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ABSTRACT

This paper discusses the results of an experiment exploring the effects of information technology intervention on decision making groups. Specifically, the study examines the effects communication modality (remote vs. face-to-face) and information load on the types of social influence used by group members and the amount of group polarization or choice shift exhibited by group members. The findings suggest that face-to-face groups use more informational influence than remote groups and that this difference increases as information load increases. Also, face-to-face groups experienced greater choice shift than remote groups at high information loads.

INTRODUCTION

Social influence, the ability of group members to influence one another during discussion, has been a topic of interest for researchers in the areas of group dynamics, management, and communications. Some of the effects of this influence have been considered potentially harmful, as is the case with the group polarization effect, the tendency of group discussion to exaggerate the opinion of group members. If the group members are predisposed to take a risky alternative, group polarization may lead to the "risky shift" phenomenon, causing the group to choose a riskier alternative than individual group members would (Davis & Hinz, 1982). However, not all effects of influence are undesirable; effects that promote group cohesiveness, as long as they don't lead to "groupthink," may encourage consensus within the group and improve the ability of the group to implement its decisions.

Social influence has also been a subject of interest to researchers of group decision support systems (GDSSs). One of the benefits attributed to GDSSs is the mitigation of the harmful effects of social influence (Clapper, McLean & Watson, 1991; DeSanctis & Gallupe, 1987; Huber, 1984). However, empirical support for this contention has been mixed (Clapper et al., 1991).

BACKGROUND

Social Influence and Group Polarization

Shaw defined groups as "two or more persons who are interacting with one another in such a manner that each person influences and is influenced by each other person" (Shaw, 1976, p. 8). Social influence is fundamental to the field of social psychology. Researchers in this area have divided influence into two broad types: informational and normative influence. Informational influence usually relies on carefully constructed arguments or the transmission of large volumes of information. It results from the acceptance of information from others as evidence of reality (Kaplan & Miller, 1987). Normative influence is more likely to rely on emotional arguments and statements of preference. It results from trying to act in conformance with others' beliefs or expectations and/or group norms (Clapper, et al., 1991).

The phenomenon of group polarization has been attributed to social influence. Polarization is the tendency of group interaction to shift a group's attitudes in the direction to which the group is predisposed. The most familiar manifestation of group polarization is choice shift. A *risky shift* occurs when an individual shifts toward a riskier position as a result of working in a group. Conversely, a *cautious shift* occurs when the individual shifts toward a more cautious position (Davis & Hinz, 1982). According to the group polarization theory, the direction of this choice shift can be predicted based on the group members' predispositions.

Both informational and normative influences are assumed to be present in decision making processes. The extent to which each one of these influences affects polarization and/or choice shift, has been debated in the group decision making literature for some time (Burnstein & Vinokur, 1977; Clapper, McLean, & Watson, 1991). Most of the research, however, seems to indicate that informational influence produces stronger and more consistent polarization effects than normative influences (Burnstein & Vinokur, 1977; Kaplan & Miller, 1987).

Previous studies comparing face-to-face and remote groups (Siegal, Dubrovsky, Kiesler, & McGuire, 1986; Gallupe & McKeen, 1990) have produced inconsistent results with regard to group polarization or choice shift. Siegal, et al. found that remote groups exhibit greater polarization than face-to-face groups but they were unable to explain this observation. In another study, Gallupe and McKeen (1990) reported that face-to-face groups experienced more polarization than remote groups. The authors noted the difference between their results and Siegal's finding but gave no explanation for the difference.

Inconsistent findings in other areas of GDSS research have been noted elsewhere (Dennis & Gallupe, 1993). One explanation for this inconsistency is that many of these studies follow what Clapper calls a "macro" approach: the group is treated as a black box while outputs are compared to inputs (Clapper et al., 1991). An alternative "micro" approach focuses on the group processes that transform inputs to outputs. Studies taking a macro approach focus on outcome variables while those taking a micro approach focus on process variables.

Outcome and Process Variables

Outcome variables measure the *results* of group interaction. For example, if the group's main task is to achieve a consensus, social influence will be measured by the difference between the relevant pre-discussion and post-discussion opinions of individual group members, without examining the possible impact other variables might have had on group processes. A macro approach is useful if the main effects are strong and unequivocal. However, if the effects are not strong, or if the processes that give rise to the effects interact with the technology used by the group, the results will be equivocal.

