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WILL DISTRIBUTED GSS GROUPS MAKE MORE EXTREME DECISIONS? AN EMPIRICAL STUDY

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Abstract

This study examines the impact of proximity, anonymity, and information exposure on group polarization in a GSS context. Proximity was studied at two levels: proximate and distributed. Anonymity was examined at two levels: identified and anonymous. Information exposure was also varied at two levels: exposure to positions without arguments and exposure to positions with arguments. The dependent variables were choice shift and preference change. Distributed groups had greater choice shift than proximate groups. When exposed to positions without arguments, distributed meetings resulted in higher preference change than proximate meetings. But when exposed to positions with arguments, proximity interacted with anonymity to alter preference change. These findings indicate that a distributed GSS setting encourages group polarization. However, group polarization can also be raised in a proximate GSS setting if the anonymity capability is used by group members to exchange mutual positions and arguments.

1. INTRODUCTION

With rapid advancements in network technologies and growing acceptance of such technologies by user communities, working in a distributed environment is fast becoming a reality. As a consequence of distributed work, people located at different places are increasingly working together to make group decisions (Turoff et al. 1993). A *group support system* (GSS) links people electronically and is a tool to support group decision making in a distributed environment (Chidambaram and Jones 1993; Jessup and Tansik 1991). From a review of distributed group decision making literature, Turoff et al. suggest that the issue of group polarization requires research attention.

Group polarization is the tendency of group members to make more extreme decisions following their group meeting (Myers and Lamm 1976). It occurs commonly in risk situations. Unfortunate incidents that have been blamed on group polarization include escalation of the Vietnam War (Janis 1972) and extremization of racial attitudes (Riley and Pettigrew 1976). However, group polarization may benefit situations involving exchange of pro-social advice on donations (Muehleman, Bruker and Ingram 1976) and mutual counseling in self-help groups (Toch 1965). Given these potential beneficial and detrimental effects, it is necessary to sometimes stimulate and other times impede group polarization. The need to understand and manage group polarization is even more critical in a distributed setting where its effects may be amplified (Turoff et al. 1993).

Siegel et al. (1986) found that distributed computer-mediated groups polarized more than proximate (face-to-face) groups, but the extent of group polarization may also depend on factors such as anonymity and information exposure. Anonymity helps to encourage uninhibited behavior and generation of novel ideas (Connolly, Jessup and Valacich 1990), factors that have been found to increase group polarization (Isenberg 1986). In proximate meetings, group members exposed to mutual positions with arguments polarized more than group members exposed solely to mutual positions (Isenberg 1986). It is not known whether this finding would apply in a distributed or an anonymous setting. This study investigates the effects of proximity (proximate versus distributed) and anonymity (identified versus anonymous) on group polarization in a GSS context. It assesses the generality of these effects across two information exposure levels (exposure to mutual positions with versus without arguments).

2. GROUP POLARIZATION

Two major theories have emerged over the past three decades to account for the phenomenon of group polarization: *social comparison theory* (SCT) and *persuasive arguments theory* (PAT) (Kaplan 1987).

2.1 Theories on Group Polarization

SCT posits that polarization occurs in group meetings because group members continually compare their positions with those of others. When a disparity is detected, they shift their positions toward the group norm in the direction valued by the group (Brown 1965). Two mechanisms occur simultaneously to account for group polarization: one-upmanship and removal of pluralistic ignorance. One-upmanship refers to the desire of group members to be distinct and better than others in the direction valued by the group. When group members are exposed to mutual positions and are aware of the valued direction, they would try to surpass each other by altering their decisions in that direction. This results in group polarization (Fromkin 1970). Removal of pluralistic ignorance occurs when group members seek to compromise between the desire to stick to their preferred positions and the desire not to deviate too far from the perceived group norm. When group members are exposed to mutual positions and realize that they have underestimated the group norm, they would alter their decisions in the direction valued by the group. This leads to group polarization (Pruitt 1971). In summary, SCT predicts that when group members are exposed to mutual positions, group polarization would occur.

PAT postulates that arguments exchanged during group meetings cause group members to adjust their preferences, thereby leading to group polarization (Vinokur and Burnstein 1974). Specifically, the extent of group polarization depends on the number of persuasive arguments exchanged. Empirical studies have demonstrated that groups polarized to a greater extent along a certain direction when exposed to a greater number of arguments supporting that direction (e.g., Kaplan 1977; Vinokur and Burnstein 1974). An argument is persuasive if it is perceived as novel or valid. Group polarization has been shown to occur to a greater extent when groups are exposed to arguments which members perceived as novel (Vinokur and Burnstein 1978b) and valid (Burnstein 1982). To summarize, PAT predicts that when group members are exposed to mutual arguments, group polarization would occur.

2.2 Relative Merits of Theories

A critical review by Isenberg on a decade of polarization studies reveals that both social comparison and persuasive argumentation contribute to group polarization, but the effects of persuasive argumentation tend to be stronger than those of social comparison. However, recent studies (e.g., Heath and Gonzalez 1995; Pavitt 1994) have offered new evidence which suggests that the role of social comparison on group polarization may have been understated in the past. Pavitt found that group members tend to present arguments that support their preferred positions and refrain from sharing arguments that contradicted their preferred positions. Supporting this contention, Heath and Gonzalez reported that group members typically engage in rationale construction rather than information collection in meetings. During rationale construction, group members would use valid and novel arguments presented by like-minded others to justify their positions. Therefore, exposure to mutual arguments on top of positions need not necessarily cause groups to polarize more.

