An Experimental Examination of Group History and Group Support System Use on Information Sharing Performance and User Perceptions

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ABSTRACT
A laboratory experiment was conducted in which group history (i.e., established versus ad hoc groups) and GSS use were manipulated. Subjects completed a hidden profile task; that is, a task where some information is held by all group members prior to the meeting while other information is held only by a subset of the group. No differences in information sharing performance were observed except that, when compared to ad hoc groups, established groups discussed less information that was initially held by one group member. Established group members were more satisfied than ad hoc group members while those using a GSS were less satisfied than no-tech groups. Group cohesion was found to be positively related to satisfaction across all treatments while cohesion was positively related to information sharing performance only for ad hoc groups that did not use a GSS. A discussion of the results in the context of prior theory and research is also presented.

INTRODUCTION
Growth in the use of group support systems (GSS) and related technologies has brought with it a need to understand how the technology influences group behaviors and performance. Although a significant number of experimental studies have been conducted, much of this research has produced results that are, in many cases, inconsistent and inconclusive (see Dennis, Nunamaker, & Vogel, 1991; Dennis, Easton, Easton, George, & Nunamaker, 1990; George, 1989). Dennis and colleagues (1990) suggested that one possible reason for these inconsistencies might be the nature of the groups used in GSS research; that is, the almost universal use of ad hoc groups in laboratory experimentation. Since groups in organizational settings are often established, research on group history and GSS appears to be justified.

The literature on group development indicates that interacting groups progress through various phases as they develop (see Mennecke, Hoffer, & Wyne, 1992). Several group development models assert that developmental phases are influenced by a number of contingencies, including interventions such as structured decision-making techniques, communication tools such as GSS, and task characteristics (see Poole, 1983; Poole & Roth, 1989; Poole & Doelger, 1986; McGrath, 1990; 1991). Implications of the group developmental models include the notion that established groups are likely to behave and perform differently than ad hoc groups and that GSS technology will likely have an important influence on the performance and behavior of these groups (Mennecke et al., 1992). Factors that may help to explain these differences include the expectation that, when compared to ad hoc group members, established group members should generally have more knowledge of other members' skills and abilities, roles should be better defined, and interpersonal feelings related to cohesion should be better developed.

Task has also been shown to be an important consideration in group research (see Dennis et al., 1991; Mennecke & Wheeler, 1993). Dennis and colleagues note the following distinction between field versus laboratory tasks:

"members of organizational groups in the field have often had asymmetrical (even conflicting) task information. Experimental groups, who in previous EMS studies have generally worked from a common description of the experimental task, would have been more likely to have a common set of information" (Dennis et al, 1991; p.116).

Stasser and colleagues conducted several studies using tasks that are asymmetrical (i.e., where each group member has unique yet complimentary information) and which are designed to have hidden profiles (Stasser & Titus, 1985, Stasser & Titus, 1987, Stasser, Taylor, & Hanna, 1989, Stasser, 1992b). Hidden profile tasks are designed so that the true profile or character of an object described in the case is hidden from individual group members when they consider the task individually. Only when group members effectively share information can the true profile be discovered. Hidden profile tasks are designed to simulate, at least in part, the types of tasks that groups often encounter in organizational settings; that is, tasks where group members possess unique task-relevant knowledge (Mennecke & Wheeler, 1993).

Stasser and colleagues consistently found that groups are not likely to discover hidden profiles because individual members frequently failed to contribute information not held in common prior to the discussion (In this paper, the term initially shared information refers to the information that members hold in common prior to group interaction, initially unshared information refers to information held by one member prior to group interactions, and partially shared information refers to information held by fewer than all the members but by more than just one person). Stasser has...
suggested, however, that groups which have a history of working together or that utilize structured decision-making techniques may be more successful in discovering hidden profiles (Stasser, 1992a). To address this question and these other issues, this research uses a hidden profile task similar to that used by Stasser and colleagues to examine how group history and the use of a GSS, an automated tool for structuring group work, influences group information sharing and member perceptions.

**PRIOR RESEARCH AND STUDY HYPOTHESES**

Much of the prior group research, both for GSS supported and no-tech groups, has examined ad hoc student groups. Further, few studies have examined groups processing a hidden profile task. This research is unique because it involves a simultaneous manipulation of both group history and GSS usage for groups processing a hidden profile task. To measure the influence of these manipulations, data for three categories of dependent variables were captured: group performance on idea sharing and individual perceptions related to satisfaction with the decision process and the solution. In addition, individual group members' perceptions about group cohesion (as measured by each member's attraction to their group) were also collected and analyzed to examine the relationship between cohesion, performance, and perceptions.

**Information Sharing Performance**

Stasser and colleagues (Stasser & Titus, 1985, 1987; Stasser et al., 1989) found that ad hoc groups of students completing hidden profile tasks often failed to effectively pool initially unshared information. However, Stasser suggested that "decision-making groups that have a history of working together on similar kinds of tasks may develop an efficient and effective division of responsibility for ..., communicating during discussions, various kinds of information" (Stasser, 1992a; p.64). Thus, group history may represent an important moderating variable in research on hidden profile tasks.