Process variables describe what happens during group interaction. Micro methodologies open the black box and examine the actual processes that produce group outcomes. These processes examine informational and normative influences and how they are affected by communication configuration, which includes (1) the patterns of communication among members of a group; (2) the methods and devices used to convey information (e.g., writing, video, teletyping); and (3) the instructions and/or software provided to improve group performance. This type of approach is necessary when the nature of the interactions between outputs and any intervening variables are not known.

Social Influence and Technological Intervention

GDSS technology can provide different levels of decision-making support and, therefore, may result in different levels and types of intervention in group processes. The GDSS literature (DeSanctis & Gallupe, 1987) classifies GDSSs according to the level of support as Level 1 (mainly communication support features, such as brainstorming and voting support), Level 2 (GDSSs enhanced by decision modeling or mathematical techniques), and Level 3 (the GDSS automatically controls group interaction and voting). Even the Level 1 GDSSs are expected to facilitate group tasks by easing the problems related to open verbal communication and discussion. GDSSs can support groups that meet at the same time at the same location such as decision rooms and legislative sessions, and remote groups that meet simultaneously or at different times.

Remote groups are affected by factors that may hinder their ability to exert informational influence. Two of these factors are directly related to remote communication: it is less efficient and it is relatively "lean" compared to face-to-face communication. Siegal et al. (1986) reported that remote groups were less efficient and attributed part of this inefficiency to the fact that typing is more difficult than speaking. It requires more time and effort to enter a comment on a keyboard than to speak it. This reduces the amount of information that can be transmitted in a given time.

Remote communication is not as "rich" a medium as face-to-face communication. Daft and Lengel (1986) define richness as "the ability of information to change understanding within a time interval." Rich media permit multiple information cues (the words spoken, tone of voice, body language, etc.) and feedback. Many of the cues present in face-to-face groups that regulate the flow of conversation or provide feedback are not present in remote groups. It would take more effort to make and support a rational argument in a lean media than in a richer one.

Another finding suggests that people may be more likely to use normative influence in remote groups. Siegal et al. (1986) reported that people are more likely to express their opinions and engage in extreme behaviors towards others in remote groups. People sometimes simply state their preference with little defense. Since people may often exert normative influence by exposing others to their choices, preferences, and opinions, the amount of normative influence used by remote group members is likely to be higher than in face-to-face groups.

In general, studies of social influence in a GDSS environment that have taken a macro approach, have found no difference between GDSS supported and face-to-face groups. However, most of the studies taking a micro approach have reported that patterns of influence behavior change in the presence of a GDSS whether or not outcomes associated with influence are affected (Clapper, 1992).

DESCRIPTION OF STUDY

The primary research question of this study is: Does the use of a GDSS affect the predominate influence type used and the degree of polarization exhibited by the group members? This question is examined through the development and testing of five hypotheses based on the theories and findings discussed above.

Studies of the effects of technological support on informational and normative influence are rare (Clapper, 1991). However, studies from social psychology give us some guidance in developing hypotheses for face-to-face groups. The groups participating in this study were given an intellective decision making task which, by definition, has a demonstrably correct answer (Laughlin & Ellis, 1986). The groups were asked to reach a unanimous decision. Kaplan and Miller (1987) found that, under these same circumstances, face-to-face groups use informational influence predominantly. Therefore, the first hypothesis is:

H1: The predominate form of influence used in face-to-face groups will be informational.

The GDSS groups in this study used a Level 1 GDSS supporting anonymous remote communication and voting. The only difference between the face-to-face groups and the GDSS groups was that the GDSS groups communicated remotely through the GDSS. Therefore, these groups were subjected to the effects of some of the factors that have been found to impact remote group communication, such as the effects of a "lean" and "inefficient" communication medium. These factors lead to the second hypothesis:

H2: Remote groups will show a higher level of normative influence than face-to-face groups.

If, as suggested above, the difference in the ability to transmit information affects the type of influence used, these effects might be exaggerated as information load (the amount of information, relevant or irrelevant, that is available to group members for examination and analysis before group discussion starts) increases. Face-to-face groups would be better able to adjust

to the additional information so the effects of the medium would increase as information load increases until the amount of information overloads the face-to-face groups. Thus, the following hypotheses:

H3: Informational influences will increase for face-to-face groups relative to GDSS groups as information load increases.