2.3 Measures of Group Polarization

Group polarization has been commonly studied using two measures: choice shift and preference change (Zuber, Crott and Werner 1992). *Choice shift* is the difference between the average pre-meeting positions of group members and the group decision. It occurs when group members change their initial positions to move toward a group decision. *Preference change* is the difference between the average pre-meeting and post-meeting positions of group members. It occurs when group members have been convinced to change their personal positions. Empirical studies have found that choice shift and preference change occur simultaneously in group meetings (e.g., McGuire, Kiesler and Siegel 1987). Moreover, choice shift has been reported to occur in greater magnitude than preference change (e.g., Whyte 1993).

3. PROXIMITY AND ANONYMITY

GSS groups have been observed to behave differently in proximate and distributed settings (e.g., Chidambaram and Jones 1993; Valacich et al. 1994) because of differences in media richness (Daft and Lengel 1986) and social presence (Short, Williams and Christie 1976) of their meeting environment. Media richness refers to the ability of communication media to facilitate understanding among people within a specific time period. Factors differentiating rich from lean media include feedback immediacy, range of communication cues, personal focus, and language variety (Daft, Lengel and Trevino 1987). Social presence refers to the extent to which communication media enable people to establish warm and personal connections (Short, Williams and Christie 1976). When GSS groups meet in distributed rather than proximate settings, group members would neither be able to exchange verbal and visual cues nor sense the presence of each other. This reduction in media richness and social presence has several consequences (Valacich et al. 1994). First, it leads to depersonalization, which results in atypical behavior among group members (Williams 1977; Jessup and Tansik 1991). Compared to proximate groups, distributed groups have exhibited more uninhibited behavior such as "flaming" (Siegel et al. 1986), produced more impulsive behavior (Diener et al. 1976), and generated more extreme opinions (Singer, Brush and Lublin 1965). Second, it reduces evaluation apprehension among group members (Nunamaker et al. 1991). In such a situation, group members are more able and willing to contribute valid and novel ideas.

Anonymity can be applied to the process or content of group decision making. Group members meeting with process anonymity cannot identify who has and who has not contributed. Group members meeting under content anonymity cannot associate specific comments to their contributors (Valacich, Dennis and Nunamaker 1992). Anonymity creates a low threat meeting environment with reduced conformity pressure and evaluation apprehension (Nunamaker et al. 1991). Compared to identified GSS groups, anonymous GSS groups have been found to generate more critical and in-depth comments during their meetings. This is because anonymity reduces behavioral constraints among group members to promote uninhibited behavior (Jessup, Connolly and Galegher 1990).

4. RESEARCH HYPOTHESES

Proximity, anonymity, and information exposure level affect group polarization by influencing the social comparison and persuasive argumentation processes during group meetings. These relationships are summarized in Figure 1. Since choice shift has been shown to correlate positively with preference change in numerous studies (e.g., Dubrovsky, Kiesler and Sethna 1991; McGuire, Kiesler and Siegel 1987), no differences have been hypothesized for choice shift and preference change.

Proximity affects group polarization in several ways. First, a reduction in media richness and social presence associated with distributed meetings can lead to depersonalization and encourage uninhibited behavior (Valacich et al. 1994). With uninhibited behavior, group members may engage in one-upmanship behavior actively and respond to the removal of pluralistic ignorance swiftly. According to SCT, this should lead to greater group polarization. Second, with distributed meetings, the reduced evaluation apprehension that comes with a reduction in media richness (Nunamaker et al. 1991) may encourage group members to share more novel and valid arguments. This is likely to increase the number of persuasive arguments generated. According to PAT, this should result in greater group polarization. Empirical studies have shown that choice shift was greater in distributed than proximate groups (e.g., Siegel et al. 1986). Therefore, distributed groups are hypothesized to experience greater polarization than proximate groups.

H1a: Choice shift will be higher in distributed groups than proximate groups.

H1b: Preference change will be higher in distributed groups than proximate groups.

Anonymity has several effects on group polarization. First, it encourages free and uninhibited behavior (Jessup, Connolly and Galegher 1990). This may cause group members to react rapidly to the removal of pluralistic ignorance. Based on SCT, this should lead to greater group polarization. Second, compared to identified GSS groups, anonymous GSS groups tend to generate more novel and original arguments (Connolly, Jessup and Valacich 1990). Such arguments tend to be more persuasive. Thus, based on PAT, this should result in greater group polarization. Third, commitment literature suggests that when people publicly