A limited number of studies have been reported examining group history. Hall and Williams (1966) compared the decision-making performance of groups by manipulating the level of intragroup potential conflict (i.e., the amount of pre-meeting agreement) and group history. The results indicate that in high conflict conditions, established groups performed significantly better in terms of decision quality and idea generation than did ad hoc groups. On the other hand, performance differences were not present in low conflict conditions. The implication of these findings is that, when conflict over task issues exists, established groups are more inclined to utilize emergent ideas and as a result they share more ideas and make better decisions. In the only known research to date examining group history in a GSS setting, Dennis, Easton, et al. (1990) compared established and ad hoc groups using a GSS. They found that established groups made more uninhibited and process oriented comments, participated more equally, made less indirect comments, and had a lower task focus. This study demonstrates how group history can moderate GSS use.

Together these findings suggest that it is possible that the rapport and trust developed among group members in many established groups will have a "lubricating" influence that potentially may increase an individual group members' willingness to contribute comments in an uninhibited manner. The groups in this experiment were asked to complete a hidden profile task similar to that used by Stasser and colleagues and similar in appearance (from the subjects' perspective) to tasks they had previously completed (see below). Based on the discussion above and the nature of the task used in this research, established group members should be more effective than members of ad hoc groups at contributing case-relevant information. This leads to the following hypothesis:

H1: Established groups will outperform ad hoc groups in sharing information

GSS provides a unique environment compared to no-tech settings. In prior no-tech research on hidden profile tasks, group members were frequently observed to hold to their initial positions during the discussion (Stasser & Titus, 1985). Normative influence theory (Kaplan, 1987) may help, at least in part, to explain these findings in that group members who hold unshared information might be discouraged from discussing this information due to normative pressures. For example, when group members are presented with information that they did not read in the case, this may create a perception of inconsistency. As a consequence, group members might become reticent to discuss unique information and instead focus their discussion on previously discussed information.

The GSS is expected to reduce normative influences by helping groups focus on the informational content of the task. For example, Huang, Raman, and Wei (1993) found that GSSs have the potential to increase informational influences and attenuate normative influences. The task used in this research does involve socially sensitive issues, therefore normative influence was expected to be important. Although subjects in all conditions were made aware of the need to focus on sharing information in the case and to make their decisions based on facts presented in the case, GSS groups are expected to benefit more from the GSS. For instance, GSS groups should be more likely to share information in an uninhibited manner and therefore outperform no-tech groups. This suggests the following hypothesis.

H2 Groups utilizing a GSS will outperform no-tech groups in sharing information

**Satisfaction**

Group history is expected to have a significant influence on member satisfaction. Specifically, established groups should be more satisfied with the decision process and outcomes than members of ad hoc groups. This prediction is derived from the expectation that the majority of established groups will have greater cohesion than ad hoc groups. This implies that individual members of cohesive established groups will possess a sense of unity and confidence in their group and in its performance capabilities (Janis, 1982). Prior research has generally found that cohesion is positively related
to satisfaction (Dorfman & Stephen, 1984; Noel, 1993). Thus, established groups should report greater satisfaction than ad hoc groups. These lead to the following hypotheses:

H3: Members of established groups will be more satisfied with the decision process than ad hoc group members.

H4: Members of established groups will be more satisfied with the group solution than ad hoc group members.

Although several factors are likely to be important in influencing satisfaction across the technology treatment, satisfaction should likely be moderated by the perceived benefits that the GSS communication channel provides. For instance, Dennis and Gallupe (1993) suggest that studies comparing GSS to no-tech groups in terms of parallelism (i.e., the ability which a GSS gives group members to communicate information simultaneously) have consistently found that group members using a GSS have had higher satisfaction than members in no-tech groups. Furthermore, since satisfaction will also likely be tied to performance and GSS groups are expected to outperform no-tech groups, members of GSS groups should report greater satisfaction. Based on this, the following hypotheses are proposed:

H5: Members of GSS groups will be more satisfied with the decision process than members of no-tech groups.

H6: Members of GSS groups will be more satisfied with the solution than members of no-tech groups.

Cohesion
It is likely that the influence of the independent variables will be moderated by the feelings members have toward one another (Dorfman & Stephen, 1984; Evans & Dion, 1991; Levine & Moreland, 1990). For instance, when compared to ad hoc groups, members of established groups should be more likely to have well developed feelings, either positive, neutral, or negative, about other members and the group as a whole. The effects of these feelings on member behaviors could have several impacts on information sharing performance. For example, group members who possess positive feelings towards other members may feel more comfortable contributing comments in an uninhibited manner whereas members who possess negative feelings toward other members of their group may feel inhibited in contributing information. Such a relationship may account for the higher variability in uninhibited comments in established groups relative to ad hoc groups reported in the study by Dennis, Easton, et al. (1990).

As with information sharing, cohesion is also likely to have an influence on member perceptions. For instance, group members who possess positive feelings towards fellow members are likely to be more satisfied with both the process used to generate their solution and with the solution itself than would group members who did not have favorable feelings about their group. For instance, in a study examining the influence of anonymity and GSS use, Noel (1993) found that group members who reported higher satisfaction also reported higher cohesion. Based on the above discussion and on the nature of the groups used in this study, the following hypothesis is proposed:

H7: Cohesion will be positively related to information sharing performance and member satisfaction.