H4: Normative influence will decrease for face-to-face groups relative to GDSS groups as information load increases.

Polarization and Choice Shift

As has already been mentioned, informational influence has been found to consistently cause stronger polarization effects. Face-to-face groups in this study were expected to use more informational influence. Also remote media have been found to reduce the effects of factors such as status and group norms. Since these are important components of normative influence, normative influence will be less effective over remote media. This leads to the following hypothesis:

H5: GDSS groups will exhibit less marked choice shift than face-to-face groups.

RESEARCH METHOD

The method used in this study is based on an experiment conducted by Kaplan and Miller (1987). Their purpose was to investigate the relative proportion of informational and normative influence in face-to-face groups while varying task type and decision rule. Our experiment holds task type and decision rule constant while varying communication modality.

Task Type

The task that the groups were assigned was to unanimously select the best candidate for a marketing manager position in a hypothetical situation. The subjects were supplied with the job description and descriptions of three candidates. The subjects were told that the descriptions of the candidates were the result of a candidate search conducted by their company. The job description consisted of 15 attributes considered desirable for the job. The candidate descriptions listed which attributes the candidates had and which ones they lacked. Like the Kaplan and Miller experiment, this task had a demonstrably correct answer; however, the answer was not obvious and required analysis of information. Therefore, participants might be equally likely to exert informational influence (based on data analysis) or normative influence (based on an overall impression of the candidates).

Pilot studies were conducted consisting of six groups (three GDSS and three face-to-face) to ensure the task had face validity and that the number of candidates and attributes were

appropriate. The number of attributes was chosen so that the subjects would be taxed but that the groups would be able to complete the task in a reasonable amount of time.

The groups receiving the high information load treatment had candidate descriptions including five additional attributes not mentioned in the job description and, therefore, not relevant to the choice. These attributes were the same for each candidate and did not appear to contribute to the decisions made by the groups.

Dependent Measures

Two dependent measures were required. The first was choice shift, which was measured by subtracting the post-test confidence rating from the pre-test confidence rating. The second measure was number of informational and normative statements used by the groups. To determine the latter measure the discussion transcripts were coded based on the scheme below. The coding scheme was adopted from Kaplan and Miller (1987) and adjusted for the task used in this experiment.

Testimony. Statements citing facts that were provided in the descriptions. Included would be queries that mention specific items and responses confirming or denying those queries.

Inferences from testimony. Statements of fact not given in the descriptions but inferred from those given. These do not include statements that express a normative belief such as "It would be easy to learn a foreign language." They include statements like "If he knew this, he would have to know that."

Values/Norms. Statements of personal values or beliefs. Judgements about the importance of certain qualifications or how easy it would be to learn a qualification are included here.

Candidate preferences. Statements that allude to preferences for a candidate including direct or implied statements.

Nonspecific pressure. Statements applying pressure on actions and decisions but not toward a particular candidate. Statements urging the group to make a decision or to "wrap it up" are included here.

Procedures. Statements about rules or procedures to be followed by the group. Questions to group members that further the decision process are included here. For example, "Should we vote now?"

Hiring issues. Statements about the hiring process of the organization.

Social conversation. Statements unrelated to the task and social in nature.

Other. Statements unrelated to the task that were not social conversation.

Three people coded the group discussion transcripts: the principal researcher, another faculty member and a doctoral student. The coders first discussed the categories and the descriptions given above and then scored the transcripts independently. A kappa statistic was calculated to determine interrater reliability (Suen & Ary, 1989, p. 111). The value for kappa was 0.79 which is considered "substantial" reliability by Landis and Koch (1977). Differences were resolved by mutual agreement among the coders.

Statements were scored as informational influence if they were testimony, inferences from testimony, or mentioned hiring issues. These statements provide evidence regarding reality. Statements were scored as normative influence if they expressed values or norms, candidate preferences, or nonspecific pressure. Procedural statements relate to efficient task accomplishment rather than choosing the best candidate, so they are not considered informational or normative influence.