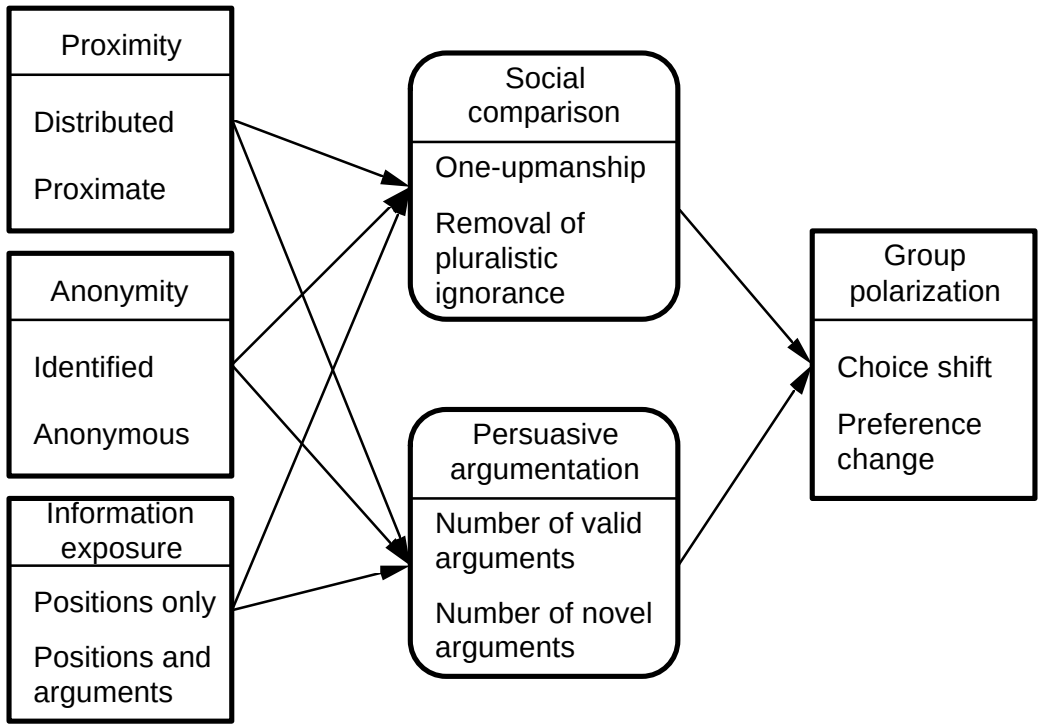

Figure 1. Summary of Relationships between Variables

reveal their positions, they are less likely to amend their positions to avoid losing face (Salancik 1977). In response to the removal of pluralistic ignorance or exposure to novel arguments, anonymity allows group members to change their positions without losing face. This should lead to greater group polarization. Hence, anonymous groups are hypothesized to have greater polarization than identified groups.

H2a: Choice shift will be higher in anonymous groups than identified groups.

H2b: Preference change will be higher in anonymous groups than identified groups.

In empirical studies involving proximate groups, greater group polarization has been reported when group members exchanged mutual arguments, which allowed them to infer mutual positions, rather than exchanged mutual positions (e.g., Kaplan 1977; Vinokur and Burnstein 1978a). McGuire, Kiesler and Siegel suggest that this finding is likely to apply in distributed groups because it is rooted in generic theories such as SCT and PAT. When group members are exposed to mutual positions without arguments, they engage solely in social comparison. However when they are exposed to mutual positions with arguments, both social comparison and persuasive argumentation are engaged. This should increase group polarization. Thus, the latter groups are hypothesized to have greater polarization than the former groups.

H3a: Choice shift will be higher in groups exposed to positions with arguments than groups exposed to positions without arguments.

H3b: Preference change will be higher in groups exposed to positions with arguments than groups exposed to positions without arguments.

5. RESEARCH METHODOLOGY

The research design was a 2x2x2 factorial controlled laboratory experiment. Five-member groups were formed. Each of the eight treatments had thirteen groups.

5.1 Independent Variables

Proximity was examined at two levels: distributed and proximate (see Figure 2). *Distributed groups* were separated by physical partitions and could only exchange textual cues. *Proximate groups* could see each other and could communicate with visual and textual cues. Group members were not allowed to use verbal cues because this could confound with the treatment on anonymity. When comments were expressed verbally, there would be no anonymity. Therefore, distributed and proximate groups differed in terms of visual cues and social presence.

