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THE IMPACT OF STRUCTURED DECISION SUPPORT IN COMPUTER CONFERENCES
ON
GROUP DECISION MAKING PERFORMANCE

by

BARBARA CARROLL, M.Sc.

A thesis submitted to
the Faculty of Graduate Studies and Research
in partial fulfilment of
the requirements for the degree of
Doctor of Philosophy
Department of Psychology

Carleton University

Ottawa, Ontario

October, 1989

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ABSTRACT

The aim of this research was to investigate the effectiveness of computer conferencing as an aid to group decision making. In particular, the benefits of structured decision support in computer conferences on measures of group decision making performance were examined. Two forms of structured decision support were used to create two different group discussion atmospheres. The first structured group communication under topic headings corresponding to the four stages of effective decision making. These topic headings were presented simultaneously when participants signed on to the conferencing system and, in order to read and add comments to their group discussion, participants were required to select one heading at a time. The second form of structured decision support used the same topic headings in conjunction with the efforts of a conference moderator who acted as social host and conference chairperson. This moderator was played by the researcher and one of her major tasks was to introduce the four topic headings sequentially so that the group discussion was focussed on only one stage of the decision making process at a time. The decision making performance of groups in these two conferencing conditions was compared with that of groups in unstructured conferences.

It was hypothesized that the three computer conferencing conditions would create different conferencing atmospheres and that, across conditions, those atmospheres would promote more effective group discussion. The major social psychological hypotheses were that structured decision support would have an impact on indices of group decision making performance related to judged decision quality, satisfaction with both decision making processes and decision outcomes, and computer

conferencing experiences. More specifically, it was hypothesized that performance on these types of indices would increase across conditions, from unstructured computer conferences, to passively structured conferences which used only communication structures in the form of topic headings, to actively structured conferences which used both communication structures and a conference moderator

Groups of three to five students participated in computer conferences over a two-week period in order to make recommendations for improving the quality of the services provided by the Trent University Library. Analysis of the transcripts of their conferences showed that the actively structured conferences created a more effective group discussion atmosphere and this was attributable to social host and chairperson roles played by the conference moderator.

There was some support for the major hypotheses in the study. Structured decision support did allow groups to coordinate their discussions so that they were able to make recommendations of higher quality. The type of structured decision support, however, did not influence quality outcomes; groups in the passively and actively structured conferences did not differ in the quality of the recommendations they made. Finally, the relationship between conference structure and the quality of the group recommendations was mediated by the number of potential solutions groups generated to the problems with the Library, and by the degree to which group members experienced a sense of group cohesion.

Neither of the forms of structured decision support had a direct impact on measures of process and outcome satisfaction. However, there was an indirect impact of structured decision support on these two satisfaction measures that was mediated by the social host and chairperson roles played by the conference moderator and by group members' experience of a sense of group cohesion during the

conference.

Based on these findings, a number of directions for future research were outlined. One was related to the examination of the impact of different forms of decision support. Another was related to the development of various aspects of group functioning over a series of decision making conferences. Yet another had to do with aspects of human-machine interface in different computer conferencing systems. A final direction for future research had to do with the investigation of the impact on quality and satisfaction indices of variables such as group size and aspects of organizationware that are typically used to distinguish between different types of group decision support systems.

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Meetings, both formal and informal, are ubiquitous in our society. It is estimated that on average each of us will spend approximately 9000 hours, or 375 days in meetings during our lifetime. Those holding managerial positions will spend considerably more than this. Middle managers typically spend about 35% of their working day in meetings and for top management the figure rises to around 50% (Doyle & Straus, 1976; see also Mintzberg, 1973, Institute for the Future, 1981, or Dennis, George, Jessup, Nunamaker & Vogel, 1988, for even higher estimates).

In general meetings are called to bring a group of people together for two major purposes: information sharing and/or decision making. It is expected that, in future, managers will spend more time in both types of meetings, but that the greatest increases in time investment will occur in those meetings involving group decision making activities. The major reason for this has to do with the nature of modern organizations and the types of decision problems they encounter. Several authors have argued that organizations today are increasingly faced with ill-structured decision problems for which there is no single best solution and for which the quality of a decision is related to the range of information, and the variety of perspectives considered in the decision making process (e.g. Brillhart, 1982; Drucker, 1977; Mitroff, Emshoff & Kilman, 1979; Schweiger, Sandberg, & Ragan, 1986). For these types of problems groups are acknowledged to be more effective decision makers than individuals and there is therefore increasing pressure in organizations to use groups as decision making bodies (cf. Brillhart, 1982; Davis, Spitzer, Nagao, & Stasser, 1978; De Sanctis & Gallupe, 1985; Fisher, 1980; Price, 1975; Turoff & Hiltz, 1982).

The increasing emphasis on groups as the working unit in organizations is coupled with an increasing concern with the problems that plague meetings. Some of these

are economic. Others revolve around scheduling difficulties. Still others have to do with group productivity, and include problems related both to inefficient time use in meetings and to faulty group processes and poor group performance.

Economic problems are now becoming a major concern particularly in decision making meetings. Decision making activities require some sort of group interaction and to enable this participants have typically met in one location. However, the recent trend towards geographically dispersed organizations has meant that those whose expertise is needed for a particular decision are less likely to occupy a single location (Hiltz & Turoff, 1978). Thus, many meetings involve substantial travel. In an inflationary era, and as meetings become more common, the cost of this travel is a growing economic problem for many large organizations (Price, 1975).

In addition to these economic problems, scheduling meetings becomes more problematic as the emphasis on group work increases. When managers spend a greater proportion of their time in meetings it is more difficult to coordinate a number of them to be in the same place at the same time for any particular meeting. This is not such a major concern for information sharing meetings because these are usually scheduled regularly. It is much more of a concern for decision making meetings for these are generally called on an ad hoc basis and must be accommodated within existing schedules (Wilson & Hanna, 1986). Moreover, the concern is compounded when decision making meetings involve travel, for then it is necessary to find and coordinate much larger blocks of time.

As meetings absorb more of managers' time, problems of reduced group productivity due to inefficient time use become more salient (Siebold, 1979). Meetings are acknowledged to be a major "time waster" in organizations (Januz & Jones, 1981; Mackenzie, 1972; Taylor, 1981). Furthermore, while there may be certain social benefits associated with the time wasted in meetings, these benefits are

costly. According to Mosvick & Nelson (1987), this unproductive time costs one Fortune 500 company an estimated \$71 million a year. Again, these time-related problems are more of a problem for decision making than information sharing meetings. In contrast to the predictable agenda and clear set of procedural traditions that characterize information sharing meetings, decision making meetings typically follow a loose agenda and allow freedom to deviate from that agenda (Wilson & Hanna 1986).

Finally, losses in group productivity can stem from the nature of group decision making processes. Within the group decision making and group problem solving literature it is widely acknowledged that group processes are subject to a variety of social influences and communication distortions that can serve to lower group performance and lead to poor decisions and recommendations (e.g., Collins & Guetzkow, 1964; Hoffman, 1965; Huber, 1982; Janis, 1972; Rohrbaugh, 1981; Steeb & Johnson, 1981; Steiner, 1972; Van de Ven, 1974). Once again this reduced performance is most serious for decision making meetings. These meetings typically deal with issues such as planning, resource allocation, policy formation, and negotiation. Consequently, bad decisions can have serious social consequences.

It is apparent from the preceding discussion that while economic, scheduling, time use and group process problems affect all meetings, they represent a greater concern for decision making meetings. The focus here will therefore be on decision making rather than information sharing meetings. Within this context, organizations have become interested in seeking ways to reduce the expenses involved in face-to-face meetings over the past 15 to 20 years (Price, 1975). They have also paid remedial attention to the other three types of problems.

Problems related to scheduling and ineffective time use have traditionally been

addressed within the time management literature. This literature offers a number of strategies for conducting meetings that will enable managers to use their time more effectively (e.g. Januz & Jones, 1981; Kobert, 1980; Mackenzie, 1972; Taylor, 1981). These strategies place the onus on the individual and assume that if each manager plans and controls his/her own time use, then groups of managers will use their joint time more effectively. Even if these strategies work, they do little to reduce the scheduling difficulties inherent in decentralized organizations.

The problems related to ineffective group processes and poor decision making performance have long been recognized both in formal parliamentary and legal contexts and, more recently, have become a major focus of attention in less formal business contexts as well. Traditionally the most popular approach to these problems has been to structure group decision making processes through the use of some sort of procedural rules. Hence, there is a considerable "How To" literature which offers sets of procedural rules, usually comprising some variant of Robert's Rules of Order, to help facilitate effective group discussion during meetings in the belief that this will improve the calibre of the groups' decisions and recommendations (see e.g. Carnes, 1980; Deschler, 1976; Doyle & Straus, 1976; Hellman, 1966; Keesey, 1974; Robert, 1984; Strauss & Strauss, 1964; Sturgis, 1950; Tropman, 1980).

Although time management strategies and procedural rules have traditionally been used to help reduce some of the problems associated with decision making meetings, alternative solutions are now being sought in the burgeoning field of information technology. In the early 1970s the concept of a Wired City, consisting of networks of interactive telecommunications, was popular and spawned research on the use of audio and/or video teleconferences as alternatives to face-to-face meetings (cf. Coll George, Strickland, Guild & Paterson, 1975; Strickland, Guild, Barefoot & Paterson,

1978; Weston, Kristen & O'Connor, 1975). However, this broad-based approach has lost some of its popularity, in large part because visual and audio teleconferences have been relatively inaccessible, expensive and plagued by severe technological constraints (see Johansen, Vallee, & Spangler, 1978, 1979, for a detailed discussion of the different brands of mediated conferencing, and Price, 1975, for an early comparison of costs).

More recently, information technology specialists have taken a more narrow approach which has focussed on decision making meetings alone, rather than on more general forms of group communication. For these researchers, the increasing urgency of the economic, scheduling and time use problems associated with these meetings has provided a major impetus for the development of computer aids to group decision making (see, e.g., Dennis et al., 1988, Kraemer & King, 1988).

There are now a wide variety of computer aids to group decision making available. Although there is no standardized way of classifying these aids, Dennis et al. (1988) have distinguished between two general classes of systems: computer-based systems for group work (CSGW) and group decision support systems (GDSS). According to these authors, these systems differ primarily in the type of support they provide. CSGWs emphasize communication needs and try to provide the means for more effective group communication. GDSSs stress decision making processes and try to provide groups with the kind of directional structure necessary to move towards decisions or recommendations. Thus, although the boundaries between the two types of systems are somewhat blurred, CSGWs usually support group activities other than decision making, while GDSSs are specifically designed as an aid to group decision making.

Within the category of GDSSs a number of different types of support systems have been identified. These are classified along a variety of dimensions including: group

size, group proximity, time dispersion, duration of the decision making session hardware, software, and organizationware (Dennis et al., 1988; De Sanctis & Gallupe, 1985, 1987; Hale & Haseman, 1987; Jelassi & Beauclair, 1987; Kraemer & King, 1988; Rathwell & Burns, 1985). While all these dimensions are pertinent two are fundamentally important for alleviating the kinds of problems with meetings that have been identified above. These are the time dispersion and software dimensions.

As defined by Dennis et al. (1988), time dispersion is concerned with whether a GDSS promotes synchronous meetings (in which all participants must be in the same place at the same time) versus asynchronous meetings (which remove these spatial and temporal constraints). In terms of some of the more pragmatic problems associated with meetings, GDSSs that provide the opportunity for asynchronous communication are most likely to be beneficial. The fact that participants need not be in the same place can alleviate the travel costs associated with many meetings. The fact that they need not participate in the meeting at the same time offers participants the advantage of working in their own offices or homes, and signing in and out of the meeting at their own convenience (Hiltz & Turoff, 1978). Hence, scheduling difficulties are likely to be greatly reduced.

The second aspect of GDSSs that is particularly important for helping to reduce some of the problems associated with decision making meetings is the software dimension. The software in a GDSS typically supports and facilitates the solution of decision problems by providing groups with some method for structuring their decision analysis (Kraemer & King, 1988). GDSSs differ in the degree to which they intervene in groups' decision making processes, with more sophisticated GDSS technology attempting more dramatic interventions (De Sanctis & Gallupe, 1987).

Kraemer & King, 1988). However, despite these differences, GDSS software is designed to improve group productivity in two major ways. First, and most importantly, it attempts to increase decision making effectiveness by encouraging groups to adopt structured decision making processes (e.g., Brillhart, 1982; Hirokawa, 1980; Maier & Maier, 1957; Rohrbaugh, 1981; Schweiger et al., 1986; Van de Ven, 1974). And second, by maintaining a strict focus on the decision problem at hand. GDSS software can also encourage groups to become more task oriented, to reduce the degree of tangential interchange, and, hence, to reduce the amount of time wasted during decision making meetings (cf. Dennis et al., 1988; Kraemer & King 1988).

Despite the promise that at least asynchronous GDSSs may help overcome the pragmatic and productivity problems that are common in meetings, Kraemer and King (1988) have noted that this potential has not been realized. A number of reasons for this have been offered. First, as Dennis et al. (1988) have pointed out, most of the existing GDSSs are synchronous rather than asynchronous. Second, Kraemer and King (1988) have criticized the type of structured decision analysis provided by GDSS software. They claim that in most GDSSs the type of decision analysis offered is governed by technology rather than an understanding of groups' decision making processes. As a result, GDSSs typically provide structured decision processes such as decision trees, multiattribute utility analysis or Delphi techniques. These computer models limit group interaction, quantify groups' decision making processes and endorse a rational model of group decision making. According to Kraemer and King (1988), GDSSs can only hope to be successful when the non-rational aspects of group decision making processes are acknowledged and when software supports the kind of decision making processes groups actually use, rather than those they should rationally use.

Given these realities, the GDSSs that are most likely to help solve the pragmatic problems that plague meetings and, at the same time, enhance groups' decision making performance are those that are asynchronous and incorporate the kinds of decision making processes effective groups naturally use. Perhaps the most fundamental aspect of these processes is that they are qualitative rather than quantitative. Thus, asynchronous GDSSs that emphasize group discussion and group communication, and that provide the software to promote effective communication, would seem to have the greatest potential to ease economic and scheduling problems in decision making meetings and, at the same time, improve group productivity (cf Hiltz & Turoff, 1978; Huber, 1984; Schwartzman, 1987).

GDSSs of the type just described would essentially incorporate the kind of communication emphasis now associated with CSGW. Dennis et al. (1988) have recently proposed such a union in what they have called electronic meeting systems (EMS). They outline a number of different EMSs including two that allow asynchronous participation when group members are in remote locations. These two are computer conferences and local area decision nets. According to Dennis et al (1988) the distinction between the two is one of group size, with the term computer conference being reserved for communication between large groups. Not all authors make such a distinction, however, and for the purposes of this paper computer conferencing will be used as a generic term to include both computer conferences (in Dennis et al.'s (1988) sense) and local area decision nets.

Computer conferences may include three types of hardware support, each emphasizing different channels of communication. They may use visual and audio channels, audio channels only, or neither visual nor audio channels. In this latter case, computer conferences rely solely on written communication. Of the three types of computer conferences, visual and audio conferences bear the greatest resemblance

to face-to-face meetings and therefore may offer the most natural forms of communication. However, as discussed earlier, they have been generally economically and technologically prohibitive. Therefore, at least at present, computer conferencing that relies on written communication seems to offer the greatest hope for some success in dealing with the problems that so often characterize meetings. On these grounds it will be the focus of the present discussion.

Although computer conferences differ in their level of sophistication, a typical conference consists of a number of individual computer terminals that are normally linked to a central computer either by telephone lines or switching networks such as TELENET or DATAPAC (Tombaugh, 1984). This central computer serves as the metaphorical conference host. It provides a common writing space (computer memory) where group deliberations occur and keeps a complete running record of all comments entered. When participants sign on they are automatically brought up to date on the proceedings that occurred in their absence. They can scan the titles of new entries and read those of interest or importance, and they can reread old entries. They can then type in any responses they wish to make to existing entries and any additional topics or comments they wish to bring up for group discussion. After editing these responses and additions the final versions are stored in the conference computer and are available to other conference participants. At the end of the conference, or at any time during the proceedings, a complete written transcript of the meeting can usually be obtained either for circulation or to allow participants to reflect on the overall discussion (cf. Hiltz & Turoff, 1978; Johansen et al., 1978b, 1979; Kerr & Hiltz, 1982; Tombaugh, 1984).

While there has been much speculation about the potential of computer

conferencing as an effective aid to group decision making, there has, as yet, been very little empirical investigation of the impact of this form of mediated communication on measures of decision quality. Most of the literature related to this area has investigated the dynamics of group communication in computer conferences. Thus, while existing research can provide some insights into the type of communication patterns fostered by computer conferences, there has been virtually no investigation of the relationship between these patterns and decision outcomes. There has also been a total lack of empirical research on the impact of varying the decision support provided by computer conferencing software on either group communication patterns or group decisions.

The investigation of questions related to the impact of computer conferencing on decision quality would appear to be a matter of some importance, because computer conferences appear to have a rosy future. There are a number of major computer conference in use (see Vallee, Johansen, Lipinski, Spangler, & Wilson, 1978; Rice, 1980, or Kerr & Hiltz, 1982, for examples). They are becoming increasingly common (Hiltz & Turoff, 1978; Kiesler, Siegel, & McGuire, 1984; Stockton, 1981). They have gained some degree of acceptance, at least among those who have already participated in them (Hiltz & Turoff, 1978; Kerr & Hiltz, 1982; Rice, 1980; Tombaugh, 1984). Finally, even more than a decade ago, they were identified as one of the forms of electronic meetings that, together, were expected to replace up to half of all face-to-face meetings in the future (Short, Williams, Christie, 1976; Williams, 1977; but see Dormois, Fioux, & Gensollen, 1978, for a more conservative estimate). Given this promise, research that investigates the quality of decisions made by computer conferencing groups can help determine the conditions under which computer conferencing can provide the kind of support for group decision making activities that will help improve group productivity and outcomes.

The research proposed here will begin the investigation of the impact of computer conferencing on the quality of group decisions. The paper will begin by reviewing the research related to the impact of computer conferencing on indices related to group decision making performance. Following this, ways of improving group decision making performance by structuring decision processes in interactive computer conferencing discussions will be considered. Finally, a major study will be proposed to examine the impact of different forms of decision process support in computer conferences on indices of group decision making performance.

COMPUTER CONFERENCES AND GROUP DECISION MAKING PERFORMANCE

As already mentioned, the relationship between computer conferencing and decision quality has not been a major focus of attention in the research literature. In 1978 Hiltz and Turoff identified the impact of computer conferencing on decision quality as an important research question. In 1985, nearly a decade later, De Sanctis and Gallupe reiterated the importance of the same question. However, with few exceptions, the problem has been almost totally ignored in the research literature.

There are several possible reasons for this neglect. One is that, while computer conferences have been in use since about 1970, the emphasis on computer conferences as aids to group decision making has occurred only in the last few years (see De Sanctis & Gallupe, 1985; Huber, 1984). A second is that developments in the field of computer conferencing have occurred very rapidly so that most researchers in the area are still preoccupied with hardware design, software innovations, questions related to the economic and technical benefits of computer conferencing, and questions related to human-machine interface. Only recently are some researchers beginning to ask questions related to both the nature of the social psychological processes that operate in computer-mediated communication, and the effectiveness of computer conferences as an alternative to face-to-face meetings in organizations (cf. Hiltz & Turoff, 1978; Kerr & Hiltz, 1982; Kiesler et al., 1984; Price, 1975; Siegel, Dubrovsky, Kiesler, & McGuire, 1986).

Whatever the precise reason for the dearth of research on the relationship between computer conferencing and decision quality, it is still the case that much of what is known in this area is speculative in nature. Much of the emphasis is on the

ways in which computer conferencing should help groups make better decisions, rather than the ways in which this medium actually does improve the quality of group decisions. The results of those few studies that have investigated group decision making performance in computer conferences are somewhat difficult to interpret. One major reason for this is that researchers have used a range of very different indices of decision quality to assess group decision making performance.

Within the literature on group decision making and group problem solving a wide variety of indices have been used to assess the quality of group decisions (see, e.g., Rubin, 1984). These fall into two general classes: those dealing with quality and those dealing with satisfaction. Both types of indices are considered necessary to assess group decision making performance on the grounds that "good" decisions are only effective if they can be implemented, and implementation is more likely when groups report high levels of satisfaction (cf. Brilhart, 1982; Dewey, 1910; Maier, 1963; Van de Ven, 1974, or Wilson & Hanna, 1986, for recognition of this point).

Indices related to issues of quality may focus directly on the decisions made by groups and provide a measure of the degree to which these decisions can be considered to be good according to some criteria. Alternatively, they may be indirect measures of decision quality and focus on the effectiveness of group processes prior to reaching a decision. The assumption underlying the use of these intermediate measures of decision quality is that the better the decision making processes employed by groups, the more effective their communication during their discussion and the better their final decision (cf. Bayless, 1974; Brilhart & Jochem, 1964; Fisher, 1980; Guetzkow & Cyr, 1964; Janis, 1972; Janis & Mann, 1977; Maier, 1963; Maier & Hoffman, 1960; Strauss & Strauss, 1964; Wanous & Youtz, 1986).

Indices related to satisfaction are typically of two types. Some deal with process

satisfaction and measure the extent to which group members are satisfied with the group's decision making procedures, or the way in which groups go about discussing some problem and agreeing upon a solution. Others deal with outcome satisfaction and measure the extent to which group members are satisfied with the final group decision and the extent to which they would be satisfied if their decision was implemented. These indices of outcome satisfaction are often referred to as measures of acceptance (Maier, 1963). In the face-to-face literature Van de Ven (1974) has argued that both process and outcome satisfaction measures are necessary in the evaluation of group decision making performance. When group discussions occur in computer conferences it seems likely that one other type of satisfaction measure is pertinent: satisfaction with computer-mediated communication. Indices of this type would essentially tap the nature of group members' experiences with aspects of computer conferencing. Such indices are likely to be important for the assessment of group decision making via computer because when participants in a decision making computer conference are not satisfied with the medium they will tend not to become conference regulars. As a result, the group discussion will lack momentum as well as content, and participants' satisfaction with group processes will likely decline. In addition, at least in real world settings, acceptance of the final decision may be a problem group members who either do not participate or participate minimally.

In face-to-face group decision making research, then, group decision making performance has been judged according to four different criteria. Thus, groups perform well and make good decisions when the quality of their decisions is judged to be high, when decisions are based on an effective analysis of the decision problem, when group members are satisfied with their group's decision making processes and when they can accept the group's final decision. In computer conferences it seems

reasonable to suppose that groups will perform well and make good decisions if the same four criteria are met, and, in addition, if group members report the kinds of positive computer conferencing experiences that encourage active participation. The following discussion will review the research literature related to the impact of computer conferencing on each of these five types of measures of group decision making performance.

The Impact of Computer Conferencing on Direct Measures of Decision Quality.

Direct measures of decision quality may be either objective or subjective. Objective measures are those in which a group of judges agree upon a correct or best quantitative solution to a particular problem. Given this solution, researchers using the same decision problem can calculate a difference measure for each subject group as an indication of whether its decision is a good one. On the other hand, subjective measures of a decision's "goodness" rely directly on the ratings of usually two and seldom more than three experts.

Of the three studies to examine the impact of computer conferencing on direct measures of decision quality, two have used decision tasks that allow for objective assessment of decision quality. All have compared the decisions made by computer conferencing and face-to-face groups. All have used synchronous conferencing systems which require group members to interact simultaneously in a single experimental session. And all have used systems that did not actively support group decision processes in any way. Instead the systems were unstructured: group members simply typed in their comments chronologically and any data analysis needed was done by hand.

In the first of these three studies, Turoff and Hiltz (1982) had groups of five

solve the Lost in the Arctic Problem which involves the rank ordering of the importance of 15 items for surviving in an arctic environment (see Eady & Lafferty, 1974, for details). In the study, individual group members first rank ordered the 15 items. Following this each group discussed the five different rank orderings until they reached consensus on a single ordering. The quality of the group's decision was calculated by summing the squared deviations of the differences between the group's rank order and the standard order determined by RCMP officers trained in subarctic rescue. With this task, Turoff & Hiltz (1982) found that the decisions made by computer conferencing groups were as good as, but no better than those reached by face-to-face groups. In both conditions, groups reached solutions that were objectively judged to be 25% closer to the criterion than the solutions generated by individual group members prior to discussion.

Turoff and Hiltz (1982) apparently found a very similar result for a qualitative, value-laden personnel selection problem without a single correct solution. The measure of improvement in decision quality for this task was, however, not reported.

Related to these two studies, Siegel et al. (1986) employed a similar methodology to compare the decision making performance of face-to-face versus computer conferencing groups (see also Kiesler et al. 1984). Using Stoner's (1961) choice-dilemma problems, they found that computer-mediated groups demonstrated significantly greater choice shift than face-to-face groups. However, they did not investigate the relationship between these "riskier" decisions and judgements of their quality.

Taken together, these results suggest that the decision outcomes of computer conferencing groups can be similar to those of face-to-face groups, at least in

synchronous computer conferences which mimic face-to-face meetings in that group discussion occurs chronologically and group decision making processes are unconstrained. Whether or not these same findings hold for the kinds of asynchronous conferences that may help alleviate the economic and scheduling problems that often plague meetings is, as yet, unclear. Similarly it is not known whether computer conferencing and face-to-face groups will make decisions of comparable quality when they are faced with decision tasks that are less experimental and more representative of the types of ill-structured problems that are commonly encountered in organizations today.

Despite these qualifications, however, the results of the studies reviewed above are provocative. They indicate that, at least in some contexts, computer conferencing in its most elementary form is not detrimental to group decision making efforts. This, in turn, suggests that more sophisticated conferences that provide software support for decision making processes which facilitate group communication may, in fact, be helpful for improving the quality of group decisions. Indeed, there is some indirect support for this contention in the broader GDSS literature (see Jarvenpaa, Rao, & Huber, 1988; Steeb & Johnston, 1981; also, for a review, see Dennis et al., 1988). There is also some similar support in the face-to-face group decision making literature (see Brillhart, 1982; Erffmeyer & Lane, 1984; Guzzo & Waters, 1982; Hirokawa, 1980; Nemiroff, Pasmore, & Ford, 1976).

The Impact of Computer Conferencing on Group Discussion Effectiveness

Measures of group discussion effectiveness have their origins in the group problem solving literature. Although many authors do not distinguish between the

terms decision making and problem solving, those who do consider problem solving to be a much broader process (see e.g. Brillhart, 1982). For them, groups are involved in decision making when they are presented with a set of decision alternatives and must choose one. They are involved in problem solving when they must gain an understanding of the problem and generate and evaluate a range of possible solutions prior to reaching a decision (Davis, 1973; Wilson & Hanna, 1986). Thus, in problem solving, much greater emphasis is placed on the group discussion that precedes the choice of one from a range of possible decisions.

Within the literature, two major measures of the effectiveness of group discussions have been used. One is the number or quantity of decision alternatives generated by a group faced with a particular decision problem, and the second is the judged quality or "goodness" of those alternatives. The greater the number of decision alternatives raised by group members and the higher the judged quality of those alternatives, the more effective the group discussion.

While measures of the quantity and quality of solution alternatives generated by groups have been the most commonly used measures of group discussion effectiveness, the time taken to make a decision has also been used. As Rubin (1984) has noted, groups that take less time to generate and evaluate the same range of decision alternatives can be assumed to have used better decision making procedures and to have conducted a more effective discussion. These groups are better able to keep their discussions focussed, to move towards a decision and, when the decision problem is value-laden, they are more successful in reaching a consensus (cf. Doyle & Straus, 1976; Gardiner & Edwards, 1975).

The impact of computer conferencing on the quantity and quality of solution alternatives and on the time taken to reach a decision has received little direct research attention. The major reason for this is that computer conferencing

research has not been primarily concerned with the effectiveness of group discussions in a decision making context. Instead, as a reflection of the emphasis on information exchange in computer conferences, researchers have addressed the more general issue of the effectiveness of computer-mediated group communication, usually as an end in itself. Nevertheless, in both theoretical and empirical comparisons of computerized and face-to-face group communication, researchers have been interested in issues related to the quantity of ideas raised, the quality of those ideas, and the efficiency of electronic group communication. They have also been interested in the accuracy with which information is exchanged during computer conferences. In addition, some researchers in the general communication literature have addressed similar issues in communication modes, such as typewritten communication, that resemble some aspects of computer-mediated communication. These two research literatures are relevant for the present discussion because they can provide some insights into the potential effectiveness of computer conferencing as a medium for group decision making.

1. Computer conferencing and the quantity of ideas expressed

Virtually all the studies in this area have used synchronous, unstructured computer conferences. Within this framework, McGuire, Kiesler and Siegel (1987) found that computer conferencing groups working on Stoner's (1961) Choice Dilemma Problems produced fewer arguments or ideas than face-to-face groups. However, most of the empirical evidence suggests that computer conferencing groups have at least the potential to generate a wider range of ideas or opinions than groups who meet in person.

Studies which have compared face-to-face groups with computer conferencing groups have generally found that participation levels for group members are more

equal in computer conferences and that the discussion is less likely to be dominated by the views of a single individual (Hiltz & Turoff, 1978; Kerr & Hiltz, 1982; Kiesler et al., 1982; Siegel et al., 1986; Williams, 1977). In addition, because social pressures to conform are less intense in computer conferences, researchers have also found that there is less overt agreement, and a greater frequency of opposing opinions, in these conferences (Hiltz & Turoff, 1978; Turoff & Hiltz, 1982). According to a recent study by Jessup, Tansik, and Laase (1988), these results may be most pronounced when participation is anonymous.

Together these findings imply that, compared to face-to-face groups, a greater proportion of the participants in a computer conference are likely to offer their ideas, opinions or perspectives on a particular issue. Furthermore, because participants are more willing to contradict the opinions of others in the group, the range of ideas expressed is likely to be greater than is the case in face-to-face contexts. Consistent with this, there is some evidence to suggest that computer conferencing groups do, in fact, generate more opinions than groups who meet in person (Hiltz & Turoff, 1978; Turoff & Hiltz, 1982).

On the other hand, there is also some evidence that, at least in well-established computer conferences, groups are more likely to engage in swearing and name calling, and to exchange insults and hostile comments than their face-to-face counterparts (Kiesler et al., 1982; Siegel et al., 1986). The extent to which this "flaming" occurs is unclear. Siegel et al. (1986) have suggested that their finding of more uninhibited comments might not be generalizable to other computer conferences. However, to the extent that this flaming does occur, it may inhibit participants' willingness to offer opinions and so reduce the number of ideas generated by the group.

If computer conferencing groups do generate more ideas and opinions than those who meet in person, then the potential benefits of computer conferences as aids to group decision making are likely to be greatest when groups are faced with the kind of ill-structured decision problems which are now common in organizations and for which there is no single best solution. For problems such as these, the quality of the final decision is dependent upon the variety of perspectives considered (Brilhart, 1982; Mitroff et al., 1979). Thus, for these types of problems, groups who generate a greater number of perspectives would be expected to have more effective discussions and, hence, a greater chance of making a good decision. However, this assumes that computer conferencing groups consider the full range of ideas generated and there is some very preliminary evidence to suggest that, at least for a sample of business managers, this may not be the case (Kiesler et al., 1982).

2. Computer conferencing and the quality of ideas expressed

There is some indirect evidence to suggest that the ideas and opinions expressed by computer conferencing groups may be of higher quality than those generated by face-to-face groups. Compared to oral communication, written communication provides a more permanent record of ideas and opinions. Because of this, there is some evidence to suggest that, when ideas are written, their authors tend to feel more accountable for them. They therefore have a greater tendency to deliberate about what they write, are less likely to communicate ideas that are incorrect and, as a consequence, they are more committed to their final product (Fondacaro & Higgins, 1984).

These results suggest that when groups rely on written, rather than oral communication, group members are more careful about what they commit to paper and, on these grounds, they may produce ideas of higher quality. There is some conceptual support for this argument in the computer conferencing literature. Hiltz

and Turoff (1978) suggest that because computer conferencing relies on a single written channel of communication it represents a less emotional and more rational form of communication. Consequently, computer conferencing groups are likely to be more task oriented than face-to-face groups and, on these grounds, their written discussions may be of higher quality than verbal discussions delivered face-to-face. However, in her evaluation of an international scientific computer conference, Tombaugh's (1984) respondents identified the poor quality of information as a significant barrier to effective communication (see also Thorngate, 1985). Given this, it may be that computer conferencing groups can generate high quality ideas, but that they do so only when ownership of those ideas is not an important issue.

3. Computer conferencing and communication efficiency

The results of studies that have compared the efficiency of computer-mediated versus face-to-face communication have been inconsistent. There is little debate about differences in the volume of the communication exchanged by groups in the two conditions when they are required to work on a specific decision task. When either groups using synchronous, unstructured computer conferences, or groups who rely on written communication are compared to face-to-face groups in this context, the findings are consistent: face-to-face groups tend to produce two to three times the verbiage generated by the computerized groups (Chapanis, Ochsman, Parrish, & Weeks, 1972; Fondacaro & Higgins, 1984; Kiesler et al., 1984; Siegel et al., 1986; Turoff & Hiltz, 1982; Williams, 1977).

The reduced volume produced by computer conferencing groups in a decision making context is, however, indicative of increased efficiency only if it is not associated with a reduction in the thoroughness with which groups discuss the decision problem. It is the evidence as to whether this volume/thoroughness trade off occurs in computer conferencing groups that is contradictory.

McGuire et al. (1987) suggest that, at least under certain conditions this trade-off does occur. On the basis of their research using synchronous computer conferences and a limited discussion time, they attributed the difference in communication volume to the fact that computer-mediated groups engage in a more superficial discussion of the decision problem than face-to-face groups. Siegel et al. (1986) found a similar pattern under the same conditions. Although both the computer-mediated and face-to-face groups in their study devoted an equal proportion of their discussion time to task related communication, the greater volume of communication produced by the face-to-face groups indicated a more thorough discussion of the decision task.

On the other hand, under the same conditions, Turoff and Hiltz (1982) reached the opposite conclusion about the relative efficiency of computer conferencing and face-to-face groups. On the grounds that the computerized and face-to-face groups in their studies reached decisions of equal quality, they argued that there was more "wasted" communication in face-to-face contexts. This suggestion that the written communication in computer conferences is better organized and more concise than face-to-face communication receives some support from Fondacaro and Higgins (1984), who found that oral communication required twice as many words as typewritten communication to produce an equally informative statement.