The dependent measures were the number of informational and normative statements. However, these values are not directly comparable. Face-to-face groups should be able to transmit a larger number of statements because of the relative efficiency of the face-to-face medium. Therefore, they would tend to have more of both types of statements, regardless of the relative proportion of each. Since the hypotheses are concerned with the relative amounts of informational and normative influence, some way of compensating for this difference in quantity is necessary.

One solution to this problem would be to calculate proportions by dividing the number of informational and normative statements by the total number of statements for each group. However, the interaction of load and mode is of interest, and ANOVA methods are not appropriate for proportional data. The alternative used here is to use total statements for each group as a covariate. By removing the variation due to total number of statements, the number of informational and normative statements may be compared directly.

GDSS

The GDSS used was the Electronic Discussion System (EDS) developed at the University of Arizona (Pendergast, 1989). EDS is a NETBIOS based system that supports real-time conferencing and anonymous voting. The interface consists of two windows. In one window, the users enter and edit their comments before broadcasting them. In the other window the broadcasted comments appear and scroll up the screen.

The system is easy to use and the pilot tests confirmed that subjects could learn and use the system with only a brief introduction. There were no indications from the group transcripts or other sources that any aspects of the software itself (other than the fact that it was a computer-mediated medium) played a role in the groups' interaction.

Subjects

Twenty-four groups were formed. Of these 24, 11 were face-to-face and 13 were GDSS, 11 were high load and 13 were low load. The subjects, who were upper division business undergraduates, completed the experiment as part of a course requirement. The grade they received for the experiment was based, in part, on their performance on the task. They were randomly assigned to three-person groups.

Procedure

The subjects were given a packet containing the job and candidate descriptions the day before the experiment was conducted. They were not told who would be in their group. They were all given an overview of the task and the type of assistance they would be using. All of the subjects had been previously exposed to group decision making, preference ranking, and voting. They were asked to review the material and to individually choose one of the three candidates.

Immediately prior to the experiment the subjects individually completed a pre-test that measured three things: (1) their knowledge of the job and candidate descriptions, (2) their initial candidate choice, and (3) their degree of confidence in their choice on a seven-point Likert scale ("Not Confident" to "Very Confident"). When they had completed the pre-test, face-to-face groups were formed and told to discuss the candidates and come to a unanimous decision on the best candidate. The face-to-face groups did not use any computerized aids during the meeting. The GDSS groups met through the EDS and care was taken so that the members would not know who else was in their group. The GDSS groups were given a lesson on the GDSS software at this point. When the groups were done with their task, the participants completed a post-test that measured (1) their own choice and their confidence in that choice and (2) the group's choice and their confidence in that choice.

RESULTS

All five of the hypotheses were analyzed using 2x2 ANCOVA. The independent variables were communication modality and information load. The dependent variables were number of informational and normative statements, and degree of choice shift. The covariate was the total number of statements.

Type of Influence Predominate in Groups

Hypotheses one and two concern the effect of communication modality on the type of influence predominate in group discussion. In the analysis of group discussion content (Table 2), communication modality is found to be highly significant with an F-statistic of 54.04. This finding strongly supports hypothesis one: informational influence predominates in face-to-face

groups. The cell means in Table 1 show that the proportion of informational statements in face-to-face groups was more than twice as great as in GDSS groups (0.580 vs. 0.261).

Table 1. Cell Means and Proportions

	Influence Type					
	Informational			Normative		
	Information Load					
Modality	Low (n=13)	High (n=11)	Averages	Low (n=13)	High (n=11)	Averages
Face-to-face (n=11)	45 (0.540)	51.6 (0.628)	48.2 (0.580)	18.6 (0.303)	15.2 (0.237)	17.1 (0.273)
Remote (n=13)	25.3 (0.345)	8.2 (0.163)	17.4 (0.261)	17.9 (0.257)	20.2 (0.376)	18.9 (0.312)
Averages	34.5 (0.435)	27.9 (0.374)		18.2 (0.279)	17.9 (0.313)	

Values in parentheses are proportions of total number of statements.

Table 2. Results of Informational Influence ANCOVA

Independent Variable	F	p-value
Communication Modality	54.04	0.0001
Information Load	2.34	0.1423
Load x Modality	7.73	0.0119
Covariate	201.98	0.0001

However, despite the fact that GDSS groups used a slightly higher proportion of normative statements (0.312 vs. 0.273), the results shown in Table 3 reveal the difference in the number of normative statements is not significant (p=0.0795). Thus, hypothesis two is not supported by the results of the experiments: GDSS groups did not use more normative statements than face-to-face groups.