METHODS
The research design is a 2x2 factorial design intended to provide a means for comparing 1) ad hoc groups with established groups and 2) GSS supported groups with no-tech groups. A total of 15-17 groups were included in each of the four cells. Each type of group, ad hoc and established, were randomly assigned to either the GSS or no-tech treatments. The task type, room, meeting agenda, time limit, and group size were held constant for all groups.

Dependent Variables
Three dependent measures were examined: the percentage of available information discussed during the meeting and individual group member perceptions related to solution and process satisfaction. Information sharing performance was operationalized as the proportion of available information that was mentioned during the meeting; that is, the number of unique pieces of information mentioned divided by the total number of pieces of information available to group members. Performance was measured by having raters code and count the individual pieces of information that were discussed during each session. Although individual pieces of information were often mentioned more than once during each session (i.e., redundant mentioning of information), an analysis of these occurrences is beyond the scope of this paper.

Both process satisfaction and decision outcome satisfaction were measured with Green and Taber's (1980) satisfaction scale. Group cohesion was examined in conjunction with the dependent measures to identify any relationship between cohesion, group performance, and satisfaction. Perceptions of cohesion were captured using the Group Attitude Scale (GAS) (Evans & Jarvis, 1986). This scale is designed to assess group cohesion by identifying the level of attraction each group member has for his/her group. The cohesion instrument was administered before and after each session, however, only scores for post-session cohesion are included in the analysis.

Subjects
Subjects for this experiment were recruited from a speech communications course at a major Midwestern university. Students in the course were randomly assigned to groups at the beginning of the semester to work on group projects throughout the entire semester. Subjects participated in the experimental session after having completed three to four other major group projects and several meetings associated with a semester-long outside-of-class project. In addition, groups were required to complete at least two additional projects subsequent to the experimental session and before the end of the semester. At the time of the subject's exposure to the experiment, the intact workgroups comprising the subject population can be characterized as well established.
on-going groups; that is, groups where members have a significant history working together as a group and anticipate having a significant future together (Mennecke et al., 1992). McGrath defines these as natural groups; that is, groups that "exist independent of the researcher's activities and purposes" (McGrath, 1984; p. 41).

Students from the same speech course were used to represent both established groups and ad hoc groups. All subjects were selected from the same course so that participants in all treatments were drawn from the same population. Students were split into two samples: a total of 33 groups (132 students) were maintained in their established structure while the remaining students were randomly re-assigned to 31 new experimental ad hoc groups (124 students). Ad hoc groups were structured so that they would be similar to the typical ad hoc experimental groups used in the majority of prior group research. In other words, they were constructed with the goal that members had no experience working together with other members and little or no expectation that they would work together in the future. For example, although some ad hoc groups contained members from the same section of the speech course, an attempt was made to combine students into ad hoc groups from different sections of the course. Summary statistics reporting on the interactions that group members had prior to the sessions are presented in the results section below McGrath (1984) would define these as concocted groups; that is, groups brought together only for the purpose of the experiment.

Task

The task used for this experiment is a hidden profile task that was adapted from Stasser and Titus (1985, 1987) and Stasser et al. (1989). Stasser and colleagues constructed hidden profiles by spreading unique and pertinent information about hypothetical student council presidential candidates among group members with the result that no one member had sufficient information to solve the case adequately (i.e., identify the true profile of each candidate). This was done to generate a pre-discussion bias in individual group members (Stasser & Titus, 1985) and to manipulate the percentage of information that was initially shared among group members (Stasser & Titus, 1987; Stasser et al., 1989). A distribution of information that was designed to generate a bias (i.e., high pre-meeting conflict) was used to enhance the group history treatment since Hall and Williams (1966) found significant differences between ad hoc and established groups only when the groups experienced high pre-meeting conflict.

The objective of the task is to rank three university student council presidential candidates. The task contains information about the candidates in the form of sixteen statements purportedly made by each candidate. These statements, which relate primarily to issues and policies facing students at the university, were rated prior to the experiment by undergraduate students who did not participate in the experiment. Student raters were instructed to score each statement for its importance and on how it would make them feel about a student council presidential candidate who made the statement. Based on the ratings, statements were combined to form a profile of each hypothetical candidate.

Profiles were constructed with the objective that each description be unequal in terms of desirability. However, the distribution of the information presented to the subjects was structured so that the true profiles of the three candidates are hidden from the subjects and so that a bias is introduced which is designed to make the best candidate appear to be less attractive. The bias is developed by initially sharing all or most of the positive information and less of the negative information about the less desirable candidates while leaving the positive information about the best candidate initially shared by only one or two group members. The information is distributed among each of the group members so that the information is available to at least one group member. Furthermore, the statements are distributed so that one quarter of the information was initially held by only one member, one quarter was initially held by two members, one quarter was initially held by three members, and one quarter was initially held by all four members of the group. For each group, the statements were randomly re-assigned to each candidate to reduce systematic biases resulting from the variability in the salience and valence of the individual statements.