Taken together, the results of studies on communication efficiency in computer conferences suggest that, when discussing a decision problem, the volume of communication generated by computer conferencing groups is less than that produced by face-to-face groups. However, at least for synchronous computer conferences that are of relatively short duration (up to 30 minutes for the studies reported above), it is unclear whether this reduced volume is associated with a gain or loss in

discussion thoroughness. In either case, McGuire et al. (1987) have suggested that computerized groups using asynchronous conferences, and without a 30 minute time constraint, may undertake a more thorough discussion of the decision task. The evidence to support this contention is mixed. Certainly, studies have consistently found that computer-mediated groups take much longer to reach a decision than face-to-face groups (Kerr & Hiltz, 1982; Kiesler et al., 1984; Siegel et al., 1986; Turoff & Hiltz, 1982). However, it is not at all clear that this increased time translates into a more thorough discussion. In fact, the majority of the relevant research evidence indicates other reasons for the additional time.

The increased time required by computer conferencing groups is partly due to the fact that typewritten communication takes longer than oral communication (Chapanis et al., 1972; Williams, 1977). In asynchronous conferences it is also partly attributable to the fact that group members are free to sign on at their own convenience and, as a result, considerable time is spent waiting for the contributions of others (Hiltz & Turoff, 1978). Over and above these reasons, however, the increased time taken by computer conferencing groups to reach a decision seems to be specifically related to the nature of group communication via computer.

Most of the studies that have shown computer conferencing groups take longer to reach a decision than groups who meet in person, have also demonstrated that computer conferencing groups have greater difficulty reaching agreement on a decision (Kerr & Hiltz, 1982; Kiesler et al., 1984; Siegel et al., 1986; Turoff & Hiltz, 1982). Researchers have claimed that the major reason for this is related to the lack of social interaction in computer conferences. Williams (1977) has suggested that, at least when group members hold conflicting opinions, the more depersonalized nature of computerized communication means that group members

are more likely to lose sight of their audience and, consequently, are less likely to compromise their position (see Kiesler et al., 1986, for empirical validation of this point). In addition, it has been suggested that, without the social interaction and cohesion that is present in face-to-face groups, at least unstructured computer conferencing groups have great difficulty coordinating and directing their efforts in order to move towards a decision (cf. Hiltz & Turoff, 1978; Turoff & Hiltz, 1982; Williams, 1977).

Consistent with this last point, research has shown that computerized discussions frequently lack focus and direction (e.g. Tombaugh, 1984; Vallee, Johansen, Randolph, & Hastings, 1978). Comments are typically retained in the order in which they were entered and thus often lack a logical sequence. Multiple topic threads are common and although printed transcripts do give a full account of the conference proceedings, they are often confusing and difficult to follow (Hiltz & Turoff, 1978; Kerr & Hiltz, 1982). Thus, it seems that while individuals in a computer conference may offer comments that are concise and relatively thoughtful, the group as a whole has difficulty establishing the kinds of procedural rules that would allow them to coordinate and integrate those comments to reach a decision.

4. Computer conferences and communication accuracy

There has been some speculation within the computer conferencing literature that computer-mediated communication might be more effective than face-to-face communication because it is a more accurate reflection of the comments offered by participants and, hence, is less subject to bias. Participants in a computer conference can, at any time, request a written transcript of the conference proceedings that is both accurate and detailed. In this way, the host computer acts as exactly the kind of unbiased group memory that Doyle and Straus (1976) have considered to be an essential ingredient to effective communication in meetings (see

Kerr & Hiltz, 1982).

The implication of this feature of computer conferences for group decision making is that computerized groups are more likely than face-to-face groups to base their decisions on the information and ideas that are actually exchanged during the group discussion, rather than on a distorted recollection of them. This advantage is likely to be most important for decision problems for which there is not a single, best solution because, in these situations, groups are often required to exchange large volumes of information before they are in a position to make a decision (cf. De Sanctis & Gallupe, 1985; Hiltz & Turoff, 1978, 1985; Johansen et al., 1979; Kerr & Hiltz, 1982; Mitroff et al., 1979; Price, 1975; Turoff & Hiltz, 1982).

While the fact that computer conferencing discussions are written helps reduce the kinds of memory distortions that can bias group decision making processes, it also has a potentially negative consequence. As Hiltz and Turoff (1978) have noted, comments in electronic meetings are on permanent record and, as such, are legitimized. Consequently, faulty information is legitimized to the same extent as correct or valid information and, without the non-verbal gestures which serve as quick self-correcting mechanisms in face-to-face meetings, it can be quite difficult to offset the effects of erroneous statements in computer conferences. Obviously, then, the provision of a written record of the conference proceedings is likely to be of benefit to computerized decision making groups, only to the extent that the transcript is based on good, sound information.

5. Summary

The preceding review has attempted to assess the impact of computer conferencing on group decision making processes along four major dimensions: the quantity of ideas or alternatives, the quality of those ideas or alternatives, communication

efficiency and communication accuracy. The factors facilitating and inhibiting group performance in unstructured conferences on each of these dimensions are summarized below in Table 1.

As can be seen from Table 1, unstructured computer conferences have the potential to support effective group communication and decision making activities. However, there are also a number of factors which prevent this potential being realized (see Johansen et al., 1979, for recognition of this point). The extent to which the kinds of inhibitory factors summarized in Table 1 actually do limit the potential of unstructured computer conferences to support group decision making activities is unclear because, in any computer conference, these factors typically coexist and almost certainly interact with each other in complex ways.

Despite this uncertainty, however, there are a number of possible reasons why unstructured computer conferences may limit the effectiveness of group communication and decision making. One is that unstructured computer conferences do not provide any kind of group process support to organize, coordinate and direct group discussions. Another is that most of the conferencing systems on which the above findings are based are synchronous and involve relatively short experimental sessions. These conferences therefore do not allow for the kind of temporal flexibility that may encourage participants to devote more effort to the decision task, and encourage the development of a sense of group cohesion that could provide a buffer against many of the communication difficulties outlined in Table 1. Thus a very different picture may emerge from the use of asynchronous conferences that are structured to provide active support for group decision processes.

TABLE 1: Factors Facilitating and Inhibiting Group Performance in Unstructured Computer Conferencing

Measures of Effective Group Discussion	Facilitating Factors	Inhibiting Factors
Quantity of ideas	<ul style="list-style-type: none"> - Egalitarian participation - Discussion of pros and cons 	<ul style="list-style-type: none"> - Negative personal comments
Quality of ideas	<ul style="list-style-type: none"> - Emphasis on rationality - Opportunity to deliberate over input 	<ul style="list-style-type: none"> - Issues related to ownership of ideas
Efficiency	<ul style="list-style-type: none"> - Written communication organized & concise 	<ul style="list-style-type: none"> - Typing is slow - Time-limited discussions superficial - Need to wait for others' comments - Difficult to coordinate and direct discussion - Hard to follow discussion when information volume is large
Accuracy	<ul style="list-style-type: none"> - Written transcript reduces memory distortions 	<ul style="list-style-type: none"> - Incorrect info. legitimized and hard to correct

**The Impact of Computer Conferencing on Members' Satisfaction
with Group Decision Making processes**

Measures of group members' satisfaction with their decision making processes

have received very little direct attention in computer conferencing research. However, there is some indirect evidence from which the level of group members' satisfaction with their decision processes may be inferred.

Johansen, De Grasse, & Wilson (1978) reported that members of three established computer conferencing systems found electronic communication more appropriate for asking questions, exchanging information and opinions, airing general ideas, giving orders and staying in touch, than they did for decision making, problem solving and related activities such as resolving differences of opinion, bargaining and persuasion (also Rice, 1987). However, the meaning of these findings is not entirely clear. They may reflect a generalized dissatisfaction with computer-aided group decision making. They may reflect a more specific dissatisfaction with the types of support for group decision processes provided in the three computer conferences studied. Or, they may simply reflect a lack of experience with decision making in these computer conferences.

The idea that groups may be opposed to any form of computer-aided group decision making has been addressed in the broader GDSS literature. Here there is some suggestion that groups may be dissatisfied with the kinds rational, quantitative computer models of group decision making that predominate in GDSS development (Kraemer & King, 1988; but see Dennis et al., 1988, or Jarvenpaa et al., 1988). Whether this dissatisfaction generalizes to the kinds of unstructured, qualitative, communication oriented conferences used in the research conducted by either Johansen et al. (1978b) or Rice (1987) is unclear. There is some reason to believe that it may. As already mentioned, groups using these kinds of conferences find it very difficult to coordinate and direct their discussion towards a decision (Hiltz & Turoff, 1978; Turoff & Hiltz, 1982; Williams, 1977). Hence, groups using unstructured conferences generally seem to be unable to structure their own

decision processes and, under these conditions, low levels of process satisfaction would be expected. However, if the kinds of conferences that allow qualitative group discussion were structured to provide the type of support groups cannot appear to generate for themselves, then the degree to which participants are satisfied with their decision processes should increase (cf. Tombaugh, 1984).

The Impact of Computer Conferencing on Group Members'

Satisfaction with Decision Outcomes

In the face-to-face group decision making literature, measures of outcome satisfaction or acceptance are usually included in research studies to assess the degree to which those who make group decisions would be willing to live with the consequences of their decisions. High levels of acceptance are believed to indicate a strong willingness to implement group decisions or recommendations. Given this, it is hardly surprising that indices of outcome satisfaction have been ignored in the computer conferencing literature.

As is apparent from the earlier section dealing with the impact of computer conferencing on direct measures of decision quality, very few studies have investigated computer conferencing as an aid to group decision making. Those that have, have not measured outcome satisfaction or acceptance. This omission is understandable because these studies have typically selected decision tasks to be consistent with past literature and for the convenience of an objective measure of decision quality. Thus, they have used tasks such as the Lost in the Arctic problem (Turoff & Hiltz, 1982), Stoner's Choice Dilemma problem (Kiesler et al., 1984; Siegel et al., 1986), and a personnel selection problem known as "Forest Ranger"

(Turoff & Hiltz, 1982).

These tasks have little relevance in the lives of subjects participating in the research projects. Any suggestion that the solutions agreed upon would be implemented would therefore have little impact upon subjects. Hence, questions related to acceptance would be likely to be perceived as having limited meaning, and the answers to those questions would tend to be somewhat arbitrary.

While the omission of measures of outcome satisfaction has not been too serious in the research on group decision making in computer conferences that has been conducted so far, it is likely to be of greater concern in studies where groups use computer conferences to make decisions about real world problems that are chosen according to criteria of subject relevance and importance, rather than convenience and/or tradition. In such studies the issue of acceptance of group decisions is both meaningful and important for the assessment of group decision making performance in computer conferences.

Group Members' Computer Conferencing Experiences

Studies that have examined group members' computer conferencing experiences have focussed on their satisfaction with computer-mediated communication. The results of these studies have generally found that, at least once they are used to it, participants accept and are satisfied with this electronic communication medium (Hiltz & Turoff, 1978; Kerr & Hiltz, 1982; Johansen, et al., 1978a; Tombaugh, 1984; Vallee, Johansen, Randolph, & Hastings, 1974). Not all those who initially express an interest in a particular computer conference become regulars, however. In fact, the evidence suggests that approximately 50% of potential users either fail

to participate at all, or do so very infrequently (cf. Kerr & Hiltz, 1982; Thorngate, 1985; Tombaugh, 1984).

The high proportion of non-participants may suggest a dissatisfaction with or dislike of computer-mediated communication. However, empirical research suggests that failure to participate in a computer conference generally has more to do with problems related to accessibility, the availability of training materials, participation costs, and lack of time than with problems stemming directly from the nature of the communication in a computer conference (cf. Hiltz & Turoff, 1978; Kerr & Hiltz, 1982; Thorngate, 1985; Tombaugh, 1984).

For those who do participate in computer conferences, the level of satisfaction they experience with the conferencing system seems to depend on a large number of variables. Some of these include the variables mentioned above as participation deterrents. However, Kerr and Hiltz (1982) have identified a number of other factors as well. They suggest that individuals are more likely to be satisfied with computer conferencing when, for example, they perceive the task to be relevant, when they have positive attitudes towards computers, when they experience a sense of group cohesion either prior to or during the conference, when the group climate is perceived to be positive and supportive, and when individuals value the process of communicating with others. Thus, satisfaction with computer conferencing seems to be influenced by a personal motivation to communicate via computer, and by social factors.

The emphasis on social factors is particularly important because computer conferencing, as a medium, eliminates visual information about other group members, facial expressions, eye contact and non-verbal gestures. It therefore does not, in itself, allow the kind of social interaction that typically helps build a sense of group spirit and group support in face-to-face situations (Hiltz & Turoff, 1978).

This restriction does not eliminate the possibility of a supportive, cohesive group environment, however. Instead, Kerr and Hiltz (1982) have claimed that it merely increases the attention group members devote to these dimensions. Over time, groups do seem to exchange personal information, get to know each other, and so establish social bonds (cf. Hiltz & Turoff, 1978; Kerr & Hiltz, 1982). One inference to be drawn from this evidence for the development of social relationships in computer-mediated communication is that asynchronous conferences, with their extended temporal framework, are more likely to foster a sense of group cohesion and mutual support than synchronous conferences. If so, then participants in asynchronous conferences would be expected to report more positive conferencing experiences than participants in synchronous conferences.

In addition to whether a conference is synchronous or asynchronous, member satisfaction with computer conferencing is also likely to be related to the kind of decision support provided by a particular conference (Hiltz & Turoff, 1978). Obviously the quantitative, rational decision processes found in most GDSSs are likely to make it more difficult to establish social contact, and to develop a sense of group cohesion, than the qualitative, communication based alternative offered by computer conferencing. Similarly, it seems reasonable to suppose that some forms of decision support in computer conferences may be more likely to facilitate a sense of cohesion more than others. In particular, those forms of support that actively try to create a positive, cohesive decision making environment would most likely be associated higher levels of group member satisfaction.

DECISION SUPPORT IN COMPUTER CONFERENCES TO IMPROVE GROUP DECISION MAKING PERFORMANCE

In the last section, literature pertaining to the impact of computer conferencing on a variety of indices related to decision quality was reviewed. On the basis of this review, several conclusions were drawn about the effectiveness of unstructured computer conferences as a medium for group decision making activities. In addition, a number of suggestions were made for improving the effectiveness of computer conferencing as an aid to group decision making. These are summarized in Table 2

The conclusions drawn and the suggestions made for each index of decision quality are necessarily tentative for they are often based on a very small body of empirical research, indirect evidence and/or speculation. Hence, generalizations cannot be made with a great deal of confidence. However, when the suggestions made for the indices of group decision making performance are taken together, three major factors emerge as being important in improving group decision making performance in computer conferences. These are: the use of asynchronous computer conferences, the use of forms of decision support that structure group discussion and communication, and the use of forms of decision support that facilitate social processes in computer conferencing groups.

Asynchronous conferences are likely to enhance both the effectiveness of group discussions and the development of a supportive, cohesive group environment. Decision support that structures group discussions may enable groups to discuss a decision task more effectively, to be more satisfied with their discussion processes, and to make decisions that are judged to be of higher quality. And, finally, decision support that fosters a sense of group cohesion may result in more positive computer

TABLE 2: Summary of the Impact of Computer Conferencing on Indices of Decision Making Performance

Index of Group Decision Making Performance	Actual and Potential Impact of Computer Conferencing
Judged decision quality	At least for some specialized tasks unstructured, synchronous conferences, which provide no specific support for group processes, do not hamper groups' decision making activities. Conferences that do provide more structured decision support may lead to improvements in decision quality.
Group Process Effectiveness	Unstructured computer conferences have the potential to support effective group discussion and decision making activities. However, communication barriers often prevent the realization of this potential. Asynchronous conferences that provide support that both structures group decision processes and allows for the development of a sense of group cohesion may improve the effectiveness of group discussions.
Process Satisfaction	A small body of indirect evidence suggests that groups in unstructured computer conferences have difficulty directing their discussions and so may not be highly satisfied with their decision making processes. Conferences that provide the type of support groups cannot provide for themselves may be associated with higher levels of satisfaction.
Outcome Satisfaction	This measure has received little attention to date. As the major index related to the implementation of decisions, it must be included in studies where groups make decisions or recommendations that have relevance for their lives.
Computer Conferencing Experiences	The evidence is largely speculative. For those with the means and the motivation to participate in a computer conference, satisfaction may be highest in asynchronous conferences with forms of decision support that facilitate the formation of a positive, cohesive decision making environment.

conferencing experiences, a greater willingness to participate and a more interactive, effective group discussion.

The importance of using asynchronous computer conferences as an aid to group decision making has been stressed from two perspectives in this paper. These conferences have not only the potential to allow groups to discuss decision problems more effectively but also, as discussed earlier, the potential to alleviate some of the scheduling and economic problems that are common in real world decision making meetings. Thus, the possible benefits of these kinds of conferences are compelling. Consequently, they will be the focus of the remainder of this paper and the term "computer conference" will be taken to mean specifically an asynchronous computer conference.

In addition to the use of asynchronous conferencing systems, the emphasis on decision support that structures group discussion and social processes underscores the importance of structural variables for improving group decision making effectiveness. Structural variables are not the only kind of variables that might influence the quality of group decisions made using computer conferencing systems, however. In particular, there has been a body of research which investigates questions related to features of human-machine interface design (see, e.g., Nickerson, 1986; Norman & Draper, 1986). This research has important implications for the effectiveness of computer conferences as aids to group decision making. Group members are more likely to participate in conferencing systems if they are easy to learn to use. Moreover, group communication in a computer conference is likely to be better organized and more comprehensible when the commands for entering, editing and sending comments are straightforward. However, while these interface design features are important they are only secondarily related

as group discussion effectiveness, decision quality, and satisfaction measures.

Whether these relationship do, in fact, hold is an empirical question, and one of some importance. If computer conferences, as communication based GDSSs, are to have a promising future, then it is essential to gain some understanding of the forms of decision support that are likely to be more or less effective in improving group decision making performance.

claim that there are two crucial roles for a conference leader or moderator. One is as a social host and the other is as a meeting chairperson. According to these authors the moderator's major function as a social host is to encourage group members to participate in the conference on a regular basis. This may be achieved in a number of ways ranging from providing participants with positive feedback about comments they have already made, to telephoning non-participating group members to persuade them to become an active part of the conference, to setting public deadlines for responses on a particular issue.

These tactics are likely to achieve two ends. First, when participants receive positive feedback about their contributions to the conference, they are likely to perceive a supportive communication environment. Under these conditions, group members are likely to increase their level of participation (Kerr & Hiltz, 1982). And when a number of group members do this the group will gather momentum, and participants will perceive an increased level of group cohesion. Thus, active leadership provided by a conference moderator may help structure the social processes related to effective group decision making.

The second beneficial effect of the efforts of an active conference moderator has to do with structuring aspects of group discussions in ways designed to improve group decision making effectiveness. As already mentioned, conference moderators can increase group members' participation levels (Kerr & Hiltz, 1982). This will increase the volume of communication exchanged by group members, which, in turn should increase the number of ideas generated by computer conferencing groups and the chances of generating high quality ideas. In addition, by setting deadlines for responses the moderator may decrease the time spent waiting for others to enter comments and so increase the efficiency of group communication in a computer

conference. Thus, an active conference moderator can promote more effective group discussion on at least three of the four dimensions considered earlier.

As a conference chairperson, the major function of a moderator or conference leader is to provide directional structure by keeping the discussion focussed and ensuring that groups move towards a decision or set of recommendations. Hiltz and Turoff (1978) have argued that a moderator can focus the discussion by frequently summarizing and clarifying the conference proceedings, and can ensure groups move towards a decision by expressing any emerging consensus, calling for votes and signalling when discussion on an issue is terminated. In addition, the moderator may be granted the power to delete comments that are off topic or incorrect (see also Kerr & Hiltz, 1982). Thus, by structuring the group discussion to emphasize both the information relevant to the decision problem and the sequential nature of decision making processes, an active moderator can help reduce the time it takes computerized groups to agree upon a decision. And, if given the power to edit and delete comments, a moderator can help increase communication accuracy, the fourth dimension of effective group discussion.

As is apparent from the points just raised, strong leadership in a computer conference can be expected to improve the effectiveness of both communication and social aspects of group decision making processes. It does mean, however, that the success of a computer conference is largely determined by the efforts of a single individual. This not only represents a major responsibility for that individual, it also provides the opportunity for him/her to exercise considerable influence over final group outcomes. Consequently, attention in the computer conferencing literature has also focussed on communication structures as a way of achieving more effective discussion and decision making. This transfers some of the burden for the success of a computer conference to the computer itself, or, more specifically to

software support for group decision making (Hiltz & Turoff, 1978).

The Role of Communication Structures

Much of the literature dealing with ways of structuring group communication in computer conferences is speculative and derived from experience with information sharing rather than decision making conferences. From this perspective, one major function of communication structures in computer conferences is to organize information and group members' comments so that computer-mediated discussions are more focussed and comprehensible. As already mentioned, in the absence of such structures, conference proceedings are recorded chronologically and, as such, frequently lack a logical coherence and are confusing to follow (Hiltz & Turoff, 1978; Kerr & Hiltz, 1982). Thus, conference participants sometimes feel overloaded with information (Hiltz & Turoff, 1985; Huber, 1982).

In order to help reduce this information overload, researchers have emphasized the importance of structuring the content of computerized group discussions. However, to date most attempts to achieve this have been in the form of "technological fixes" (Johansen et al., 1979; Kerr & Hiltz, 1982). These involve the addition of software options and system features which, for instance, allow participants to colour code their comments for identification, to obtain graphic feedback about the votes or preferences of other group members, to send multiple messages simultaneously, or to have increased flexibility in retrieving comments on a certain topic, or by a particular group member (cf. Safayeni, Lee & MacGregor, 1988; Jarvenpaa et al., 1988; or Turoff & Hiltz, 1982, for examples of studies of this type). While these types of technological innovations have been a common way

of attempting to structure computerized group communication, they provide little in the way of direct support for group decision processes.

Very recently, a small body of research has examined the effect of varying specific structural variables on group communication, problem solving and decision making performance. For example, Siegel et al (1986), examined the impact, on communication patterns, of computer conferences that were structured by the use of mechanisms to ensure strict turn-taking (only one person had controlled the cursor at a time, and others had to request the use of it from that person), and sequential rather than simultaneous communication. In the same research they also examined the impact of computer conferencing versus electronic mail on communication patterns. Overall, they found that groups in structured conferences generated more procedural communication related to control of the cursor, but were more satisfied with unstructured conferences. However, there were very few communication difference between groups using unstructured computer conferences and electronic mail systems.

Similarly, Jessup et al. (1988) compared different computer conferencing structures. They manipulated anonymity and proximity and found that problem solving groups working anonymously, and in different locations generated a greater communication volume, but that those working in the same room were more satisfied with their conferencing experience.

These studies are encouraging in that they demonstrate that structural variables can influence both patterns of group communication and members' satisfaction with that communication. However, these findings are also limited in the sense that the variables that have been manipulated have more to do with the conditions under which group communication occurs and less to do with kinds of group process support that may facilitate computer conferencing discussions and enhance the

quality of group decision making performance. Thus, the question still remains as to which type of communication structures are most likely to provide effective decision support in computer conferences.

In the absence of relevant research, potentially effective forms of decision support in computer conferences must be derived from first principles. As a starting point, Hiltz and Turoff (1978) argue that the use of procedural rules, such as Robert's Rules of Order, are unlikely to be useful aids to group decision making in computer conferencing systems simply because many of those rules are either inapplicable or inappropriate in conferences where participants do not meet in the same place at the same time. Thus, the kinds of decision support that are likely to be useful in computer conferences do not necessarily parallel those typically found in face-to-face decision making meetings.

Hiltz and Turoff (1985) do, however, provide a more constructive suggestion for increasing the effectiveness of computer-mediated group discussions. Following Huber (1982), they suggest that group discussions will be more organized, focussed and comprehensible, and hence more effective, when they are organized under different topic headings. In these topic-oriented discussions, participants' comments are not just entered chronologically into a general discussion, as they are in unstructured conferences. Instead, they are either entered into, or routed to appropriate topic headings, each of which represents a sub-discussion restricted to one aspect of the decision problem.

While the exact topic headings that are most likely to be useful will depend on factors such as the nature of the decision task and the organizational environment, Hiltz and Turoff (1985) mention some possibilities. For example, group discussions may be organized under pro and con topic headings. They may also be organized under headings representing different perspectives, or the views of different

interest groups.

It seems likely that these topic-oriented discussions will be helpful in focussing group discussions, clarifying the content of the discussion and preventing information overload. However, the kinds of topic headings mentioned above do not, in themselves, provide the kind of directional structure that would allow groups to integrate the separate topic threads and move towards a decision. Hiltz and Turoff (1985) recognize this and suggest that this integrative group task can be achieved by the kinds of voting techniques used in Delphi systems. These involve a series of iterations whereby preferences are obtained from individuals, pooled and fed back to individual group members so they can revise their initial preferences (see Hiltz & Turoff, 1978; Rohrbaugh, 1981, or Siebold, 1979, for detailed descriptions of these techniques).

While these systems may be effective, they do restrict group interaction for at least a part of the discussion time. An alternative form of decision support which does not impose such a restriction can be derived from the face-to-face group decision making literature. This type of support would still organize the group discussion in a computer conference under topic headings. However, these topic headings would not only organize the content of the discussion but also incorporate a directional structure that would help groups move towards a decision or set of recommendations.

The kinds of topic headings that achieve both these ends simultaneously can be derived from stage theories of group decision making. A number of stage theory models of group decision making have been discussed in the literature (cf. Brillhart, 1982; Brillhart & Jochem, 1964; Burgoon, Heston, & McCroskey, 1974; Doyle & Straus, 1976; Larson, 1969). All of these are variants of Dewey's (1910)

Reflective Thinking Model which posits the following five stages: problem definition and analysis, establishment of criteria by which to judge possible solutions, solution generation, solution evaluation, and plans for implementation. Furthermore, all are prescriptive and outline the sequence of steps groups should logically follow in order to improve the quality of their decisions (Fisher, 1980).

Some possible disadvantages of using rational models as a basis for decision support systems were discussed earlier and, there, it was argued that some of these disadvantages could be overcome by focussing on the decision processes groups do use rather than those they should use. This distinction has also been addressed in face-to-face group decision making research. Those researchers who have focussed on descriptive models of effective group decision making, have typically found that group decision making processes can be divided into four major stages: problem definition and analysis, generation of solution alternatives, evaluation of solution alternatives, and making a final decision (cf. Bell, 1982; Hirokawa, 1980; Maier, 1963; Rubin, 1984). Groups generally do not establish explicit evaluation criteria as a separate stage of the decision making process but, instead, develop implicit criteria either as they generate possible solutions or as they discuss the merits of each of these solutions.

Not all researchers agree with these four stages. In particular, there is some debate about whether or not the generation of solution alternatives and the evaluation of those alternatives are two distinct stages (see, e.g., Bales & Strodtbeck, 1951). However, the weight of evidence favours the distinction (cf. Brilhart & Jochem, 1964; Burgoon et al., 1974; Doyle & Straus, 1976; Hoffman, 1965; Maier, 1963; Van de Ven, 1974).

Given that, in face-to-face contexts, effective group decision processes seem to involve four major phases, it seems reasonable to suppose that when computer

conferencing groups structure their decision processes in the same way their group discussions may also be more effective and the quality of their decisions or recommendations may be higher. Thus, computer conferencing systems that enable groups to organize their discussion under topic headings such as Analysis (problem definition and analysis), Alternatives (generation of solution alternatives), Evaluation (evaluation of solution alternatives) and Decision (making a final decision), are likely to structure group communication in a way that can focus the group discussion and reduce information overload, and, at the same time, provide the kind of directional structure that would allow groups to coordinate their discussion and move towards a decision. This type of communication structure therefore offers the promise of effective decision support in computer conferences.

Combining Leadership and Communication Structures

So far, the discussion in this section has emphasized the importance of both leadership (in the form of a conference moderator) and communication structures (in the form of topic headings that reflect the four major stages of effective group decision making) for improving group decision making performance and outcomes. The remaining question is whether these two forms of structure provide more effective decision support when used alone, or when used in combination with each other. The only insight provided by the literature on this issue was mentioned earlier: leadership alone may be problematic. It places an onerous responsibility on the conference moderator and, as a result, there is the potential for that moderator to orchestrate the group discussion for his/her own ends. Hence, the efforts of a conference moderator may be most effective when used in conjunction with the kinds of communication structures proposed above.

At this point, it is unclear whether communication structures alone can improve group decision making performance. In the absence of empirical evidence, it is possible to speculate that topic headings corresponding to the four major stages of effective group decision making may be a sufficient form of decision support in themselves. When the topics Analysis, Alternatives, Evaluation and Decision are used to organize group discussions, all four topics would be listed simultaneously, in the above order, at the beginning of the conference and, whenever participants signed on to the computer conferencing system, they would be required to select one of the four topics before entering comments into the group discussion. Assuming that group members have an implicit knowledge about the directional nature of these categories, the listing of topic headings should make that knowledge explicit, and groups should pass through the four stages of effective group decision making.

While computer conferences structured by decision support that uses a simultaneous presentation of the topic headings Analysis, Alternatives, Evaluation and Decision may be a more effective aid to group decision making than no structured decision support, the question arises as to whether this kind of communication structure, when used in conjunction with the leadership efforts of a conference moderator, may be an even more effective form of decision support in computer conferences. At least conceptually, it seems possible to integrate these two types of structure in a way that promises further enhancement of group decision making performance. There are undoubtedly a number of ways of doing this. One way, however, is suggested by the results of face-to-face group decision making research which show that effective groups usually do analyze the decision problem before generating solution alternatives (Bales & Strodtbeck, 1951; Hirokawa, 1983; Maier & Solem, 1952; but see Bell, 1982). Similarly, effective groups are generally those

who adopt creative problem solving techniques and generate alternatives before attempting to evaluate them (cf. Bayless, 1974; Burgoon et al., 1974; Doyle & Straus, 1976; Guzzo & Waters, 1982; Hoffman, 1965; Maier, 1963; Van de Ven, 1974; but see Brillhart & Jochem, 1964). Thus, one potentially effective way of combining communication structures and the efforts of a conference moderator would be to use the same four topic headings Analysis, Alternatives, Evaluation, and Decision but to impose a more rigid directional structure by having a conference moderator, as chairperson, introduce these topics one at a time, with the timing of the introduction of each decision making stage being determined in a way that maintains the continuity of the group discussion.

While this combination of communication structures and conference leadership has the potential to be a more effective form of decision support than the use of the simultaneous presentation of the same communication structures alone, this potential may not be realized, however, unless the conference moderator serves a number of additional functions. The sequential introduction of topic headings focuses group attention on only one decision making stage at any particular time, and is therefore likely to seem relatively artificial and intrusive to participants. In addition, the sequential presentation of topic headings may lead groups to become engrossed in a part of the decision task and, consequently, lose sight of the whole. It may also mean groups lose some of the spontaneity that makes discussions lively and fun. Thus, groups in moderated conferences supported by the sequential presentation of decision making stages alone, may experience their discussions to be overly constrained, fragmented and dull, and may therefore find it difficult to build the kind of momentum and group cohesion necessary for productive and satisfying decision making.

If these consequences do, in fact, follow from the use of the sequential presentation

of group decision making stages, it seems likely that they could be offset by other duties performed by the conference moderator. These may include reminding participants about where the discussion is headed and about what will occur at each stage, and providing feedback that would let groups know how well they are progressing and how far they have progressed through each stage. These duties, together with those related to the timing of the introduction of each of the four topic headings, should help locate groups in the decision making processes and so allow them to maintain some focus on the task as a whole. They should also provide groups with support not just for their participation but for their progress as well. If the moderator can achieve these ends, then groups whose discussions are supported by the sequential presentation of decision making stages may be better able to gather and maintain momentum. They may also develop a sense of group cohesion as feedback about their progress draws attention to their joint effort. Given that these benefits do occur, the superiority of the moderator's sequential presentation of decision making stages is most likely to be realized when coupled with other chairperson and social host functions.

The preceding discussion argued that group decision making performance may be improved by two forms of decision support. The first relied on communication structures alone, and involved the simultaneous presentation of the four topic headings Analysis, Alternatives, Evaluation and Decision. The second combined communication structures and leadership. It used the same four topics and relied on a conference moderator to present them sequentially, to coordinate the group discussion and to provide support for participants within topic headings. It was further argued that of the two forms of decision support, the second would bring about the greater improvement in indices of group decision making performance such

as group discussion effectiveness, decision quality, and satisfaction measures.

Whether these relationship do, in fact, hold is an empirical question, and one of some importance. If computer conferences, as communication based GDSSs, are to have a promising future, then it is essential to gain some understanding of the forms of decision support that are likely to be more or less effective in improving group decision making performance.

THE RESEARCH STUDY

Research Design

In order to gain some understanding of the relative effectiveness of the structured computer conferencing systems developed in the preceding section, a study was designed to compare group decision making performance in three computer conferencing systems: self-structured, passively structured and actively structured. The Self-Structured conferences were essentially unstructured in the sense that comments were simply entered chronologically and the entire group discussion was stored in one memory location. In addition to this, however, groups had the option of choosing their own topic headings if they wanted to organize their discussion. The purpose of including the unstructured conferences was to establish a baseline of computer-mediated group decision making performance. The option of allowing groups to structure their group discussion themselves was included for two reasons to determine whether computer conferencing groups would choose topic headings as a way of organizing their discussion and, if they did, to learn what kinds of topic headings they would naturally choose.

In the Passively Structured conferences the group discussion was organized under the four topic headings Analysis, Alternatives, Evaluation and Decision. The four topics were listed at the beginning of the conference and, whenever participants signed on, they were required to select a topic heading before they could read or add comments to the group discussion. At any time during the discussion they were, however, free to choose any of the four topic headings.

The Actively Structured conferences involved the same four topic headings but included a conference moderator who introduced the headings sequentially rather

than simultaneously. At any time, participants could read the comments entered under previous topic headings, but were required to add comments to the one topic presently under discussion. In addition to introducing new topic headings, the moderator's duties also included: summarizing the group discussion every 24 hours, providing feedback about group progress within a topic heading, providing direction by telling groups what was expected of them at each stage of the decision making process, creating a positive, supportive conference environment, and encouraging participation by sending private messages to group members offering positive feedback on their comments and ideas.