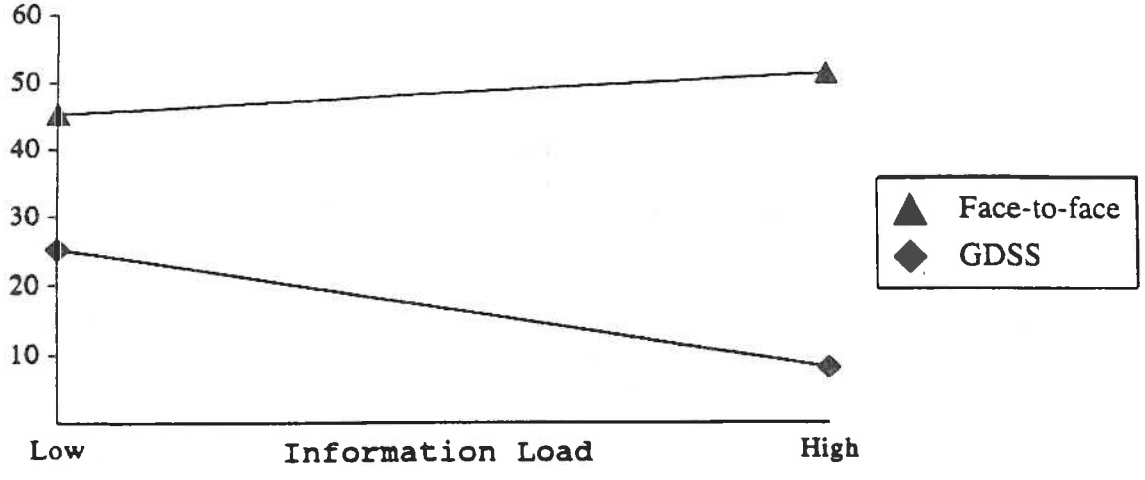
Table 3. Results of Normative Influence ANCOVA

Independent Variable	F	p-value
Communication Modality	3.43	0.0795
Information Load	0.25	0.6211
Load x Modality	3.28	0.0858
Covariate	36.09	0.0001

Influence, Modality, and Information Load

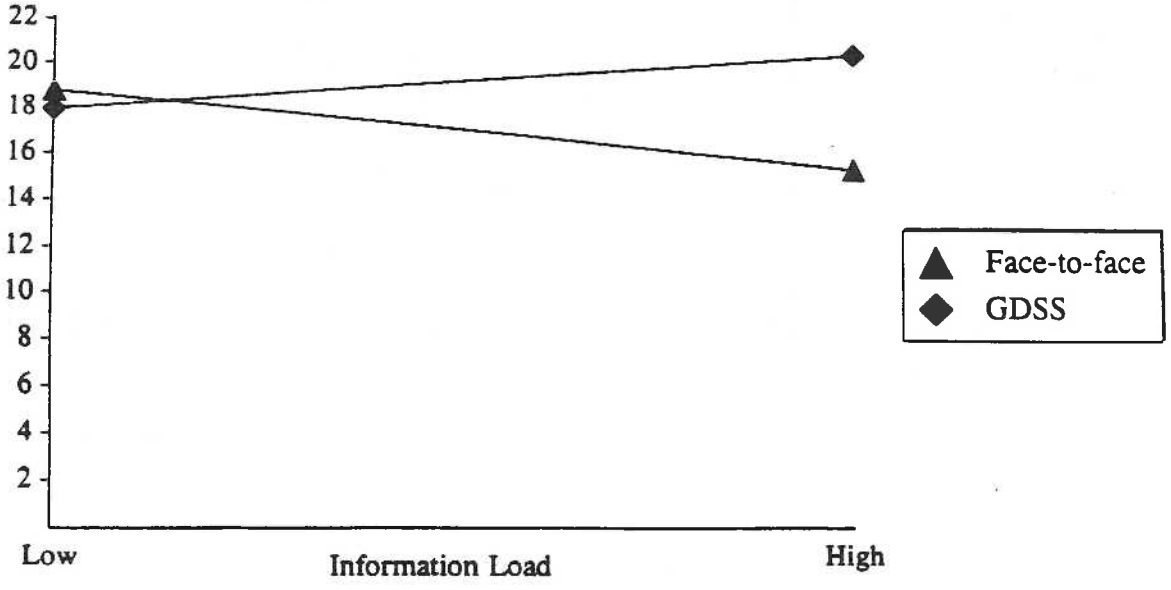
Hypothesis three concerns informational influence and the interaction between communication modality and information load. Table 2 shows that this interaction is significant at the 0.0119 level. The profile of the interaction (Figure 1), illustrates that the difference between face-to-face and GDSS groups increases as the information load increases. This supports hypothesis three: informational influence increases for face-to-face groups relative to GDSS groups as information load increases.