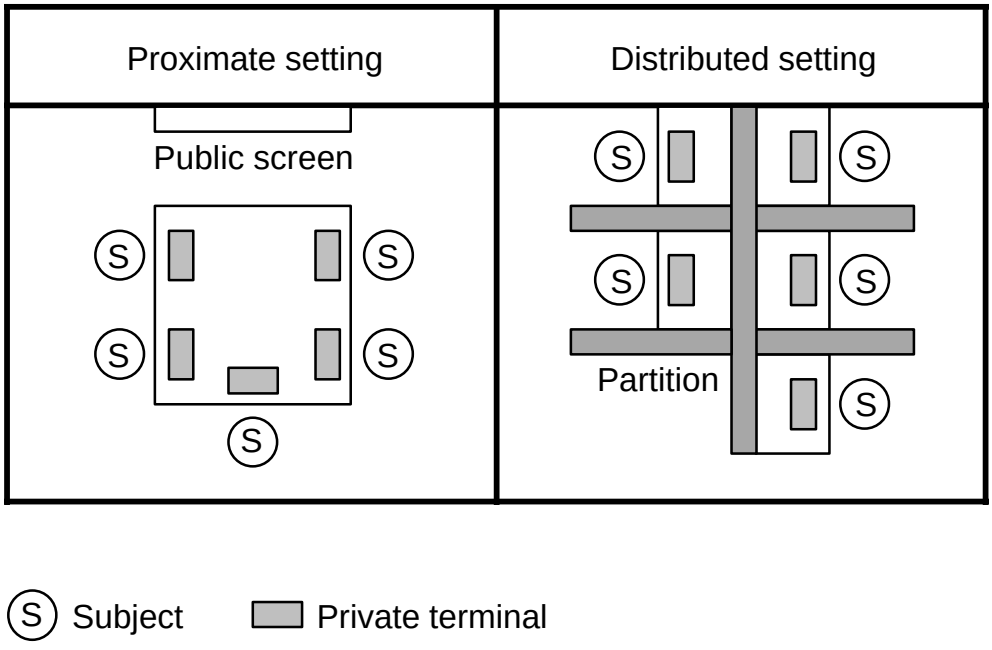

Figure 2. Proximate and Distributed Settings

Anonymity was investigated at two levels: identified and anonymous. *Identified groups* were aware of the comments contributed by each group member. Identities of contributors were tagged to their respective comments. *Anonymous groups* were not able to tell who contributed what comments. Comments were not tagged with identities of their contributors. Differences between identified and anonymous groups could be attributed to content anonymity.

Information exposure was studied at two levels: *positions without arguments* and *positions with arguments*. Under the former condition, group members exchanged their mutual positions without disclosing underlying reasons. Group polarization detected could be explained by SCT. Under the latter condition, group members exchanged both their mutual positions as well as supporting arguments. Group polarization detected could be due to both SCT and PAT.

5.2 Dependent Variables

The dependent variables were choice shift and preference change (Zuber, Crott and Werner 1992). Choice shift was computed from the pre-meeting positions of group members and the group decision (see Appendix). A higher score reflects greater choice shift. Preference change was computed from the pre-meeting and post-meeting positions of group members (see Appendix). A higher score indicates greater preference change.

5.3 The Task

The expected value task, adapted from Paese, Bieser and Tubbs (1993), was employed. It required subjects to select a scheme, among a number of alternatives, to increase the market share of their organization. The probabilities of success of alternative schemes were paired with payoffs in an inverse fashion so that the expected value (multiplication of probability and payoff) of all alternative schemes remained constant. These probabilities ranged from 0.1 (most risky) to 0.9 (most cautious) at intervals of 0.1. Subjects were told that the task had no correct answer and they had to base their decisions on personal preferences.

5.4 The GSS

The GSS used for both the distributed and proximate settings was SAGE (Wei et al. 1996). In both settings, each group member was equipped with a private terminal. In the proximate setting, group members entered their opinions using their private terminals. Collective opinions were displayed on a shared public screen. In the distributed setting, a window at each private terminal allowed group members to enter their opinions while a separate window displayed collective opinions. The window for entering opinions had two sections. The first section allowed group members to enter their positions only. The second section enabled groups that exchanged both positions and arguments to enter the underlying reasons for their positions. Groups that exchanged only positions were instructed to use only the first section, while groups that presented arguments on top of positions were told to use both sections of the window. The experiment administrator made a quick check of the windows to ensure group members' adherence to instructions as they entered their opinions.

5.5 Presentation of Opinions

All treatments had simultaneous opinion generation and sequential opinion presentation. In each round of group decision making, group members had to enter their opinions into their private terminals concurrently. When all group members had completed, the opinions of group members would be displayed one person at a time. The communication network used in all treatments had a wheel topology (Shaw 1978). Group members could not communicate directly with each other. Although these measures resulted in restrictions during group decision making, they were essential experimental controls.

5.6 Decision Making Procedure

Subjects were given ten minutes to read the task description. This was followed by an explanation of the group decision making process, which comprised a series of rounds. In each round, group members had to present their opinions. Based on the results of each round, they proceeded to the next round and did likewise. The meeting ended when the group had attained consensus (all group members converged at the same position) or completed a maximum of four rounds. If no consensus was reached after four rounds, the average positions of group members would be taken as the group decision. The use of such a tight decision making process helped to control for amount of discussion, a potential confounding factor affecting group polarization (Kaplan 1977; McGuire, Kiesler and Siegel 1987). After the meeting, subjects were asked to individually restate their opinions and respond to questions for control and manipulation checks.

5.7 The Subjects

The subjects were 520 information systems undergraduates from a large university. Their average age was 21.5 years. Members of both genders were equally represented. The subjects were randomly assigned to groups, which were randomly assigned to treatments. This helped to control for confounding factors arising from differences in individual attributes. Course credit was given to subjects to encourage them to take their task seriously.

6. DATA ANALYSES

All statistical tests were conducted at a 5% level of significance. Perceptual questions for control and manipulation checks were all anchored on a seven-point scale ranging from strongly disagree (1) to strongly agree (7).

6.1 Control Checks

Subjects responded to questions soliciting their demographic and background information. Two questions assessed their group experience: "I have a lot of experience working in groups" and "I have a lot of experience making group decisions." Two other questions measured their task knowledge: "I have a lot of knowledge on this kind of task" and "I have a lot of experience working on this kind of task." ANOVA tests detected no significant differences between subjects in different treatments in terms of age, group experience, and task knowledge. Mann-Whitney tests found no significant differences in the proportion of male to female subjects across proximity, anonymity, and information exposure levels. Controls over subject characteristics, through random assignment of subjects, appeared to be successful.