Despite these structural variations, the three types of conferencing systems used in this research had two important features in common. First, in addition to the public conference forum, they all allowed participants to exchange private mail messages among themselves. Second, through the private mail system, they all allowed access to a resource person to whom participants could direct questions about the system, as well as requests for information related to the decision task. A major function of the private mail system was to examine whether group members would use this, rather than the conference forum, to exchange social and personal information. The resource person was included to simulate access to the kinds of background information typically available to those involved in group decision making activities in organizations.

Elaboration and Clarification of Features of the Research Design

Before outlining the predictions in this study, it is first necessary to discuss the implications of two features of the research design. These have to do with the manipulation of the decision support independent variable, and the identity of the conference moderator

As is apparent from the descriptions above, the degree of structured decision support available to groups increased across the three conferencing conditions. The self-structured conferences provided no structured decision support, the passively structured conferences employed decision support in the form of communication structures, and the actively structured conferences combined communication structures with the efforts of a conference moderator. These manipulations were chosen with two objectives in mind. One was to increase the degree of structure across conditions, and the other was to create conference discussion atmospheres that were as different as possible. The creation of widely different conference atmospheres did constrain the type of structured decision support used. While the degree of structured decision support did increase across conditions, this increase was not linear because the communication structure and moderator variables used in the actively structured conferences were not independent. Instead, by introducing the four topic headings sequentially the moderator effectively confounded the communication structure independent variable. Thus, the actively structured conferences differed from the passively structured conferences not only in the presence versus absence of a moderator, but also in the sequential *versus* simultaneous presentation of topic headings.

The confounded nature of the communication structure variable is, in fact, a statistical rather than conceptual problem. Conceptually, if, given a particular communication structure, it is the moderator's task to enhance group decision making performance as much as possible, then it seemed reasonable and even desirable that the moderator interact with the communication structure in order to achieve this end. Indeed, for the types of structure used in this research, there is, as outlined earlier, empirical evidence to support the validity of this interaction

Statistically the confound means that any differences between the passively and actively structured conferences in decision outcomes or satisfaction ratings is attributable to structural differences resulting from the use combination of communication structure, the use of a moderator and the interaction between the two. As long as the interaction between the two variables is kept in mind, however, the confound presents no great interpretive challenge.

The second design feature that needs clarification is related to the fact that the researcher played the role of conference moderator in the actively structured conferences, thereby raising the possibility of experimenter bias in certain of the results. Such a biasing effect was not considered to be serious in this study precisely because, in order to bias the results in favour of her hypotheses, the researcher would have tried to enhance the decision making performance of groups in the actively structured conferences to ensure that they made decisions of higher quality, and were more satisfied with their decision processes and outcomes. But this was precisely what a good moderator was required to do, irrespective of his/her identity.

With the conferencing features outlined above, the decision making performance of groups using self-structured versus passively structured versus actively structured computer conferencing systems was investigated. Decision performance was assessed on dimensions of quality and satisfaction using indices discussed earlier. These were: judged decision quality, a number of indices of group discussion effectiveness, process and outcome satisfaction, and computer conferencing experiences. The general hypothesis was that computer conferencing structure would influence group decision making performance, with performance increasing from self-structured to passively structured to actively structured conferences. Despite the exploratory nature of this research, two types predictions were derived. First, specific predictions were made about the direct impact of computer

conferencing structure on most of the quality and satisfaction indices just mentioned. Second, predictions related to the interrelations between the different types of performance measures were generated. These latter predictions dealt with the indirect effects of computer conferencing structure in which some performance measures played a mediating role between conference structure and other performance measures.

Predictions Related to Judged Decision Quality

The predicted relationship between computer conference structure and judged decision quality was based on two major arguments developed in the last section. The first was that computer conferences which structured group decision processes would be more effective aids to group decision making than unstructured conferences. The second was that decision support which emphasized the sequential nature of the major stages of group decision making would be more effective than support that presented the stages simultaneously, as long as a conference moderator was present to maintain a group's focus on the whole decision task and reinstate some of the spontaneity that may be lost in this more artificial conference environment.

Together these two arguments suggest that actively structured conferences may provide more effective support for group decision making processes than passively structured conferences, and that passively structured conferences, in turn, may encourage the use of more effective decision making processes than self-structured conferences. According to the face-to-face literature, these variations in decision process should be related to variations in decision quality (cf. Fisher, 1980; Guetzkow & Cyr, 1964; Janis, 1972; Janis & Mann, 1977; Maier, 1963; Strauss &

Strauss, 1964). Given this, it was predicted that judged decision quality would increase across conditions. Groups in the actively structured conferences were expected to make the best decisions, whereas groups in the self-structured conferences were expected to make the poorest decisions.

Predictions related to Group Discussion Effectiveness

A similar general prediction can be made with respect to the effectiveness of group discussions. Effective decision making processes are almost synonymous with effective group discussions in a decision making context. As just mentioned, the effectiveness of the decision support provided by the three types of computer conferencing systems was expected to increase across conditions. Hence, group discussions would be expected to least effective in the self-structured conferences and most effective in the actively structured conferences.

More detailed rationales for this general hypothesis depend upon the specific measure of group discussion employed. In the earlier review demonstrates, four major types of variables have been used in the computer-mediated communication literature to assess group discussion effectiveness. These are: the quantity of ideas, the quality of ideas, communication efficiency and communication accuracy. Not all of the indices mentioned earlier in each of these four categories are applicable here. Some are more relevant for face-to-face versus computer-mediated research. However, if these four kinds of variables are integrated and applied specifically to a decision making context, then they seem to tap three major dimensions of group discussions: discussion thoroughness, emphasis on decision processes or procedures, and the development of a sense of group cohesion. Thus, group discussions can be

considered to be effective to the extent that they involve a thorough analysis of all aspects of the decision problem, emphasize group decision making processes, and generate the kind of supportive climate which encourages group members to participate on a regular basis, and in which groups can develop a rapport that will help them coordinate their efforts to reach a decision. Predictions were derived for the relationship between computer conferencing structure and each of these three aspects of group discussion effectiveness.

1. Discussion Thoroughness

There are two major ways to measure the extent to which a group discussion involves a thorough analysis of a particular decision problem. One is to measure thoroughness in terms of communication volume. The other involves the traditional measure of effectiveness: the number of alternatives considered.

Communication Volume Perhaps the simplest index of discussion thoroughness based on communication volume is the number of sentences generated by a group during its discussion. However, despite its simplicity, this is likely to be a reasonable measure of discussion thoroughness only if increases in communication volume reflect increased attention to the decision task. Therefore a more precise measure of thoroughness may be the number of task related sentences generated by group members.

Using communication volume to measure discussion thoroughness, it was predicted that the total number of sentences generated by group members would increase across conditions. This prediction was made largely on intuitive grounds. It seemed reasonable to suppose that, because the two structured conferencing conditions emphasized four stages of group decision making, groups in these conditions would feel some obligation to devote some time and effort to each stage and would therefore be less likely than groups in the self-structured conferences to omit

or give only passing attention to one or more stages. Thus, as the number of topic headings increased the total communication volume was also expected to increase. Furthermore, the obligation to devote time to each stage of the decision making process was expected to be strongest for groups in the actively structured conferences: at any one time their attention was focussed on only one stage and, within that stage the conference moderator actively tried to encourage as much communication as possible. Hence, communication volume would be expected to be greater in the actively than in the passively structured conditions.

These increases in communication volume were expected to be at least partly attributable to increases in task related communication. The rationale for this was that the use of topic headings related to the four stages of group decision making processes would serve to remind groups of the primary purpose of their discussion and so keep their discussion focussed on the task. Moreover, this focus was expected to be strongest in the actively structured conferences because part of the moderator's job in those conferences was to ensure groups not only focussed on the decision task but also considered as many perspectives as possible. Thus, it was predicted that the volume of task related verbiage would increase across conditions, with groups in the actively structured conferences generating the greatest volume and groups in the self-structured conferences the smallest volume.

The Number of Alternatives In a decision making context the number of alternatives can refer to the number of alternatives considered at any of the four stages of the decision making process. Thus, it may refer to the number of dimensions of the decision task identified during the analysis of the problem, the number of potential solutions generated, or the number of solutions evaluated. In addition, at least for ill-structured problems that require a set of recommendations

rather than a single solution, the number of alternatives may refer to the number of specific recommendations made.

Within the face-to-face literature there is evidence that, relative to groups whose decision processes are unstructured, groups with structured decision processes tend to identify a greater number of problem dimensions and a greater number of solution alternatives (cf. Hill, 1984; Hirokawa & Sheerborn, 1986; Mitroff et al., 1979; Van de Ven, 1974). Furthermore, there is evidence that the number of solution alternatives generated is greater when this stage precedes the evaluation of those alternatives (cf. Burgoon et al., 1974; Doyle & Straus, 1976; Hoffman, 1965; Maier, 1963; Van de Ven, 1974). Based on this body of evidence two predictions were made.

The first of these predictions was that, relative to groups in the self-structured conferences, groups in the two structured computer conferences would identify a greater number of problem dimensions. In addition, because the conference moderator in the actively structured conferences specifically tried to elicit as many dimensions of the decision problem as possible from group members, it was predicted that groups in the actively structured conferences would generate more problem dimensions than groups in the passively structured conferences.

The second prediction was that groups in the two structured computer conferences would generate more solution alternatives than groups in the self-structured conditions. Furthermore, because of the sequential presentation of decision making stages, it was expected that groups in the actively structured conferences would generate more solution alternatives than groups in the passively structured conferences. An additional rationale for the second part of this prediction came from the fact that, again, the conference moderator in the actively structured conferences

attempted to ensure that groups did consider a wide range of alternatives.

There has been little investigation of the impact of structural aspects of group discussions on either the number of solutions evaluated or the number of recommendations made by groups. Therefore it was simply hypothesized that both the number of solutions evaluated and the number of recommendations made would differ across conditions. It was, however, expected that the number of solutions evaluated and the number of recommendations made would be greatest in the actively structured conferences because of the conference moderator's attempts to ensure that as many solution alternatives were evaluated and considered at the final stage of the decision making process.

2. Process Emphasis

The second major type of index of group discussion effectiveness that was outlined earlier had to do with the emphasis groups place on decision making processes and procedures. There are at least two ways of measuring the degree to which groups attempt to direct their discussion towards a decision. One is a measure of the quantity of the group discussion devoted to procedural statements dealing with how a group will go about conducting its discussion and reaching its decision. The other is a measure of the degree to which groups make effective use of the decision support provided, and move sequentially through the four stages associated with effective group decision making.

The Volume of Procedural Communication The number of sentences in computer conferencing discussions devoted to procedural issues was predicted to increase across conditions, with groups in self-structured conferences generating the smallest volume and groups in actively structured conferences generating the largest

volume. The rationale for this was based on the argument that as the degree of support for decision making processes increased across conditions, attention would be increasingly focussed on process and procedure, and, as a result of this, groups would spend more time discussing procedural issues (see Siegel et al., 1986).

Sequential Progression Through Decision Making Stages As discussed earlier, group discussions are thought to be most effective when they pass through stages of the decision making process in a linear, sequential fashion. Thus, effective groups analyze the problem prior to generating solutions, generate solutions prior to evaluating them, and pass through all three stages before reaching a decision

The degree to which groups followed this pattern was predicted to increase across conditions. By introducing topic headings corresponding to the four stages of group decision making, the passively structured conferences were expected to allow groups to approximate the ideal pattern more closely than the self-structured conferences. The reason for this was related to the fact that, in the passively structured conferences, participants saw the four stages listed in sequence as topic headings. This emphasis and ordering was expected to trigger participants' implicit knowledge of the sequential nature of the four stages.

The degree to which groups in the passively structured conferences followed the sequence of decision making stages was, however, expected to be lower than that followed by groups in the actively structured conferences. Although the decision support provided in the passively structured conferences did suggest an ordering of the four decision making stages, participants could choose to ignore this sequence and enter comments under any topic heading. This freedom was limited for groups in the actively structured conferences. In these conferences, topic headings appeared one at a time and the conference moderator attempted to focus the discussion on the one active topic, and to discourage group members from entering comments to earlier

topics (these were still available so participants could reread earlier comments if they wished). Thus, the decision support provided in the actively structured conferences imposed a more rigid temporal structure and, given this, groups in this condition were expected to approximate the ideal progression through the four decision making stages most closely.

3. Group Cohesion

The third, and final type of measure of group discussion effectiveness has to do with a sense of group cohesion. When groups are engaged in decision making activities a sense of group cohesion relies, in large part, on participants' motivation to be part of the group, and on a group's ability to coordinate their efforts to reach a decision (cf. Shaw, 1981). Predictions were made for both components of group cohesion.

Motivation to be Part of the Group In the face-to-face literature, this motivation is typically measured in terms to the degree to which participants are attracted to others in the group (see Shaw, 1981). In a computer conferencing environment the degree to which individuals are attracted to others in the group cannot be determined using the usual kinds of measures of interpersonal attraction simply because in computer conferences there is a lack of both social cues and cues related to physical appearance. Instead, measures of group members' motivation to be part of the group must be communication based. In this context, it seems reasonable to suppose that group member's motivation to be part of the group can be inferred from the volume of positive, supportive communication exchanged between group members and perhaps from the extent to which group members address personal greetings to each other (cf. Deutsch, 1968). When the volume of these types of communication increases, it can be assumed that group members are more involved with the group

and, hence, that their motivation to be part of the group is increased.

Based on this argument, it was predicted that groups in the actively structured conferences would exchange a greater volume of both positive, supportive communication and personalized greetings than groups in the other two conferencing conditions. The reason for this was related to the fact that, in the actively structured conferences, one of the moderator's duties was specifically to promote this type of communication. No predictions were made concerning differences between groups in the self-structured versus passively structured conferences.

The Ability to Coordinate Group Effort There are undoubtedly many ways of measuring a group's ability to coordinate its efforts or activities. In the earlier discussion it was noted that unstructured decision making computer conferences have great difficulty reaching consensus about a final decision. Hence, one important coordination measure may be related to a group's ability to integrate its discussion and produce a decision. One rough, informal index of this ability is simply a binary measure of whether or not group were able to reach a decision. A more formal and informative index would be the number of sentences devoted to integrating the discussion to agree upon a decision.

Given these measures, it was predicted that groups in the self-structured conferences would have greater difficulty reaching a decision in the time available and would therefore generate a smaller volume of integrative discussion. Groups in the two structured conferencing conditions were expected to devote more effort to integrating their discussions and reaching a decision because the topic heading Decision specifically drew attention to to this aspect of the decision making process. Moreover, groups in the actively structured conferences were predicted to be more effective in this respect than groups in the passively structured condition. The

performance increment between these two conditions was expected because, towards the end of their group discussion, groups in the actively structured conferences had their attention focussed on only this aspect of the decision making process. In addition, the conference moderator in this condition tried to ensure that, when groups were in the process of making their final decisions, they at least considered all the solutions they had previously evaluated.

Predictions Related to Ratings of Process Satisfaction

Computer conferencing structure was expected to influence participants' ratings of the degree to which they were satisfied with their decision making processes. The effectiveness of the decision support provided by the computer conferencing systems was expected to increase across conditions. Based on this, it was expected that group members' perceptions of the benefits of this support would become more positive across conditions, and would be reflected in increased levels of process satisfaction.

This direct effect, however, was expected to be relatively weak. While process satisfaction is likely to be related to the effectiveness of the decision support provided, it is also likely to be related to the way in which groups interact with that support to conduct a more or less effective discussion. Moreover, at least intuitively, it seems that group members' ratings of process satisfaction may rely more heavily on the degree to which their group used the decision support to have an effective discussion, than on effectiveness of that support itself. Hence, it was expected that much of the effect of conference structure on process satisfaction would be mediated by measures of discussion effectiveness.

Predictions Related to Ratings of Outcome Satisfaction

The relationship between computer conferencing structure and outcome satisfaction was investigated but no specific predictions were made. Although there is some evidence in the face-to-face literature that structuring group processes can increase group members' satisfaction with their final decision (cf. Ertfmeier & Lane, 1984; Lane, Mathews, Chaney, Ertfmeier, Reber, & Tweddle, 1982; Garo, 1985, Murnighan, 1982), it was not clear whether the same kind of relationships would hold in the context of computer conferences. The major reason for this was that any impact of conference structure on outcome satisfaction seemed most likely to operate indirectly, because outcome satisfaction is a measure of the result of the interaction between the decision support provided in a computer conference and groups' response to that support.

Predictions Related to Computer Conferencing Experiences

Given the variety of dimensions of conferencing experience, investigation of possible relationships between computer conference structure and conferencing experience was largely exploratory. Thus, while it was hypothesized that groups in the different conditions would differ in their conferencing experiences, few specific predictions were made. However, because the passively and actively structured conferences employed topic headings corresponding to the four major stages of group decision making, it was expected that groups in the the self-structured conferences would experience their conferences to be more disorganized and more likely to lack direction than groups in either of the two structured conference conditions.

Furthermore, based on the lack of leadership structure in the self-structured and passively structured conferences, it was expected that groups in both these conditions would experience a relative lack of leadership and a less positive and supportive environment. Taking the effects of these two forms of structural decision support together, it was expected that group members' experiences with computer conferencing would become more positive across conditions, especially on dimensions related to a sense of organization and direction.

Secondary Predictions of the Interrelations Between Different Aspects of Group Decision Making Performance

So far predictions have been derived for the direct impact of computer conferencing structure on quality and satisfaction aspects of group decision making performance. These predictions have treated each these quality and satisfaction indices as separate outcome measures and have ignored the relationships between these variables. However, it seems highly likely that these indices are interrelated. There is evidence in the face-to-face literature that effective group discussion is associated with high quality decisions and increased levels of satisfaction (cf. Fisher, 1980; Guetzkow & Cyr, 1964; Janis, 1972; Janis & Mann, 1977; Maier & Hoffman, 1960; Van de Ven, 1974; Wanous & Youtz, 1986). Furthermore, it seems reasonable to suppose that computer conferencing experience will play a moderating role between computer conference structure and measures of judged decision quality, process and outcome satisfaction. Group members who have negative experiences are unlikely to contribute regularly to the group discussion and the chances the group will make a good decision are impaired. Similarly, Group members who have

negative conferencing experiences are unlikely to be aware of, or satisfied with either the group's decision making process or the outcome of the group's discussion.

Based on the preceding arguments, it seemed that indices of group discussion effectiveness and computer conferencing experience could be best conceptualized as intermediate variables that played a mediating role between conference structure and the outcome variables of judged decision quality, process satisfaction and outcome satisfaction. Given this it was hypothesized that these intermediate variables would be positively related to the three outcome measures of decision quality and process and outcome satisfaction.

In addition to these relationships, it was hypothesized that the outcome measures of quality and satisfaction would be interrelated. Groups who were satisfied with their decision making processes were expected to have used effective processes, and to have been more likely to make good decisions. Similarly, groups who made high quality decisions were likely to be pleased with their achievement and, it was expected that this pleasure would be reflected in high levels of outcome satisfaction. Thus, it was predicted that both process and outcome satisfaction would be positively related to decision quality, and that as process satisfaction increased so would outcome satisfaction.

Finally, the relationships between measures of group discussion effectiveness and computer conferencing experience were investigated. Because of the exploratory nature of these relationships no specific predictions were made. However, it was expected that measures of the emphasis groups placed on decision processes would be related to dimensions of computer conferencing experiences involving leadership. It was also expected that communication-based measures of group cohesion would be related to the experience of a sense of group cohesion.

In earlier sections predictions were made about the impact of computer conferencing structure on measures of judged decision quality, group discussion effectiveness, process satisfaction, outcome satisfaction and computer conferencing experiences. In addition, this section predicted some relationships between these five types of variables. These two sets of predicted relationships can be integrated into a conceptual model which outlines the expected mechanisms by which computer conferencing structure influences group decision making performance. This model is outlined above in Figure 1.

FIGURE 1: Predicted Model of the Influence of Structured Decision Support in Computer Conferences on Group Decision Making Performance

THE TASK

Prior to conducting the research designed to test the hypotheses derived in the last section, it was necessary to select a decision task. This task selection process is important in both individual and group decision making research, for there is widespread evidence that decision tasks are not interchangeable. Instead, at both a theoretical and an empirical level, the nature of the task has been shown to influence group processes and patterns of communication, and these may, in turn, have an impact on group decision outcomes. (cf. Cartwright, 1973; Collins & Guetzkow, 1964; Golembiewski, 1962; Hare, 1962; Hoffman, 1965; Hoffman & Maier, 1961; Johnson & Johnson, 1987; Kahneman & Tversky, 1984; Myers & Lamm, 1976; Newell & Simon, 1972; Phillips, 1973; Pruitt, 1971; Roby, 1968; Shaw, 1981)

While the type of decision task used in research studies does have an impact on group communication processes, and perhaps on group outcomes as well, there is some reason to believe that this task influence may be maximized under certain conditions. With individual decision makers, it has been suggested that the impact of the task is likely to be particularly important when tasks are not emotionally arousing and when individuals are motivated to perform well on the task (Dawes, 1975; Newell & Simon, 1972)

If these arguments can be applied to group decision making performance, then task selection is likely to be a matter of considerable concern in the research just outlined. In this research, subjects were required to participate in an asynchronous computer conference over a two-week period (see later section on Method for details). Given this kind of time commitment, it was considered essential to induce

high levels of subject motivation to ensure continued participation. This was done by selecting a task that was highly relevant to subjects and by providing a reward for the group with the best decision making performance. Conditions were therefore actively

manipulated so that subjects would be motivated to perform well. Hence, it seemed likely that the task used in this research would have a major, rather than a minor impact on group performance outcomes.

The impact of the decision task on indices of group decision making performance is not a great concern for the internal validity of research studies, for subjects in all conditions are typically required to discuss and make decisions about the same task. It is, however, a great concern for a study's external validity, because the results of any particular group decision making study may not generalize beyond the type of task used in that study (cf. Bell, 1982; Collins & Guetzkow, 1964; Hare, 1962; Hoffman, 1965; Phillips, 1973; Roby, 1968). Consequently, decision tasks that are convenient for laboratory research may not generalize to real world situations. Furthermore, the chances of such generalizations would seem to be even smaller in the present research, because of the need to minimize the possibility of subject attrition.

Throughout this paper the primary rationale for examining computer conferencing as an aid to group decision making was to try to alleviate some of the problems encountered in decision making committee meetings in business environments. Therefore, generalization to real world situations was a major research aim. Given this, it was considered particularly important to select a decision task that was representative of the kinds of decision tasks encountered in organizational settings. Furthermore, it was believed that the decision task should

incorporate the kinds of decisions that are most common in organizations on the grounds that common tasks would be less likely to be specific to particular committees or organizations, and, hence, would be more likely to generalize to other organizational settings.

One way to select such a task is simply to use a problem that has already been discussed and solved in some organization (see Bartunek & Murnighan, 1984; Cosier & Rechner, 1985; Guzzo & Waters, 1982; Hirokawa, 1983, or Schweiger et al., 1984 for examples of this approach). However, it is not clear whether the tasks of this type that have been used in past research are typical of the kinds of decisions usually made by committees in business organizations. In addition, even if the task is representative, the decision makers used in research usually are not. When the subjects are students (as they usually are and as they were in the present research) they lack the kind of background information and organizational familiarity that real world committee members possess.

Although students typically lack corporate experience, they do have some shared familiarity with their University as an organization. Therefore, when student subjects are used, a preferable alternative would be to use a university task. This approach has been used in past research (see, e.g., Hirokawa & Pace, 1983; Weston, Kristen & O'Connor, 1975). However, most of the studies that adopt this approach seem to have chosen tasks primarily according to a criterion of subject relevance. While this criterion is important for subject motivation, it does not guarantee that the tasks are necessarily representative of the kind of decisions commonly made by university committees.

Some insight into the kinds of decisions commonly made by real world committees can be found in the business literature. There it is suggested that committees

frequently encounter at least two generic types of tasks. One type involves long-, medium- or short-range planning (Steiner, 1970, 1974). The other type requires groups to make either general or specific policy decisions (Dale, 1970; Phillips 1973). However, there is as yet very little empirical evidence to support these contentions. In particular, it is not known whether these are the only types of tasks commonly encountered by groups in committee meetings. It is also not known how frequently these types of tasks occur, or whether they occur more or less frequently than other committee tasks. More importantly for research with student subjects, it is not known whether these types of tasks are representative of the kinds of decisions made by university committees.

In order to determine the kinds of decision tasks groups discuss in university committee meetings, and the relative frequency with which they made different types of decisions, a pilot study was conducted. This used an archival methodology to examine the minutes of committee meetings held at Trent University. This University was chosen on the grounds that the subjects in this research were all Trent students.

Using a sample of the minutes of Trent University committee meetings, the decisions recorded were classified according to type. The resultant taxonomy of recorded decisions was interpreted to be indicative of the types of decision tasks most frequently discussed by university committees. The decisions made with the greatest frequency were then used to derive the decision task used in the present research.

METHOD

Sample:

The minutes of the meetings of 178 committees are archived at Trent University.

These committees consist of 90 ongoing committees, and 88 committees set up to deal with one specific issue, at a particular state in Trent's development, and then disbanded. From this collection, a sample of 15 committees was randomly selected for analysis. For each of these 15 committees, an academic year between 1964 and 1986 was randomly chosen and the minutes of all meetings for that year were examined. Using this strategy, the meetings for which minutes were analyzed are summarized in Table 3 below.

TABLE 3: Trent University Committees and Years Selected for Analysis

COMMITTEE	YEAR
1. Senate Advisory Committee on the University Bookstore	1972-1973
2. Library Services Committee	1977-1978
3. Site Development Committee	1971-1972
4. Lady Eaton Student Council	1968-1969
5. Science Workshop Advisory Committee	1970-1971
6. Economics Departmental Committee	1979-1980
7. Committee on Colleges	1982-1983
8. Computer Services Committee	1974-1975
9. Joint Committee on Arts and Sciences	1975-1976
10. Committee on Confidentiality	1972
11. Political Science Departmental Committee	1979-1980
12. Supervisory System Senate Subcommittee	1986-1987
13. Status of Women Committee	1975-1976
14. Senate Budget Committee	1985-1986
15. Graduate Studies Committee	1973-1974

The meetings held by each of these committees ran from September of one year to May of the next. However, any meetings held in June, July or August of the second year were considered to be part of the same academic year, and were also included in the analysis. The under-representation of the minutes of meetings held in the 1960s

reflects the fact that the expansion of Trent from two to five colleges and from one to two campuses did not occur until after 1968. Consequently, many University committees were not in operation until the early 1970s.

Procedure:

On examination of the committee meetings it became apparent that they differed in both their level of formality and their decision making mechanisms. In some committees there was strict adherence to Robert's Rules of Order and all decisions were framed in terms of a formal motion. In other committees decisions were recorded more informally. Similarly, some decisions were made by the entire committee during a particular meeting, while others were made by appointed subcommittees and reported during the meeting. Given this variability, some criteria were established to determine what constituted a decision and what decisions were to be included in the analysis.

For the purposes of this study, a decision was considered to have been made whenever there was a formal motion and a subsequent vote. Moreover, when the minutes were more informal, clauses such as: "There was consensus that ..." or "It was agreed that ..." were taken to indicate that a decision had been taken. The clause "It was suggested that" was taken to mean a decision had been made only if it followed discussion on an issue and provided there was no recorded opposition to the suggestion.

In addition to these criteria, decisions were included in the analysis if they were made by committees during a meeting, made by subcommittees and reported during the meeting, or made by individual committee members granted executive powers by the rest of the committee. In addition, if a decision was announced by a committee member during a meeting and it was unclear as to whether that decision had been

made by a subcommittee or a body independent of the committee, the decision was recorded. This ambiguity occurred in only two cases.

The classification of decisions was not done according to any definite, a priori scheme. On the basis of the literature presented earlier, it was expected that both planning and policy decisions would occur. However, beyond this, the approach taken was to explore the decision types that would emerge from an examination of the minutes, rather than to classify decisions according to some preconceived belief about the types of decisions that should appear in committee meetings.

Given the above criteria, the minutes of the meetings held by each of the 15 committees were examined. For each committee, the meetings held in the year selected for analysis were put in chronological order and the minutes were then read in that order so that decisions could be interpreted within the overall context of the meetings. After reading the minutes of the meetings of each committee it was possible to get an overall sense of what the committee had tried to achieve during the year. Based on this, the decisions made during the meetings of each committee were recorded with their content specified. Following this, decisions that, on a conceptual level, seemed to reflect the same type of decision task were clustered together. During this process, the emphasis was on classifying decisions using as small a set of categories as possible.

RESULTS AND DISCUSSION

The number of meetings held, and the total number of decisions made by each of the 15 committees in the year chosen for analysis is presented in Table 4. Also included is the mean number of decisions per meeting for each committee. Based on

these means, it is apparent that the committees form two distinct groups. The first, a low decision frequency group, contains 11 of the 15 committees and each of these made between two and four decisions per meeting. The second, a high decision frequency group, contains the remaining four committees that made between six and eight decisions per meeting. These differences in decision frequency may suggest that different committees serve different functions, with some committees emphasizing decision making activities and others, such as Advisory Committees, stressing functions such as information gathering and issue clarification.

TABLE 4: The Number of Meetings, Number of Decisions and the Mean Number of Decisions per Meeting for Trent University Committees

COMMITTEE NUMBER	NUMBER OF MEETINGS	NUMBER OF DECISIONS	MEAN NUMBER OF DECISIONS/MEETING
1	3	7	2.33
2	5	19	3.80
3	8	49	6.13
4	10	70	7.00
5	2	12	6.00
6	3	3	4.33
7	10	30	3.00
8	3	23	7.67
9	5	19	3.80
10	5	13	2.60
11	7	33	4.71
12	1	2	2.00
13	4	9	4.13
14	5	13	2.60
15	8	33	4.13
All Committees	79	345	4.28 (S.D.=1.68)

An examination of the minutes of the meetings of the 15 Committees generally did not support this contention. One Committee in the low frequency group, the Supervisory System Senate Subcommittee (#12), did appear to serve primarily a non-decision making function. However, with this exception, the differences between the low and high decision frequency committees could be attributed to specific situations or events, rather than to differences in function.

Generally speaking, it appeared that the 11 low decision frequency committees represented a baseline or normal level of decision making activity, and that the level of decision making activity of the remaining four committees had been temporarily inflated by the particular issues those committees faced during the year used in the analysis. For example, in 1971-72 the Site Development Committee (#3) was involved in decisions related to the design, construction and expansion of Trent's second campus. In 1968-69, Lady Eaton College had just opened and the Student Council (#4) was required to make precedent setting decisions regarding student elections, residence rules of conduct, and annual College social events. And, in 1974-75, Trent had just purchased a computing system and the Computer Services Committee (#8) was faced with a series of decision related to the use and implementation of this system.

This argument suggests that at least committees in this study may be generally involved in some basic level of decision making activity, and that this level may be inflated as committees are called upon to deal with specific issues that arise sporadically, during periods of major innovation and change. If this is so, then the committees in the present sample, with the possible exception of one committee (#12), seemed to serve similar functions with respect to decision making. It

therefore makes sense to combine the decisions made by the different committees in order to develop a taxonomy of decision tasks. As a result, all 345 decisions were included in the classification analysis. Examination of these decisions yielded six decision categories: procedural, planning, policy, resource allocation, personnel selection, and negotiation.

Procedural Decisions

Procedural decisions were defined to be any decision that had to do with meetings per se, rather than with the content of items discussed in those meetings. Examples of this type of decision include adoption of the minutes of previous meeting(s), approval of a motion to adjourn, acceptance of a motion to either defer a decision or table a motion and agreement on date(s) of next meeting(s). Of the 345 decisions, 140 (40.6%) were classified as procedural in nature. In the case of Committee #12, the only decision tasks encountered were of a procedural nature.

Planning Decisions

The criteria for classifying planning decisions were somewhat difficult to determine because many decisions seemed to qualify for membership in a number of different categories. However, by focussing on the content of the decision itself rather than on the related issue, it was established that planning decisions would be considered to be decisions that related to forming and approving details of a future plan of action, or to any stage or aspect of the implementation of a planned course of action. They would be decisions that approved new projects conditional upon the future availability of funds, but not decisions that oppose projects on the grounds that there is no funding available at present. In the former situation the proposed projects remain a plan for the future. In the latter, the implication is that the proposed projects will not be considered at a later date. Finally, planning decisions

would also include financial decisions related to generating new sources of revenue, and decisions regarding plans to implement a policy in the future. These decisions are concerned with "How?" and "When?" questions. They are therefore not decisions related to the actual implementation of a policy.

Using these criteria, examples of planning decisions included: a decision to plan an end-of-term dinner for student members of Lady Eaton College, approval of expansion of Computer Services when funds became available, a decision to request building plans for an indoor walkway, and a decision to look into ways of improving the registration process. In all, 67 of the 341 (19.4%) decisions recorded were classified as being related to planning issues.

Policy Decisions

The criteria for classifying decisions as policy decisions were, like the criteria for planning decisions, somewhat difficult to establish because policy making often involves planning and resource allocation components. However, by focussing on the content of specific decisions rather than on the more general issues underlying them, policy decisions were considered to be those decisions that were either related to the formulation and adoption of a policy, or to the establishment of criteria for allocating resources or selecting personnel. They also included decisions relating to the acceptance of policy statements drafted by other committees, but only when this acceptance (or lack of it) was requested as feedback for the policy making activities of those other committees.

Examples of decisions classified according to these criteria included: a decision regarding the dress code for students at College dinners, a decision to include a student representative on the Computer Services Committee, establishment of criteria to be used in hiring and tenure decisions, a decision about regulations

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governing the scheduling of course tests and assignments, and a decision to continue using the previous policy regarding course-faculty evaluation. Of the total 345 decisions analyzed, 65 (18.8%) involved some aspect of policy making.

Personnel Selection Decisions

The establishment of classification criteria for this category was more straightforward than for either planning or policy making decisions. Thus, personnel selection decisions included hiring decisions, acceptance of students to honours and graduate programmes, and appointment of committee members in the absence of information about whether or not this appointment involved a ballot. They did not include situations in which committee members volunteered for particular positions and were elected unopposed.

The ranking of job candidates, the approval of members for a hiring committee, the selection of candidates for external scholarship submission, and the selection of graduate students were all examples of personnel selection decisions. In all there were 27 such decisions so that, on average, 7.8% of the committees' decision tasks had to do with personnel selection.

Resource allocation decisions

The classification of resource allocation decisions, like that of personnel selection decisions, was also quite straightforward. A decision was considered to involve resource allocation if it related to budget proposals, to the approval of funding for projects, or to the allocation or reallocation of space. For example, the following were all classified as resource allocation decisions: a decision regarding the allocation of new space to the Geography department, a decision to support the proposed library budget, a decision to allot funds to cover the expenses of visiting faculty, and decisions concerning budget priorities. Overall, 41 decisions, or 11.9%

of all decisions, were judged to involve resource allocation.