Figure 1. Interaction of Communication Modality and Information Influence for Informational Statements



Hypothesis four concerns normative influence and the interaction between communication modality and information load. The profile of the interaction (Figure 2) demonstrates that, as expected, the relative number of normative statements increases for GDSS groups as information load increases. However, as shown in Table 3, this interaction is not significant (p=0.0858). Therefore, the results do not support hypothesis four: there is no evidence that normative influence will decrease for face-to-face groups relative to GDSS groups as information load increases.

Figure 2. Interaction of Communication Modality and Information Influence for Normative Statements



Polarization

The results for the polarization analysis are shown in Table 5. The cell means in Table 4 show that face-to-face groups had slightly more polarization than remote groups (0.90 vs. 0.64). However, this difference is not significant (p=0.0692).

Table 4. Polarization Cell Means

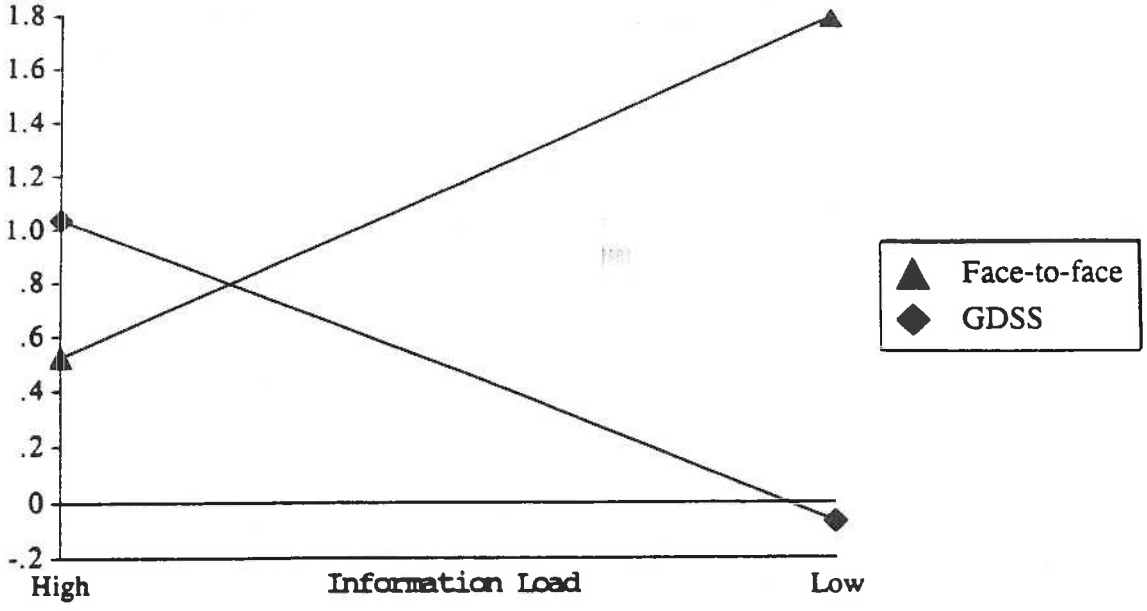
Communication Modality	Information Load		
	Low (n=13)	High (n=11)	Average
Face-to-face (n=11)	0.524	1.778	0.900
GDSS (n=13)	1.037	-0.067	0.642
Averages	0.813	0.625	

Table 5. Results of Polarization ANCOVA

Independent Variable	F	p-value
Communication Modality	3.41	0.0692
Information Load	0.04	0.8355
Load x Modality	10.69	0.0017

The interaction between communication modality and information load is found to be significant (p=0.0017). The profile in Figure 3 clearly shows that face-to-face groups experience greater polarization than GDSS groups at higher information loads. Hypothesis five is partially supported: GDSS groups will exhibit less marked choice shift than face-to-face groups at high information load.