6.2 Manipulation Checks

Subjects also answered questions assessing the effectiveness of experimental manipulation. Two questions assessed the manipulation on anonymity: "I could trace each decision to the group member who proposed it" and "I was aware of the decisions made by each group member." Identified groups agreed more on these questions than anonymous groups ($t = 166.59$, $p < 0.01$ and $t = 22.94$, $p < 0.01$ respectively). Two questions evaluated the manipulation on information exposure: "I understood the reasons for the decisions of other group members" and "I knew the reasons behind the decisions of other group members." Groups exposed to positions with arguments agreed more on these questions than groups exposed to positions only ($t = 18.75$, $p < 0.01$ and $t = 120.53$, $p < 0.01$ respectively). The manipulation on anonymity and information exposure appeared to be successful. No checks were necessary for the manipulation on proximity because subjects in the distributed setting were physically separated whereas those in the proximate setting could see each other.

6.3 Hypotheses Tests

Choice shift and preference change were significantly correlated ($R^2 = 0.65$, $F(1,102) = 187.31$, $p < 0.01$). Thus, a MANOVA test involving both dependent variables was performed. There was a significant interaction among proximity, anonymity, and information exposure ($F(2,95) = 4.15$, $p < 0.02$). This allowed separate ANOVA tests to be applied to choice shift and preference change. A square-root transformation (Weisberg 1985) allowed choice shift and preference change to satisfy the homogeneity requirement of ANOVA. Although both variables could not meet the normality requirement, this was not critical if all treatments had equal cell sizes (Hays 1994), which was the case in this study. Nevertheless, significant ANOVA results were confirmed using the Mann-Whitney test. Table 1 summarizes descriptive statistics for the dependent variables. Table 2 reports the ANOVA results.

Table 1. Means (Standard Deviations) of Dependent Variables

Proximity	Anonymity	Information exposure	Choice shift	Preference change
Proximate	Identified	Pos. only	0.64 (0.54)	0.34 (0.41)
		Pos. with arg.	0.43 (0.44)	0.31 (0.25)
	Anonymous	Pos. only	0.65 (0.42)	0.25 (0.32)
		Pos. with arg.	1.18 (1.11)	0.91 (0.87)
Distributed	Identified	Pos. only	0.86 (0.52)	0.51 (0.47)
		Pos. with arg.	1.22 (1.41)	1.00 (1.07)
	Anonymous	Pos. only	1.09 (0.93)	0.72 (0.70)
		Pos. with arg.	1.22 (0.86)	0.58 (0.47)
Cell size			13 groups	13 groups

Pos. = Positions Arg. = Arguments

Table 2. Results of ANOVA Tests

	Choice shift	Preference change
Proximity (PR)	$F(1,96) = 4.88$, $p = 0.0294$*	$F(1,96) = 4.50$, $p = 0.0365$*
Anonymity (AN)	$F(1,96) = 2.02$, $p = 0.1585$	$F(1,96) = 0.72$, $p = 0.3967$
Information exposure (IE)	$F(1,96) = 0.36$, $p = 0.5477$	$F(1,96) = 4.67$, $p = 0.0333$*
PR x AN	$F(1,96) = 0.55$, $p = 0.4620$	$F(1,96) = 0.92$, $p = 0.3399$
PR x IE	$F(1,96) = 0.10$, $p = 0.7506$	$F(1,96) = 0.78$, $p = 0.3784$
AN x IE	$F(1,96) = 1.14$, $p = 0.2880$	$F(1,96) = 0.08$, $p = 0.7756$
PR x AN x IE	$F(1,96) = 1.83$, $p = 0.1796$	$F(1,96) = 5.24$, $p = 0.0243$*

* $p < 0.05$

The ANOVA test on choice shift found a significant main effect due to proximity ($F(1,96) = 4.88$, $p < 0.03$), confirmed by the Mann-Whitney test ($\chi^2 = 4.34$, $p < 0.04$). Distributed groups experienced greater choice shift than proximate groups. H1a was supported. H2a and H3a were not supported. The ANOVA test on preference change detected significant main effects due to proximity ($F(1,96) = 4.50$, $p < 0.04$) and information exposure ($F(1,96) = 4.67$, $p < 0.04$). Moreover, there was a significant interaction among proximity, anonymity, and information exposure ($F(1,96) = 5.24$, $p < 0.03$). H1b, H2b, and H3b were not supported because interpretation of an interaction preceded that of main effects.

Simple effects analysis (Keppel 1991) was used to examine this three-way interaction. For groups exposed solely to positions, the ANOVA test found a significant main effect due to proximity ($F(1,48) = 4.79$, $p < 0.04$), confirmed by the Mann-Whitney test ($\chi^2 = 3.82$, $p < 0.05$). Under this condition, distributed groups had greater preference change than proximate groups. For groups exposed to positions with arguments, the ANOVA test revealed a significant interaction among proximity and anonymity ($F(1,48) = 4.99$, $p < 0.04$). This two-way interaction was further examined in two ways. First, the data for proximate and distributed groups were separated. Among proximate groups, the anonymous condition resulted in greater preference change than the identified condition ($t = 5.55$, $p < 0.03$; $\chi^2 = 5.89$, $p < 0.02$). There were no corresponding differences for distributed groups. Second, the data for identified and anonymous groups were separated. Among identified

groups, the distributed condition produced greater preference change than the proximate condition ($t = 4.57$, $p < 0.05$; $\chi^2 = 4.50$, $p < 0.04$). No corresponding differences were found for anonymous groups. Therefore, the two-way interaction resulted from proximate identified groups having lower preference change than groups under other treatments.