Negotiation Decisions

Decisions in this category related primarily to issues such as bargaining or negotiating labour or service contracts. They would, for instance, include decisions concerning the list of demands to be taken to the bargaining table, or whether or not to continue negotiations. In the 345 decisions analyzed here only one (0.3%) was classified as reflecting a negotiation task. It was a decision to continue negotiations regarding the possibility of the Canadian Imperial Bank of Commerce renting University space to open a campus branch of their bank.

The six categories outlined above accounted for 341 or 98.8% of the 345 decisions used in the analysis. The four unclassified decisions were all made by the Graduate Studies Committee (#15) and involved the approval of Master's Theses. These could conceivably have been classified as personnel decisions, in the sense that the Committee could be seen to be selecting candidates to receive a Master's degree from the University. However, personnel selection usually has connotations of bringing people into, rather than sending people out of an organization. In addition, the Master's theses in question had already been passed by the relevant department so that, if these decisions were instances of personnel selection, it was questionable whether the students had been selected by the Graduate Studies Committee or by their respective Thesis Committees.

An alternative classification for these four decisions would have involved a seventh category of evaluation decisions. This seems to be a more appropriate description of decisions related to approving Master's degrees. However, again there is the problem of which committee has made the evaluation. The Graduate Studies Committee is a university committee and therefore is typically made up of people

from different disciplines. Given this, it seems most likely that this committee reviews the recommendations of the relevant Departmental Committee and that the Departmental Committee is primarily responsible for the evaluation. The minutes of the Graduate Studies Committee are silent on this point. It was therefore decided to leave the four thesis approval decisions unclassified in the present analysis. At the same time it is worth noting that, while the committees selected for this study may not have made evaluation decisions, other committees in the University did deal with and make decisions about evaluation tasks. It is, however, not clear what proportion of committees were involved in such tasks.

The content analysis of the 345 decisions made in a sample of Trent University committee meetings revealed six major categories: procedural, planning, policy, personnel selection, resource allocation, and negotiation. Of these, procedural decisions were the most common, accounting for approximately 40% of all decisions. However, while common, these decisions typically represent decision tasks that are trivial in the sense that they seldom involve any discussion and are more a matter of form than true decisions. On these grounds procedural decisions were excluded from further analysis.

With procedural decisions omitted from consideration, 32.68% of all non-procedural decisions involved planning issues, 31.71% were policy decisions, 20% were resource allocation decisions, and 13.17% were personnel selection decisions. Thus, planning and policy issues emerged as the most frequently encountered types of tasks in committee meetings. However, resource allocation and personnel selection decisions were also fairly common. Together these four types of decisions accounted for 57.9% of all decisions made by the 15 committees surveyed, and for 97.56% of all non-procedural decisions made by those committees.

Planning, policy, resource allocation and personnel selection decisions were not only common in the sense that they occurred frequently. They were also common in the sense that they were represented in the majority of the committees surveyed. Thus, of the 14 committees who made non-procedural decisions (Committee #12 was omitted from this analysis), 92.85% made decisions related to planning, 100% made policy decisions, 71.43% made resource allocation decisions and 57.14% made personnel selection decisions. Furthermore, 35.71% of the committees encountered all four types of decision task, 42.86% encountered three of the four types of task and the remaining 21.43% committees encountered only policy and planning decisions.

These findings suggest that the university committees in this study were not specialized decision making bodies, in the sense that they made primarily one type of decision. Instead, at least the 14 committees who made non-procedural decisions seemed to encounter all four major types of decision tasks. One possible implication of this is that these four types of decision tasks are interdependent. Thus, committees may typically encounter issues which involve a series of different types of decisions, and which therefore incorporate two, three or all four of the common types of decision tasks that were identified above.

Some support for this suggestion came from the difficulty encountered in establishing criteria for classifying planning and policy decisions. This difficulty stemmed from the fact that these two categories did not seem to be independent, either of each other or of the resource allocation and personnel selection categories. A number of decisions in each of these categories could be classified as primarily planning or policy decisions but only if taken out of temporal context. If taken in that context, they were obviously part of a larger decision process that included

decisions in other categories as well.

The extent to which this interdependence occurred was investigated by taking a broader perspective than had been taken earlier. Thus, planning, policy, resource allocation and personnel selection decisions were re-examined and categorized according to whether or not they involved two or more decision categories. Examples of decisions that were classified as involving more than one type of decision task included: a decision regarding when to implement a new accounting policy, a decision to draft changes to a policy statement, and a decision to support the proposed library budget.

The results of this additional analysis indicated some degree of classification ambiguity for 59.7% of the planning decisions, 43.08% of the policy decisions, 53.66% of the resource allocation decisions, and 14.81% of the personnel selection decisions. These findings suggested that the vast majority of personnel selection decisions were independent of the other three major decision categories and did not involve planning, policy making or resource allocation components. However, some interdependence between the other three categories appeared to occur in approximately half of the planning, policy making and resource allocation decisions.

Overall, the pilot study results showed that planning, policy making, resource allocation and personnel selection decisions were common in the university committees surveyed. Of these, planning, policy making and resource allocation decisions appeared to be most prominent: more than two thirds of the committees made decisions of these types, and approximately half of these decisions involved some classification ambiguity. These findings were consistent with the management literature where planning, policy making and resource allocation are considered to be major organizational functions (see Thorngate & Strickland, 1982). It therefore

seemed that these types of tasks would be most likely to generalize beyond the committees surveyed, and even beyond a University environment.

Based on the results of the pilot study, there were two possible ways of selecting a group decision making task that would be likely to have a high degree external validity. One was to select either a planning, policy making or resource allocation task. The other was to acknowledge that planning, policy making and resource allocation were often aspects of a more general decision task, and, on these grounds, to choose a task that incorporated all three types of decision making activity. Given that those committees who made non-procedural decisions were generalized decision making bodies who frequently made all three types of decisions, the latter approach was adopted. Thus, a decision task was selected to incorporate planning, policy making and resource allocation.

One of the major emphases within organizations of all types has to do with organizational change and development (see, e.g., Huse, 1985; Kirkpatrick, 1985, or Weiss, 1986). Given this, real world decision making groups are frequently called upon to make recommendations for change in some aspect of their organization. Recommendations of this type involve planning, policy making and resource allocation: organizational change must be planned, new policies are usually required to implement the planned changes, and the changes typically require some budget reallocation. Therefore decision tasks in which groups are required to make organizational change, or improvement, incorporate the three most prominent types of decisions identified in this study. Hence, when students were used to study the impact of computer conferencing structure on group decision making performance, a decision task that required them to make recommendations for improving an aspect of their organization, Trent University, was used to try to ensure high external

validity.

METHOD

Subjects

Subjects were 111 females and 39 males who were assigned to 30 groups of five individuals. All were undergraduate students at Trent University. They ranged from 18 to 42 years, with an average age of 20.3 years. One hundred and thirty two of the subjects were first year students, enrolled in Introductory Psychology and Computer Studies courses. The remaining 18 subjects consisted of 13 second year students, two third year students and three fourth year students. Those students enrolled in Introductory Psychology were given four course credits for their participation. The others participated on a voluntary basis. All subjects were eligible for a \$200 prize awarded to the group whose decision making performance was judged to be the best.

Materials

The Task

Consistent with the results of the pilot study, the type of decision task used required subjects to make recommendations for improving an aspect of Trent University. The specific task asked subjects to make recommendations for improving the quality of the services provided by the University's Bata Library¹. The library was chosen over other aspects of University life because of its relevance for students. Complaints about the library are commonplace at the University. During the 1987-88 academic year these complaints culminated in a student protest

which attracted well over half the student body, raised an average of \$10 per student to boost the library's acquisitions budget, and resulted in the establishment of a Library Services Committee whose mandate was to review the operation of the library and make recommendations for the future.

The Computer Conferencing System

The computer conferencing system used was MEET, a programme developed by Warren Thorngate (1985) and adapted for the VAX system at Trent in 1988. The version of MEET used in this research was a simplified version of the original programme because of the limitations of the type of VAX BASIC offered at Trent. However, this simplified version contained all the essential features of the original conferencing system. It also included additional subroutines that monitored the choices made by subjects during their sessions on MEET. Thus, at the end of the study there was available for each group a complete record of who had read any particular comment, who had sent any particular comment, and where they had sent it.

MEET was chosen over the available alternatives for three major reasons. First, while the alternatives were essentially adaptations of an E-mail system, MEET is specifically a computer conferencing programme. Second, as a conferencing programme, MEET is extremely easy for subjects to learn and use. And third, because MEET was set up on Trent's VAX system there were no participation or administration costs, and any technical problems encountered during the study could be quickly rectified.

MEET consists of a public conference forum, where group members conducted their discussion about the library, and a mail facility which allowed participants to send private mail messages to others in their group. Using MEET several

conferences could take place simultaneously. Participants were, however, registered in only one conference. They therefore had access to only one group discussion. In addition, they could send messages to members of their own group, but not to members of other groups.

In order to give participants a conceptual understanding of the conferencing system, MEET uses a Hotel analogy. Consequently the public conference forum is conceptualized as the CONFERENCE ROOM, and the private mail system as the MAILROOM. When participants signed on to MEET they were given the choice of going to either the MAILROOM (to exchange private messages) or to the CONFERENCE ROOM (to contribute to the group discussion). In the MAILROOM they could check their mailbox to see if other group members had sent them a message. They could also write and edit a message, and then send it to one or more group members.

When participants selected the CONFERENCE ROOM they were confronted with a list of one or more topic headings that were used to organize the group discussion. In order to contribute to their group discussion, they were required first to select one of these topics, and then read the comments entered by others under that heading, and/or add new comments to the group discussion on that topic. Topic headings could be added at any time during the group discussion, but only by the researcher. The number and type of topic headings in the CONFERENCE room varied across the three conferencing conditions and these variations will be discussed in more detail in the Procedure Section below.

The Questionnaires

Two questionnaires were used in this research (see Appendix A for copies of these questionnaires). The first was a Background Questionnaire that was given to

subjects prior to their conference participation. In addition to demographic information about age and sex, this questionnaire was designed to tap individual dimensions that may have an impact on computer-mediated group decision making performance. These dimensions included: intelligence, knowledge of the University library, committee work experience, experience with computers, and attitudes towards computers. Subjects' average grade in their last year of academic study (at either University or High School) was taken as a measure of intelligence. Subject's knowledge of the library was measured indirectly by variables such as: year in university, number of visits to the library in the last month, and participation in the 1987-88 student demonstration about the library. Committee work experience was measured in terms of the number of committees subjects had been involved in over the past two years, and the number of those committees on which they had served as Chairperson. Finally, computer experience and attitudes towards computers were measured using a questionnaire developed and tested by Tombaugh and Dillon (1987).

The second questionnaire used in this research was a Post-Decision Questionnaire, given to subjects at the end of their conference participation. It was designed to measure individual subjects' satisfaction with their group decision making processes and with their final recommendations, and to tap individuals' perceptions of the task, their level of participation, and the roles played by different members of the group during the discussion. It also assessed different aspects of subjects' participation experiences, and determined whether subjects had met face-to-face during their participation, if so, whether they had discussed the library task. The assessment of subjects' participation experiences included questions related to: the problems subjects had encountered which served to limit

their participation, the factors that had encouraged them to participate, the kinds of factors that had either inhibited or facilitated their group discussion, and the quality of their computer conferencing experiences.

Procedure

The student subjects were recruited in lectures and labs in the last week of classes before the Christmas break in 1988, and in the week before the second term reading week in mid-February, 1989. The second recruitment session was necessary because approximately 25 of the subjects recruited before Christmas failed to appear for their training session on MEET.

In order to recruit subjects, students were given a brief description of the study, and of the nature of their participation. Following this, interested students were asked to write their names and phone numbers on sign-up sheets that were circulated through the class. When all the sign-up sheets had been returned, the list of names was randomized and subjects were called in this random order to arrange for a training session to learn how to use MEET. Assignment to one of the available training sessions was not random but depended upon students' schedules and the number of people already signed up for a particular training session. However, within any training session, the order in which subjects were scheduled was also the order in which they were phoned.

Because subjects in this research were participating in an asynchronous computer conference over a two week period, subject attrition was expected to be a major problem. Two important sources of subject attrition were expected. First, it was expected that some of the subjects scheduled for a training session would not

appear. Second, it was expected that some of the subjects who had been trained to use MEET would not, in fact, participate in their group's conference. In order to try to minimize the expected attrition rate, it was considered to be important to train five people in each group and accept the fact that some would choose not to become active participants. In this way the first source of subject attrition was eliminated and the second was accepted as being a realistic picture of the participation patterns in real world computer conferences.

Based on this strategy for reducing the rate of subject attrition, subjects were assigned to groups of five upon their arrival at the training session. The assignment was done in the order in which subjects had been scheduled. The number of subjects trained together varied from one to 15, depending upon the number of students scheduled at that particular time, and the number of scheduled students who chose to attend their training session. Thus, the requirement that each group contain five members at the beginning of the training session, meant that group members were sometimes trained together and sometimes trained in different sessions.

When individuals who had been assigned to different groups were trained together care was taken to ensure that they belonged to groups assigned to the same computer conferencing condition. This was necessary because each of the three conferencing conditions differed in their use of topic headings in MEET's CONFERENCE ROOM and, hence, required different instructions. Training groups from different conditions together would therefore have confounded the independent variable manipulation. For example, training groups in the self-structured condition with groups in the passively structured condition would have primed groups in the self-structured condition to structure their discussion using the same topic headings that were

provided for the passively structured conferences.

Although training groups in the same conferencing conditions together did allow for a valid manipulation of computer conferencing type, it also introduced a possible order effect because the groups were not trained in random order, but rather in blocks of groups belonging to the same condition. This process of trading-off one type of confound against another is typical in group research and, in this case, it was felt that the possibility of an order effect was less serious than the very real possibility of a confounded independent variable.

The training sessions were generally between 45 and 50 minutes in length. During the sessions group members were first introduced to computer terminals. This was necessary because some subjects had no computing experience and had never turned on a computer terminal. Subjects were then given a general conceptual understanding of the way in which computer conferencing systems work. In particular, they were informed that conferences typically consisted of a public conference forum where group discussions were conducted, and a mail system which allowed group members to exchange private messages with other individuals in the group. It was stressed that the private mail messages could be notes on any topic and need not be restricted to the subject of the group discussion.

Following this general discussion, the Hotel analogy of MEET was explained to help subjects keep track of where they were in the system, and, using a series of overheads, the operation of MEET was explained in detail. In both the MAILROOM and the CONFERENCE ROOM, subjects learned what would appear on the screen in response to any of the MEET commands they used. They were also given instruction in how to use MEET's Editing system.

In this part of the training session, groups in all three conditions received the

same illustrative examples in which conference discussions were organized under topic headings. These examples included a conference in which groups were asked to plan a large party and organized their discussion under topics such as FOOD, DRINK, or ENTERTAINMENT, and a conference which replicated an actual self-help group meeting. In this latter conference the discussion was organized under topic headings representing agenda items. These included: FALL SEMINAR SERIES, TRAINING SESSIONS, FUTURE FUNDING and AGM AGENDA ITEMS. These examples were chosen for clarity, to enable all groups to gain an understanding of the function served by topic headings in general. They were also chosen to provide groups in the self-structured condition with examples of the kinds of topic headings that had been used in other conferences, in order to guide them in any attempt they made to organize their own discussion.

Immediately after the training sessions subjects were given their own computer accounts, with their own usernames and passwords. Subjects could not change their own passwords and so were urged to keep the ones they had been given private. They were given a mini-manual explaining the commands they would need to use MEET successfully (see Appendix A for a copy of the manual). They were also given phone numbers for the researcher in case they encountered problems not covered in this mini-manual.

Once they had received their computer accounts subjects were given instructions about their participation. Details of these instructions are included in Appendix A. Subjects were told that their group of five was to use MEET to discuss the problems with the University Library and to make recommendations for improving the quality of the services provided by the library. To assist them in this task, subjects were given a sheet containing background information about the Library (see Appendix A

for details). Subjects were told that if they had additional questions about the Library they should not approach Library staff but, instead, should send a mail message to the researcher who would have a mailbox in the MAILROOM. She would act as a resource person for each group and would provide them with whatever additional information they requested about the Library.

Subjects were reminded that the major purpose of the study was to investigate how groups communicated when they used computer conferencing systems. Given this, they were requested not to meet and conduct their discussion face-to-face, but to confine their communication to the MEET system. They were asked to sign-on to MEET, and participate in their group discussion, once a day for the following two weeks. However, in recognition of the fact that many Trent students frequently go home for weekends, subjects were informed that they were not expected to make a special trip to the University on weekends in order to participate.

Specific participation instructions were given to subjects in each of the three conferencing conditions (see Appendix A for the verbatim instructions). Subjects in the self-structured conferencing condition were told that their group discussion would be organized under a single topic heading - GENERAL - and that when they signed-on to MEET and selected the CONFERENCE ROOM option, they would need to select the GENERAL topic before they could read, write and add comments to their group discussion. They were further told that if they wished to organize their discussion by adding additional topic headings, then they were to contact the researcher through her mailbox in the MAILROOM. When she received the list of specific topic headings they had decided upon, she would add them to the CONFERENCE ROOM topic options. Subjects were informed that any discussion that had occurred

prior to the addition of the new topic headings would remain under the GENERAL topic heading. However, after the addition, participants could choose either the GENERAL topic or one of the new topics before reading and writing comments.

Subjects in the passively structured conferencing condition were told that their group discussion would be organized under four topic headings - ANALYSIS, ALTERNATIVES, EVALUATION and DECISION - all of which would be added by the researcher at the beginning of the conference. The purpose of each of these four topics was explained to subjects and they were informed that when they signed-on to MEET and chose the CONFERENCE ROOM, they would be required to select one of the four topic headings before being able to read and write comments. They were told that the first comment under each topic heading would be a reminder that would reiterate the purpose of that topic. Furthermore, they were told that when they had finished with the selected topic heading they could leave it, chose another topic and read and respond to the comments under that heading.

Subjects in the actively structured condition were told that their conferences would begin with only one topic heading - ANALYSIS. Participants who signed on and chose the CONFERENCE ROOM, would therefore need to select ANALYSIS before they could read or write comments about the library. Subjects were also told that when the group discussion on the analysis of the problems with the library seemed to be exhausted, the researcher, as conference moderator, would add the second topic ALTERNATIVES. Thereafter they could read comments under either ANALYSIS or ALTERNATIVES, but they were requested to write comments only under the second of these topics. In particular, they were asked not to add any further comments to the topic ANALYSIS. In a similar fashion subjects were instructed about the addition of the other two topics, EVALUATION and DECISION, and that the timing of these

additions would be determined by the researcher as conference moderator. As in the passively structured condition, the purpose of each of the topic headings was explained to subjects and reiterated in the first comment under each topic heading in the CONFERENCE ROOM.

In addition to the instructions for using MEET, subjects in the actively structured conferences were informed that the researcher would play an active role as conference moderator. They were told that in addition to adding successive topic headings, the researcher, as conference moderator would send them private mail messages congratulating them on any good ideas they generated, would summarize the content of the group discussion from time to time, and would report on the progress of their discussion.

Following these specific MEET instructions, subjects were informed that at the end of their two-week conference they were to summarize their recommendations for improving the Library in point form. These recommendations would then be forwarded to a panel of three judges - a faculty member, a student, and the head of the Library - who would grade them for economic feasibility, creativity and workability. Finally, subjects were told that the group who received the highest average rating from the judges would be awarded a \$200 prize. This was offered as a way of increasing subject motivation with the hope of ensuring increased levels of participation and decreased levels of subject attrition.

At the end of the training session subjects were given the Background Questionnaire to complete and, once this was done, they left with instructions that they could begin their conference the following morning, after it had been set up by the researcher. They were asked to meet again at the same time in two weeks in

order to get their four participation credits (where applicable) and complete the Post-Decision Questionnaire.

During the conferences, the researcher, as resource person, checked her mailbox daily for messages requesting information about the system or the Library, and for messages from groups in the self-structured groups requesting the addition of new topic headings. In addition, the researcher, as conference moderator, signed on to the conferences in the actively structured condition once a day. At that time she read all the comments that had been added to the group discussion over the past 24 hours. She then summarized these contributions and wrote one or more comments informing the group about their progress and about when the next topic heading may be added. In addition to this conference input, the researcher, as moderator, also wrote mail messages of encouragement to subjects who had just signed on for the first time, and mail messages providing positive feedback for significant or innovative comments that had advanced the group discussion over the previous day.

After one of the two weeks of their conference, the researcher sent participants a mail message reminding them that they had one more week to complete their discussion and make their recommendations for improving the Library. The final time and meeting place was restated and subjects who could not make the meeting were requested to inform the researcher.

In addition to providing input throughout the actively structured conferences, the moderator was responsible for introducing the topic headings in that condition sequentially and hence was required to judge the timing of the introduction of the topics ALTERNATIVES, EVALUATION, and DECISION. Two major criteria were used for this task and both were subjective. The first was that the next topic heading was introduced when the discussion of the present topic seemed to be exhausted. The

discussion under any particular topic heading was considered to be exhausted if, following the moderator's most recent summary of the ideas raised during the discussion of that topic, group members signed on to MEET and either did not contribute any further ideas, contributed ideas that were merely repetitions of earlier ideas, or naturally began discussion of the next topic. If the discussion had either ceased or began to cycle in this fashion, the moderator announced the introduction of the next topic and entered the new topic heading. In addition, the moderator introduced the next topic if a group member indicated that the discussion under the present topic was exhausted and requested the introduction of the next topic.

The second criterion used to determine when to introduce the next topic heading was a pragmatic one that ensured that groups did, in fact, have the opportunity to discuss all four topic headings during the two week conference. Thus, if the discussion under one topic heading was showing no signs of exhaustion after four days, the moderator would announce to the group that it would be necessary to move on to the next topic in order to complete discussion of the library task within the allotted two week period. In this case, participants were told that the next topic heading would be added in approximately 36 hours, and that they should make sure they had raised as many ideas and issues as possible before that time. Again, the next topic was introduced if a group member expressed concern about the limited time left and requested the addition of a new topic so the group could move on.

At the end of each conference participants met for a period of approximately 20 minutes to fill out the Post-Decision Questionnaire. Following this they were given their four participation credits (where applicable), and thanked for their participation. They were also told they would receive a feedback sheet that put the

study in context and provided them with a more detailed description of the purpose of the study (see Appendix A for a copy of this feedback sheet). Finally, subjects were informed that the names of the people group who won the \$200 would be posted on the Psychology Department notice board. They were then allowed to leave.

Those subjects who either did not participate in the conference to which they had been assigned, or participated but failed to appear for the final meeting, were sent a copy of the post-decision questionnaire in the University mail with instructions to complete it and return it to the researcher's mailbox. Those who had not returned completed questionnaires in two or three weeks received a reminder in which the importance of their cooperation for the success of the study was emphasized.

RESULTS

Background Characteristics of Sample

The majority of the 150 subjects in this study (64.7%) reported a B average in their last year of academic study. Of the remainder 26% reported an A average, and 9.3% a C average. The absence of subjects with D averages is perhaps not too surprising given that 88% of the subjects were first year students, and an average of C or better is necessary to be admitted to Trent.

Overall the subjects were moderately familiar with the Library. Although at least one subject reported visiting the Library 40 times in the previous month, the average was considerable lower than this ($M=6.3$; $s.d.=.52$). Only four per cent of all subjects had attended the student demonstration about the Library held during the previous year but this finding was not surprising, given the high proportion of first year students in the study.

Most subjects had had some committee experience in the last two years. Approximately 71% had served on at least one committee during that time and 14% reported serving on five or six. On average, subjects had served on two committees ($M=2$; $s.d.=1.92$). In addition, of those who had served on committees, almost two thirds (64.5%) had acted as Chairperson on at least one of their committees.

Subjects' computing experience was calculated on the basis of questions one through nine in Section B of the Background Questionnaire. Using the scoring key outlined in Appendix C, the minimum possible score was zero and the maximum possible score was 75. Subjects' scores ranged from zero to 55, with an average of

14.2 (s.d.=9.97). Hence, subjects were not, on average, experienced computer users. Seventeen of the 150 (11.3%) had no experience at all, the modal score was between 10 and 15, and only five subjects (4.8%) had scores in excess of 35.

Subjects' attitudes towards computers were calculated on the basis of Question 10 in Section B of the Background Questionnaire (see Appendix C for the semantic differential scoring procedure). Despite the relative lack of computing experience subjects generally did not report negative attitudes towards computers. With scores ranging from a low of 22 to a high of 154, and a neutral point of 88, the mean score for the sample was 102.9 (s.d.=14.16) indicating that, on average, subjects had very mildly positive attitudes towards computers. Indeed, no subjects reported moderately or strongly negative attitudes towards computers, and only four (2.7%) reported attitudes in the mildly negative range (55 to 77). On the other hand, the attitudes of the majority (53.7%) of the subjects were in the mildly positive range (99 to 121), and 16 subjects (10.7%) had attitudes that were either moderately or strongly positive.

Participation Patterns

Subjects' patterns of participation in their computer conferences can be measured in three major ways: the number of times they logged on to MEET (participation rate), the percent of the group discussion they contributed and the percent of comments in the conference that were read by either all of the majority of conference participants. Each of these will be examined separately.

Participation Rates As expected, the subjects' participation rates varied considerably. Subjects were asked to sign-on to MEET once a day for two weeks.

exclusive of weekends. Hence, they were asked to sign-on to the computer 10 times. The number of times per week participants logged on to MEET can be seen in Table D-1. From Table D-1 it is clear that, of the 150 subjects, 134 (89.3%) signed on to MEET at least once.

Based on these participation rates, subjects were classified as either non-participants, occasional participants, or conference regulars. Since participants were asked to sign on to MEET once a day for 10 days (two working weeks), a conference regular was defined as someone who signed on more than five times, or the equivalent of at least once every second day. Occasional participants were those who signed on between one and four times, or the equivalent of twice a week or less.

The number of non-, occasional and regular participants are summarized in Table D-2. As can be seen in that table, 33 (24.8%) signed on to MEET at least 10 times and a further 59 (39.85%) subjects signed on between five and nine times. Overall, then, almost two thirds of the subjects (64.65%) were conference regulars. Almost a quarter of the subjects were classified as occasional participants (24.68%). However, there were relatively few of the subjects in this category who had very low participation rates. Only 12 (8.96%) signed on once or twice. Of these, only three signed on once and then withdrew from their conference, and the other 9 signed on twice, or the equivalent of once a week.

Group Composition Given the lack of participation by 17 subjects, not all groups contained five members who were active in the sense that they had signed on to MEET at least once. However, the majority of the groups (53.3%) contained five active members. Of the remaining 14 groups, 11 (36.7%) contained four active members and three (10%) contained three active members. When subjects were assigned to groups of five, no attempt was made to control the sex composition of the groups.

Thus, after attrition, six groups contained only females, and 26 of the 30 groups contained a majority of females. No groups were composed entirely of males.

Group Discussion Contributions Log-on rates, by themselves, do not give an accurate picture of conference participation. While they do demonstrate that subjects signed on to MEET, they give no indication of what subjects did once they were on their conferencing system. In order to conclude that the log-on rates did actually represent a group discussion, it was necessary to examine the proportion of the total communication volume entered that could be attributed to each individual who participated in a conference, whether on a regular or occasional basis. The frequency of participants contributing different proportions of their group discussions are summarized in Table D-3. As can be seen from that table, 25 (16.67%) contributed less than 10% of their group discussion. However, over half (56.67%) contributed more than their 20% share of the group discussion, and seven subjects (4.67%) contributed more than half of their group discussion. Indeed, one subject contributed nearly three quarters of one conference discussion. A Pearson's correlation coefficient was calculated in order to establish whether there was a relationship between the number of times subjects logged on to MEET and the proportion of the group discussion that could be attributed to them. This correlation was significant indicating that those who signed on to their conferences regularly tended to be those who contributed a higher proportion of their group discussion ($\chi^2(132) = .27, p < .01$).

In general, subjects who participated in a computer conference did appear to confine their discussion to MEET, as requested. While 23 (17.8%) of the 129 active participants who responded to the question reported talking face-to-face with others in their group, only nine (7%) admitted to discussing the Library during those

conversations. In all these cases, the subjects reported that their face-to-face discussions about the library had been brief and general.

Proportion of Discussions Read by Group Members The preceding section suggests that when subjects logged on to MEET they did tend to contribute to their group discussion. This finding, while useful, does not give a full understanding of the participation patterns in the conferences, because it does not give any indication of whether subjects' read the contributions of others. To the extent that they did not, the conferences were less like group discussions and more like a number of individual soliloquies.

In order to determine whether the group discussions had any sort of coherence, the proportion of all statements read by all group members were calculated. On average, 24.07% of the statements entered into conference discussions were read by each active participant in the group and this proportion did not vary across conditions ($F(2,27)=.523$, ns. (see Table D-4 for ANOVA and Summary Tables)). Given that this proportion was somewhat low, the coherence of group discussions was investigated further by calculating the proportion of statements in the conference discussions read by the majority of active participants. This analysis revealed that more than three quarters of all statements (76.9%) were read by the majority of group members and, again, this proportion did not vary across conferencing conditions ($F(2,27)=1.996$, ns. (see Table D-5 for ANOVA and Summary Tables)). These two results taken together offer some evidence to support the notion that group members not only contributed to their discussions but also based their contributions on other members' comments.

Comparison of Participating and Non-Participating Group Members

Although the number of subjects who failed to sign on to MEET was small (17), a series of t-tests was performed to gain some insight into why these subjects chose not to participate in their computer conference. It seemed possible that those who failed to sign on to MEET may have been either less experienced with computers, or reported more negative attitudes towards computers. In order to test these suppositions two one-tailed t-tests were performed. Neither was significant ($t(148) = .88$, $p = .1901$ for computing experience, and $t(147) = .555$, $p = .2899$ for attitudes towards computers).

While non-participants did not report more negative attitudes towards computers in the abstract, it was possible that, when faced with a concrete system (MEET), they did perceive more severe problems associated with using the computer and, as a result, abandoned the project. A test of this was possible because non-participating subjects were sent a copy of the post-decision questionnaire and asked to complete Question 8 which examined factors that limited subjects' participation. Of the 17 non-participants, nine completed this question. When the numbers circled for each of the 10 potential problems were summed a total problem score was obtained, and this could range from a low of zero to a high of 40. A one-tailed t-test on these scores revealed that, on average, those who participated in a computer conference had a problem score of 9.28, while those who failed to sign-on to MEET had a problem score of 12.56. This difference was marginally significant ($t(134) = -1.721$; $p = .0437$).

In order to gain some further understanding of the nature of the problems encountered by the two groups, a factor analysis was performed on the 10 problem

items in Question 8. Using a Varimax rotation, this analysis yielded three orthogonal factors (see Table D-6 for the factor analysis Summary Table). With a minimum factor loading of .5, all three factors were interpretable. Three of the 10 potential problems had significant loadings on the first and largest factor. These had to do with computer conferencing being a complicated communication medium, with the lack of face-to-face contact, and with a dislike of using a computer to communicate. Thus, the first factor seemed to be related to a preference for face-to-face communication.

The second factor incorporated problems related to lack of assistance in learning to operate the conferencing system, difficulty in understanding the instructions for using MEET, and lack of experience with computers. This factor was labelled an intimidation factor. Subjects with high scores on this factor would be expected to lack experience using computers and to need considerable guidance when using a computer conferencing system.

The third and final factor was essentially a time pressure factor. The problem with the highest loading was a lack of time. However, lack of typing skills and difficulties in gaining access to a computer terminal also loaded significantly. Without typing skills participation in a computer conference was much more time consuming. In addition, based on informal subject reports, lack of access to a computer terminal seemed to be primarily related to line-ups at the terminals on campus. Thus, lack of access to a terminal was a problem because of the waiting time involved.

It seemed reasonable to suppose that, relative to participants, non-participants would show a greater preference for face-to-face communication, feel more intimidated by the conferencing system, and experience greater time pressure. In order to test these suppositions three one-tailed t-tests were performed using the

factor scores for each dimension. The results showed no significant differences between the two groups in either their preference for face-to-face communication, or the degree of time pressure they experienced ($t(134)=-.259$; $p=.3979$, and $t(134)=-.812$; $p=.2092$ respectively). However, there was a highly significant difference between the two groups on the intimidation factor ($t(134)=-2.777$; $p=.0031$). Non-participants appeared to be more intimidated by the idea of using a conferencing system than those who did participate in the study ($M=.87$ (s.d.=1.29) for non-participants, and $M=-.06$ (s.d.=.95) for participants).

The results of the preceding analysis are somewhat suspect because the small number of non-participants and the marked differences in the two sample sizes increase the chances of violating the assumptions underlying the use of the t-test. Nevertheless, if the results are considered to be largely descriptive, they do tend to suggest that those subjects who chose not to participate did so primarily because their lack of experience made them unsure about how to use MEET and, as a result they were intimidated by the idea of a computer conference. Thus, it seemed that participation was not limited by lack of experience per se, but by the psychological ramifications of that inexperience. Given this, participation rates could perhaps have been increased with more personalized instruction. In particular, some supervised, individualized, hands-on experience on MEET may have been helpful.

Factors Influencing Participation

For those who signed-on to MEET at least once there were a number of factors that either encouraged or discouraged participation. These included: task characteristics the reasons for participation, the problems encountered during participation, and

factors that either facilitated or inhibited group discussion.

Task Characteristics Subjects' perceptions of the Library task were assessed on a 7-point rating scale in Question 5 of the Post-Decision Questionnaire. The scores for each of the 10 items in Question 5 were combined to produce a score for task difficulty and task interest (see Appendix C for details of the scoring procedure). Based on these scores, the mean rating for task difficulty was $M = 3.94$, and the mean rating for task interest was $M = 5.6$. Thus, subjects did not find the Library task either easy or difficult. They did, however, perceive it to be moderately interesting. Given this pattern, the Library task may have served to promote participation.

Reasons for Participation The reasons that encouraged subjects' participation were assessed in Question 9 of the Post Decision Questionnaire. Of those who participated in their computer conference, 119 cited one or more factors that encouraged their continued participation in the study. The three most frequently mentioned reasons were: interest in the task (21.5%), interest in the research project (19.2%) and interest in using the computer to communicate (18.5%). Responses were classified as interest in the research project if subjects mentioned both interest in the task and interest in using the computer. Thus, almost 60% of the subjects were motivated to try to solve the Library's problems and/or to communicate via computer. The aspect of MEET that was most frequently cited as a reason for continued participation was the private mail system. This was perceived to be fun by 8.5% of participants. A complete list of the reasons given for participating, and the percentage of participants who mentioned each reason can be found in Table D-7.