This task was also used because it would appear to the subjects to be similar to tasks that they were required to work on in their speech classes. Students were generally awarded grades for diligently processing these tasks; therefore, the experimental task was expected to represent a problem that was typical of the type they had frequently worked on and received course credit for completing.

Experimental Environment and Procedures

All groups completed the experimental task in the same setting. Group members using the GSS were seated at four workstations situated proximate to one another while group members in the no-tech treatment sat in the same locations with the computer monitors removed. The Topic Commenter tool in the GroupSystems™ GSS was used for information sharing, discussion, and voting. The Topic Commenter tool is designed so that comments can be inserted by the user under one of several topics (in this case four topics — three for the names of the three candidates and one for discussion and selection). GSS groups were required to communicate using only the computer.

After arriving at the experimental facility, all groups were read an introduction to the experiment by the facilitator and then they were asked to read and sign a subject consent form.

1

The difference in the favorability of each candidate was included in this research for an exploratory analysis of the relationship between subject preferences, information recall, and decision quality. Due to space constraints, the results of these analyses are not included in this paper. However, favorable, neutral, and negative statements were distributed equally among initially shared, partially shared, and unshared information to minimize any bias due to variability of statement salience.
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Table 1: ANOVAs and Cell Means for Session Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group History</th>
<th>Technology</th>
<th>Interaction</th>
<th>Ad Hoc No-tech</th>
<th>Ad hoc GSS</th>
<th>Est. No-tech</th>
<th>Est. GSS</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Groups</td>
<td></td>
<td></td>
<td></td>
<td>16</td>
<td>15</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td># Votes</td>
<td>F(1,60)=0.014; p=0.906</td>
<td>F(1,60)=6.67; p=0.012*</td>
<td>F(1,60)=0.014; p=0.906</td>
<td>1.38 (0.62)</td>
<td>1.87 (0.83)</td>
<td>1.38 (0.62)</td>
<td>1.82 (0.81)</td>
</tr>
<tr>
<td>Session Time</td>
<td>F(1,60)=6.944; p=0.011*</td>
<td>F(1,60)=1.008; p=0.319</td>
<td>F(1,60)=0.191; p=0.664</td>
<td>22.88 (10.48)</td>
<td>25.93 (7.68)</td>
<td>18.25 (7.67)</td>
<td>19.47 (7.43)</td>
</tr>
<tr>
<td>Hours Worked Together Prior to Session</td>
<td>F(1,214)=108.7; p&lt;0.001***</td>
<td>F(1,214)=0.131; p=0.717</td>
<td>F(1,214)=0.121; p=0.728</td>
<td>0.14 (0.48)</td>
<td>0.11 (0.42)</td>
<td>16.60 (17.25)</td>
<td>15.51 (14.61)</td>
</tr>
<tr>
<td># of Members Known</td>
<td>F(1,218)=1415.7; p&lt;0.001***</td>
<td>F(1,218)=0.011; p=0.915</td>
<td>F(1,218)=0.010; p=0.919</td>
<td>0.40 (0.74)</td>
<td>0.39 (0.68)</td>
<td>3.00 (0.00)</td>
<td>3.00 (0.00)</td>
</tr>
<tr>
<td>Cohesion (pre-meeting)</td>
<td>F(1,252)=127.3; p&lt;0.001***</td>
<td>F(1,252)=0.014; p=0.905</td>
<td>F(1,252)=0.001; p=0.970</td>
<td>113.27 (77.88)</td>
<td>113.48 (77.94)</td>
<td>143.78 (71.15)</td>
<td>144.21 (79.84)</td>
</tr>
<tr>
<td>Cohesion (post-meeting)</td>
<td>F(1,252)=62.01; p&lt;0.001***</td>
<td>F(1,252)=3.614; p=0.058?</td>
<td>F(1,252)=6.129; p=0.014*</td>
<td>128.50 (23.17)</td>
<td>115.42 (27.42)</td>
<td>144.37 (22.10)</td>
<td>145.84 (21.15)</td>
</tr>
</tbody>
</table>

*** α=0.001 ** α=0.01 * α=0.05 ? α=0.10

19 point, 20 item scale, Larger=Greater Cohesion

RESULTS
Both group and individual level analyses of dependent variables were performed. The type and quantity of information mentioned during the meeting was analyzed at the group level while individual member perceptions of satisfaction and cohesion were analyzed at the individual level. All statistical tests of significance were conducted with alpha set at 0.05. Statistical tests generating probabilities less than or equal to 0.10 and greater than 0.05 are considered to approach significance.

Sixty-four four-member groups participated in the experimental sessions (256 students). A total of 118 females and 138 males with an average age of 21 years participated. Table 1 shows several summary statistics including the number of votes taken, the session time, the average number of hours of interaction with one or more of the other members of his/her group that each member reported, the average number of people that each member reported knowing prior to the session, and pre- and post-meeting cohesion.