7. DISCUSSION OF RESULTS

In general, proximity had an impact on group polarization in a GSS context. Distributed groups attained higher choice shift compared to proximate groups. With the exception of the treatment involving anonymity and the exchange of positions with arguments, distributed groups also produced higher preference change than proximate groups. Thus, the absence of visual cues and social presence in a distributed setting have helped to stimulate group polarization.

Within the context of this study, anonymity and information exposure had little impact on group polarization. Both these factors had no impact on choice shift. However, among the four proximate treatments, anonymous groups who exchanged mutual positions with arguments experienced greater preference change than groups under the other three treatments. Hence, a certain degree of group polarization can be stimulated in a proximate setting if group members used the anonymity capability of a GSS to exchange mutual positions with arguments during their meetings.

These findings have implications for GSS users. In situations where group polarization is beneficial, such as those involving pro-social advice and mutual counseling, groups can best meet in a distributed setting where group polarization is generally high. If they have to meet in a proximate setting, they can encourage group polarization by employing the anonymity capability of a GSS to exchange mutual positions and arguments. Conversely, in situations where group polarization is detrimental, such as when either extreme caution or extreme risk is undesirable, groups can best meet in a proximate setting without anonymity to dampen group polarization.

This study seeks to maximize internal validity rather than generalizability or realism. Hence, the use of a laboratory experiment involving undergraduate subjects, an artificial task, and a restricted procedure for group decision making. Therefore, caution should be exercised when generalizing these results to organizational groups and settings.

8. COMPARISON OF FINDINGS

Reviewing past studies on conventional meetings, Zuber, Crott and Werner note that choice shift and preference change were positively correlated and tended to occur simultaneously. The findings by McGuire, Kiesler and Siegel show that this relationship also applies in distributed meetings. Results of this study further extend the generality of the relationship between choice shift and preference change by showing that it holds for both distributed and proximate settings as well as both identified and anonymous conditions.

Siegel et al. found that distributed groups had greater choice shift than proximate groups when working without anonymity. Since both treatments differed on several factors, their result could be due to verbal cues, visual cues, or social presence. By eliminating verbal cues, this study arrived at the same conclusion. Hence, greater choice shift observed for distributed groups in both studies could be due to the absence of visual cues or lack of social presence. Given that reviews of the communication literature have found little impact with visual cues (Mehrabian 1972; Williams 1977), it is plausible that higher choice shift results from a lack of social presence. This contention needs to be tested in future research.

Siegel et al. also compared distributed groups under both anonymous and identified conditions. They found that anonymity had no effects on choice shift. This study arrived at a similar conclusion. A plausible explanation for the lack of effects for anonymity is group size. Anonymity tends to have a greater impact with larger than smaller groups (Valacich, Dennis and Nunamaker 1992) because, in larger groups, it is more difficult to guess the contribution of each group member. This study and that by Siegel et al. used small groups of five and three members respectively. The small group sizes might have dampened the impact due to anonymity. Future studies can assess this observation.

Earlier empirical studies have concluded that the persuasive argumentation process contributed significantly to group polarization, compared to the social comparison process (Isenberg 1986). In this study, the effect of persuasive argumentation was assessed by comparing a treatment that permitted only social comparison with another that allowed both persuasive argumentation and social comparison to occur. The lack of significant differences between these treatments suggests that, over and above social comparison, persuasive argumentation had little impact on group polarization. This finding generally supports the contention of Heath and Gonzalez and of Pavitt that social comparison, rather than persuasive argumentation, might have played a bigger role in group polarization than widely believed in earlier studies.

Clapper, McLean and Watson (1991) and Tan, Wei and Watson (1993) found that group members become less susceptible to group pressure as their proximity to other members decreases. This study found that distributed GSS groups had greater group polarization than proximate GSS groups. Collectively, these findings suggest that when people experience less group pressure in a distributed setting, they may be more uninhibited in their behavior. This may result in greater occurrence of one-upmanship, which leads to greater polarization.

9. FUTURE RESEARCH

Results of this study suggest several possibilities for further research. First, visual cues and social presence can be evaluated separately to assess their individual impact on group polarization. This can be achieved with video-conferences which involve visual cues but not social presence. Second, group size can be varied to see whether anonymity would affect group polarization in larger groups. Third, experiments involving multiple meeting sessions can be carried out to determine whether prolonged use of GSS capabilities would diminish differences among the various proximity and anonymity treatments, as suggested by Walther (1995). Fourth, instead of using tasks involving gain situations (as in this study), future research can focus on tasks depicting loss situations. Prospect theory (Kahneman and Tversky 1979) predicts that people are risk-averse in gain situations but risk-seeking in loss situations. Thus, it is interesting to observe whether the findings of this study can be generalized to a task having a loss scenario.

This study shows that the use of distributed meetings, enabled by developments in network technologies, could lead to groups making more extreme decisions. Since such decisions are helpful in some but harmful in other situations, a challenge facing the research community is to develop a contingency theory on when it is appropriate and when it is inappropriate to use distributed meetings. Given the rapid proliferation of new technological innovations among network communities and widespread adoption of such technological innovations by users, it becomes increasingly important that knowledge be pursued and made available to guide the proper use of new technological innovations.