Problems Encountered During Participation The problems which limited

subjects' participation were assessed in Question 8 of the Post-Decision Questionnaire. For each problem item, scores could range from 0 (indicating no problem) to 4 (indicating a major problem). Only two items were pervasive in the sense that the majority of participants gave them a rating of 2 or greater. These were: lack of time (65.4%) and lack of face-to-face contact (60.3%) (see Table D-8, for a complete listing of the percentage of participants who encountered each of the problems).

Factors Facilitating Group Discussion In an open-ended question (Question 11 of the Post Decision Questionnaire) participants were asked to describe any ways in which computer conferencing had made it particularly easy for the group to discuss the Library Task. Seventy of the 133 active participants responded to this question. Two facilitating aspects of computer conferencing were mentioned by at least a quarter of these subjects. These were: the freedom to sign-on at your own convenience (28.6%) and the lack of face-to-face contact (25.7%). The facilitating effects of a lack of face-to-face contact were, at first, somewhat anomalous because lack of face-to-face contact was also mentioned as a pervasive problem in computer conferencing. However, the benefits of not being face-to-face with other group members were related to the lack of interruptions by others, and individuals lack of concern about what others thought about the ideas they expressed (see Table D-9 for a complete listing of facilitating factors).

Factors Inhibiting Group Discussion Finally, participants were asked, in an open-ended question (Question 12 of the Post-Decision Questionnaire), to list any ways that computer conferencing had made it particularly difficult for the group to discuss the Library task. Two inhibiting factors were mentioned by at least a quarter of the 78 subjects who responded to this question. These were: lack of

feedback (33.3%) and difficulties coordinating and directing the group discussion (24.4%). The lack of feedback stemmed from two sources. It was related to the lack of participation by some of the other group members. It was also related to the lack of immediate feedback. In this latter case, others in the group did participate, but the turn-around time on comments was simply considered to be too slow. Other inhibiting factors and the percentage of participants endorsing each can be found in Table D-10.

**TESTS OF HYPOTHESES RELATED TO THE DIRECT IMPACT OF COMPUTER
CONFERENCING
STRUCTURE ON INDICES OF GROUP DECISION MAKING PERFORMANCE**

The major purpose of this study was to examine the effect of different computer conferencing conditions on indices of decision making performance. The three conferencing conditions differed in the type of decision support they provided, and in the degree to which that decision support was structured. In the Self-Structured (SS) condition no structured decision support was provided but group were given the opportunity to add some form of communication structure if they chose to do so. The Passively Structured (PS) conferences provided communication structure which involved the simultaneous presentation of topic headings corresponding to the four major stages of group decision making. In the Actively Structured (AS) conferences the decision support was an amalgam of communication structure and conference leadership. The four topic headings used in the PS conferences were also used in the AS conferences, but one of the moderator's tasks was to add these headings sequentially instead of simultaneously.

Given these three conferencing variants, two issues require discussion prior to testing the hypotheses outlined above. One of these issues is related to whether groups in the SS condition did choose to structure their conferences in any way. The other deals with the nature of the moderator's input.

Self-Structured Groups Of the 10 groups in the SS conferencing condition, two chose to add topic headings as a way of structuring their conferences. One requested the addition of headings at the beginning of their discussion of the library task. They requested 12 separate topic headings, each of which corresponded to different problems individual group members identified with the library. They then used these headings to generate and evaluate solutions to each individual problem. They did not use the one GENERAL topic heading provided for them, and so had no means of considering either their set of problems, or their set of solutions as a whole.

The second self-structuring group requested the addition of topic headings three days before the end of their conference. In contrast to the large number of topic headings selected by the first self-structured group, this second group requested only three topic headings. These corresponded to major solutions that the group wished to incorporate into their recommendations. Therefore, under these headings the group elaborated upon and refined their solutions.

Overall, the two groups who chose to structure their discussion using some form of communication structure both selected topic headings related to the content of their discussions. Neither spontaneously generated the kind of topic headings used in the PS and AS conferences. Each did find it necessary to organize their discussion during one particular stage of their decision making process (ANALYSIS and DECISION, respectively). Furthermore, the timing of the introduction seemed to influence the degree to which the group discussion was fragmented. The early

addition of topic headings promoted discussion which considered problems with the library separately and independently of each other. The late addition, on the other hand, promoted a more integrated discussion. These differences in the timing of the introduction of topic headings did appear to have some impact on indices of group decision making performance; however, these will be discussed later, in the context of those performance indices.

The Nature of the Moderator's Input in the Actively Structured Conferences As mentioned earlier, the moderator performed a number of roles in the AS conferences. She summarized the content of each group's discussion every 24 hours, tried to promote discussion, provided feedback about group progress within a topic heading, provided direction by telling groups what was expected of them at each stage of the decision making process, tried to create a positive, supportive conference environment, and encouraged participation by sending private message to group members offering positive feedback on their comments and ideas. Perhaps most critically, she also determined when it was time to introduce a new topic heading and at that time instructed the group to concentrate their efforts on the next phase of their group discussion. Examples of the moderator's input related to summarizing the discussion, to promoting discussion, to offering support and encouragement, to procedural issues, and to introducing topic headings, are given in Appendix B.

As can be seen from Appendix B, the moderator's input involved three different types of communication. The summaries of the group discussion and the attempts to promote group discussion comprised task relevant sentences, and the encouragement and positive feedback given to subjects in both the CONFERENCE and MAILROOM was in the form of sentences that could be classified as supportive. Finally, the communication that dealt generally with procedural issues, and specifically with

introducing new topic headings, could be classified as procedural.

In order to determine the relative effort the moderator devoted to each of her major roles, the proportion of her total input devoted to task, supportive and procedural input was calculated. In addition, the proportion of her total input classified as 'Other' was calculated. Sentences in this category were largely sentences related to the computer system MEET and its use. The relative proportions of each of these types of communication are shown below in Figure 2.

As can be seen from Figure 2, just over 40% of the moderator's input was related to task-relevant matters which included summaries of the content of the group discussion and statements meant to promote group discussion. Approximately 30% of the moderator's input was related to procedural issues dealing with direction both within topics and in the movement from one topic to the next. Finally, just over one quarter of the moderator's input was supportive in nature. Thus, the moderator devoted approximately 70% of her input to communication that would allow groups to work more effectively together, and just over 25% to promoting a positive, supportive group decision making climate.

The Impact of Computer Conferencing Structure on Group Discussion Effectiveness

The structured decision support in the PS and AS conferences was intended to promote group discussions that were more effective than those in the baseline SS condition. In addition, the addition of moderator roles (including the sequential presentation of the PS communication structure) in the AS conferences was intended to encourage group discussions that were more effective than those in the PS

conferences. Tests of the hypotheses related to the impact of conference structure on indices of group discussion effectiveness are somewhat problematic. The problem arises specifically in the AS conferences and is related to the nature of the indices of group discussion effectiveness used in this research. These indices are communication based indices of discussion thoroughness, process emphasis and

FIGURE 2: Proportion of Moderator's Input Devoted to Task Relevant, Procedural, Supportive, and Other Communication in Actively Structured Conferences

1 = Task Relevant Communication; 2 = Procedural Communication; 3 = Other Communication; 4 = Supportive Communication

group cohesion. In the AS conferences, however, the moderator's roles were also communication based and involved the same types of communication. Thus, a question

centres around whether or not analyses using the communication based indices of group discussion effectiveness should include the moderator's input. Resolution of this problem revolves around the issue of possible interdependence between the moderator's communication and that of the group members.

The Interdependence of the Communication Generated by the Moderator and the Group Members in the Actively Structured Conferences

In the AS conferencing condition, the presence of a moderator, and her specified roles, is the independent variable manipulation that distinguishes between the PS and AS conferences. As mentioned earlier, the moderator is not independent of the communication structure variable common to both the AS and PS conferences. Nevertheless, the AS conferencing groups do experience a type of structure that is missing in the PS conferences. Given this, the question of interdependence revolves around whether the communication contributed by the moderator is equivalent to her specified roles. If so, then the volume of different types of communication generated by the moderator can be considered to be a traditional independent variable. Under these conditions, the dependent variables are indices of different types of communication generated by the group members in response to the moderator's input. The hypotheses related to group discussion effectiveness would, in the AS condition, therefore test the impact of conferencing structure, including the moderator's input, on the communication generated by participating group members

Such an interpretation makes little sense in light of what is known about the interactive nature of groups and group processes. In the group process literature there is evidence that while leaders have an impact on the communication behaviour

of followers in a group, the followers, in a reciprocal fashion, also have an impact on the communication behaviour of leaders (see Sims & Manz, 1984). Thus, in this research, the conference moderator's input was initially equivalent to the roles she was required to play. Once that initial communication was entered into the conference, however, there was the potential for later moderator input to be influenced by the communication contributed by participating group members. For example, one of the moderator's tasks was to summarize the content of group discussions periodically. Once she had done this it was possible that group members would perceive this to be helpful, or expected, and would take it upon themselves to provide such summaries. In this case, when the moderator next signed on to perform her summarizing task, she would find this task was unnecessary and she would essentially be prevented from performing part of her specified role. Thus, members of the group may contribute statements that negate at least part of the moderator's role. In this way, feedback loops are possible and, with the exception of the moderator's initial input, the volume and nature of her communication is best conceptualized as being determined not only by the roles she is required to play as moderator, but also by the volume and nature of the communication entered by participating group members.

Based on the preceding argument, it is apparent that there is an inherent conceptual interdependence between the moderator and the group members' communication. Therefore, the moderator's communication is not equivalent to her roles but is, in part, the effect of those roles. Thus, it is not, strictly speaking, an independent variable. Instead, it is partly an independent variable and partly a dependent variable. Similarly, the group member's communication is not a dependent variable in the traditional sense. Not only is it produced in response to

the moderator's input, but also it can shape that input. Given this, the question becomes one of conceptualizing the hypotheses related to the impact of computer conference structure on indices of group discussion effectiveness.

Group Discussion Effectiveness Hypotheses as Manipulation Checks In the AS conferences the moderator's input is part of the structured decision support. Hence, in these conferences, there is an interdependence between the decision support provided and the statements participants contribute to their group discussion. Therefore, in the AS conferences, it makes little sense to conceive of a unidirectional impact of conference structure on indices of group discussion effectiveness. To do so is to ignore the potential of feedback loops between group members' and the moderator's communication.

A better approach would seem to be to acknowledge the possibility of these feedback loops and try to gain some insight into the extent to which these loops operated in the AS conferences. This approach necessitates a focus on the fact that the moderator's input is, in part, a dependent variable, corresponding to the effect of the roles the moderator was required to play. From this perspective hypotheses relating to the impact of computer conferencing structure on indices of group discussion effectiveness are in part just that; however, they are also, in part, checks of the structured decision support manipulation. Thus, rather than viewing these hypotheses in the traditional sense, it seems more appropriate to conceptualize the creation of different decision support variants in the three computer conferencing conditions as an attempt to create three distinct group discussion environments or atmospheres that would lead to different quality and satisfaction outcomes.

Within this framework the hypotheses dealing with group discussion effectiveness can perhaps best be conceptualized as checks of the effectiveness of the

computer conferencing decision support manipulation. This reconceptualization does not have a great impact on the data analysis for the SS and PS groups. It does, however, have implications for the data analysis for groups in the AS conferences. The major one of these is that the volume of the moderator's communication is no longer something that is assumed, but becomes something to be investigated in the same way as the communication generated by the participating group members. Hence, it is necessary to use indices of group discussion effectiveness that include the communication of both the participating group members and the moderator. In this way, some insight can be gained into the group dynamics involved as a consequence of the kind decision support provided. Analysis of the total volume of different types of communication (including that generated by the moderator) can give an overall sense of whether the intended conferencing environment or atmosphere was achieved. Furthermore, comparison of this total volume with the volume generated by the five group members alone can provide insight into the degree to which the conferencing atmosphere can be attributed to the efforts of the moderator. To the extent that the desired conferencing atmosphere was created, and to the extent that this atmosphere could be attributed to the moderator's communication, there is some confirmation that the decision support manipulation in the AS conferences was successful in the sense that it provided the kind of discussion environment or atmosphere that would be expected to enhance quality and satisfaction outcomes.

From this perspective, the hypotheses related to discussion effectiveness were tested. Group discussion effectiveness was measured using communication based indices of discussion thoroughness, decision process emphasis and group cohesion. Hypotheses related to each of these types of indices were tested separately.

1a) Hypotheses Related to Discussion Thoroughness - Indices Related to Communication Volume

Two indices of communication volume were used to measure discussion thoroughness. These were: the total number of sentences in the discussion, and the total number of task related sentences generated during the conference sessions. The calculation of the first measure was straightforward. The total number of task relevant sentences included sentences whose focus was the Library, requests for information about the Library and requests for feedback on ideas related to the Library (examples of sentences classified as task relevant are given in Table E-1)

Total Number of Sentences In order to test the hypothesis that the number of sentences generated during the groups discussions would increase across conferencing conditions a one-way ANOVA was performed. The average number of sentences generated during the group discussion was: 202.5 in the SS conferences, 269.8 in the PS conferences and 355.7 in the AS conferences. These differences were significant ($F(2,27)=5.113$, $p=.0131$ (see Table D-11 for the ANOVA and Summary Tables). Follow-up analysis using Dunn's multiple comparison revealed that groups in the SS conferences generated significantly fewer sentences than groups in the AS conferences ($tD(3,27)=3.19$, $p<.05$). The communication volume generated by groups in the PS conferences did not differ from that generated by groups in either the SS or AS conditions ($tD(3,27)=1.401$, ns, and $tD(3,27)=1.789$, ns, respectively).

Because computer conferencing structure had a significant impact on communication volume, the two groups in the SS condition who chose to organize their discussion under topic headings were examined. One of these groups generated a

total of 342 sentences and the other generated a total of 456 sentences. These two groups generated the two highest communication volumes in the SS condition and, in fact, produced communication volumes more in keeping with the average volume generated by groups in the AS condition. For this reason, these two groups were eliminated from the analysis and the ANOVA on the total number of sentences in the group discussion was repeated.

With only eight groups in the SS condition, the mean number of sentences generated for that condition dropped from 202.5 to 153.375. The standard deviation also decreased, indicating that the remaining unstructured groups were somewhat more homogeneous in the number of sentences they produced than groups in the other two conditions. The results of this second ANOVA on the number of sentences produced during group discussions were highly significant ($F(2,25)=10.921$, $p=.0004$ (see Table D-12 for ANOVA and Summary Tables)). Follow-up analysis using Dunn's procedure indicated that, with the two outliers removed, groups in the SS conferences generated significantly fewer sentences than either groups in the PS or the AS conferences ($t_D(3,25)=2.689$, $p<.05$; and $t_D(3,25)=4.672$, $p<.01$ respectively). The number of sentences generated by the two structured conditions did not differ significantly ($t_D(3,25)=2.104$, ns). The mean number of sentences produced by groups in each of the three conferencing conditions are shown in Figure 3.

The Number of Task Relevant Sentences In order to test the hypothesis that the number of task relevant sentences generated during group discussion would increase across conferencing conditions, a one-way ANOVA was performed. The results indicated that while the mean number of task relevant sentences did increase across conditions (155.4 for SS conferences, 200.2 for PS conferences, and 248.8 for AS

conferences) this trend did not reach significance ($F(2,27)=2.805$, $p=.0782$). The ANOVA and Summary Tables for this analysis are presented in Table D-13.

FIGURE 3: The Mean Number of Sentences Generated by Groups in Three Conferencing Conditions

Given the relationship between conferencing structure and communication volume discussed earlier, it seemed possible that the average number of task relevant sentences in the SS condition may have been artificially inflated by the two groups who chose to organize their group discussion under topic headings. Support for this notion came from the fact that the two groups who did use topic headings to organize their discussions generated the greatest numbers of task relevant sentences in the SS condition (242 and 417). On these grounds the two groups who used topic headings were eliminated from further analysis of the volume of task relevant communication.

With these two outliers removed from the SS condition, the ANOVA on the number of task relevant sentences generated during the group discussions was repeated. The mean number of task relevant sentences generated by the groups in the SS conferences decreased to 111.9 and the results of this second ANOVA revealed significant differences between conferencing conditions ($F(2,25)=8.86$, $p=.0012$ (see Table D-14 for ANOVA and Summary Tables)). Follow-up analysis using Dunn's procedure indicated that the SS conferences generated fewer task relevant sentences than either the PS conferences ($tD(3,25)=2.7$, $p<.05$), or the AS conferences ($tD(3,25)=4.185$, $p<.01$). However, groups in the PS and AS conferences did not differ from each other in the number of task relevant sentences they generated ($tD(3,25)=1.576$, ns).

Although the two structured conferences did not differ from each other in terms of the volume of task relevant discussion, they did differ in that the AS volume included input from the conference moderator who periodically summarized the content of the group discussion. Thus, it was possible that, without these summaries, groups in the PS condition actually produced a higher volume of task relevant communication.

In order to test this a one-way ANOVA was performed on the number of task relevant sentences generated by the five group members alone. With the input of the conference moderator removed, the results were significant ($F(2,25)=4.036$, $p=.0303$ (see Table D-15 for ANOVA and Summary Tables)). Follow-up analysis using Dunn's procedure revealed that the PS and AS conferencing groups still did not differ in their level of task relevant communication ($tD(3,25)=1.014$, ns). The groups in the PS condition still produced significantly more task relevant sentences than groups in the SS conferences ($tD(3,25)=2.819$, $p<.05$). Without the moderator's input, however, groups in the AS conference produced no more task

relevant communication than groups in the SS conferences ($F(3,25)=1.862$, ns).

The mean differences in task relevant communication with and without the input of the conference moderator are shown in Figure 4.

FIGURE 4: Volume of Task Relevant Communication by Groups in Different Computer Conferencing Conditions With and Without the Conference Moderator's Input

Taken together this pattern of results suggests that structured conferences can lead groups to increase their volume of task relevant communication, but when there is an active conference moderator, this increase can be attributed to the efforts of that moderator, rather than to the efforts of the group itself.

There was the possibility, however, that these findings were confounded by the content of the private mail messages group members exchanged through the

MAILROOM. It may have been, for instance, that as the degree of structure increased across conditions, subject felt increasingly uncomfortable discussing the Library task publicly, and so conducted more of their task relevant discussion privately. In order to test for differences such as this a one-way ANOVA was performed on the number of task relevant sentences exchanged in the MAILROOM. This revealed that, while groups in each condition did exchange some task related information in the MAILROOM, the degree to which groups in the three conferencing conditions did so was not significantly different (see Table D-16 for ANOVA and Summary Tables).

While groups in the PS and AS conferences produced more task relevant communication than groups in the SS conferences, the total volume of communication was also greater for these two structured conditions. Therefore, it is not clear whether the increase in task relevant communication was merely a reflection of a greater communication volume or a reflection of a greater degree of task orientation. In order to determine this, the proportion of the total number of sentences in the discussion which were task related was calculated for each group and a one-way ANOVA was performed on the derived index. The results showed that while groups devoted approximately 70% of their conference to discussion of the Library and its problems, there were no significant differences across conditions in this percentage (see Table D-17 for ANOVA and Summary Tables). Thus, although groups in the two structured conferencing conditions generated a greater volume of task relevant communication, they were no more task oriented in their approach.

1b) Hypotheses Related to Discussion Thoroughness - Indices Related to the Number of Alternatives

The number of alternatives generated by groups in this research was interpreted in four separate ways. Thus, it could refer to the number of problems with the Library that were identified, the number of solutions to the Library's problems that were generated, the number of solutions that were evaluated, or the number of recommendations proposed. In order to test the hypotheses that all four variables would increase across conditions a series of four one-way ANOVAs were performed.

The results of the analysis on the number of problems identified revealed that, although the number of problems identified increased across conditions, these differences failed to reach significance (see Table D-18 for ANOVA and Summary Tables). On the other hand, the analysis on the number of solutions generated did reveal a significant difference between conditions ($F(2,27)=4.57$, $p=.0195$ (see Table D-19 for ANOVA and Summary Tables)). The results, shown in Figure 5, indicated a curvilinear trend across conditions. Follow-up analysis using Dunn's procedure indicated that, on average, groups in the PS conferences generated significantly more solutions than groups in the SS conferences ($t(3,27)=2.868$, $p<.05$). Groups in the AS conferences generated a mean number of solutions that was intermediate to these two extremes and did not differ significantly from either the number of solutions generated by groups in the SS conferences ($t(3,27)=.606$, ns), or the number of solutions generated by groups in the PS conferences ($t(3,27)=2.262$, ns).

The results of the analysis on the number of solutions evaluated and the number of recommendations submitted to the judges revealed the same kind of curvilinear

trends across conditions that were demonstrated for the number of solutions generated. However, neither of these trends were significant (see Tables D-20 and D-21 for the ANOVA and Summary Tables for the number of solutions evaluated and the number of recommendations, respectively).

It seemed likely that the number of problems identified, solutions generated, solutions evaluated, and recommendations offered would increase with communication volume. To test this Pearson's correlations were performed between each of the first four variables and the total number of sentences generated during group discussions. The results indicated that communication volume was significantly related to the number of problems identified ($r(28)=.688$, $p<.01$), the number of solutions generated ($r(28)=.624$, $p<.01$), and the number of recommendations ($r(28)=.396$, $p<.05$).

Given these results, together with the earlier finding that communication volume was related to conference structure, it was possible that the results of the ANOVAs reported above were confounded by the two groups in the SS conferences who did organize their discussion under topic headings. These two groups were therefore omitted from the analysis and the four ANOVAs repeated. The F-values for these analyses were only very slightly different from the values obtained with the two outliers included, and the pattern of results was identical (see Tables D-22 to D-25 for the ANOVA and Summary Tables for each of the four variables).

FIGURE 5: The Number of Solutions Generated by Groups in Different Computer Conferencing Conditions

2. Hypotheses Related to Process Emphasis

Two types of variables were used to measure the extent to which groups focussed on decision making processes. These were: the degree to which groups focussed on procedural issues, and the degree to which they adopted the sequential decision making processes associated with effective group performance.

The Volume of Procedural Communication The volume of procedural communication was calculated by counting the number of sentences generated in the conference discussions that dealt with decision making procedures and so emphasized

what the group was to do, or how they were to tackle the Library Task (examples of sentences classified as procedural are given in Table E-2). In order to test the hypothesis that the number of procedural sentences generated during group discussions would increase across conditions, a one-way ANOVA was performed. The mean number of procedural sentences produced by groups was 14.7 in the SS condition, 33 in the PS condition, and 49.5 in the AS condition. These differences were highly significant ($F(2,27)=32.255$, $p=.0001$ (see Table D-26 for ANOVA and Summary Tables)).

Given the relationship between conference structure and the volume of procedural communication, it was again possible that the two groups in the SS condition who organized their discussion under topic headings may have confounded the results. They were therefore removed from the analysis and the ANOVA on the number of procedural sentences was repeated. In this case, the results of the analysis without these two outliers were only marginally different from the results of the ANOVA in which they were included ($F(2,25)=26.334$, $p=.001$ (see Table D-27 for ANOVA and Summary Tables)).

With all 10 groups in the SS condition, follow-up analysis using Dunn's procedure indicated that groups in the SS condition generated fewer procedural sentences than groups in either the PS condition ($tD(3,27)=4.222$, $p<.01$), or the AS condition ($tD(3,27)=8.028$, $p<.01$). In addition, groups in the PS condition produced significantly fewer procedural sentences than groups in the AS condition ($tD(3,27)=3.806$, $p<.01$). These differences in the volume of procedural communication are shown in Figure 6 below.

While the volume of procedural communication increased across conferencing conditions, earlier results showed the same trend for the total volume of

communication, with groups in the AS conferences generating significantly more sentences in their discussions than groups in the SS condition. It was therefore unclear whether the increase in procedural communication reflected an increase in total communication, or an increase in the proportion of the group discussion devoted to procedural issues.

In order to test whether the proportion of the discussion devoted to procedural issues increased across conditions a one-way ANOVA on the ratio of procedural to total sentences generated in the conferences was performed. The results showed significant differences between conditions ($F(2,27)=8.056$, $p=.0018$ (see Table D-28 for ANOVA and Summary Tables)). Groups in the AS conferences devoted 28.6% of their discussion to procedural issues and this was significantly greater than either the 9.8% allotted to procedural issues by groups in the SS conferences ($t(3,27)=3.796$, $p<.01$) or the 13.6% allotted by groups in the PS conferences ($t(3,27)=3.028$, $p<.05$). The proportion of the discussion devoted to procedural issues did not differ for groups in the SS and PS conditions ($t(3,27)=.768$, ns)

The fact that groups in the AS condition were more process oriented than groups in the other two conditions may have been attributable to the presence of the conference moderator who had procedural input when she informed group members of their progress through the decision making process and of what they were to do next. In order to test for possible differences across conditions in the procedural communication generated by the five group members, the procedural input generated by the moderator was removed.

In addition to the moderator's input, the researcher had procedural input into all three conditions in the sense that the first comment under each topic heading was a reiteration of the instructions given to subjects concerning what kinds of comments

were to be entered under each topic headings. This input was greater for the two structured conditions because they involved four topic headings, rather than one GENERAL heading. Hence, this input may also account for the increase in the volume of procedural communication across condition. It was therefore subtracted from the total number of procedural sentences for each group, along with the moderator's input.

In order to test whether the differences in procedural communication across conditions was attributable to the efforts of the researcher/moderator alone, a one-way ANOVA was performed on the number of procedural statements generated by the five group members. The results of this analysis failed to reach significance ($F(2,27)=3.122$, $p=.0603$ (see Table D-29 for ANOVA and Summary Tables). Thus, the differences across conditions in the volume of procedural communication contained in the group discussions about the Library could be accounted for by the efforts of the researcher/moderator. The groups themselves generated approximately the same number of sentences related to procedural issues irrespective of the type of conference structure. These findings are shown in Figure 6 below.

The results shown in Figure 6 were not altogether surprising. Subjects frequently reported that they had seen the need for leadership and for a focus on procedures, in order to integrate the group discussion and produce a set of recommendations. However, they also reported a great reluctance to take on this role themselves for fear of imposing their views on others in the group.

Given this barrier to public displays of leadership, it was possible that subjects who saw the need for some directive input may have channeled that input through the MAILROOM on the grounds that private mail messages are more personal and, as

such, are perceived to be less coercive. If this was the case, then the added focus on decision processes in the two structured conferencing conditions may have meant that groups in those conditions exchanged a greater volume of procedural communication via private mail messages.

FIGURE 6: The Volume of Procedural Communication Generated by Groups in the Three Conferencing Conditions With and Without the Researcher/Moderator's Input

In order to test this idea a one-way ANOVA was performed on the number of procedural sentences exchanged by the five group members in the mailroom. The results revealed no significant differences across conditions (see Table D-30 for

ANOVA and Summary Tables). Again, it was possible that any differences between conferencing condition were masked by the level of procedural communication generated in the MAILROOMs of the two groups in the SS condition who did use topic headings. These two groups were therefore eliminated from the analysis and the ANOVA was repeated.

With only the eight unstructured conferences in the SS condition, there were significant differences in the amount of procedural communication exchanged privately by groups in different conferencing conditions ($F(2,25)=6.403$, $p=.0057$ (see Table D-31 for ANOVA and Summary Tables)). Using Dunn's procedure, follow-up analysis revealed that groups in the PS conferences generated significantly more procedural sentences in the MAILROOM than groups in either the SS condition ($t(3,25)=2.61$, $p<.05$), or the AS conferences ($t(3,25)=3.389$, $p<.01$). However, the number of procedural sentences exchanged in the MAILROOM by groups in the SS condition and the AS conferences did not differ significantly ($t(3,25)=.586$, ns). These results are summarized in Figure 7.

Taken together the results in this section suggested that the total volume of procedural communication contributed to the group discussion increased across conditions, and that groups in the AS conferences were more process oriented than groups in the other two conditions. However, these differences were attributable to the procedural input of the researcher/moderator. Thus, groups in structured conferences who had a moderator to attend to procedural issues, relied on that moderator to direct their group discussion. However, groups in structured conferences without a moderator seemed capable of providing some of that direction themselves, but only in the privacy of the MAILROOM.

Sequential Decision Making Processes The examination of the degree to which

FIGURE 7: The Number of Procedural Sentences Exchanged Privately by Group Members in Three Computer Conferencing Conditions

groups passed through the four stages of effective decision making sequentially, was preceded by the derivation of indices capable of capturing this sequential movement. In order to derive these indices sentences in the group discussion were first classified according to their decision making function. Thus, consistent with the four topic headings used in the two structured conferences to represent the stages of effective group decision making, sentences in the group discussions were classified as being related to the analysis of the Library task, to the generation of solution alternatives, to the evaluation of solutions, or to the decision about which recommendations to propose. For simplicity these four types of sentences will be referred to as relating to analysis, solutions, evaluation, and decision (see Tables E-5 to E-8 for examples of sentences classified as serving each of these functions).

Using this classification scheme, an average of 83.5 per cent of all the sentences generated by group members could be classified. Analysis of variance indicated that this classification rate did not vary significantly across conferencing conditions (see Table D-32 for ANOVA and Summary Tables).

The number of sentences related to analysis, solutions, evaluation and decision was calculated for each group and for each of the 14 days of their conference. Those days in which no comments were added to a group discussion were eliminated from analysis (these typically corresponded to weekend days when subjects were not required to sign-on to the computer). Once this was done, the remaining days were divided into four approximately equal time periods. Although it has been traditional to use three time periods for this type of analysis (Bales, 1950), and, more recently, the use of seven or eight time periods has been advocated (Hirokawa, 1983; Poole, 1981), four time periods were chosen here to correspond to the four stages of effective decision making. For each of the four time periods, the total number of sentences related to analysis, solutions, evaluation and decision were calculated.

Given the theory that effective decision making groups first analyze the problem, then generate solution alternatives, then evaluate those alternatives, and then decide on a set of recommendations, the focus on analysis, alternatives, evaluation and decision should ideally peak in the first, second, third and fourth quarters of the group discussion process, respectively. Based on this ideal sequence of decision making stages, specific predictions were made for each of the four different types of sentences concerning the ordinal relations between the emphasis placed on that type of communication in different time periods.

In order to make these predictions it was first necessary to obtain a measure of the focus on any particular type of communication that would allow meaningful

comparison of the emphasis placed on that type of sentence during different time periods. One way to do this has been suggested by Bales and Strodtbeck (1951). According to their methodology, analysis sentences would be considered to peak during the first quarter of the discussion if the greatest proportion of all analysis sentences occurred during that quarter. Although this kind of measure has been popular in the literature, it has recently been refined by Hirokawa (1983). He has recognized that groups may be more or less active during different time periods, and has attempted to correct for this variation. Thus, in order to determine whether analysis sentences peak during the first quarter, he would first calculate the proportion of the discussion in each time period devoted to analysis, and then consider that the emphasis placed on analysis peaked during the first quarter if the proportion of the discussion devoted to analysis was greatest in that quarter. Of these two approaches, the second was used in this research because group discussions took place over a two week period, so that there was the very real possibility of sizeable variations in participation levels during different time periods.

Using this measure of the attention given to different types of communication, predictions were made for analysis, alternatives, evaluation and decision sentences dealing with the relationships between the proportion of the discussion devoted to each type of sentence in different time periods. Thus, it was expected that the proportion of the discussion devoted to analysis would be greatest in the first quarter of the discussion and would decrease thereafter. Similarly, it was expected that the proportion of the discussion devoted to alternatives would increase from the first to second quarter of the discussion and decrease thereafter, and that the proportion of sentences devoted to evaluation would increase from the first to the third quarter and then decrease. Finally, it was expected that the proportion of the discussion devoted

to decisions would increase across from the first to the fourth time period.

These predicted patterns represented the decision making behaviour of groups who followed the ideal, sequential progression through the four stages of the decision making process. Thus, for each of the four types of sentences, the degree to which variations across time in the proportion of the group discussion devoted to that type of communication matched the predicted pattern was taken as a measure of the degree to which groups emulated sequential movement through the decision making stages.

Ordinal Pattern Analysis (OPA) was developed by Thorngate and Carroll (1987) as a method of analyzing the degree to which predicted patterns of change over time match the temporal patterns observed in the data. Using this technique, OPA indices were calculated for each group, for each of the four types of sentences. Thus, for example a group's OPA index for analysis sentences was a measure of the degree to which that group devoted the greatest proportion of its discussion to analyzing the Library's problems during the first quarter of the discussion, and devoted successively smaller proportions of the discussion to analysis across subsequent time periods (details of the calculations are outlined in Appendix C). These OPA indices could vary from -1 to +1. An index of +1 indicated that the group had followed exactly the pattern associated with sequential progression through decision making stages. An index of -1 indicated that the group failed to follow this ideal pattern at all. An index of 0 indicated that the ideal predicted pattern matched the observed pattern no more often than would be expected on the basis of chance.

In order to test the hypotheses that the degree to which groups passed sequentially through the four stages of group decision making processes would increase across conditions, one-way ANOVAs were performed on the OPA indices calculated for each group on the proportion of the discussion devoted to analysis, alternatives,

evaluation, and decision. The ANOVA and Summary Tables for these analyses can be found in Tables D-33 to D-36 respectively. The results revealed no significant differences in the degree to which groups demonstrated sequential movement through the four decision making stages. Groups in both the PS and AS conditions did show a greater tendency to concentrate on generating solutions to the problems with the Library during the second quarter of their discussion (average OPA indices were .699 for groups in the PS conferences, .566 for groups in the AS conferences and .173 in the SS conferences), but this increased tendency failed to reach significance ($F(2,27)=3.05$, $p=.0639$).

Although groups in the three conferencing conditions did not differ in the degree to which they adopted sequential decision making processes, there was evidence that groups generally demonstrated at least some of the behaviour associated with sequential passage through the four decision making stages. The mean OPA index for degree to which groups followed the ideal sequence of decision making steps when analyzing the decision problem was .884, indicating that, on average, groups tended to place greatest emphasis on analyzing the problems with the Library during the first quarter of their discussion, and that this emphasis decreased in successive quarters. Similarly, groups tended to place increasing emphasis on deciding upon their final recommendations as they neared the end of their group discussion (the mean OPA index was .925). However, their tendency to concentrate on alternatives and evaluation during the second and third quarters of their discussion was less marked (the average OPA indices were .450 and .613 for alternatives and evaluation respectively). These findings are summarized below in Figure 8.