In total, 8 groups were deadlocked; 2 ad hoc GSS groups, 4 established GSS groups, and 2 established no-tech groups. None of the ad hoc no-tech groups reached a deadlock decision. There was no significant difference in the likelihood of deadlock status across any of the manipulations (F=2.095, p=0.132). However, because of the potential impacts on group member satisfaction and member attraction to group, the groups' deadlock status was examined as a covariate (see below). Results from the analysis of the pre-session group cohesion scores confirm that established group members had significantly higher cohesion prior to the session than ad hoc group members. The differences in post-session

statement. All groups were then asked to fill out several preliminary questionnaires including the cohesion instrument. Following this, GSS groups were provided with non-task related training on the use of the GSS. Following the introduction and training (GSS groups only), subjects were asked to read the case, then rank the candidates based on their preferences, and, finally, write down those pieces of information about the candidates that they could recall. Following this, all materials were removed from the subjects and they were asked to process the case based on what they could recall about the candidates. All groups were instructed to use a structured heuristic to process the case. This heuristic requested that subjects first attempt to recall and discuss relevant information about the candidates without stating a preference or voting (15 minutes) and then discuss the case openly (45 minutes). All groups were told to continue to discuss and vote on the candidates until agreement was reached, deadlock occurred, or the time limit elapsed. Deadlock occurred when members of the group agreed that they were unable to achieve unanimous agreement on the case. The agenda was used to structure the group discussion in a similar manner to that used by Stasser and Titus (1987). Facilitation during the sessions was performed by one of the researchers and was limited to tasks such as delivering scripted instructions, assisting groups in the transition from the information sharing phase to the discussion and selection phase, and correcting the group if it strayed from the agenda. When groups completed the task, they were asked to complete several follow-up questionnaires and then debriefed.
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<table>
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<th>Ad Hoc No-tech</th>
<th>Ad hoc GSS</th>
<th>Est. No-tech</th>
<th>Est. GSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>F(1,60)=4.921; p=0.030*</td>
<td>F(1,60)=0.291; p=0.592</td>
<td>F(1,60)=1.121; p=0.294</td>
<td>42% (9.1)</td>
<td>40% (10.4)</td>
<td>33% (11.9)</td>
<td>37% (9.7)</td>
</tr>
<tr>
<td>Held by 1 Person</td>
<td>F(1,60)=8.892; p=0.004***</td>
<td>F(1,60)=0.004; p=0.952</td>
<td>F(1,60)=0.617; p=0.435</td>
<td>34% (15.0)</td>
<td>32% (16.2)</td>
<td>21% (13.2)</td>
<td>23% (11.1)</td>
</tr>
<tr>
<td>Held by 2 People</td>
<td>F(1,60)=0.074; p=0.787</td>
<td>F(1,60)=0.840; p=0.363</td>
<td>F(1,60)=0.029; p=0.865</td>
<td>33% (11.5)</td>
<td>34% (16.7)</td>
<td>30% (11.8)</td>
<td>32% (13.9)</td>
</tr>
<tr>
<td>Held by 3 People</td>
<td>F(1,60)=2.120; p=0.151</td>
<td>F(1,60)=2.193; p=0.144</td>
<td>F(1,60)=1.490; p=0.227</td>
<td>48% (14.8)</td>
<td>39% (14.1)</td>
<td>40% (16.4)</td>
<td>40% (11.9)</td>
</tr>
<tr>
<td>Held by 4 People</td>
<td>F(1,60)=0.243; p=0.624</td>
<td>F(1,60)=0.706; p=0.404</td>
<td>F(1,60)=0.019; p=0.890</td>
<td>52% (16.5)</td>
<td>56% (17.7)</td>
<td>50% (16.8)</td>
<td>53% (20.7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Process Satisfaction</th>
<th>Solution Satisfaction</th>
<th>Mean/(Std.Dev.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Held by 1 Person</td>
<td>F(1,231)=20.63; p&lt;0.001***</td>
<td>F(1,231)=16.74; p&lt;0.001***</td>
<td>19.92 (3.28)</td>
</tr>
<tr>
<td>Held by 2 People</td>
<td>F(1,231)=1.597; p=0.280</td>
<td>F(1,231)=2.918; p=0.089?</td>
<td>18.32 (3.58)</td>
</tr>
<tr>
<td>Held by 3 People</td>
<td>F(1,231)=5.95; p=0.002**</td>
<td>F(1,231)=0.189; p=0.664</td>
<td>18.32 (3.58)</td>
</tr>
<tr>
<td>Held by 4 People</td>
<td>F(1,231)=0.008***</td>
<td>F(1,231)=0.091; p=0.755</td>
<td>18.32 (3.58)</td>
</tr>
</tbody>
</table>

* α=0.001  ** α=0.01  * α=0.05  ? α=0.10

Table 2: ANOVAs and Cell Means for Information Sharing and Satisfaction

The hypotheses for information sharing were tested by counting the number of case-relevant statements that were mentioned (or typed) by a group member during the discussion. The inter-rater agreement was 84% (κ=0.168; Z=1.89; p=0.0294). The proportions used in the analyses represent the percentage of statements in each category that were mentioned at least once during the session. The percentage generated through this process represents the performance of the group in surfacing information; higher percentages indicate better performance in sharing information. The percentage of available information that was mentioned by each group was calculated for five categories of information: initially unshared information, partially shared information (information initially held by two or three people), initially shared information, and the total percentage of information discussed across these four classes of information combined.