10. REFERENCES

Brown, R. *Social Psychology*. New York: The Free Press, 1965.

Burnstein, E. "Persuasion as Argument Processing." In H. Brandstatter, J. H. Davis and G. Stocher-Kreichgauer, Editors, *Contemporary Problems in Group Decision-Making*. New York: Academic Press, 1982, pp. 103-124.

Chidambaram, L., and Jones, B. "Impact of Communication Medium and Computer Support on Group Perceptions and Performance: A Comparison of Face-to-Face and Dispersed Meetings." *MIS Quarterly*, Volume 17, Number 4, 1993, pp. 465-491.

Clapper, D. L.; McLean, E. R.; and Watson, R. T. "An Experimental Investigation of the Effect of a Group Decision Support System on Normative Influence in Small Groups." In J. I. DeGross, I. Benbasat, G. DeSanctis, and C. M. Beath, Editors, *Proceedings of the Twelfth International Conference on Information Systems*. New York, 1991, pp. 273-282.

Connolly, T.; Jessup, L. M.; and Valacich, J. S. "Effects of Anonymity and Evaluative Tone on Idea Generation in Computer-Mediated Groups." *Management Science*, Volume 36, Number 6, 1990, pp. 689-703.

Daft, R. L., and Lengel, R. H. "A Proposed Integration among Organizational Information Requirements, Media Richness, and Structural Design." *Management Science*, Volume 32, Number 5, 1986, pp. 554-571.

Daft, R. L.; Lengel, R. H.; and Trevino, L. K. "Message Equivocality, Media Selection, and Manager Performance: Implications for Information Systems." *MIS Quarterly*, Volume 11, Number 3, 1987, pp. 355-366.

Diener, E.; Fraser, S.; Beaman, A. L.; and Kelem, R. T. "Effects of Deindividuating Variables on Stealing by Halloween Trick-or-Treaters." *Journal of Personality and Social Psychology*, Volume 33, Number 2, 1976, pp. 178-183.

Dubrovsky, V. J.; Kiesler, S. B.; and Sethna, B. N. "The Equalization Phenomenon: Status Effects in Computer-Mediated and Face-to-Face Decision-Making Groups." *Human-Computer Interaction*, Volume 6, Number 2, 1991, pp. 119-146.

Fromkin, H. "Effects of Experimentally Aroused Feelings of Undistinctiveness upon Valuation of Scarce and Novel Experiences." *Journal of Personality and Social Psychology*, Volume 16, Number 3, 1970, pp. 521-529.

Hays, W. L. *Statistics*. New York: Holt, Rinehart and Winston, 1994.

Heath, C., and Gonzalez, R. "Interaction with Others Increases Decision Confidence but Not Decision Quality: Evidence against Information Collection Views of Interactive Decision Making." *Organizational Behavior and Human Decision Processes*, Volume 61, Number 3, 1995, pp. 305-326.

Isenberg, D. J. "Group Polarization: A Critical Review and Meta-Analysis." *Journal of Personality and Social Psychology*, Volume 50, Number 6, 1986, pp. 1141-1151.

Janis, I. L. *Victims of Groupthink*. Boston: Houston, 1972.

Jessup, L. M.; Connolly, T.; and Galegher, J. "The Effects of Anonymity on GDSS Group Process with an Idea-Generating Task." *MIS Quarterly*, Volume 14, Number 3, 1990, pp. 313-321.

Jessup, L. M., and Tansik, D. A. "Decision Making in an Automated Environment: The Effects of Anonymity and Proximity on Group Process and Outcome with a Group Decision Support System." *Decision Sciences*, Volume 22, Number 1, 1991, pp. 266-279.

Kahneman, D., and Tversky, A. "Prospect Theory: An Analysis of Decision Under Risk." *Econometrica*, Volume 47, Number 2, 1979, pp. 263-291.

Kaplan, M. F. "Discussion Polarization Effects in a Modified Jury Decision Paradigm: Informational Influences." *Sociometry*, Volume 40, Number 3, 1977, pp. 262-271.

Kaplan, M. F. "The Influence Process in Group Decision Making." In C. Hendrick, Editor, *Group Processes*. Newbury Park, California: Sage, 1987, pp. 189-212.

Keppel, G. *Design and Analysis: A Researcher's Handbook*. Englewood Cliffs, New Jersey: Prentice-Hall, 1991.

McGuire, T. W.; Kiesler, S. B.; and Siegel, J. "Group and Computer-Mediated Discussion Effects in Risk Decision Making." *Journal of Personality and Social Psychology*, Volume 52, Number 5, 1987, pp. 917-930.

Mehrabian, A. *Nonverbal Communication*. Chicago: Aldine-Atherton, 1972.

Muehleman, J. T.; Bruker, C.; and Ingram, C. M. "The Generosity Shift." *Journal of Personality and Social Psychology*, Volume 34, Number 3, 1976, pp. 344-351.

Myers, D. G., and Lamm, H. "The Group Polarization Phenomenon." *Psychological Bulletin*, Volume 83, Number 4, 1976, pp. 602-627.

Nunamaker, J. F.; Dennis, A. R.; Valacich, J. S.; Vogel, D. R.; and George, J. F. "Electronic Meeting Systems to Support Group Work." *Communications of the ACM*, Volume 34, Number 7, 1991, pp. 40-61.