Although groups, on average, tended to begin and end their discussions relatively effectively, but had greater difficulty moving sequentially through the middle half of

their discussions, not all groups followed this pattern. Seven of the 30 groups followed the ideal sequential pattern exactly and analyzed the problems with the Library, then generated solutions, then evaluated those solutions, and then decided upon their recommendations. Of these seven groups, three were in the PS conferences, three in the AS conferences and only one was in the SS condition. In addition to this, a further six groups demonstrated effective decision making processes for three of the four types of sentences. Of these six groups, three participated in PS conferences, two participated in AS conferences, and one participated in the SS condition. In addition, five of the six groups deviated from the ideal pattern in either the second or third quarter of their discussions, but managed to follow ideal decision making practices during the other.

Overall, then, groups who either followed or closely approximated the ideal sequential passage through decision making stages were more likely to be in one of the two structured conditions. Furthermore, groups who demonstrated effective decision making processes in three of the four quarters of the group discussion most often had trouble concentrating either on generating solution alternatives during the second quarter of the discussion, or on evaluating those alternatives during the third quarter of the discussion.

3. Hypotheses Related to Group Cohesion

Two types of communication-based indices of group cohesion were used in this research. The first was related to participants' motivation to be part of the group, and the second was related to groups' ability to coordinate their efforts to make recommendations.

FIGURE 8: Mean OPA Indices For the Proportion of the Group Discussion Devoted to Analysis, Alternatives, Evaluation and Decision.

NOTE: 1=Analysis, 2=Alternatives, 3=Evaluation, 4=Decision

Motivation to be Part of the Group Participants' motivation to be part of the group measured by the volume of positive, supportive communication and by the degree to which group members used personalized greetings. The volume of positive, supportive was measured by the volume of positive, supportive communication and by the degree to which group members used personalized greetings. The volume of positive, supportive communication was calculated by counting the number of sentences in the conference discussion that expressed agreement with the ideas of others, or that offered overt praise of others' ideas or efforts (examples of sentences

classified as supportive are given in Table E-3).

In order to test the hypothesis that the number of supportive sentences would be higher for groups in the AS conferences than for groups in the other two conferencing conditions, a one-way ANOVA was performed. The mean number of supportive sentences was 19.5 for groups in the SS condition, 26.8 for groups in the PS conditions, and 42.5 for groups in the AS conditions. These differences were significant ($F(2,27)=4.013$, $p=.0298$ (see Table D-37 for ANOVA and Summary Tables)). Follow-up analysis using Dunnett's multiple comparison test revealed that groups in the AS conferences did generate significantly more positive statements than groups in the SS conferences ($t(2,27)=2.772$, $p<.05$). Groups in the PS conferences did not differ in their level of supportive communication from groups in either the SS conferences ($t(2,27)=-.88$, ns) or the AS conferences ($t(2,27)=1.892$, ns).

Although groups in the AS conferences generated a greater volume of supportive communication than groups in the SS condition, these differences were not indicative of a greater focus on this type of communication. The results of an ANOVA on the proportion of the total conference that was devoted to supportive statements were not significant (see Table D-38 for ANOVA and Summary Tables).

The difference that was reported above in the level of supportive communication generated during group discussions in the SS and AS conferences, may have been attributable to the efforts of the conference moderator in the AS condition. One of the moderator's tasks was to promote supportive communication in the group discussion and, to do this, she generated this type of communication herself. In order to test whether the increase in supportive communication in the AS condition was attributable to the moderator's efforts, a one-way ANOVA was performed on the

number of supportive sentences generated by the five group members alone, without the input of the conference moderator. The results of this analysis showed no differences across conditions in the volume of supportive communication generated by the five group members alone (see Table D-39 for ANOVA and Summary Tables). A comparison of the level of supportive communication in group discussions with and without the efforts of the conference moderator in the AS condition is shown in Figure 9.

The finding that the five members of groups in the three conferencing conditions did not differ in the level of supportive statements they generated may be confounded by the volume of negative, disintegrative communication exchanged during the conferences. If this differed across conditions, then the conference environment for groups in those conditions with a higher frequency of negative statements would effectively be less supportive. In order to test this possibility a one-way ANOVA was performed on the total number of negative sentences generated by the five group members. These sentences could involve disagreement with the ideas of others, they could involve overt criticism of other group members, or they could involve personal insults (for examples of sentences classified as negative, see Table E-4). The frequency of these negative sentences was relatively low in all conferencing conditions and the differences between conditions were not significant (see Table D-40 for ANOVA and Summary Tables). Thus, groups in the three conferencing conditions did not differ in the degree to which their conferencing environment was a supportive one. This finding added support to the earlier conclusion that the differences between the SS and AS conditions in the total level of supportive communication produced during group discussions could be attributed to the moderator's supportive input in the AS conferences.

FIGURE 9: The Volume of Supportive Communication Generated by Groups in the Three Conferencing Conditions With and Without The Moderator's input in the AS conference

While the level of negative communication generated by group members was eliminated as a confounding effect, it was still possible that the differences between the SS and AS conditions in the level of supportive communication was confounded by the volume of positive, supportive sentences exchanged privately in the MAILROOM. In order to test this possibility, a one-way ANOVA was performed on the number of supportive sentences exchanged in private mail messages, including those sent by the researcher in her role as Library and system resource person. The results of this analysis showed that although a greater number of supportive sentences was exchanged in the MAILROOM of the AS conferences than in either of the other two conditions, this difference failed to reach significance (see Table D-41 for ANOVA

and Summary Tables).

Participants' motivation to be part of the group was not only measured in terms of the volume of positive, supportive communication, but also in terms of the number of personalized greetings that were exchanged at the beginning and end of comments in the conference discussions. In order to test the hypothesis that groups in the AS conferences would use a greater frequency of personalized greetings than groups in either of the other two conferences, a one-way ANOVA was performed on the number of personalized greetings used at the beginning and end of comments in the conferences (see Table E-9 for examples of these greetings). This showed that differences between conditions in the tendency to use such greetings failed to reach significance (see Table D-42 for ANOVA and Summary Tables). Furthermore, this pattern was unchanged with the efforts of the resource person and conference moderator excluded from analysis (see Table D-43 for ANOVA and Summary Tables).

The Ability to Coordinate Group Effort In this research, a group's ability to coordinate its group effort was measured in two ways, each of which related to the group's ability to integrate the group discussion to produce recommendations. One was an informal measure of whether a group had made a definite set of recommendations at the end of their two-week conference, and the other was the volume of group communication that was devoted to reaching some sort of consensus about which solution alternatives would be offered as recommendations.

As mentioned earlier, while three groups in the SS conferences failed to make any recommendations at all, the 10 groups in each of the two structured conferencing conditions all submitted recommendations to the three judges at the end of their two week conference. This suggested that the lack of decision process structure in the SS conferences may have made it difficult for groups to coordinate and integrate their

discussion.

In order to test the hypothesis that groups' ability to integrate their discussion may increase across conditions, a one-way ANOVA was performed on the total number of sentences generated during conferencing discussions that were related to decisions about which solutions should be included in the final recommendations. The results of this ANOVA showed that although the volume of integrative sentences increased from the SS to the PS conditions and then decreased in the AS condition (see Figure 10), these differences failed to reach significance (see Table D-44 for ANOVA and Summary Tables)).

In the AS conferences, the moderator contributed some of the integrative sentences when she identified either an emerging consensus, or potential recommendations that had not yet been voted upon. Thus, the results of the preceding analysis may have revealed more striking differences between conditions without the integrative input of the conference moderator in the AS condition. To test this possibility, a one-way ANOVA was performed on the number of integrative sentences generated by the five group members alone. These results revealed the same curvilinear pattern across conditions, but, in this analysis, the difference was just significant ($F(2,27)=3.544$, $p=.043$ (see Table D-45 for ANOVA and Summary Tables)). However, follow-up analysis using Dunn's procedure showed that the difference between the SS and PS conferences approached but did not reach significance ($tD(3,27)=2.43$, ns).

The Impact of Computer Conferencing Structure
on Quality and Satisfaction Outcomes

Decision Quality

In order to test the hypothesis that decision quality would increase across conferencing conditions, an overall measure of decision quality was required for each group. To obtain this three judges were used. These included a Psychology Department Faculty Member, an Honours student and the head of the Library Services Committee. The judges were specifically chosen to represent a range of perspectives on the Library, its problems and the solutions to those problems.

The groups had been instructed to summarize the recommendations they wished to submit to the judges at the end of their group discussion. These 30 one-page summaries were randomized and then submitted to each of the three judges. The judges were asked to grade the quality of each set of recommendations (out of 100) on the basis of three criteria. Following Hirokawa (1983) these included criteria of economic feasibility and workability (or the degree to which the recommendations would reduce the problems in the Library). In addition, because the topic headings in the two structured conferencing conditions represented the four decision making stages associated with creative problem solving, a criterion of creativity was included. The exact instructions given to the judges can be found in Appendix A

When the judges had finished their grading task Pearson Product Moment correlations were performed on the feasibility, workability and creativity scores for each judge, in order to determine whether these indices could be meaningfully combined into an overall measure of decision quality for each judge. These

correlation matrices are presented in Table D-46. For the first judge the correlations ranged from .81 to .92. For the second they ranged from .87 to .95. And for the third judge they ranged from .97 to .98. Thus, for each judge the relationships between the three components of decision quality were highly significant.

Given these interrelationships, an overall index of decision quality was calculated for each of the three judges by taking the average of the economic feasibility, workability and creativity components. Following this, Pearson correlations were performed on the quality ratings of the three judges in order to determine the degree of interjudge reliability. The results are summarized in Table D-47. All correlations between judges' measures of decision quality were highly significant. This finding had conceptual as well as statistical significance because judges were chosen specifically to provide a wide range of perspectives on the Library. Given the overlap between individual judges' ratings, a single measure of decision quality was obtained for each group by taking the average of the three judges' ratings.

In order to test the hypothesis that the quality of the group recommendations would increase across conditions from the self-structured conferences to the actively structured conferences, a one-way ANOVA was performed using the overall quality index just derived. The results revealed significant differences in the quality of the recommendations made by groups in different conferencing conditions ($F(2,27)=6.096$, $p=.0065$ (Table D-48 for ANOVA and Summary Tables)). Groups in the SS conferences received an average grade of 39.4%, groups in the PS conferences received an average grade of 67.9%, and groups in the AS conferences received an average grade of 62.2%. These results are shown in Figure 10.

Using Dunn's Multiple Comparison Procedure for planned, nonorthogonal comparisons, the recommendations made by groups in the PS conferences were

judged to be significantly better than those made by groups in the SS conferences ($t(3,27)=3.301$, $p<.01$). The recommendations made by the groups in the AS conferences were also judged to be of significantly higher quality than those made by groups in the SS conferences ($t(3,27)=2.636$, $p<.05$). However, although the quality of the recommendations made by groups in the PS was, on average, higher than the quality of recommendations made by group in the AS conferences, the differences were not significant ($t(3,27)=.665$, ns).

FIGURE 10: The Effect of Conferencing Condition on Decision Quality

NOTE: Condition 1 = SS conferences; Condition 2 = PS conferences; Condition 3 = AS conferences.

Consistent with these findings the three groups who made the poorest recommendations were in the SS condition, and these groups failed to make any recommendations at all (quality was zero). Similarly, the groups who had the three

highest grades for decision quality were all in the PS condition (grades of 86.1%, 78.8% and 77.3% respectively).

The improvement in the quality of the recommendations made by groups in the two structured conferencing conditions may be attributable to the confounding influence of a number of variables, including background variables related to ability, or familiarity with the Library (see Hoffman, 1965; Shaw, 1981). If the members of the groups in the two structured conferencing conditions had better academic records, or spent more time in the Library, then they may be expected to be in a better position to make good recommendations. In order to test for these possible confounds one-way ANOVAs were performed on academic standing, and the number of times students reported having visited the Library during the previous month. The results of these ANOVAs were non-significant (see Tables D-49 and D-50, for the ANOVA and Summary Tables for academic standing and the number of visits to the Library, respectively). Hence, the differences in the quality of the recommendations made by the groups in the two structured conferencing conditions were not confounded by either ability or familiarity with the library.

A second potential confound had to do with group members' perceptions of the Library task. If individuals in the structured conferencing groups perceived the task to be more interesting and less difficult, then they may have been motivated to exert a greater effort, and this increased effort may have accounted for their improved quality ratings. Using the scores for task difficulty and task interest derived earlier, two one-way ANOVAs were performed. The results indicated no significant differences between conditions for either task difficulty or task interest (see Tables D-51 and D-52, for the ANOVA and Summary Tables for each of the two task variables). Hence, the superiority of the recommendations made by groups in the

two structured conferencing conditions could not be accounted for on the basis of subjects' perceptions of the Library task.

A third, and final, potentially confounding influence had to do with group composition. Groups with a greater number of active members may have offered a wider variety of perspectives and so made better recommendations. In addition, the percentage of females in the groups may have influenced the quality of the recommendations because mixed-sex groups often outperform all female groups (see Hoffman, 1965; Shaw, 1981). Again, one-way ANOVAs failed to confirm these suppositions: there were no significant differences between conditions for either the number of active group members, or the percent of females in the group (see Tables D-53 and D-54 for ANOVA and Summary Tables).

Having eliminated the possibility that the superior recommendations made by the groups in the two structured conferencing conditions were confounded by some of the more obvious background, task and group composition variables, the quality of the recommendations made by individual groups were examined. As already stated, three of the 10 groups in the SS condition failed to make any recommendations at all. While each of these groups discussed a number of problems with the library and raised some possible solutions, they could not coordinate their discussion and so did not discuss, agree upon or propose any specific recommendations.

In order to see whether the superiority of the recommendations made by the groups in the two structured conferencing conditions was attributable to the fact that some groups in the SS conditions did not make any recommendations, a one-way ANOVA was performed on the quality of the group recommendations with these three groups eliminated from the analysis. The results of this analysis were not significant (see Table D-55 for ANOVA and Summary Tables). The seven groups in the SS conferences received an average grade of 56.3%, and this was not

significantly different from the average grades of groups in either the PS or AS conditions.

These findings suggest that the structured computer conferences did not allow groups to make superior recommendations per se, but instead provided them with a mechanism for coordinating their discussion to produce a set of specific recommendations. In particular, in both the PS and the AS conferences, the topic DECISION served as an explicit reminder of the need to get some kind of consensus in order to produce a set of recommendations.

Some additional support for this argument comes from the two groups in the SS condition who did choose to organize their group discussion under topic headings. Of these, one made recommendations that were judged to be as good as those made by groups in the two structured conferencing conditions (60%). The other failed to make any recommendations. In keeping with these outcome differences, the two groups made quite different use of the topic headings they added.

The first group added topic headings towards the end of the two-week conference and these corresponded to different solution alternatives. In these topics, the group evaluated and decided whether to propose specific solutions. The bulk of the group discussion took place under the GENERAL heading, and the added topics were generated out of recognition of the need to specify a set of recommendations. The topic headings therefore served the same kind of integrative function as the EVALUATION and DECISION topics in the two structured conferencing conditions. Having agreed upon individual solutions, the discussion in the GENERAL topic seemed to make it relatively easy for the group to summarize these solutions in a set of recommendations.

In contrast, the other group selected topic headings within two days of beginning their conference and these corresponded to what they perceived to be the problems

with the Library. They generated a large number of topic headings (12) and, after the second day, confined their discussion solely to these topics. They did not use the GENERAL topic at all and, as a result, their entire discussion was fragmented. Without a common focus, they lacked any mechanism for integrating the different strands of their discussion. Thus, while they did discuss a number of potential solutions they were unable to turn these into a set of recommendations.

Process and Outcome Satisfaction

Subjects' levels of satisfaction with their group decision making processes and products were assessed on 7-point rating scales in Questions 1 through 4 of the Post-Decision Questionnaire. Questions 1 and 2 dealt with satisfaction with the group discussion and with satisfaction with the way the group reached a decision, respectively. These two questions therefore tapped satisfaction with group processes, and individuals' ratings on Questions 1 and 2 were added to give a total process satisfaction score. Similarly, Question 3 dealt with satisfaction with the final recommendations and Question 4 dealt with subject's level of satisfaction if their group's recommendations were implemented. Thus, a total outcome satisfaction score was calculated by summing subjects' ratings on Questions 3 and 4. Both satisfaction measures could range from a low of two (extremely dissatisfied) to a high of 14 (extremely satisfied), with a neutral point of eight.

Process Satisfaction In order to test the hypothesis that process satisfaction would increase across conditions, a one-way ANOVA was performed. The results showed the expected trend. Process satisfaction increased across conditions from a neutral to a slightly positive average rating. Thus, the mean rating was 8.7 for

groups in the SS condition, 9.7 for PS groups, and 10.3 for AS groups (item ratings of 4.35, 4.85 and 5.15, respectively). This trend, however, was only marginally significant ($F(2,27)=2.913$, $p=.0581$ (see Table D-56 for ANOVA and Summary Tables).

Given this marginally significant result, it was possible that the two groups in the SS condition who did organize their discussion under topic headings were masking differences between conditions. In order to test this possibility, these two groups were eliminated from analysis and the ANOVA was repeated. The results of this second ANOVA were not significant (see Table D-57 for ANOVA and Summary Tables). On examination of the two groups, these results were not too surprising. Of the two groups, one made recommendations and the other did not. Individuals in the group who did make recommendations had a mean process satisfaction rating of 12.2 which was almost the highest in the SS condition (the highest was a rating of 12.3). On the other hand, individuals in the group who did not make recommendations had a mean process satisfaction rating of 3.5 and this was the lowest in the SS condition. Thus, for these two groups process satisfaction ratings seemed to have more to do with whether or not recommendations were made than with the use of topic headings to structure the discussion.

Outcome Satisfaction No specific predictions were made regarding the impact of computer conferencing type on outcome satisfaction. However, the possibility that groups in the three conferencing conditions differed in outcome satisfaction was explored using a one-way ANOVA. This showed that while groups in all three conditions were, on average, mildly satisfied with the outcome of their group discussion, the differences in their level of satisfaction were not significantly different (see Table D-58 for ANOVA and Summary Tables).

The Impact of Computer Conference Structure
on Conferencing Experiences

Subjects were asked about their computer conferencing experiences in Question 10 of the Post-Decision Questionnaire. Using a 7-point rating scale, subjects were asked to indicate the extent to which they either agreed or disagreed with 17 items related to a variety of conferencing experiences. The ratings on these 17 items were scored in a positive direction and then summed to yield a score which reflected the extent to which individuals' computer conferencing experiences were positive (see Appendix C for details of the scoring procedure). The minimum score was 17 and the maximum was 119, with a neutral point of 68.

In order to test the hypothesis that conferencing experiences would become increasingly positive across conditions, a one-way ANOVA was performed on the total experience scores. This analysis revealed that, on average, participants' conferencing experiences were mildly positive. The overall ratings were 78.9 for SS groups, 82.9 for PS groups, and 84.2 for AS groups, and these were equivalent to item ratings of 4.64, 4.88 and 4.95, respectively. There was a trend in the expected direction; however, this trend was not significant ($F(2,121)=1.298$, ns (see Table D-59 for ANOVA and Summary Tables).

In order to interpret these findings, the internal consistency of the questionnaire that tapped computer conferencing experiences was investigated using item-total correlations between the raw scores (not corrected for direction of scoring) on each of the 17 items and the total score reflecting the extent to which computer conferencing experiences were perceived to be positive. These correlations are shown in table D-60. As can be seen from that Table, the only item that did not

correlate significantly with the total rating of conferencing experiences was the one dealing with the extent to which there was no difficulty getting good information about the library. Thus, in general, the findings that subjects experiences with computer conferencing were mildly positive seems to reflect their real perception rather than a problem with the questionnaire that tapped those perceptions.

The nature of conferencing experiences Given that conferencing conditions did not influence the extent to which participants perceived their conferencing experiences to be positive, it was possible that groups in the three conditions reported differences in their experiences with certain aspects of computer conferencing. In the hopes of identifying major dimensions of conferencing experiences, a factor analysis was performed on subjects' responses to these 17 items. Using a Varimax rotation this analysis yielded five orthogonal factors (see Table D-61 for the factor analysis Summary Table). With a minimum factor loading of .5 four of the five factors were readily interpretable.

Four of the 17 items had significant loadings on the first major factor. These were related to: frustration with entering comments, the perceived rigidity of the conferencing system, difficulty in keeping the discussion focussed, and difficulty following the group discussion. This factor seemed to reflect a frustration with working within the confines of the computer conferencing system. It was therefore labelled a frustration factor.

Five of the 17 items had significant loadings on the second factor. These were related to: a sense of leadership, a lack of organizational difficulty, a supportive environment, generally quick responses to the contribution of others, and the development of a strong group spirit. This factor reflected groups' ability to work together, and to provide the kind of mutual support that encouraged members to sign-on frequently and respond to others' contributions. This was fairly clearly a

group cohesion factor.

The third factor had significant loadings for 3 of the 17 items. These were related to: the lack of opportunity for social interaction, the perceived artificiality of the group discussion, and the lack of opportunity to get to know other group members. This was clearly a lack of social contact factor.

The fourth and fifth factors were smaller than the first three. The two items that loaded significantly on the fourth factor were related to the lack of difficulty getting good information about the Library, and the difficulty in knowing if everyone agreed with the recommendations. These two items together may have indicated that groups who perceived they had had a sound, informed discussion of the Library's problems were frustrated at their inability to arrive at a consensus about their recommendations. Thus, this factor may have indicated a resolution frustration. However, on the basis of the inferential leaps required to derive this label, together with the earlier finding that the first of the two items defining this factor lacked internal consistency, this fourth factor was not included in further analyses.

The fifth, and final factor, incorporated only one of the 17 items in Question 10. This was the item: the free expression of ideas was encouraged. This fifth factor could therefore be interpreted as a freedom of expression factor.

In order to test for differences between conferencing conditions on each of the four interpretable dimensions of conferencing experience, a series of one-way ANOVAs were performed on the factor scores for each dimension. These results showed that while groups in the PS condition experienced greater frustration in their conferences than groups in the other two conditions, these differences were not significant (see Table D-62 for ANOVA and Summary Tables). Similarly, while groups in the PS condition were less bothered by the lack of social contact in their conferences than groups in the other two conditions, the differences were, again, not

significant (see Table D-63 for ANOVA and Summary Tables). Finally, there were no significant differences between conferencing conditions in the degree to which subjects felt free to express their ideas (see Table D-64 for ANOVA and Summary Tables).

While groups in the three conferencing conditions did not differ on dimensions of frustration, lack of social contact, or freedom of expression, they did differ in the extent to which they experienced a sense of group cohesion ($F(2,121)=4.742$, $p=.0104$ (see Table D-65 for ANOVA and Summary Tables)). The results are shown below in Figure 11.

FIGURE 11: Group Cohesion Scores for Groups in Three Computer Conferencing Conditions

Post hoc comparisons using Tukey's HSD revealed that group in both the PS and the AS conferences experienced a greater sense of group cohesion than groups in the SS

condition ($LD=.514$, $p<.01$, and $LD=.605$, $p<.01$, respectively) However, groups in the two structured conferencing conditions did not differ from each other in their experience of group cohesion ($LD=.091$, ns).

Problems encountered in using computers While Question 10 of the Post-Decision Questionnaire was the major measure of computer conferencing experiences, experiential variables related to the problems encountered when using the computer to participate in this study were also investigated. The problems subjects encountered using the computer to participate in this study were assessed in Question 8 in the Post- Decision Questionnaire. These were factor analyzed earlier and yielded three orthogonal factors labelled preference for face-to-face communication, intimidation and time pressure. Of these, the time pressure factor was considered to be the most important here because of the fact that groups were not trained in random order. During the training sessions there was some effort made to control for order effects. Nevertheless, the majority of the groups in the PS conferences were trained during the first week of term, the majority of the groups in the SS conferences were trained during the second week of term, and the majority of the groups in the AS conferences were trained during the third week of term.

This order was largely dictated by the availability of training rooms and the researcher's time constraints. However, it also meant that the majority of the groups in the AS condition were participating in their conferences later in the term, at a time when essays and labs were due, when mid-term tests were approaching, and when the computer science students were using the terminals on campus for assignments. Given this, it was possible that these groups experienced a greater degree of time pressure than groups in the other two conditions. If so, then this increased time pressure could lower participation levels and reduce the effort group

members were willing to devote to building group momentum. As a result, earlier predicted differences between the PS and AS conferences in variables such as the quality of recommendations, the volume of task relevant communication, and the experience of group cohesion may have been masked by a training order effect.

In order to test this possibility, a one-way ANOVA was performed on the time pressure factor scores. The results of this analysis showed that while groups in the PS conferences did report less time pressure than groups in the other two conditions, these differences were not significant (see Table D-66 for ANOVA and Summary Tables). Thus, the lack of predicted differences between the PS and AS conferences, could not be accounted for by increased time pressure in the AS conferences.

In addition to this analysis, two ANOVAs were performed on the factor scores of the other two problem factors in order to investigate whether, as a result of their participation, groups in the three conditions differed in the extent to which they preferred face-to-face communication, or the degree to which they were intimidated by using computers to discuss the Library problem. The results of these two analyses showed no significant differences between groups in the three conferencing conditions (see Tables D-67 and D-68 for the ANOVA and Summary Tables for face-to-face preference and intimidation scores respectively).

The roles played by individual group members The final type of conferencing experiences investigated had to do with participants' perceptions of the roles played by others in their group. Perceptions of leadership roles within the group were considered to be particularly important because the decision support in the three different conferencing conditions focussed on providing the kind of direction and coordination typical of a task leader, and on providing the kind of supportive decision making climate usually fostered by a socio-emotional leader. The differences already

demonstrated between conditions on these dimensions may have meant different needs for group members to adopt leadership roles in the three conditions. If so, then the degree of leadership attributed to group members in different conferencing conditions, may have confounded the influence of conference structure on indices of group performance.

The roles played by individual group members were assessed in Question 6 of the Post-Decision Questionnaire. Although participants were asked to rank order the members of their group on each of eight roles, many subjects found this to be an impossible task, and others found it to be extremely difficult. Rather than risking arbitrary responses to this question, it was decided to have subjects describe only the person in the group who best personified each role. When each group had completed this, the number of times each group member was named as the most representative of a particular role was calculated, and this was taken as a measure of the degree to which they were perceived to have played that role within the group. When more than one group member was named, by an individual subject, as typifying a particular role both of the group members' named received a point

Once the scores for each individual on each of the roles were calculated, a factor analysis was performed to identify major role dimensions. Using a Varimax rotation this analysis yielded two orthogonal factors (see Table D-69 for the factor analysis Summary Table). With a minimum factor loading of .5 two factors emerged and both were interpretable.

Six of the eight roles had significant loadings on the first, major factor. These roles applied to group members who: talked the most, had the best ideas, was the most knowledgeable about the library, was the best organizer, was the most valuable group member and who was the most argumentative. Together, these roles seemed to

incorporate the components of task leadership. It was therefore labelled a task leadership factor.

The other two roles in Question 6 had significant loadings on the second factor. These applied to group members who: were the most concerned about group members' feelings, and were the most fun to work with. These two roles seemed to capture the essence of a socio-emotional leader. The second factor was therefore labelled a socio-emotional leadership factor.

In order to test for differences between conferencing conditions in task and socio-emotional leadership, the variance of the factor scores on each of the two dimensions was first calculated for each group. A low group variance on either of these dimensions was taken to mean that no one individual adopted a clear leadership role. Similarly, increases in variance on either of these dimensions were taken to be indicative of the emergence of a task or socio-emotional leader.

Following these calculations differences in the degree to which task and socio-emotional leaders emerged in groups in the three conferencing conditions were examined in two one-way ANOVAs on the group variances of the task and socio-emotional leadership factor scores. The result: showed that while task leaders were more likely to emerge in groups in the two structured conferencing conditions, this trend was not significant (see Table D-70 for ANOVA and Summary Tables). Similarly, while there was a tendency for socio-emotional leaders to be more likely to emerge in the PS conferences, it was not significant (see Table D-71 for ANOVA and Summary Tables).

TESTS OF HYPOTHESES RELATED TO THE INTERRELATIONSHIPS BETWEEN DIFFERENT INDICES OF GROUP DECISION MAKING PERFORMANCE

The five types of indices of group decision making performance used in this research were: judged decision quality, indices of group discussion effectiveness, process satisfaction, outcome satisfaction, and computer conferencing experiences. Of these, judged decision quality, process satisfaction and outcome satisfaction were considered to be outcome variables, and indices of group discussion effectiveness and computer conferencing experiences were considered to be intermediate variables that played a mediating role between computer conference structure and the outcome variables. Given this conceptual model, the analysis was divided into four sections. The first examined the relationships between the three outcome variables, the second examined the relationships between indices of group discussion effectiveness and the outcome variables, the third examined the relationships between computer conferencing experiences and the outcome variables, and the fourth examined the relationships between group discussion effectiveness and computer conferencing experiences.

One problem with some of the correlational analyses in each of these four sections was that while some variables (e.g. judged decision quality and the communication volume variables) were calculated at the group level, others (e.g. the variables measuring satisfaction and conferencing experiences) were measured at the individual level. Therefore, when correlations were performed between variables measured at different levels, some decision was required as to which of the two levels was the most appropriate for analysis. Correlations could be performed at the group level, by taking a group average for variables measured on individual group members. Alternatively, each member of a particular group could be assigned their

group's score for variables measured at the group level, and the correlations could be performed at the individual level. Of these two alternatives, the second was adopted throughout the analysis on the grounds that when variables were measured on individual group members, correlations based on group averages may mask important intragroup differences in those indices measured at the level of the individual group member.

1. The Relationships Between Outcome Variables

In order to examine the relationship between judged decision quality, process satisfaction and outcome satisfaction, Pearson Product Moment correlations were performed. These results, summarized in Table D-72, revealed significant positive correlations between judged decision quality, and individual group members' ratings of both process and outcome satisfaction. Thus, as judged decision quality increased so did group members' satisfaction with both their decision making processes ($r(123) = .318, p < .01$) and their final recommendations ($r(123) = .33, p < .01$). Furthermore, as individuals' satisfaction with their decision making processes increased, so did their satisfaction with their group product ($r(123) = .575, p < .01$).

2 The Relationships Between Indices of Group Discussion Effectiveness and The Outcome Measures

The classes of measures of group discussion effectiveness discussed earlier were related to discussion thoroughness, process emphasis and group cohesion. The

interrelations between these three blocks of indices of group discussion effectiveness, and between the indices in each block and the quality of the groups' recommendations, were calculated using Pearson Product Moment Correlations

Indices of Discussion Thoroughness and Judged Decision Quality The results of the correlations on indices of discussion thoroughness are shown in Table D-73. They indicate that the total number of sentences in the conference discussions was highly correlated with the number of task relevant sentences ($t(28)=.97, p<.01$), and also with the number of problems identified ($t(28)=.547, p<.01$), the number of solutions generated ($t(28)=.571, p<.01$), the number of solutions evaluated ($t(28)=.478, p<.01$), and the number of recommendations ($t(28)=.405, p<.05$). However, while the total number of sentences was significantly related to all measures of discussion thoroughness, it was not significantly related to decision quality ($t(28)=.267, ns$).

The volume of task related communication in the conferences was significantly related to the number of problems identified ($t(28)=.505, p<.01$), to the number of solutions generated ($t(28)=.601, p<.01$), to the number of solutions evaluated ($t(28)=.509, p<.01$), and, marginally, to the number of recommendations submitted for judgement ($t(28)=.361, p=.05$). This pattern of results was unchanged when the moderator's task related communication was removed (see Table D-73).

The number of solutions generated and the number of recommendations were both positively related to decision quality ($t(28)=.439, p<.05$, and $t(28)=.744, p<.01$ respectively), and the number of solutions evaluated was marginally related to decision quality ($t(28)=.364, p<.05$). This pattern of findings suggests that the volume of task relevant communication generated during conference discussions had an indirect influence on recommendation quality, which operated through the number

of solutions generated and incorporated into the final recommendations.

Indices of Decision Process Emphasis and Decision Quality As can be seen from Table D-74, the results of the correlations on indices of process emphasis showed that, while the different indices of process emphasis were unrelated to each other, two of these indices were related to the quality of recommendations. First, the total volume of procedural communication was positively related to the quality of group recommendations ($t(28)=.455, p<.01$). This relationship could be attributed to the researcher/moderator's input for, without this input there was no significant relationship between the volume of procedural communication generated by the five group members and the quality of their recommendations. In addition to the total volume of procedural communication in the group conferences, the degree to which groups matched a sequential passage through decision making stages at the end of their discussion was also a significant predictor of the quality of recommendations ($r(28)=.624, p<.01$).

Communication-Based Group Cohesion and Decision Quality Finally, as can be seen from Table D-75, the total volume of supportive communication generated during group discussions was highly related to the total number of personalized greetings exchanged ($t(28)=.65, p<.01$), and to the volume of supportive comments generated by the five group members alone ($t(28)=.892, p<.01$). As the five group members generated more supportive communication, they made more frequent use of personalized greetings ($t(28)=.558, p<.01$), and spent more time integrating their discussion to produce a set of recommendations ($t(28)=.452, p<.05$). However, only the volume of supportive communication generated by the five group members was related to the quality of the group's recommendations ($t(28)=.55, p<.01$).

Indices of Discussion Thoroughness and Measures of Process and Outcome Satisfaction In order to examine the relationship between measures of group

discussion thoroughness and individual group members' ratings of process and outcome satisfaction, Pearson's Product Moment correlations were performed. The correlations, shown in Table D-76, demonstrated that neither process nor outcome satisfaction was related to the volume of task relevant communication generated during the discussion (either with or without the moderator). However, process satisfaction was positively related to the number of problems identified during the discussion ($t(119)=.198$, $p<.05$), and both process and outcome satisfaction were related to the number of recommendations made ($r(119)=.36$, $p<.01$, and $t(119)=.326$, $p<.01$). This pattern of findings confirmed that individuals focussed on outcomes (the number of recommendations) when assessing outcome satisfaction, and on the more obvious aspects of the entire decision making processes (the number of problems identified, and the number of recommendations) when assessing process satisfaction.

Indices of Decision Process Emphasis and Measures of Process and Outcome Satisfaction As can be seen from Table D-77, the correlations between indices related to process emphasis and the two measures of satisfaction showed that both process and outcome satisfaction were related to the volume of procedural communication generated during the group discussion ($t(119)=.203$, $p<.05$, and $t(119)=.2$, $p<.05$, respectively). These findings were, however, attributable to the procedural input of the researcher/moderator: the volume of procedural communication generated by the five group members alone was unrelated to either process or outcome satisfaction.