Hypothesis 1 predicted that established groups would be better than ad hoc groups at sharing information. The results of the ANOVA analyses for two categories of information (all information and information held by one member) were significant or approached significance (see Table 2). The results for these two variables, however, uniformly run opposite to the direction indicated in the hypothesis. Therefore the group history hypothesis is not supported and is partially contradicted. Hypothesis 2 predicted that GSS groups would outperform no-tech groups at sharing information. The findings for this hypothesis show no significant differences for any of the variables (see Table 2). Therefore the technology hypothesis is not supported. In general, however, the trend of the results is consistent with Stasser and colleagues’ information recall model (Stasser & Titus, 1985, 1987, Stasser et al., 1989) in that the percentage of information discussed increases proportionally to the number of people possessing the information prior to the discussion. Results indicate that no significant interaction between the group history and GSS treatment exists (Table 2). The deadlock status of the group, however, was found to be a significant covariate for the information that was initially held by two members (F(1,60)=6.868, p=0.011). A comparison of the means for this variable suggests that deadlocked groups mentioned less information than groups that reached a consensus agreement.

The inferior results for both the established and GSS groups runs opposite to those expected. Several possible explanations can be suggested to account for these findings, however, one factor which may be important relates to subject involvement and motivation in the case. To evaluate this possibility, an analysis was made of a post-session questionnaire that asked subjects to rate their perceptions of personal involvement in the case. The results showed that, on
Table 3: Linear Regression for Cohesion Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>F Ratio</th>
<th>F Prob</th>
<th>df</th>
<th>Mult. R</th>
<th>R²</th>
<th>Adj. R²</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AD HOC -- NO TECH</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Information</td>
<td>6.5983</td>
<td>0.022* (1,14)</td>
<td>0.566</td>
<td>0.3203</td>
<td>0.2718</td>
<td>0.00375</td>
<td></td>
</tr>
<tr>
<td>Held by 4 People</td>
<td>3.5489</td>
<td>0.081? (1,14)</td>
<td>0.4497</td>
<td>0.2022</td>
<td>0.1453</td>
<td>0.00541</td>
<td></td>
</tr>
<tr>
<td>Held by 2 People</td>
<td>3.4262</td>
<td>0.085? (1,14)</td>
<td>0.4434</td>
<td>0.1966</td>
<td>0.1392</td>
<td>0.00372</td>
<td></td>
</tr>
<tr>
<td>Process Satisfaction</td>
<td>11.2593</td>
<td>0.002** (1,54)</td>
<td>0.4154</td>
<td>0.1725</td>
<td>0.1572</td>
<td>0.05971</td>
<td></td>
</tr>
<tr>
<td>Solution Satisfaction</td>
<td>6.9792</td>
<td>0.011* (1,54)</td>
<td>0.3383</td>
<td>0.1145</td>
<td>0.0981</td>
<td>0.05195</td>
<td></td>
</tr>
<tr>
<td><strong>AD HOC -- TECH</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Process Satisfaction</td>
<td>22.1851</td>
<td>0.000*** (1,49)</td>
<td>0.5583</td>
<td>0.3117</td>
<td>0.2976</td>
<td>0.09191</td>
<td></td>
</tr>
<tr>
<td>Solution Satisfaction</td>
<td>8.3140</td>
<td>0.006** (1,49)</td>
<td>0.3809</td>
<td>0.1451</td>
<td>0.1276</td>
<td>0.06458</td>
<td></td>
</tr>
<tr>
<td><strong>ESTABLISHED</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process Satisfaction</td>
<td>19.5554</td>
<td>0.000*** (1,121)</td>
<td>0.373</td>
<td>0.1391</td>
<td>0.132</td>
<td>0.05689</td>
<td></td>
</tr>
<tr>
<td>Solution Satisfaction</td>
<td>20.4701</td>
<td>0.000*** (1,121)</td>
<td>0.3804</td>
<td>0.1447</td>
<td>0.1376</td>
<td>0.06173</td>
<td></td>
</tr>
</tbody>
</table>

*** α=0.001 ** α=0.01 * α=0.05 ? α=0.10

average, group members reported relatively high involvement in the case (M=2.27; 1=highly involved, 5=uninvolved). Although no differences in reported involvement were found across the group history treatment (F(1,240)=0.131, p=0.718), GSS groups reported significantly lower involvement than no-tech groups (F(1,240)=6.600, p=0.011). These findings suggest that, as planned, the task was involving and rewarding. Nevertheless, this analysis cannot rule out the possibility that the lack of an extrinsic reward for superior performance may have contributed to the inferior performance for the established and GSS groups.