Figure 3. Interaction of Communication Modality and Information Load for Choice Shift



DISCUSSION

By using the "micro" approach to examine the group decision process, this study has been able to focus on several important group process variables and their interactions. The impact of the communication modality on the type of predominate influence was clearly demonstrated. Not only did face-to-face groups use a higher proportion of informational influence than their GDSS counterparts, but the difference increased as informational load increased. Groups using a Level 1 GDSS used less informational influence than face-to-face groups although the results did not support the hypothesis that GDSS groups would use more normative influence than face-to-face groups. The study also confirmed that informational influence tends to produce more marked choice shifts. Face-to-face groups, who were shown to use more informational influence, also exhibited more marked polarization. This was especially so as information load increased.

Two attributes of remote media were believed to affect informational influences in GDSS groups: relative inefficiency and leanness. There was some evidence that these attributes influenced the groups in this study. As in other studies, the remote groups in our study were less efficient that the face-to-face groups. The GDSS groups took significantly longer to finish the task (20 vs. 15 minutes, $t=3.1$, $p=0.0027$) and exchanged fewer statements (65 vs. 80).

Time spend on procedural matters may have contributed to the inefficiency observed in the GDSS groups. GDSS groups used a significantly higher proportion of procedural statements (0.21 vs. 0.06). It appears that, despite being given the same amount of instruction about the task as the face-to-face groups, the GDSS groups spent more time deciding how to proceed and what to do next. This may be due, in part, to the fact that lean media eliminate some of the cues that help regulate face-to-face conversation. A simple factor, such as knowing the order in which statements are made, is helpful to group members in understanding one another. In remote conversations it is sometimes difficult to know in what order statements are made, since participants can enter statements simultaneously, with display order determined by such things as typing speed. It is likely that people become more efficient with a remote medium as they become more accustomed to it. Users of public bulletin boards develop ingenious ways to convey meaning. The extent of this improvement is a subject for study.

CONCLUSION

This research has demonstrated the importance of using models and methodologies that help analyze intervening communication process variables ("micro" methodologies) in group decision making situations. By examining the interaction between communication modality and social influence variables, the study illustrated more clearly how communication configuration affects group processes and, consequently, outputs from the group. This approach provides new research possibilities leading to a better understanding of group work.

One interesting area is the impact of higher level GDSSs on the communication variables discussed in this paper. Level 2 and Level 3 GDSSs are designed to support the use of informational influence; for instance, the decision modeling and analysis tools of Level 2 GDSSs permit a group member to condense an argument and supporting information into a relatively small bandwidth; the structure provided by Level 3 GDSSs is typically designed to encourage a rational approach to decision making. Level 1 GDSSs provide no such support. Thus, despite the fact that they have been found to foster a more uninhibited exchange of opinions and ideas (Siegal et al., 1986), using a Level 1 GDSS for remote communication limits the members' ability to exert informational influence.

Siegal et al. (1986) reported that 40% of the inefficiency they observed in remote media was due to typing. They did not give an explanation for the remaining 60%. The results of this study suggest that some portion of this figure may be due to coordination problems. GDSSs should be designed with these inefficiencies in mind. Further research is required to determine how this might be done.

This study examined only one of the dimensions of communication configuration and only one type of task. Researchers might study the effects of the interaction among all of the communication configuration dimensions and group process variables for different task types (i.e., problem solving, communication, or persuasion).

REFERENCES

Beauclair, R. (1987). *An experimental study of the effects of specific GDSS applications on small group decision making.* Working paper, University of Louisville.

Burnstein, E. & Vinokur, A. (1977). Persuasive argumentation and social comparison as determinants of attitude polarization. *Journal of Experimental Social Psychology, 13*, 315-332.

Clapper, D. L. (1992). *An experimental investigation of the effects of a group decision support system on normative influence in small groups.* Unpublished dissertation, Georgia State University.