Given the earlier finding of conferencing condition differences in the volume of procedural communication exchanged by group members in the MAILROOM, the correlations between this type of communication and the two satisfaction measures

were conducted. These showed a significant negative relationship between the volume of procedural communication exchanged in the MAILROOM and process satisfaction ($r(119) = -.34$, $p < .01$), and a marginally significant negative relationship between the same type of communication and outcome satisfaction ($r(119) = -.197$, $p < .05$). This indicated that when group members' exchanged a high frequency of private mail messages telling others in the group what they should be doing in the conference, satisfaction with both the decision making process and product tended to be low. This, in turn, may have indicated that group members tended to exchange procedural information in the MAILROOM when they perceived that the group discussion was not progressing well.

Examination of the correlations between the OPA indices and the two satisfaction indices, revealed that individual's ratings of process satisfaction were significantly related to the degree to which their group had focussed on generating solutions and agreeing upon recommendations during the second and fourth quarters of the group discussion ($r(119) = .197$, $p < .05$, and $r(119) = .312$, $p < .01$, respectively). Individuals' ratings of outcome satisfaction were related to the degree to which groups analyzed the problem in the first quarter and agreed upon recommendations during the last quarter of their discussion ($r(119) = .336$, $p < .01$, and $r(119) = .294$, $p < .01$, respectively).

Communication-Based Group Cohesion and Measures of Process and Outcome Satisfaction The correlations between the group cohesion variables and the two satisfaction indices are shown in Table D-78. These analyses showed that both process and outcome satisfaction were significantly related to the volume of supportive communication generated in the conference ($r(119) = .458$, $p < .01$, and $r(119) = .269$, $p < .01$) and to the frequency with which personalized greetings were used ($r(119) = .337$, $p < .01$, and $r(119) = .327$, $p < .01$). The findings related to the

volume of supportive communication could not be attributed solely to the efforts of the moderator in the AS conferences. Without this moderator's input, both process and outcome satisfaction were still significantly related to the volume of supportive communication generated by the five group members alone ($r(119)=.436$, $p<.01$, and $r(119)=.257$, $p<.01$).

In addition, as expected from the previously discussed interrelations between the volume of supportive communication and the number of integrative sentences, both process and outcome satisfaction were significantly related to the number of sentences devoted to integrating the group discussion to arrive at some consensus regarding the content of the final recommendations ($r(119)=.311$, $p<.01$, and $r(119)=.267$, $p<.01$, for process and outcome satisfaction respectively).

3. The Relationships Between Computer Conferencing Experiences and Outcome Measures

The major indices of computer conferencing experiences were factor scores on dimensions of frustration, lack of social contact, group cohesion and freedom of expression. The relationships between each of these four experiential dimensions and the three outcome measures were examined using Pearson's Product Moment correlations.

The Relationship Between Experiential Dimensions and Judged Decision Quality

The correlations between factors scores on each of the four experiential dimensions and the quality of group recommendations are shown in Table D-79. As can be seen there, the only significant correlation was between group cohesion and judged decision quality ($r(118)=.347$, $p<.01$). Thus, as group members experienced a

greater sense of group cohesion the quality of their group recommendations improved. Multiple regression analysis indicated that group cohesion was a significant predictor of the quality of group recommendations ($F(4,117)=4.442$, $p=.0022$) which accounted for 13 percent of the variance in recommendation quality (see Table D-80).

The Relationships Between Experiential Dimensions and Process Satisfaction The correlations between the four experiential factors and process satisfaction are shown in Table D-79. These results showed that process satisfaction was negatively related to frustration ($r(118)=-.258$, $p<.01$), positively related to group cohesion ($r(118)=.555$, $p<.01$), and negatively related to lack of social contact ($r(118)=-.241$, $p<.05$). Thus, subjects reported higher levels of process satisfaction when they perceived their group to be highly cohesive, when they were not frustrated by computer conferencing, and when they did not experience a lack of social contact during the conference.

In order to examine the combined effects of the four orthogonal experiential factors on process satisfaction a multiple regression analysis was performed. The results of this analysis are summarized in Table D-81. They indicated that lack of frustration, group cohesion and no experienced lack of social contact were significant predictors of process satisfaction ($F(4,118)=24.098$, $p=.0001$). Of these three dimensions, group cohesion was the strongest predictor and lack of social contact the weakest. Together they accounted for 45% of the variance in process satisfaction.

The Relationships Between Experiential Dimensions and Outcome Satisfaction The correlations between the factor scores on each of the four experiential dimensions and outcome satisfaction are summarized in Table D-79. The pattern of findings for outcome satisfaction was somewhat similar to that found for process satisfaction. Correlations between outcome satisfaction and both group cohesion and lack of social

interaction were significant ($r(118)=-.432$, $p<.01$, for group cohesion, and $r(118)=-.207$, $p<.05$, for lack of social interaction). However, the correlation between outcome satisfaction and frustration was not ($r(118)=-.157$, ns). Hence, subjects' ratings of outcome satisfaction increased when they experienced their group to be highly cohesive and did not experience a lack of social contact.

In order to determine the combined effect of the experiential dimensions on outcome satisfaction a multiple regression analysis was performed (see Table D-82 for Summary Tables). The results of this analysis showed that a sense of group cohesion and no experienced lack of social contact were significant predictors of outcome satisfaction ($F(4,117)=10.533$, $p=.0001$). Group cohesion was the stronger of the two predictors, and together the two dimensions accounted for 26.5% of the variance in outcome satisfaction.

4. The Relationships Between Indices of Group Discussion Effectiveness and Indices of Computer Conferencing Experiences

In order to examine the relationship between group discussion effectiveness and conferencing experiences, Pearson's Product Moment correlations were performed between each of the four dimensions of computer conferencing experience and discussion thoroughness, decision process emphasis and communication-based group cohesion. The results of the correlations for each of these three aspects of group discussion effectiveness are summarized in Tables D-83 to D-85.

Computer conferencing experiences and Indices of Discussion Thoroughness As can be seen from Table D-83 group cohesion was significantly related to indices of discussion thoroughness. In particular, subjects experienced a greater sense of group cohesion as the total number of sentences in the conference discussion

increased ($r(122)=.299$, $p<.01$) and as the number of task relevant sentences increased ($r(122)=.242$, $p<.05$). Group cohesion was also positively related to the number of problems with the Library identified by the group ($r(122)=.338$, $p<.01$), and to the number of recommendations submitted for judgement ($r(122)=.235$, $p<.05$). These findings suggested that, at least in part, the experience of group cohesion was related to a sense that the group had been able to work together to identify the problems with the Library and to make recommendations to alleviate those problems.

In addition to these findings, the results in Table D-83 showed that subjects were less likely to experience a lack of social contact in their conference discussions as the total number of sentences generated in the conference increased ($r(122)=-.222$, $p<.05$), as the number of sentences generated by the five group members alone increased ($r(122)=-.198$, $p<.05$), and as the number of solutions generated increased ($r(122)=-.206$, $p<.05$). Thus, the lack of social contact in computer conferences did not appear to be a problem when the five group members were active in generating solution alternatives.

Computer Conferencing Experience and Decision Process Emphasis The results of the correlational analysis presented in Table D-84 indicated that neither frustration with computer conferencing, nor the freedom to express ideas in computer conferencing discussions were related to indices of process emphasis. However, the experience of group cohesion was marginally related to the total volume of procedural communication generated in the conference ($r(118)=.198$, $p<.05$), and was related to the degree to which groups focussed on agreeing upon recommendations, rather than analysis, or solution generation and evaluation, during the last quarter of their discussion ($r(118)=.237$, $p<.01$). In addition, lack

of social contact was negatively related to the volume of procedural communication contributed by the five group members alone ($t(118) = -.245, p < .05$).

These findings suggested, again, that the experience of group cohesion was related to the group's ability to work together and, in this case, to work together to pull their discussion together to produce recommendations during the last quarter of their conference. The findings also suggested that group members were more likely to experience a lack of social contact when the members themselves played an active role in organizing their group and their group discussion.

Computer Conferencing Experience and Communication-Based Group Cohesion As in the preceding section, the correlations in Table D-85 indicated that neither frustration with computer conferencing, nor the freedom to express ideas during the conference were significantly related to the communication-based indices of group cohesion. However, the experience of group cohesion was significantly related to the volume of supportive communication generated during the conference ($t(122) = .407, p < .01$), to the volume of supportive communication generated by the five group members alone ($t(122) = .411, p < .01$), and to the frequency with which personalized greetings were exchanged during the discussion ($t(122) = .38, p < .01$). In addition, lack of social contact was negatively related to both the total volume of supportive communication generated during the conference ($t(122) = -.221, p < .05$), and the volume generated by the five group members alone ($t(122) = -.238, p < .05$).

These findings suggested that group cohesion was not only related to a group's ability to work together, but also to the group's ability to generate a positive, supportive conference environment that allowed for the development of affective ties between group members, and increased their motivation to be part of the group. Again, group members were less likely to experience a lack of social contact with

others in their group when they actively attempted to offset it with supportive feedback and encouragement during the conference.

Computer Conferencing Experiences and Individual Communication Patterns In the preceding three sub-sections both the group cohesion and the lack of social contact dimensions of computer conferencing experience were related to the volume of communication contributed by the five group members alone. Thus, individuals' experienced high levels of group cohesion when the volume of supportive communication generated by group members was also high. And individuals' did not experience a lack of social contact when the group generated a high volume of task relevant communication, a low volume of procedural communication, and a high volume of supportive communication.

On the basis of these findings it was unclear whether any particular individual's report of his/her conferencing experiences reflected the input of other members of the group, or the input of that particular individual him/herself. In order to test whether dimensions of conferencing experience were related to individuals' contributions to their group discussion, Pearson Product Moment correlations were performed between factor scores on the four dimensions of computer conferencing experience, and the volume of the task relevant, procedural and supportive communication generated by individuals, rather than groups. The results of these correlations are shown in Table D-86.

These findings showed that individuals who perceived their group to be highly cohesive, did not generate a greater volume of supportive sentences ($r(122) = .183$, ns), but did use personalized greetings with greater frequency ($r(122) = .26$, $p < .01$). Thus, the results indicated that when others in the group generated more supportive communication, individual group members perceived the group to be highly cohesive and responded by using personalized greetings more frequently.

The results in Table D-86 also showed that when individuals perceived a lack of social contact in their conference, they were less likely to generate positive, supportive statements themselves ($t(122) = -.244, p < .05$). However, the volume of procedural and task relevant statements individuals generated were unrelated to their perception of a lack of social contact in the conference. These findings suggested that when individuals experienced a lack of social contact, they tended not to generate the kind of supportive communication that would have helped to build a sense of group cohesion.

Finally, the results in Table D-86 demonstrated that when individuals were frustrated with their conferencing experiences, they were more likely to generate procedural statements in private mail messages to other group members ($t(122) = .275, p < .01$), and when they experienced freedom to express their ideas in the conference, they were less likely to generate procedural statements ($t(122) = -.226, p < .05$). These findings suggested that frustration with computer conferencing was related to a lack of organization and direction in the conference, and that individuals felt freer to express their ideas when they were playing a less directive role within the group.

DISCUSSION

The major hypotheses in this research investigated the impact of structured decision support in computer conferences on indices of group decision making performance, including judged decision quality, indices of group discussion effectiveness, process satisfaction, outcome satisfaction and computer conferencing experiences. Secondary hypotheses were also derived to examine the relationships between these indices of group decision making performance. These latter hypotheses were proposed in order to gain a more complete understanding of the mechanisms by which structured decision support had an impact on group decision making performance. In this section, the results of the major hypotheses will be discussed first. Following this, the results of the secondary hypotheses will be discussed in the context of elaborating upon the findings of the major hypotheses.

Discussion of Hypotheses

The first major hypothesis was that judged decision quality would increase across conditions, from SS to PS to AS conferences. This hypothesis was partially supported. Groups in the two structured conferencing conditions did make recommendations of higher quality than groups in the unstructured conferences; however, groups in the AS conferences did not make recommendations that were judged to be any better than groups in the PS conferences. The superior quality of the recommendations made by groups in both the PS and AS conferences was attributable to the fact that the mean decision quality in the SS condition was lowered

by three groups who failed to make any recommendations at all, and so received quality ratings of zero percent. When these three groups were eliminated from analysis, groups in the SS condition made recommendations that were as good as those made by groups in the two structured conditions. Thus, the major benefit of the forms of decision support in the two structured conferencing conditions seemed to be that they enabled groups to integrate the threads of their discussions to produce a set of recommendations and, in this way, eliminated recommendations of extremely poor quality.

The second group of hypotheses were related to the impact of structured decision support on three types of indices of group discussion effectiveness: discussion thoroughness, decision process emphasis and communication-based group cohesion. The first hypothesis was that discussion thoroughness would increase across conditions. Two indices related to communication volume were used to assess discussion thoroughness. These were: the total number of sentences, and the number of task relevant sentences generated during group discussions. Using these indices, the hypothesis was partially confirmed. Both the total volume of communication, and the volume of task relevant communication was greater in the two structured conferencing conditions than in the unstructured conferences. However, the increases in task relevant communication for groups in the two structured conditions could be attributed to the increased total volume generated by these groups: they were no more task oriented than groups in the unstructured conferences.

Although the volume of communication and the volume of task relevant communication were greater for the two structured conditions, the addition of a conference moderator in the AS condition did not increase either the total volume of communication or the volume of task relevant communication beyond that generated

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by groups in the PS conferences which made use of communication structures alone. However, the increased volume of task relevant communication for groups in the AS conferences was found to be attributable to the efforts of the conference moderator. When the moderator's input (in the form of periodic summaries of the group discussion) was removed, the volume of task relevant communication generated by groups in the AS conferences was intermediate between the volume generated by groups in the SS and PS conditions, and did not differ from either.

In addition to the volume of communication and the volume of task relevant communication, discussion thoroughness was assessed by the number of problems identified, the number of solutions generated, the number of solutions evaluated and the number of recommendations made. Using these indices, it was hypothesized that the number of problems identified and the number of solutions generated would increase across conditions. It was also hypothesized that the number of solutions evaluated and the number of recommendations made would differ across conditions. Of these, only the hypothesis related to the number of solutions generated by groups in different conferencing conditions received any support. It was found that groups in the PS conferences generated significantly more solutions than groups in the SS condition and groups in the AS conferences generated an intermediate number of solutions that did not differ from the number generated by either the SS or the PS groups. This pattern of results was identical to the pattern found for the volume of communication generated by the five group members alone.

The second hypothesis related to the impact of conference structure on group discussion effectiveness was that the extent to which groups emphasized decision processes would increase across conditions. When decision process emphasis was measured by the number of procedural sentences, the hypothesis was confirmed.

groups in the SS conferences generated fewer procedural sentences than groups in the PS conferences, and groups in the PS conferences, in turn, devoted less time to procedural issues than groups in the AS conferences. However, groups in the SS and PS conferences did not differ in the extent to which they were procedurally oriented: both devoted a smaller proportion of their group discussion to procedural issues than groups in the AS conferences, where the moderator had considerable procedural input.

The increases across conditions in the volume of procedural communication generated during group discussions could be attributed to the efforts of the moderator/researcher. When statements reminding participants of the purpose of the topic headings, providing feedback about their progress, and informing them of what they were to do next were eliminated, groups in the three conferencing conditions did not differ in the volume of procedural communication generated by the group members themselves. The volume of procedural communication generated by group members in the MAILROOM did differ, however, with groups in the PS conferences generating more procedural sentences than groups in either of the other conditions.

These findings suggested that when there was a conference moderator group discussions maintained a greater focus on procedural issues, but that group members relied on the moderator to provide that focus. Groups in the PS conferences, with structured decision support, but without a moderator, did seem capable of focussing on procedural issues and providing some direction for their group discussions, but only in the privacy of the MAILROOM.

In addition to the hypothesis for indices of decision process emphasis related to the volume of procedural communication, it was hypothesized that the degree to

which groups followed the ideal, sequential passage through the four major stages of effective group decision making would increase across conditions. This hypothesis was not confirmed. Groups in all conditions approximated this sequential pattern most closely during the first and last quarters of their discussions but had greater difficulty following the ideal pattern of group decision making during the middle half of their discussion. However, a fifth of the groups had difficulty following this ideal pattern during only one of the two middle quarters of the discussion, and a further quarter of the groups had no difficulty. These groups followed the ideal sequence of decision making stages exactly.

The last hypotheses in the group of hypotheses dealing with the impact of structured decision support on group discussion effectiveness were related to indices of communication-based group cohesion. It was hypothesized that groups in the AS conferences would generate more supportive communication during their discussions than groups in the other two conferencing conditions. This hypothesis was supported. Moreover, as expected the increased volume of supportive communication in the AS conferences was attributable to the efforts of the conference moderator. When this input was removed, groups in the three conditions did not differ in the degree to which they generated a supportive conferencing environment.

It was also hypothesized that groups' ability to coordinate their effort would increase across conditions. Using the number of integrative sentences as a measure of this ability, the hypothesis was unsupported.

The third major hypothesis in this research was that group members' satisfaction with their group's decision making processes would increase across conditions. Although the data did show an increasing trend in process satisfaction across conditions, this trend was only marginally significant. While no specific predictions

were made for the relationship between conferencing structure and group members' satisfaction with the product or outcome of their group discussions, differences between conferencing conditions in outcome satisfaction were examined. Again, the data showed an increasing trend in outcome satisfaction across conditions. However, this trend was not significant.

The final major hypothesis was related to the impact of conference structure on conferencing experiences. Although the hypotheses related to conferencing experiences were largely exploratory, it was predicted that the degree to which participants' reported positive conferencing experiences would increase across conditions. This hypothesis was not supported: groups in all conditions reported somewhat negative conferencing experiences. However, group members in the three conferencing conditions did differ in one particular kind of experience. Group members in both the PS and the AS conferences experienced a greater sense of group cohesion during their conferences. They perceived their conferences to be more supportive, and to have a greater sense of direction. Participants in the AS conferences did not report a greater sense of group cohesion than participants in the PS conferences, suggesting that the sense of group cohesion may have had more to do with communication structure than with the leadership provided by the conference moderator.

The results discussed so far can be summarized as follows: relative to groups in the SS condition, groups in both the PS and AS conferencing conditions were more likely to be able to integrate their discussions to make recommendations, produced longer transcripts, generated more task relevant communication. In addition, groups in the PS conferences generated a greater number of solutions. The volume of procedural communication did increase across conditions, as long as the moderator's

input was included, and groups in the PS conferences generated more procedural communication in the MAILROOM than groups in either of the other two conditions. The discussions of groups in the AS conferences contained more supportive communication and this effect was attributable to the efforts of the conference moderator. Conference structure was marginally related to process satisfaction, but unrelated to outcome satisfaction. And finally, groups in the two structured conferences experienced a greater sense of group cohesion than groups in the SS condition.

Elaboration of Major Findings

In order to elaborate upon the nature of the impact of structured decision support on group decision making performance, a number of secondary hypotheses were proposed to investigate the relationships between the different indices of group decision making performance. In deriving these hypotheses the indices related to group discussion effectiveness and computer conferencing experiences were conceptualized as intermediate variables that may play a mediating role between computer conference decision support and the outcome variables of judged decision quality, process satisfaction and outcome satisfaction.

For the sake of clarity, the results of these secondary hypotheses will be discussed in three major sections corresponding to the indirect impact of conference structure on each of the three outcome variables. Following this, the relationships between the intermediate indices of group discussion effectiveness and computer conferencing experience will be discussed. Finally, the relationships between judged decision quality, process and outcome satisfaction will be discussed.

1. The Indirect Impact of Structured Decision Support on Judged Decision Quality

It was hypothesized that indices of group discussion effectiveness would be positively related to judged decision quality. This hypothesis was confirmed for a number of group discussion indices. Thus, as judged decision quality increased so did the number of solutions generated, the number of solutions evaluated, the number of recommendations made, the total volume of procedural communication, the degree to which groups approximated the ideal sequence of decision making steps during the final quarter of their discussion, and the volume of supportive communication generated by the five group members. However, only two of these correlates, the number of solutions generated and the total volume of procedural communication, varied across conferencing conditions.

It was also hypothesized that computer conferencing experiences would be positively related to judged decision quality. This hypothesis was supported for experiences related to a sense of group cohesion. As groups' made better recommendations they experienced a greater sense of group cohesion. In addition, the experience of group cohesion varied across conferencing conditions.

These results, when combined with the earlier results suggested that while the structured decision support used in this research had a direct influence on judged decision quality, it also had an indirect influence through the number of solutions generated, the volume of communication devoted to procedural issues, and the degree to which group members' experience a sense of group cohesion during their conference. Groups in the PS conferences generated more solutions than groups in the SS condition, and this increased volume of potential solutions also enhanced decision quality. The volume of procedural communication generated during group discussions increased across conditions, but increases in the moderator/researcher's

procedural input from the PS to AS groups did not translate into increased decision quality. And finally, groups in the two structured conferencing conditions experienced a greater sense of group cohesion, which, in turn, was related to improved decision quality.

While groups in the structured conferences generated more sentences and more task relevant communication, neither of these indices were related to decision quality. This is perhaps not surprising because both these volume measures are highly related to the number of solutions generated. Thus, with respect to measures of decision quality, an important benefit of increasing the volume of task relevant communication through conference structure may have been that it allowed groups to generate more potential solutions.

The volume of procedural communication exchanged in the MAILROOM did not mediate between decision support and judged decision quality. While the volume of this type of communication was greater for groups in the PS conferences, it was unrelated to the quality of group recommendations.

Similarly, the communication-based indices of group cohesion did not mediate the relationship between structured decision support and judged decision quality. As a result of the conference moderator's input, groups in the AS conferences did enjoy a more supportive conference environment. However, judged decision quality was only related to the number of integrative sentences generated by the five group members.

What was striking about the indirect effects of conference structure on judged decision quality was the apparent lack of importance of the conference moderator. Although the moderator in the AS conferences did work to try to encourage groups to generate as many solutions as possible, this attempt did not increase the number of solutions generated. Similarly, although the moderator did try to build a sense of

group cohesion, through the creation of a supportive conference environment, and although groups in the AS conferences did experience a greater sense of group cohesion than groups in the SS condition, they experienced no greater sense of group cohesion than groups in the PS conferences that used communication structures alone.

Thus, it could be concluded that structured decision support using topic headings corresponding to the four major stages of group decision making allowed groups to make better recommendations, but that, at least with respect to indices of decision quality, the role of the conference moderator was relatively unimportant.

2. The Indirect Impact of Structured Decision Support on Process and Outcome Satisfaction

It was hypothesized that indices of group discussion effectiveness would be positively related to both process and outcome satisfaction. These hypotheses were supported for several group discussion indices. As group members' level of satisfaction with their group's decision making processes increased so did discussion thoroughness indices of number of problems they identified and the number of recommendations. In addition, as process satisfaction increased the total volume of procedural communication in the group discussion increased, the volume of procedural communication exchanged in the MAILROOM decreased, and the degree to which groups concentrated on evaluating solutions and agreeing upon recommendations during the second and fourth quarters of their discussion increased. Finally, as process satisfaction increased so did the following measures of communication-based group cohesion: the total volume of supportive communication in the conference, the frequency with which personalized greetings were exchanged, the volume of supportive communication generated by the five group members

themselves, and the number of integrative sentences.

The correlates of outcome satisfaction were almost identical to those for process satisfaction. Thus, outcome satisfaction was related to the same indices of discussion thoroughness, decision process emphasis and communication-based group cohesion as process satisfaction with two exceptions. First, outcome satisfaction was related to the degree to which groups followed ideal decision processes when analyzing the problem, rather than when generating solutions. Second, it was unrelated to the number of problems identified.

Of these correlates of process and outcome satisfaction the only ones that varied across conferencing conditions were the total volume of procedural communication, the volume of procedural information exchanged in the MAILROOM, and the total volume of supportive communication generated in the conference discussion. Hence, conference structure had an indirect impact on both process and outcome satisfaction through the volume of procedural and supportive communication.

In addition to the hypothesized relationships between indices of group discussion effectiveness and both process and outcome satisfaction, the relationships between computer conferencing experiences and process and outcome satisfaction were investigated. The results indicated nearly half the variance in ratings of process satisfaction was accounted for by the degree to which group members experienced a sense of group cohesion, did not experience their conferences as frustrating and were not bothered by the lack of social contact. Similarly, approximately a quarter of the variance in outcome satisfaction was accounted for by the degree to which group members experienced a sense of group cohesion and did not experience a lack of social contact in their conferences. Of these dimensions of conferencing experience, only a sense of group cohesion varied across conferencing conditions. Thus, computer

conference structure had an indirect impact on both process and outcome satisfaction through experiences related to group cohesion.

Results discussed earlier showed that the forms of structured decision support used in this research had no direct impact on outcome satisfaction and only a marginally significant impact on process satisfaction. However, conference structure did have indirect effects through the volume of procedural and supportive (but not task relevant) communication, and through participants' experiences related to a sense of group cohesion.

While the role of the conference moderator in the AS conferences was relatively unimportant with respect to the quality of recommendations made by groups, examination of the indirect effects of conference structure on measures of satisfaction indicated that the moderator's role with respect to process and outcome satisfaction was somewhat more critical. Groups in the AS conferences generated more procedural and supportive communication during their discussions than groups in the other two conditions. These differences were attributable to the efforts of the conference moderator and, in turn, were related to both process and outcome satisfaction. In addition, given conferences with decision support using communication structures, the addition of a conference moderator seemed to reduce the volume of procedural information exchanged in the MAILROOM. This was an advantage because the volume of this communication was negatively related to both satisfaction measures and this relationship may have meant that much of the procedural communication in the MAILROOM involved attempts to coerce non- or minimally participating group members into playing a more active role in the group discussion.

3. The Interrelationships Between Indices of Group Discussion Effectiveness and Computer Conferencing Experiences

The relationships between indices of discussion thoroughness, decision process emphasis and communication-based group cohesion and dimensions of computer conferencing experience were investigated. Two of the four dimensions of conferencing experience were related to these three types of communication indices. First, the degree to which participants were bothered by a lack of social contact in their conference decreased as the volume of the group discussion increased, and as the number of solutions generated increased. Thus, when group members were active conference participants who were involved with important aspects of decision making they were less likely to experience a lack of social contact.

More importantly, in view of its mediating role, a sense of group cohesion was also related to a number of communication variables. The extent to which participants experienced a sense of group cohesion was related to the volume of communication, the total volume of task relevant communication, the number of problems identified and the number of recommendations made. It was also related to the total volume of procedural communication and the degree to which groups focussed on integrating their discussions to make recommendations during the last quarter of their conference. Thus, a sense of group cohesion was related to a group's ability to work well together.

In addition, the degree to which participants experienced a sense of group cohesion increased with the total volume of supportive communication, the volume of supportive communication contributed by the five group members, and the frequency with which personalized greetings were exchanged. These findings suggested that the experience of a sense of group cohesion in computer conferences was related not only

to a group's ability to work well together, but also to the extent to which they could foster the sort of supportive climate that encouraged group members to want to be an active part of the group. Furthermore, the relationships between the experience of group cohesion and individual communication patterns showed that, when group members experienced a sense of group cohesion they were more likely to contribute supportive statements and to use personalized greetings. Thus, to the degree that participants experienced a sense of group cohesion, they responded by contributing the sorts of communication that would function to increase at least the socio-emotional aspects of group cohesion.

This cyclical pattern seemed to be at least partly attributable to the efforts of the conference moderator. Of the communication-based correlates of the experiential dimension of group cohesion, two (the total volume of procedural communication and the total volume of supportive communication) played a mediating role between conference structure and the satisfaction indices. Groups whose discussions had higher levels of either procedural or supportive communication were typically groups in the AS conferences, and the increased volume of these types of communication was attributable to the efforts of the conference moderator. Thus, the most critical role of the conference moderator may have been related to her procedural and supportive input. When group discussions were directed and organized and when the decision making climate was supportive, participants experienced a sense of group cohesion and, as a result, followed the moderator's lead in generating the kind of supportive communication that helped develop a stronger sense of group cohesion. This sense of group cohesion may then have encouraged groups to put more time and effort into discussing the Library's problems and making recommendations for improvement. And this, in turn, may have contributed

to the quality of the final group product.

4. The Interrelationships Between Measures of Decision Quality and Satisfaction

It was expected that the outcome measures of judged decision quality, process satisfaction and outcome satisfaction would be interrelated. This expectation was confirmed: as decision quality increased so did process and outcome satisfaction, and as the degree to which participants were satisfied with their group's decision making processes so did the degree to which they were satisfied with the outcome or product of their discussion.

Summary

The discussion so far has centred on: the direct effects of structured decision support on quality and satisfaction indices, the indirect effects mediated by group discussion effectiveness and computer conferencing experiences, the relationships between group discussion effectiveness and conferencing experiences, and the interrelationships between the quality and satisfaction indices. These findings can be integrated using the earlier model of the predicted relationships between these sets of variables was outlined (see Figure 1, p. 63). This general model was supported for some indices of group discussion effectiveness and conferencing experiences. On the basis of the findings just discussed, a more specific model can now be outlined of the influence of structured decision support on group decision making performance. This is summarized in Figure 11 below.

General Discussion

In general, the results in this research are supported to some extent by previous findings. First, the major finding that groups in computer conferences with

structured decision support made better recommendations than groups in

FIGURE 12: The Influence of Structured Decision Support in Computer Conferences on Group Decision Making Performance

unstructured conferences is consistent with the face-to-face research which suggests that structured, but interactive group discussions yield decisions of higher quality (Brilhart, 1982; Erffmeyer & Lane, 1984; Hirokawa, 1980; Guzzo & Waters, 1982; Nemiroff, et. al, 1976). However, the fact that groups in the AS conferences (where topic headings corresponding to the four stages of effective decision making were presented sequentially) did not make better recommendations than groups in the PS conferences (where these same topic headings were presented simultaneously) contradicts the face-to-face findings that effective groups analyse before they generate solutions, and generate solutions before they begin the evaluation of them (Bales & Strodtbeck, 1951; Bayless, 1974; Burgoon et al., 1974; Guzzo & Waters, 1982; Hirokawa, 1983; Hoffman, 1965; Maier, 1963; Van de Ven, 1974).

There may be two major reasons why the sequential presentation of topic headings did not lead to higher quality recommendations. One is that the order in which the topic headings were listed in the PS conferences alerted groups to the sequence of decision making stages and, as a result, groups in the PS conferences approached their decision making task sequentially, in the same way that groups in the AS conferences did. The other is that groups in both the AS and PS conferences simply did not follow a fixed, sequence of steps in their discussions of the decision task. It seems likely that both explanations have some merit. The majority of the groups in the two structured conditions followed ideal, sequential decision making processes for most or all of their discussion, and these groups were split almost equally between the PS and AS conditions. The remainder had difficulty following the sequence of steps associated with effective group decision making. These results are in keeping with Poole and Roth's (1989) recent finding that while some decision

making groups do move sequentially through decision stages, others do not progress linearly but instead tend to cycle through stages as solutions to problems lead to the identification of other problems, and as the evaluation of solutions leads to new or modified solutions, and to new problems (see also Poole & Doelger, 1986). The results are also in keeping with the body of research that has found no relationship between the use of sequential decision making processes and decision quality (Brilhart & Jochem, 1964; Bell, 1982).

The suggestion that groups do not necessarily pass through decision stages sequentially does not automatically negate the use of topic headings corresponding to these stages. Indeed groups whose discussion was structured by the use of the topic headings ANALYSIS, ALTERNATIVES, EVALUATION, and DECISION did make better recommendations than groups whose discussions were unstructured. Moreover, at least in part, this structure did appear to provide some additional direction that allowed groups to collect recommendations together, so that very poor recommendations were eliminated.

Given that the topic headings used in this research did enhance the quality of group recommendations, groups in the AS conferences may have failed to make better recommendations than groups in the PS conferences because the moderator manipulation was ineffective. There are a number of possible reasons why this manipulation may not have been effective. One is that the moderator herself was ineffective. The role of moderator was played by the researcher, who also acted as the resource person, and trained groups to use the conferencing system MEET. Given these multiple roles, together with the time pressure of running as many as 25 groups at one time, the researcher did experience a certain amount of role confusion and this may have interfered with her role as conference moderator.

This interference may have taken two forms. First, the multiple roles played by the researcher may have confounded the social host role she played as moderator in the AS conferences. As social host the moderator was to try to create a supportive conference environment. However, during the training sessions, it became quickly apparent that subjects' participation during the two-week conferences depended, to some extent, upon the degree to which the researcher could generate enthusiasm for the project. In addition, as resource person, the researcher tried to ensure continued participation by responding positively to those who experienced some difficulties with the computer system. Thus, as trainer and resource person, the researcher may have created a somewhat positive conferencing climate in all three conditions, rather than in just the AS conferences.

In addition to interfering with her role as social host, the multiple roles played by the researcher may have interfered with her moderator role of meeting chairperson. This role focussed on providing procedural input. However, during the training sessions the examples used exposed subjects to a variety of decision making contexts, and, from these, they may have gleaned general procedural information relevant to group decision making. In addition, in clarifying the instructions for each condition, the researcher provided participants with procedural information that was specific to their decision making task. Hence, subjects in all three conditions may have possessed general and specific procedural knowledge.

Despite these possible effects of role confusion, the researcher, as moderator, did contribute a greater volume of both supportive and procedural communication to the AS conference discussions than to the discussion in the PS conferences, suggesting that she did, in fact, do her job as conference moderator. Therefore the confounding effects of the different roles played by the researcher would be expected to be

influential only if they produced in a ceiling effect which made her role as moderator superfluous. However, the fact that subjects in all conditions reported somewhat negative conferencing experiences, and the fact that participants did not experience a very strong sense of group cohesion, provide some evidence that argues against a ceiling effect for the supportiveness of the conference environment. Furthermore, the fact that process satisfaction ratings were in the neutral to slightly positive range may indirectly indicate that groups were not procedurally adroit.

The above argument suggests that, despite the experience of some role confusion on the part of the researcher, she played her roles as social host and as conference chairperson effectively, and it is unlikely that ceiling effects neutralized the impact of these roles. Given this, an alternative explanation for the finding that groups in the AS conferences did not produce recommendations of higher quality than groups in the PS conferences may be that the role of moderator as conference chairperson was simply superfluous. The topic headings used in this research to organize the group discussion corresponded to the four stages of effective decision making and so were, by their nature, directional. They may therefore have implicitly prompted groups in the PS and AS conferences to be aware of procedural issues in their discussion so that the moderator's procedural input while there, was unnecessary.