Hypotheses 3 and 4 predicted that established group members would report higher satisfaction with the decision process and with the solution than ad hoc group members. The results for the ANOVA analyses support these hypotheses (see Table 2). Established group members reported significantly higher satisfaction with both the decision-making process and with the solution generated by the group than did ad hoc group members. The results also indicate that no significant interactions between the group history and GSS treatments existed. However, the group deadlock status was a significant covariate for both process satisfaction (F(1,231) = 18.504, p=0.000) and solution satisfaction (F(1,231) = 8.491, p=0.004). A comparison of the means for these variables suggest that deadlocked groups were less satisfied with the process and the solution than were groups that reached a consensus agreement. In general, these results are consistent with the expectations derived from prior research and suggest that established group members have a greater confidence in their group's performance and about the process used by their group. It is interesting to note, however, that established groups were also significantly less effective at surfacing case-relevant information than ad hoc groups, thus, in this case member satisfaction appears to be unrelated to actual performance.

Hypotheses 5 and 6 predicted that GSS groups would be more satisfied than no-tech groups. The results of the analyses are significant or approach significance and indicate that, when compared to GSS groups, no-tech groups were more satisfied with the solution and the process (Table 2). Therefore, these hypotheses are not supported and are contradicted.

Hypothesis 7 predicted that reported scores on the cohesion scale would be positively related to a group's performance in sharing information and to individual group member satisfaction. In order to isolate the influence of cohesion from the influences of the experimental treatments, a one-way ANOVA was performed to identity whether post-session cohesion varied across treatments. The results indicate that cohesion levels for the ad hoc groups in the GSS and no-tech treatments were significantly different from each other. Furthermore, although the post-session cohesion for established groups was found to be significantly greater than for ad hoc groups, no differences between GSS and no-tech groups were found for established groups (F(1,255)=23.627, p<0.0001; {Established}>{Ad Hoc/No Tech}>{Ad Hoc/GSS}; also see Table 1). Based on these findings, three separate analyses were conducted: one for ad hoc/GSS groups, one for ad hoc/no-tech groups, and one for the established groups (with data for GSS and no-tech established groups collapsed together). The analyses were conducted using linear regression with cohesion included as the independent variable (see Table 3).

The results of the analyses for the ad hoc GSS groups and the established groups indicate that cohesion is positively related to satisfaction but not to information sharing performance. On the other hand, the results for ad hoc no-
tech groups shows a positive relationship between both information sharing performance (i.e., for partially shared and shared information) and satisfaction.

In summary, the results from this analysis offer partial support for Hypothesis 7. For instance, cohesion was significantly related to performance for the ad hoc no-tech groups but not for groups in the other treatment conditions. This finding suggests that there is an interaction across the technology/group history treatment between group performance and cohesion. For satisfaction, however, the results were consistent across all treatments in that cohesion was positively related to satisfaction. These results are consistent with the findings reported by Noel (1993) and suggest that there is a substantial link between group member feelings about their group and their satisfaction.

**DISCUSSION**

The results of this study have several important implications for research on small groups in both GSS and no-tech settings. In particular, they point out that both GSS usage and group history have the potential to significantly impact user performance and perceptions. Several of the more important implications that can be derived from this study are discussed in detail below.

The results for information sharing performance indicate that group history only made a difference for unshared information and that performance was not significantly influenced by GSS usage. Contrary to expectations, established groups discussed significantly less information than ad hoc groups. The results for group history may be attributed, at least in part, to the greater time taken by the ad hoc groups in completing the task. It is possible that ad hoc groups needed more time to coordinate their activities and define member roles. In addition, however, the greater cohesion present in the established groups combined with the absence of an extrinsic reward structure linked to performance may have caused established groups to be less vigilant in their processing of the case.

Tanis (1982) suggests that one potential consequence of Groupthink is that cohesive group members will refrain from engaging in vigilant decision-making activities. Vigilance is characterized by a more thorough examination of the issues and statements presented in the task. Almost by definition, vigilant groups would be expected to take more time examining and discussing case relevant issues. The relationship between shorter session times for established groups and their poor information sharing performance may suggest that these groups were less vigilant during the decision-making process.

One potential hypothesis which might be developed to account for a lack of vigilance may be tied to the issue of motivation. For instance, although the task was designed to be involving for students (i.e., high intrinsic motivation), the lack of extrinsic motivation for superior performance may have had important and unanticipated impacts on the behavior and performance of established groups. For instance, many established groups may have developed norms which focused on promoting premature agreement rather than on vigilantly making a decision. Prior research has found that superior group performance is associated with a shared commitment to the task (Greene, 1989; Hackman, 1980) and high task based cohesion (Zaccaro & Lowe, 1988). The findings relating to subject involvement in the case suggest that, as planned, the task was involving and rewarding for subjects and thus leaves open the possibility that it was the lack of an extrinsic reward structure that may have contributed to the inferior performance for the established groups.

