction between the sense of anonymity group members have, the requirements of a judgmental task to participate abundantly, and the potential opportunity to freely share information promoted by this context that has an effect on the influence the number of members and the development of their contributions have on decision outcomes. However, these modal differences and their effects (degree of development of arguments and of proposal generation) cannot be demonstrated without a direct comparison between the modes.

This study also underscores the structuring nature of argument practices in CMGs. It is a cornerstone of the group problem-solving literature that groups with more structured decision-making outperform those whose processes are less structured. Structure can be facilitated in CMGs when members are aided by sophisticated decision-support software. Indeed, in such instances CMGs may outperform FtF groups because of the capability of the software to better structure members' decision processes. However, results of the present study offer insight into why CMGs are more structured than FtF groups.

Consistent with the structurational perspective (DeSanctis & Poole, 1994; Poole et al., 1996), structure is an inherent aspect and consequence of CMG interactions, especially in argumentative discussion related to decision making in these computer-mediated groups. The anonymity provided to members (which encourages participation), the text-based nature of the medium (which facilitates argument

construction), and the need to compensate for the loss of expertise and status cues associated with influence in FtF groups, all engender patterns of argument and reason-giving discourse that simultaneously structure CMGs' deliberation and lead to choices among alternatives. Although the discursive patterns can be read as systems of argumentative exchange and choice making, they also fundamentally structure members' interaction relative to the decisions they must make (Meyers et al., 1991).

Limitations and Future Research

The absence of comparable FtF groups in this study does not allow us to comment on the precise nature of differences between CMC and FtF groups in argument structures and argument-outcome links. However, research on FtF group communication provides a point of comparison and allows researchers to form conclusions based on what is already established, even if the conclusions are based on different modes of communication. For example, examination of the frequency of argument acts in studies of FtF groups by Meyers et al. (1991; 2000) and Meyers and Brashers (1998) reveals that arguments in those FtF groups were far less developed across a variety of tasks—including judgment tasks like the one employed in this study. For example, in a study of 73 subjects in 15 FtF groups, Meyers et al. (1991) found members used reason-using arguables (1,138; 13.5%), reason-giving arguables (104; 1.3%), reinforcers (1,142; 13.6%), promptors (203; 2.3%), and delimitors (170; 2.1%). In contrast, this study revealed that, although 63 members of these 11 CMGs made comparable use of reason-using arguables (431; 9.7%) and reinforcers (488; 14.3%), they made much more extensive use of reason-giving arguables (457; 10.5%), promptors (266; 7.7%), and delimitors (588; 15%). Comparative research is needed to determine the pervasiveness and nature of these argument differences between FtF groups and CMGs. Ideally, such research would also utilize a larger sample of organizational participants and not student groups in which status and educational differences might differ from groups composed of workforce participants. Moreover, the anonymity inherent in the CMGs in this study might pose a limitation for generalizing the results of this study because such long-term anonymity may be atypical of organizational CMGs. However, the task from this study does substantially resemble organizational work tasks, inasmuch as the task was interdependent, purposeful, and the basis for meaningful rewards, as noted earlier. Thus, we suggest a distinction between the nature of the task and the nature of the work groups performing the task.

Furthermore, consistent with the previous distinction between the positivity of argument statements in FtF groups and the relatively high numbers of promptors (negative statements) and delimitors in this study, it may be that the differences observed are a function of both the text-based nature of the medium and the potential for anonymity. If so, we would predict more reason giving and reason using in CMGs than in FtF groups, regardless of member identifiability in the CMGs, but greater frequencies of delimitors and promptors only in CMGs where members have anonymity.

Overall, findings support the DVM and extend research on FtF groups to the computer-mediated context. Influence in CMG decision making is attributable

more to the number of members and the development of their arguments than to the valence of their responses or reactions. Furthermore, consistent with prior research, CMG members seem to capitalize on features of the medium (e.g., the text-based nature, anonymity, turn taking, etc.) to influence other group members. This is evident in the large numbers of statements advanced, as well as the high degree of development in the arguments. Although this study did not make a direct comparison between FtF groups and CMGs, these findings may illuminate the argumentative nature of influence in the decision-making process in a mediated context and set an agenda for future research in this area.

Appendix
Argument Coding Scheme[1]

ARGUABLES
A. Potential arguables
    1. ASRT: *Assertions*. Statements of fact or opinion.
    2. PROP: *Propositions*. Statements that call for support, action, or conference on an argument-related statement.
B. Reason-using arguables
    3. ELAB: *Elaborations*. Statements that support other statements by providing evidence, reasons, or other support.
    4. RESP: *Responses*. Statements that defend arguables with disagreement.
C. Reason-giving arguables
    5. AMP: *Amplifications*. Statements that explain or expound on other statements in order to establish the relevance of the argument through inference.
    6. JUST: *Justifications*. Statements that offer the validity of previous or upcoming statements by citing a rule of logic (provide standards whereby arguments are weighed).
REINFORCERS
    7. AGRE: *Agreement*. Statements that express agreement with another statement.
    8. AGRE (PLUS): *Agreement* (*plus*): Statements that express agreement with another statement and then go on to state an arguable, promptor, delimitor, or nonarguable.
PROMPTORS
    9. OBJC: *Objection*. Statements that deny the truth or accuracy of an arguable.
    10. OBJC (PLUS): *Objection* (*plus*). Statements that deny the truth or accuracy of an arguable and then go on to state another arguable, promptor, delimitor, or nonarguable.
    11. CHAL: *Challenge*. Statements that offer problems or questions that must be resolved if agree ment is to be secured on an arguable.
DELIMITORS
    12. FRAM: *Frames*. Statements that provide a context for and/or qualify arguables.
    13. F/SE: *Forestall/Secure*. Statements that attempt to forestall refutation by securing common ground.
    14. F/RE: *Forestall/Remove*. Statements that attempt to forestall refutation by removing possible objections.
NONARGUABLES
    15. PROC: *Process*. Nonargument-related statements that orient the group to its task or specify the process the group should follow.
    16. UNRE: *Unrelated*. Statements that are unrelated to the group's argument or process (tangents, side issues, self-talk, etc.).
    17. INCP: *Incompletes*. Statements that do not support a cogent or interpretable idea (due to interruption, stopping to think mainstream, etc.), but are completed as a cogent idea else where in the transcript.

[1] (Canary, Brossman, & Weibold, 1987; Camry, Ratledge, & Seibold, 1982; Meyers, Seibold, & Brashers, 1991; reprinted with permission from Meyers, Seibold, & Brashers, 1991).

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