Clapper, D. L. & McLean, E. R. (1991). *Information technology in support of group activity: A theoretical framework and implications for research, the information systems research arena of the 90's: Challenges, perceptions, and alternative approaches.* Working paper, Clarkston College.

Clapper, D. L., McLean, E. R. & Watson, R. T. (1991, December 16-18). An experimental investigation of the effect of a group decision support system on normative influence in small groups. *Proceedings of the Twelfth Annual International Conference on Information Systems.* New York.

Daft, R. L. & Lengel, R. H. (1986). Organizational information requirements, media richness and structural design. *Management Science, 32*(5), 554-571.

Davis, J. H. & Hinz, V. B. (1982). *Current research problems in group performance and group dynamics, in group decision making.* Brandstatter, H., Davis, J. H. & Stocker-Kreichgauer, G., Eds., pp. 1-20. New York: Academic Press.

Dennis, A. & Gallupe, R. B. (1993). A history of group support systems empirical research: Lessons learned and future directions. In *Group Support Systems: New Perspectives*, Leonard Jessup and Joseph Valacich, Eds., pp. 59-76. New York: Macmillan Publishing Co.

DeSanctis, G. & Gallupe, R. B. (1987). A foundation for the study of group decision support systems. *Management Science, 33*(5), 589-609.

Deutsch, M. & Gerard, H. G. (1955). A study of normative and informational social influences upon individual judgement. *Journal of Abnormal and Social Psychology, 51*, 626-636.

Gallupe, R. B. & McKeen, J. D. (1990). Enhancing computer-mediated communication: An experimental investigation into the use of a group decision support system for face-to-face and remote meetings. *Information & Management, 18*, 1-13.

Gallupe, R. B., DeSanctis, G. & Dickson, G. (1988). Computer-based support for group problem finding: An experimental investigation. *MIS Quarterly, 12*(4), 591-624.

Huber, G. P. (1984). Issues in the design of group decision support systems. *MIS Quarterly, 8*(3), 195-204.

Jessup, L. M., Connolly, T. & Galagher, J. (1990). The effects of anonymity of GDSS group process with an idea-generation task. *MIS Quarterly, 14*(3). 312-321.

Kaplan, M. F. (1977). Discussion polarization effects in a modified jury decision paradigm: Informational influences. *Sociometry, 40*, 262-271.

Kaplan, M. F. & Miller, C. E. (1987). Group decision making and normative versus informational influence effects of type of issue and assigned decision rule. *Journal of Personality and Social Psychology, 53*(2), 306-313.

Landis, J. R. & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*, 159-174.

Laughlin, P. R. & Early, P. C. (1986). Demonstrability and social combination processes on mathematical intellective tasks. *Journal of Experimental Social Psychology, 22*, 177-189.

McGrath, J. E. (1984). *Groups: Interaction and performance,* Englewood Cliffs, NJ: Prentice-Hall, Inc.

Mintzberg, H. (1975). The manager's job: Folklore and fact. *Harvard Business Review, 53*(4), 49-61.

Myers, D. G. & Lamm, H. (1976). The group polarization phenomenon. *Psychological Bulletin, 83*, 602-627.

Pendergast, M. O. (1989). *Interprogram communication for PC/LAN-based collaborative applications: PLEXNET, a session level communication system.* Unpublished dissertation, The University of Arizona.

Siegal, J., Dubrovsky, V., Kiesler, S. & McGuire, T. W. (1986). Group processes in computer-mediated communication. *Organizational Behavior and Human Decision Processes, 37*, 157-187.

Suen & Ary. (1989). *Analyzing quantitative behavioral observation data.* Hillsdale, NJ: L. Erlbaum.

Weeks, G. D. & Chapanis, A. (1976). Cooperative versus conflictive problem solving in three telecommunication modes. *Perceptual and Motor Skills, 42,* 879-917.

Watson, R. T., DeSanctis, G. L. & Poole, M. S. (1988). Using a GDSS to facilitate group consensus: Some intended and unintended consequences. *MIS Quarterly, 12*(3), 463-478.

Zigurs, I., Poole, M. S. & DeSanctis, G. L. (1988). A study of influence in computer-mediated group decision making. *MIS Quarterly, 12*(4), 625-644.