The results from the study fail to support the hypotheses for GSS and information sharing; no differences were observed between no-tech and GSS groups in information sharing performance. Group size has been found to be an important variable in GSS-supported idea generation (Valacich, Dennis, & Nunamaker, 1992; Valacich, Dennis, & Connolly, 1994). In general, these studies have found that larger groups benefit more from a GSS than do smaller groups. Furthermore, Valacich, Wheeler, Mennecke, and Wachter (1994) found that there was a critical group size of approximately 7 members for groups processing a hidden profile task. When group size was below this critical mass, GSS groups were not able to integrate the case-relevant facts effectively (i.e., the GSS did not assist in convergent task processing). The underlying premise of Valacich and colleagues' proposition appears to be consistent with the results from this research. In addition, these results may point to the need to better define the link between task characteristics and interpersonal influence. For instance, although this task possessed characteristics that could be used to define it as an intellective task, it also included characteristics that are often associated with preference or judgement tasks (e.g., socially sensitive issues). In this case, normative influences may have played a more important role than expected based on prior research on intellective tasks and social influence (Huang et al., 1993). Finally, as noted above, the reported involvement in the case reported by GSS groups was significantly lower than for no-tech groups. The lean communication characteristics of the GSS may have caused GSS group members to feel more disconnected from the task and therefore less motivated to process the task thoroughly.

In terms of satisfaction, the results indicate that established groups and no-tech groups were more satisfied with the process and solution than were ad hoc groups and GSS groups, respectively. The results for the group history treatment confirmed the hypotheses and suggest that group history is an important factor in attitude formation. The results for the GSS treatment, on the other hand, do not support the hypotheses and indicate that the GSS groups were less satisfied. It is likely that the restrictive implementation of the GSS and the nature of GSS interactions help to account for the findings. The GSS communication channel was possibly too lean of a medium to transmit the complex concepts and social cues that people would usually attempt to convey in a socially complex task such as this. The results reported by Noel (1993) linking perceptions of higher restrictiveness to lower process satisfaction and a lower evaluation of the GSS lend support to this argument. Furthermore, these results are consistent with much of the prior laboratory-based research that has found GSS supported groups to be less satisfied than no-tech groups (e.g., Gallupe, DeSanctis. & Dickson, 1988;
Cohesion was found to be positively related to satisfaction across all treatment conditions. The results linking satisfaction and cohesion confirm the results reported by Noel (1993) and others (e.g., Dorfman & Stephen, 1984; Widmeyer & Williams, 1991) and indicate that perceptions of satisfaction reflect not only feelings which members have about the meeting itself, but they also reflect on the group’s shared experiences, interpersonal feelings, and the relationships that exist within the group irrespective of process interventions (Keyton, 1991). Gouran (1973) suggests that perceptions related to the quality of the other participants’ contributions to the group effort have strong impacts on satisfaction. Given this, it seems reasonable that other relational issues such as group cohesion would also have the potential influence satisfaction. The results from this research appear to support this proposition. Furthermore, these results indicate that researchers should be cautious in their use and interpretation of satisfaction instruments, particularly if the results are interpreted without consideration of group composition and cohesion. Likewise, the results indicate that a near significant positive relationship exists between cohesion and information sharing performance for ad hoc no-tech groups. These findings expand on Noel’s (1993) research where a relationship only between cohesion and satisfaction was found.

Finally, the fact that more than ten percent of the groups were deadlocked has important implications for this research and for future research. It appears that there was an interaction between the type of task, the type of GSS, and the type of groups that were used in this research. In addition, the absence of a reward or other form of motivation for successful task completion probably contributed to these findings. The fact that no ad hoc no-tech groups were deadlocked while at least two groups in each of the other treatment conditions were deadlocked supports the view that an interaction between these variables exists.

CONCLUSIONS

As is often the case, this investigation generated more questions than it answered. Nevertheless, several important conclusions and implications for further research can be derived from this study. First, the results confirm that group history is an important variable in research, particularly as it relates to member perceptions. The finding that member satisfaction is related to cohesion suggests that further research is needed to examine the relationship between user satisfaction, group history, and interpersonal attraction. This research also suggests that the nature of the motivation and rewards that are provided to groups, particularly in the context of established groups, are important and should be considered in interpreting research on intact groups. In particular, these results call into question the assumption that the mere use of intact student groups in research is necessarily better than the use of ad hoc student groups. These findings suggest that without adequate motivation and reward structures, established groups can potentially represent an inferior population from which to draw subjects. Finally, the relatively large number of deadlocked groups observed in this research and their influence on the results suggest that additional research should focus on examining factors that lead to deadlocked decisions and how this influences member perceptions and performance.

Generalizations of the results of this study to other contexts are limited by the nature of the experimental setting, the subject population, and the type of task used in this research. For instance, the use of students in experimental research has been criticized (e.g., Gordon, Slade, & Schmidt, 1986). Although the established groups were on-going (i.e., they would continue to work on other projects after the experimental session), they were scheduled to be broken up at the end of the semester. Furthermore, established groups in a field setting working on a task that is involving to them and that has significant potential to impact their lives would be expected to respond quite differently than students. Finally, the one-time nature of this study also limits the generalizability of the findings to other contexts. In particular, over time, groups that use GSS technology would be expected to adapt to and change the way they interact as they continue to use the technology over time (see DeSanctis & Poole, 1994; Hollingshead, McGrath, & O'Connor, 1993; Mennecke, Hoffer, & Wynne, 1992). Therefore, results are likely to differ for groups composed of non-student participants or groups that are studied in longitudinal research.

REFERENCES