Paese, P. W.; Bieser, M.; and Tubbs, M. E. "Framing Effects and Choice Shift in Group Decision Making." *Organizational Behavior and Human Decision Processes*, Volume 56, Number 1, 1993, pp. 149-165.

Pavitt, C. "Another View of Group Polarizing: The 'Reasons for' One-Sided Oral Argumentation." *Communication Research*, Volume 21, Number 5, 1994, pp. 625-642.

Pruitt, D. G. "Choice Shifts in Group Discussion: An Introductory Review." *Journal of Personality and Social Psychology*, Volume 20, Number 3, 1971, pp. 339-360.

Riley, R. T., and Pettigrew, T. F. "Dramatic Events and Attitude Change." *Journal of Personality and Social Psychology*, Volume 34, Number 5, 1976, pp. 1004-1015.

Salancik, G. R. "Commitment and the Control of Organizational Behavior and Belief." In B. M. Staw and G. R. Salancik, Editors, *New Directions in Organizational Behavior*. Chicago: St. Clair, 1977, pp. 1-54.

Shaw, M. E. "Communication Networks Fourteen Years Later." In L. Berkowitz, Editor, *Group Processes*. New York: Academic Press, 1978, pp. 351-362.

Short, J.; Williams, E.; and Christie, B. *The Social Psychology of Telecommunication*. New York: John Wiley, 1976.

Siegel, J.; Dubrovsky, V.; Kiesler, S. B.; and McGuire, T. W. "Group Processes in Computer-Mediated Communication." *Organizational Behavior and Human Decision Processes*, Volume 37, Number 2, 1986, pp. 157-187.

Singer, J.; Brush, C.; and Lublin, S. "Some Aspects of Deindividuation: Identification and Conformity." *Journal of Experimental Social Psychology*, Volume 1, Number 4, 1965, pp. 365-378.

Tan, B. C. Y.; Wei, K. K.; and Watson, R. T. "Dampening Status Influence using a Group Support System: An Empirical Study." In J. I. DeGross, R. P. Bostrom, and D. Robey, Editors, *Proceedings of the Fourteenth International Conference on Information Systems*. Orlando, Florida, 1993, pp. 77-89.

Toch, R. *The Social Psychology of Social Movements*. Indianapolis: Bobbs-Merrill, 1965.

Turoff, M.; Hiltz, S. R.; Bahgat, A. N. F.; and Rana, A. R. "Distributed Group Support Systems." *MIS Quarterly*, Volume 17, Number 4, 1993, pp. 399-417.

Valacich, J. S.; Dennis, A. R.; and Nunamaker, J. F. "Group Size and Anonymity Effects on Computer-Mediated Idea Generation." *Small Group Research*, Volume 23, Number 1, 1992, pp. 49-73.

Valacich, J. S.; George, J. F.; Nunamaker, J. F.; and Vogel, D. R. "Physical Proximity Effects on Computer-Mediated Group Idea Generation." *Small Group Research*, Volume 25, Number 1, 1994, pp. 83-104.

Vinokur, A., and Burnstein, E. "Depolarization of Attitudes in Groups." *Journal of Personality and Social Psychology*, Volume 36, Number 4, 1978a, pp. 872-885.

Vinokur, A., and Burnstein, E. "Effects of Partially-Shared Persuasive Arguments on Group-Induced Shifts: A Group Problem-Solving Approach." *Journal of Personality and Social Psychology*, Volume 29, Number 2, 1974, pp. 305-315.

Vinokur, A., and Burnstein, E. "Novel Argumentation and Attitude Change: The Case of Polarization Following Group Discussion." *European Journal of Social Psychology*, Volume 8, Number 3, 1978b, pp. 335-348.

Walther, J. B. "Relational Aspects of Computer-mediated Communication: Experimental Observations over Time." *Organization Science*, Volume 6, Number 2, 1995, pp. 186-203.

Wei, K. K.; Tan, B. C. Y.; Sia, C. L.; and Raman, K. S. "Hypertext: A New Approach to Construct Group Support Systems." *International Journal of Information Management*, Volume 16, Number 3, 1996, pp. 163-181.

Weisberg, S. *Applied Linear Regression*. New York: John Wiley, 1985.

Whyte, G. "Escalating Commitment in Individual and Group Decision Making: A Prospect Theory Approach." *Organizational Behavior and Human Decision Processes*, Volume 54, Number 3, 1993, pp. 430-455.

Williams, E. "Experimental Comparisons of Face-to-Face and Mediated Communication: A Review." *Psychological Bulletin*, Volume 84, Number 5, 1977, pp. 963-976.

Zuber, J. A.; Crott, H. W.; and Werner, J. "Choice Shift and Group Polarization: An Analysis of the Status of Arguments and Social Decision Schemes." *Journal of Personality and Social Psychology*, Volume 62, Number 1, 1992, pp. 50-61.

APPENDIX

Let I_i = Position of subject i at *first* round of meeting
F_i = Position of subject i at *last* round of meeting
P_i = Position of subject i *after* meeting
n = Number of subjects per group

Group decision (G) = $\sum_{i=1}^{n} F_i / n$

Preference change = $\left| \sum_{i=1}^{n} (P_i - I_i) \times 10 / n \right|$

Choice shift = $\left| \sum_{i=1}^{n} (G - I_i) \times 10 / n \right|$