If this explanation has merit, then it may well be that a conference chairperson would have a greater impact if different types of topic headings had been used. For example, in legal and parliamentary discussions, which are organized into pro and con arguments, the judge and speaker of the house play important procedural roles. In addition, the present study provides some anecdotal evidence that discussions organized under topic headings corresponding to different problems or solutions may benefit from the presence of a conference chairperson.

Of two groups in the SS condition who chose to organize their discussions under topic headings, one used potential solutions as topic headings. This group introduced the topic headings late in the discussion, after they had narrowed down their list of potential solutions. During the second half of their discussion, one group member did emerge in a chairperson role. She suggested the topic headings, requested their addition, and, at the end of the conference, was responsible for directing the group's attention back to the GENERAL topic so that recommendations could be entered.

The other group in the SS condition who organized their discussion under topic headings did so at the beginning of their discussion and chose topic headings corresponding to different problems with the library. In this group one individual also took a leadership role, but she did so the first time she signed-on to the computer. She quickly organized the topic headings and gave instructions to the others in the group regarding their participation. However, towards the end of the conference this group member abdicated her leadership role and, in fact, felt very strongly that no one group member should act as chairperson at that stage, but that the group, as a whole, should arrive at their recommendations.

In both these groups there was evidence of the emergence of a chairperson who took responsibility for procedural issues. The difference was that in the first group the chairperson was most active towards the end of the discussion, and in the second group the chairperson was active early in the discussion, but did not follow through towards the end of the conference. These differences seemed to have an impact on the quality of recommendations. While, the first group made recommendations of average quality, the second failed to make any recommendations at all. Thus, it may be that, for these types of topic headings, the role of chairperson is important for coordinating the group discussion, particularly after the addition of specific topic

headings.

So far, the discussion has focussed on the direct impact of structured decision support in computer conferences on judged decision quality. In addition to this direct influence, indirect influences were also found to operate through the number of solutions generated, and the experience of a sense of group cohesion. The indirect influence through the number of solutions is well supported in the creative problem solving literature (cf. Fisher, 1980; Guetzkow & Cyr, 1954; Janis, 1972; Maier, 1963; Maier & Hoffman, 1960; Van de Ven, 1974; Van de Ven & Delbecq, 1974; Wanous & Youtz, 1986). Similarly, the indirect influence through the experience of group cohesion is supported by recent findings that group cohesion is related to the quality of group outcomes in business games (cf. Wolfe & Fox, 1988; Miesing & Prebie, 1985), and by the findings of the groupthink literature that cohesive groups, in the absence of adequate decision procedures, make decisions of poor quality (see Callaway & Esser, 1984; Janis, 1972; Janis & Mann, 1977).

Although the direct and indirect effects of structured decision support in computer conferencing on decision quality are fairly well supported by previous research, the support for the effects of structured decision support on the two satisfaction indices is less clearcut. In part this stems from the fact that satisfaction indices have received less attention in the literature than indices of decision quality. However, in part it also stems from the fact that the results found for computer conferencing groups here, are simply not consistent with analogous findings in the face-to-face literature.

In this research there was only a marginally significant relationship between the type of decision support in computer conferences and the participants' reported level of satisfaction with their group's decision making processes. These findings

contradict Van de Ven's (1974) results which found that groups whose discussions were structured by the use of Nominal Group Techniques (NGT) were more satisfied with their decision making processes. However, the two studies may not be comparable. Apart from the face-to-face versus computer-mediated communication differences, NGT groups are only minimally interactive. Thus, the contradictory results may be explained on the basis of differences in the nature and level of group interactiveness.

One reason for the lack of relationship between type of decision support and process satisfaction in this research may stem from what is essentially a voting method confound. The groups used here were instructed to make recommendations the group was "willing to submit to the Library Services Committee". Although it was not intended, this instruction may have prompted groups to use, at least implicitly, consensus voting methods which, according to Murnighan (1982), require that all group members express agreement with the recommendations. There is some informal evidence that this may have happened: in a few groups individual group members summarized any emerging consensus, and several participants in other groups did complain that, in the absence of immediate feedback, it was difficult to know whether everyone agreed with the recommendations. If groups generally did use consensus as a criterion for proposing specific recommendations, then this procedural strategy, rather than the decision support manipulation, may have been responsible for the satisfaction ratings. At least in face-to-face research, consensus voting methods have been found to be related to ratings of process satisfaction (cf. Brillhart, 1982; Murnighan, 1982).

An alternative explanation for the finding that the type of decision support was not strongly related to ratings of process satisfaction, and one which is embedded in the

preceding argument, is that process satisfaction is determined more by the way a group uses the decision support provided, and less by the nature of that support itself. There is some indirect support for this. The relationship between decision quality and process satisfaction suggests that decision quality plays a mediating role between decision support and process satisfaction. Thus, the type of decision support provided may be associated with ratings of process satisfaction only when groups use that support to make decisions or recommendations of high quality.

In addition to this, the results show that the relationship between decision support and process satisfaction is mediated by the procedural and supportive input of the researcher/moderator. These findings suggest that, with respect to process satisfaction, the important aspects of the type of decision support provided in this research may be attributable to the sense of direction and the supportive climate provided by the conference moderator. Of these two factors, the sense of direction given by the moderator's procedural input may be the more important determinant of process satisfaction. When group members had to generate procedural communication themselves, they did tend to do so in the MAILROOM, but only at the expense of their satisfaction with the group's decision processes.

While there are a number of reasons why process satisfaction did not vary with the type of decision support used in this research, it should be pointed out that the overall level of satisfaction was, at best, only slightly positive. This is in keeping with the results found by Johansen et al. (1978) when they had members in unstructured conferences rate the degree to which they found that computer conferencing was a satisfactory medium for different kinds of communication (see also Rice, 1980). Furthermore, because their subjects were members of established conferences, there is some reason to believe that at least groups in the SS condition

would not report increased levels of process satisfaction over time, if they were to work together on other decision problems. Whether this same finding would be expected for the groups in the two structured conditions is unclear. In view of the fact that the concept of organizing a group discussion under topic headings was new to most participants, and the findings that, when groups did chose to structure their discussion, they chose very different types of topic headings, it may be that over time groups in the PS and AS conditions would become acclimatized to the rather artificial topic headings, and report higher levels of process satisfaction.

As mentioned earlier the pattern of findings for outcome satisfaction was extremely similar to that for process satisfaction. In particular, ratings of outcome satisfaction did not vary across conferencing conditions. This finding is inconsistent with research using face-to-face groups (e.g. Erffmeyer & Lane, 1984; Lane et al ., 1982; Gero, 1985, Murnighan, 1982). The difference may be attributed to differences in factors such as face-to-face versus computer mediated communication, the type of decision structure used, or the nature of the decision task. Alternatively, it may be due to the greater time commitment (two weeks) required of subjects and the effort they put into the decision task during that time.

When subjects completed the post-decision questionnaire a number of them indicated high levels of outcome satisfaction and commented that if they had made certain recommendations they would naturally be satisfied with them and be extremely happy if they were adopted by the library. Given that the majority of subjects invested many hours and a great deal of effort into trying to solve the problems with the Library, this reaction suggests that the outcome satisfaction measures may have been more a reflection of participants' need for cognitive

consistency than a true assessment of the outcome of their group work (cf. Aronson & Mills, 1959).

While this argument may have applied to some subjects, it seems unlikely that it held for subjects in general. There are three reasons for this. First, on average, the ratings of outcome satisfaction were only mildly positive, and this was in keeping with the level of process satisfaction. If the measure of outcome satisfaction was, in fact, artifactual, somewhat higher ratings would have been expected. Second, outcome measures were related to the measure of judged decision quality, and therefore were at least partly a reflection of actual group outcomes. And, third, the impact of the type of decision support on outcome satisfaction is mediated by the same variables that mediate the relationship for process satisfaction. Thus, the finding that when groups work well together in a supportive conference environment and make recommendations of high quality, they tend to be satisfied with those recommendations indicates that ratings of outcome satisfaction are grounded in both group work and the products of that work.

Overall, the results provide some support for the claim that the key to capitalizing on the potential of computer conferencing lies in the use of communication structures that organize group discussions under topic headings and strong conference leadership (Hiltz & Turoff, 1978, 1985; Kerr & Hiltz, 1982; Turoff & Hiltz, 1982). However, they also suggest that communication structures, or at least those used in this research, and conference leadership operate in different ways to enhance group decision making performance. The use of topic headings corresponding to the four major stages of effective group decision making seem to make it easier for groups to work together and produce decisions or recommendations of higher quality. On the other hand, the leadership efforts of a conference moderator

appear to influence the tone of the conference environment and satisfaction ratings.

Limitations

While the results of this study are promising, there are also a number of limitations that may prevent generalization of the findings. Two of these were alluded to earlier. The first had to do with the multiple roles played by the researcher and the possible consequences of role confusion. Although this did not seem to have a major impact upon the results, it may be advisable, in future research, for these roles to be played by another individual.

Having someone other than the researcher play the role of the moderator, in particular, would also alleviate concerns related to the issue of experimenter bias. As discussed earlier this was not, in fact, a major concern in this research because the kind of bias the researcher was likely to introduce corresponded to the kind of input expected of any good moderator. However, by having the researcher act as moderator in the AS conferences, it was possible that she could have had a "best" set of recommendations in mind and passed these on to groups in the AS conferences. This would have increased their chances of making higher quality recommendations than groups in the other two conditions. Although this is a legitimate concern, it would have been difficult for the moderator to introduce this sort of bias given the nature of the task and the fact that she was not one of the judges. Indeed, the results argue against the presence of this sort of bias since the groups in the AS conferences did not make recommendations that were significantly better than those made by the groups in the PS conferences.

The second possible limitation alluded to earlier relates to the fact that the topic

headings used here lacked intuitive appeal for most participants, and were dissimilar to those topics chosen by the two groups that did organize their discussion. This may suggest that the results are confounded by a novelty effect, and that if the same groups were to participate in other conferences, with different decision problems but with the same type of decision support, then they may become accustomed to the topic headings, use them more effectively, and produce better recommendations. Furthermore, over time, group cohesion may increase and this, in itself, may improve a group's ability to work together.

In addition to the limitations already mentioned, there are several others which may qualify the results. First, it was suggested above that communication structures and conference leadership may operate in different ways, with communication structures having their major impact on quality measures, and leadership having its major impact on satisfaction indices. Whether these two channels of influence would generalize to different types of topic headings is unclear. In particular, when topic headings are used that represent content categories rather than process categories, it seems likely that the conference moderator may play a critical role as chairperson. In particular, the moderator's procedural input may be essential to coordinate and direct the group discussion, and to help groups integrate their discussion to produce final decisions or recommendations. Thus, with topic headings corresponding to content categories, the conference moderator's role may have an impact on quality as well as satisfaction indices.

Another possible limitation has to do with the nature of the subjects used. In this research considerable effort was devoted to the choice of decision task. The task selected was not only one that was relevant to the subjects but also one that was representative of the kinds of decisions that are actually made in the organization

they had in common: the University. This latter criterion was used to try to ensure high external validity in the hopes that the results would generalize to groups working within organizations. However, while the task may have allowed such generalizability, the subjects used may have limited the degree to which the results could be generalized to organizational environments. There are two reasons why this may have been the case. First, almost 90 per cent of subjects were first year students with limited knowledge of both the University and the Library. Second, the groups generally did not make recommendations of very high quality. The average was 56.5 per cent for all groups, and 62.13 per cent for those groups who did actually submit recommendations.

There are two ways of discussing the possible limitations of the subject sample in this research. One is to ask whether there another subject sample would have been more appropriate for the selected decision task (the Library task), and the other is to ask whether another decision task would have been more appropriate for the subject sample used in this study.

In answer to the first of these questions, different results may have been obtained if the subjects had been upper year students, faculty or Library personnel. Individuals in these categories could be assumed to have more experience with the Library and a greater understanding of the Library's problems and constraints. On these grounds, the Library task would presumably be of greater relevance to upper level students, faculty, or Library personnel, and they would therefore be in a better position to discuss the Library task thoroughly and produce good, realistic recommendations.

The seriousness of the limitations imposed by the use of first year subjects is, however, in doubt. The results show that the first year students in this study did use

the library, and reasons for this are outlined in Footnote 1. Thus, they had some knowledge of the library. This knowledge was somewhat selective in that subjects generally had very little idea about either University funding or financial allocation within the University, and many of them had no clear idea of what automation in the Library entailed, or of what kinds of benefits would follow from automation.

Whether upper level students would have this type of knowledge is unclear. Certainly faculty and Library personnel would be expected to be well versed in these issues. Thus, although the use of first year students may well limit the generalizability of the findings, it is not clear whether the use of upper year students would have represented a major advantage. The use of Library personnel or faculty as subjects would have been preferable. However, the library has a total of only 37 staff and is therefore too small a sample for this type of research. In addition, it is highly unlikely that 150 of the approximately 200 academic staff would have volunteered for a study involving a time commitment of at least four hours.

Even though the use of first year students may have limited the generalizability of the findings in principle, in practice this limitation may not be too serious. Despite the fact that most subjects had been at the University for only a term, there was evidence that many were aware of, and tried to overcome their inexperience. Requests for information about the Library were made by approximately three quarters of the groups during their conferences, and a number of subjects did request information from more senior students and from Library personnel. In addition, a handful of subjects were either working part-time in the Library, or were student representatives on Library committees. Thus, many students may have been more representative of Library personnel than their time at the University

would suggest.

Some support for this notion came from the judge who was also the head of the Library Services Committee. He provided rather detailed feedback on the recommendations made by the student groups. On the basis of that feedback 70 to 80 per cent of the submitted recommendations had either been tried in the past, or in the process of being implemented now, or were planned for the future. Of the remainder, perhaps five to 10 per cent were new solutions that were greeted by the Library judge with enthusiasm. The rest, according to the Library judge, had no great merit.

This feedback suggests that the subject groups did approach the Library task in ways that were somewhat similar to those used by Library personnel in the past. Therefore the fact that the overall average quality of the recommendations was not terribly high may have more to do with the intractable nature of the problems with the Library, than with the idea that the students were not representative of those who typically make decisions about the Library. It may also have been bounded by human decision making capabilities. Certainly, the average quality ratings are consistent with the kinds of quality ratings achieved by experts in the literature on individual judgement and decision making (cf. Goldberg, 1959; Hoffman, Slovic, & Rorer, 1968; Meehl, 1954; Oskamp, 1965).

The second way of discussing the limitations imposed by the subject sample is, as mentioned earlier, to ask whether another decision task would have been more appropriate for use with first year subjects. Within the group research area, the NASA Moon Survival Problem or its Arctic, Mountain or Sea variants, have been used in the vast majority of published studies (see Hall & Watson, 1970; Eady & Lafferty, 1974; Kast & Rosenzweig, 1967; and Nemiroff and Passmore, 1976,

respectively). These tasks require subjects to rank order the importance of 15 items for surviving in a specified environment. While these environments differ, they are typically not environments that are familiar to most undergraduates.

Many group researchers who have not used some variant of the Moon Survival Problem in their research, have opted for either a real world problem or some kind of business simulation game. Very often the real world problems are ones that have already been solved in real world settings. And often they are problems about which subjects can generally be expected to have little knowledge. For example, Hirokawa (1983) used a task related to controlling speeding in Seattle on its arterial highways, and Rohrbaugh (1981) asked undergraduates to pick the winners of horse races.

Some group researchers have tried to select decision tasks that are of relevance to student subjects (see, e.g., Hirokawa & Pace, 1983; or Weston et al., 1975). However, these examples are relatively rare, and the overwhelming majority of group studies have relied on decision tasks that have little relevance for student subjects and about which they can be expected to have little experience or knowledge. From this perspective, then, the first year students used in this study were every bit as qualified to discuss the Library task as they would have been to discuss one of the more traditional group psychology tasks.

In addition to the possible limitations already mentioned, a further limitation may be related to the computer system, MEET, that was used in this research. Although subjects generally found MEET straightforward and easy to use, some did complain that it was frustrating and time consuming to have to scroll through all the comments that had been entered under a topic heading whenever they wished to read, write, or add a comment to that topic heading. Several subjects complained that it was

frustrating to be automatically logged off the computer if they forgot to punch return at the end of a line, or if someone else tried to use a MEET command at exactly the same time. They also complained about the fact that many terminals on campus did not have "No-Scroll" buttons so that messages were restricted to a single screen. Although these last two complaints were actually related to the computing system within the university, and not to MEET, subjects typically did not make the distinction.

Given these complaints, even though they were not common, a modified version of MEET may have produced higher satisfaction and/or quality ratings. More generally, however, the fact that even some subjects were frustrated by specific aspects of the computer system, rather than by the computer system in general, may suggest that group performance is sensitive to differences between computer systems on a number of critical dimensions. Thus, it is not clear to what extent the results of this study would generalize to other computer systems, with different hardware and software options.

The final limitations of the present study are related to the fact that in focussing on structured decision support in asynchronous computer conferences, this research held constant a number of the dimensions along which GDSSs are typically classified (see Dennis et al., 1988). Two of these dimensions may have important implications for the present findings. They are group size and organizationware.

In this research relatively small groups of three to five were used. In the real world, group decision making often involves larger groups and there is some reason to believe that their group processes may differ. Within the face-to-face research there is evidence that group size of five is optimal because it is large enough to represent a variety of abilities and knowledge, but small enough to avoid

organizational and interpersonal problems (Shaw, 1981; Slater, 1958). In larger groups factions are more likely to form, increasing the potential for conflict, and organizational difficulties make it harder for groups to work together and to reach consensus. Larger groups therefore require strong leadership, but, at the same time, place demands on the group leader that are proportional to the size of the group. In addition, as group size increases group cohesion declines, with the result that group members are more likely to become dissatisfied, and so to contribute little or nothing to the group discussion. Thus, as group size increases, the volume of the group discussion decreases and participation becomes more skewed, with more of the ideas being generated by fewer group members, and, with the number of ideas generated levelling off for groups of more than nine or 10 members (cf. Bales, Strodtbeck, Mills, & Riseborough, 1951; Bettinghaus, 1968; Hoffman, 1965; Shaw, 1981).

It is not clear whether these same patterns occur in computer conferences, for they have been shown to encourage more egalitarian participation (see Kerr & Hiltz, 1982; Kiesler et al., 1984; Siegel et al., 1986). However, the importance of variables such as the volume of communication, the degree to which participants experience a sense of group cohesion, leadership (in the form of a moderator), and the difficulties of reaching consensus in computer conferences has been discussed in the context of the present research. Hence, it seems likely that larger computer conferencing groups will differ from groups of three to five (with respect to indices of group decision making performance) on one or more of these dimensions. The existence and nature of these differences is, of course, an empirical question.

In addition to limitations due to group size, the generalizability of the results of this study may be limited by the failure to consider variables related to

organizationware. Organizationware includes such things as the type of hierarchical structures within organizations, the incentive and reward systems in organizations, the organizational climate, and management procedures for collaborative group work (cf. Dennis et al., 1988; Kraemer & King, 1988). In this research, the impact of these kinds of variables was minimized. The groups were essentially egalitarian in nature and the researcher, as conference moderator, played a neutral role with respect to either the Library or the University Administration.

Given these conditions, the only way in which organizationware variables may have entered into the study was through \$200 prize offered to encourage continued participation. One or two groups did make attempts to come up with recommendations that would please the judges, and, in particular, the Library judge, in order to increase their chances of winning the prize. Although this type of reasoning was uncommon, the fact that it did occur at all is an indication that decision processes in computer conferences may be highly sensitive to the realities of organizational environments. If this is case, then different patterns of participation and communication, different recommendations, and different levels of satisfaction may be found in real life organizational settings.

Directions for Future Research

The preceding discussion on the limitations of the present research provides a number of directions for future research. Some are specific extensions of the study reported here. Thus, future research could examine the role of the conference moderator when coupled with communication structures that employed content category topic headings instead of headings corresponding to group decision making

stages. It could also study groups involved in a number of decision tasks over a more prolonged period of time, in order to investigate developmental trends in group cohesion, communication patterns, leadership roles and decision outcomes. Finally, future research could investigate the effects of using computer conferencing systems that, for example, varied in the degree to which they were easy to learn, straightforward to use, and offered users flexibility when reading or adding comments.

Other directions for future research are more general extensions of the present study, and include other dimensions that have been considered important in computer supported group decision making activities. Most notably, studies which use real world groups and vary group size, or dimensions of organizationware may offer insights into both the generalizability of the present findings, and the decision support variants that are most likely to be helpful when computer conferences are used as aids to group decision making in real world organizations.

Despite the limitations of the present research, and the need for future research in the area, the results found here are of some importance because they support the claim that structured decision support which promotes effective group discussion can increase the effectiveness of computer conferencing as an aid to group decision making. They are also encouraging in that they provide some understanding of the possible mechanisms by which structured decision support influences group decision outcomes.

If, as many believe, computer conferences become increasingly common as aids to group decision making in the future, then it is important to investigate the effectiveness of different forms of structured decision support in these conferences now. In addition, it is important to investigate ways in which these forms of support

interact with factors such as the conferencing system, the nature of the task, the size of the group, and the relationships between group members. By conducting this type of research, researchers may be able to provide computer conferencing GDSSs that meet the social psychological, the instrumental and the technical needs of decision making groups in the future. In the absence of such research, the chances of realizing the potential of computer conferencing as an aid to group decision making are reduced. Furthermore, if computer conferences are used by decision making groups under these conditions, then future research will tend to revolve around finding solutions to existing problems, leaving researchers with less time to explore the full potential of computer conferencing GDSSs.

FOOTNOTES

1. The vast majority of the subjects in this study were first year students who had been at Trent for only a term. It can therefore be argued that the Library task was not appropriate or relevant for this sample because first year University students typically do not use the library facilities and, hence, would be expected to have, at best, very limited knowledge of the library, its operation, or its problems. Based on this argument it would obviously have been advantageous to use upper year students. An attempt was made to do this. Subjects were recruited from the two largest second year courses, including the Statistics course that is compulsory for all Psychology majors. Subjects were also recruited from the fourth year Honours class in Psychology. However, without the necessity of earning four credits for research participation, few upper year students volunteered. This is perhaps not too surprising, given the time demands of the study. Subjects were asked to give a minimum of four hours, and many reported giving up to 10 hours.

Given that it was not possible to obtain a sample of upper year students, the subject sample is a limitation of the study. The seriousness of the limitation is, however, unclear. It is undoubtedly true that first year students in larger universities typically do not use the Library facilities and, hence, would have very limited ability to make recommendations for improving the quality of the services provided by the Library. The situation at Trent is somewhat different because, as a small Liberal Arts school, Trent has a commitment to small group teaching. Given this, first year courses typically include a tutorial or workshop component in which the emphasis is on student participation. The discussions, seminars, assignments

and labs conducted in these small group sessions typically rely on material that is either available in the library, or placed on reserve in the library. Thus, unlike students from larger universities, first year students at Trent are required to go to the Library on a fairly regular basis and can be expected to know something about the operation of the Library by their second term. The limitation imposed by the nature of the subject sample in this research may therefore not be as serious as it seems on first glance.

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APPENDIX A

RESEARCH MATERIALS

BACKGROUND QUESTIONNAIRE

SECTION A

Please complete the following:

1. Age: _____

2. Sex:

Male _____ Female _____

3. Year in university:

(Check one)

First	_____
Second	_____
Third	_____
Fourth	_____
Other	_____

4. Average grade in your last year of academic study (at either University, Community College or High School):

(Check one)

A (80-100)	_____
B (70-79)	_____
C (60-69)	_____
D (50-59)	_____
Less than 50	_____

5. How many times have you been to the Bata Library in the last month?

6. Did you take part in the Bata Library Student demonstration during the last (1987-1988) academic year?

(Check One)

Yes	_____
No	_____

7. Below please list any committees on which you have served over the past two years. These may be formal committees associated with an organization, or they may be informal groups, such as teams or groups of friends, that meet for the purpose of discussing some issue, making a decision, planning and organizing some event, etc. If you have been involved in more than six committees, write down only those six in which you have been most recently involved. For each committee indicate the number of committee members involved. Also indicate whether you participated as a committee member or were chosen as group leader, chairperson, or team captain.

	<u>Committee</u>	<u>No. of Members</u>	<u>Your Role</u>	
			Member	Leader
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____
5.	_____	_____	_____	_____
6.	_____	_____	_____	_____
	_____	_____	_____	_____

SECTION B

1. How much do you know about using computers?

- ☐ nothing (go to question 10)
☐ a little
☐ a lot

2. By what method did you first learn how to use computers?

- ☐ formal classroom lessons
☐ informal hands-on training either by yourself or from a
 colleague or friend

3. a) How many computer programming courses have you taken (include University, College, High School, etc.)?

- ☐ 0
☐ 1
☐ 2
☐ 3
☐ 4 or more

b) How many non-programming courses have you taken where you have used a computer as a tool?

- ☐ 0
☐ 1
☐ 2
☐ 3 or more

4. List the systems you have worked on (i.e. VAX, Commodore-64, IBM PC, Atari-500, MacIntosh, ZXB1, etc.).

_____	_____
_____	_____
_____	_____

5. How much work experience do you have using computers?

- ☐ none - go to question 7
☐ some
☐ considerable

6. How would you rate your level of skill acquisition in each of the following types of computer use?

None - no experience

Novice - have had a little exposure, but little chance to develop skill

Intermediate - feel quite confident in dealing with the things you have been taught, but you have not learned all about the system

Expert - have mastered one system and could teach others about it

	None	Novice	Intermed.	Expert
Word Processing	()	()	()	()
Information Retrieval	()	()	()	()
Book-keeping	()	()	()	()
Forecasting	()	()	()	()
Inventory Management	()	()	()	()
Statistical Work	()	()	()	()
Programming	()	()	()	()
System Design	()	()	()	()
Other: _____	()	()	()	()
_____	()	()	()	()

7. How much experience do you have using computers for recreational purposes?

___ none - go to question 10

___ some

___ considerable

8. Where do you have access to a computer for recreational use?

___ your home

___ your place of work

___ other: _____

9. How much time do you spend on recreational use, per week, in a typical week?

	<u>Never</u>	<u>Under 1 hr</u>	<u>1-3 hrs</u>	<u>more than 3 hrs</u>
Creative designs	()	()	()	()
Games	()	()	()	()
Home or personal record keeping	()	()	()	()
Word processing	()	()	()	()
Teaching children	()	()	()	()

Other: _____ () () ()
() () ()

10. Below you will find pairs of adjectives which have opposite meanings (e.g., adaptable-unadaptable). Please mark on the scale how you feel each of the adjectives describes a computer (If you are familiar with more than one computer, answer this question as it relates to the computer you like to use most). For example, for the easy-difficult pair, a check mark in column 2 would indicate that you think computers are quite easy to use. Similarly, for the adjective pair hindering-helpful, a check mark in column 5 would indicate that you think computers are slightly helpful.

Only make one mark for each pair.

-1- -2- -3 -4- -5- -6- -7-

Extremely Quite Slightly Neutral Slightly Quite Extremely

[illegible]

POST-DECISION QUESTIONNAIRE

Instructions: The four questions below relate to your feelings about the recommendations for improving the quality of the services provided by the library that your group has just made. For each question please circle the number that best describes your feelings using the following scoring key:

- 3 = Extremely Dissatisfied
- 2 = Moderately Dissatisfied
- 1 = Slightly Dissatisfied
- 0 = Neutral
- 1 = Slightly Satisfied
- 2 = Moderately Satisfied
- 3 = Extremely Satisfied

For example, if you were "slightly satisfied" with the final recommendations made by your group, you would circle "1", whereas if you were "moderately dissatisfied" with the recommendations you would circle a "-2".

1. How satisfied were you with the manner in which your group went about discussing the library's problems?

-3	-2	-1	0	1	2	3
----	----	----	---	---	---	---

2. How satisfied were you with the way in which your group reached a decision about the best way to improve the quality of the services provided by the library?

-3	-2	-1	0	1	2	3
----	----	----	---	---	---	---

3. How satisfied were you with the final recommendations made by your group?

-3	-2	-1	0	1	2	3
----	----	----	---	---	---	---

4. How satisfied would you be with the services provided by the Bata Library if the recommendations made by your group were adopted by the library?

-3	-2	-1	0	1	2	3
----	----	----	---	---	---	---

5. Below you will find pairs of adjectives which have opposite meanings (e.g. easy-difficult). Please mark on the scale below how you feel the adjectives relate to the library problem you have just discussed. For example, for the interesting-boring pair of adjectives, a check mark in column #1 would mean that you found the library problem extremely interesting. Similarly, for the complex-simple pair, a check mark in column #5 would mean that you found the library problem slightly simple. Only make one mark for each pair.

[illegible]

6. This question concerns your beliefs about the different roles individual members of your group (including yourself) played in the discussion of the problems with the library. Listed below are a number of statements describing some of the roles that may emerge in group discussions. Please rank order the members of your group in terms of the degree to which you feel each of the statements below reflects their role in the group. For example, when rank ordering group members in terms of who talked the most, write the name of the person this statement describes the best in column '1', the name of the person it describes second best in column '2', the name of the person it describes third best in column '3', the name of the person it describes fourth best in column '4', and the name of the person it describes least in column '5'.

	- 1 - (Best)	- 2 -	- 3 -	- 4 -	- 5 - (Least)
a) Talked the most	_____	_____	_____	_____	_____
b) Most concerned about group members' feelings	_____	_____	_____	_____	_____
c) Had the best ideas	_____	_____	_____	_____	_____
d) Most knowledgeable about the library	_____	_____	_____	_____	_____
e) Was the best organizer in the group	_____	_____	_____	_____	_____
f) Was the most fun to work with	_____	_____	_____	_____	_____
h) Was the most valuable member of the group	_____	_____	_____	_____	_____
i) Was the most argumentative	_____	_____	_____	_____	_____

7. If the entire group discussion (excluding private mail messages) is taken to be 100%, please indicate what percentage of the discussion you think you contributed:

8. Please circle the number that best represents whether the following factors were problems which limited or detracted from your participation.

	Not at all a problem				Major Problem
Difficulties with access to a computer terminal.	0	1	2	3	4
Lack of assistance in learning to operate the conferencing system.	0	1	2	3	4
The instructions on how to use the conferencing system were difficult to understand.	0	1	2	3	4
Using a computer conference to communicate is complicated.	0	1	2	3	4
Lack of experience with computers.	0	1	2	3	4
The need to be able to type to enter my comments.	0	1	2	3	4
Lack of face-to-face contact.	0	1	2	3	4
Dislike of using a computer to communicate.	0	1	2	3	4
Lack of time.	0	1	2	3	4
Lack of motivation to participate.	0	1	2	3	4

Other problems (Please summarize)?

9. Were there any factors that encouraged you to participate in your computer conference? (Please describe briefly)

10. Below are a number of statements describing aspects of your experiences with computer conferencing in this study. Please read each statement and then indicate the degree to which you either agree or disagree with it, using the following scale:

- 3 = strongly disagree
- 2 = moderately disagree
- 1 = mildly disagree
- 0 = neutral
- 1 = mildly agree
- 2 = moderately agree
- 3 = strongly agree.

For example, if you strongly agree with the statement "It was easy to keep the group discussion focussed" you would circle '3', whereas if you mildly disagree with the statement "Entering comments was frustrating" you would circle '-1'.

It was easy to keep the group discussion focussed.	-3	-2	-1	0	1	2	3
Entering comments was frustrating.	-3	-2	-1	0	1	2	3
The lack of opportunity for social interaction with others made it difficult to feel part of a group.	-3	-2	-1	0	1	2	3
There was confusion about what the group was expected to do.	-3	-2	-1	0	1	2	3
The free expression of ideas was encouraged.	-3	-2	-1	0	1	2	3
It was easy to follow the group discussion.	-3	-2	-1	0	1	2	3
The structure imposed by the computer conferencing system was too rigid.	-3	-2	-1	0	1	2	3
Group members were generally supportive of each other.	-3	-2	-1	0	1	2	3
The way in which comments had to be entered made the discussion seem artificial.	-3	-2	-1	0	1	2	3
There was not enough opportunity to get to know other group members.	-3	-2	-1	0	1	2	3
There was no problem getting good background information about the Library.	-3	-2	-1	0	1	2	3

It was difficult to get the group organized.	-3	-2	-1	0	1	2	3
Group members usually responded quickly to others' contributions.	-3	-2	-1	0	1	2	3
It was hard to know if everyone agreed with the recommendations that were adopted.	-3	-2	-1	0	1	2	3
The group lacked leadership.	-3	-2	-1	0	1	2	3
Having to type comments did not restrict the group's discussion.	-3	-2	-1	0	1	2	3
A strong group spirit developed during the discussion.	-3	-2	-1	0	1	2	3

11. Were there any ways, apart from those mentioned in Question #10, in which computer conferencing made it particularly easy for your group to discuss the Library problem? If so, please describe them briefly:

12. Were there any ways, apart from those mentioned in Question #10, in which computer conferencing made it particularly difficult for your group to discuss the Library problem? If so, please describe them briefly:

13. During the time in which you were involved in your computer conference, did members of your group get together outside the conference to discuss the Library problem? If so, please provide details about how you got together (in person or by telephone), how often you did so, and what aspects of the Library problem you preferred to discuss either over the phone or face-to-face:

POINTS TO REMEMBER WHEN USING MEET

1. Sign-on information:

Your Username is:

Your Password is:

2. When you first sign-on you will be in the LOBBY of the MEET Hotel. From the LOBBY you can go to the MAILROOM or the CONFERENCE. The MAILROOM is where private mail messages are exchanged between individual group members. The CONFERENCE is the public forum where you can read and add comments to one or more of the TOPICs being discussed by your group.

3. To sign-off the computer you must (L)ease the MEET Hotel. To do this you must be in the Hotel LOBBY. If you are in the MAILROOM you must (L)ease the MAILROOM to return to the LOBBY. If you are in the CONFERENCE room you must first (L)ease the TOPIC you have been attending to, then (L)ease the CONFERENCE room to return to the LOBBY.

4. In the CONFERENCE room the group discussion is organized under one or more TOPIC headings. In order to read or add comments to the discussion you must first select the TOPIC you are interested in. You then read and add comments to that TOPIC. If you write a comments and then decide that it would be more appropriate to send it to a TOPIC other than the one you are currently attending to, simply (L)ease that TOPIC, select the TOPIC you consider to be more appropriate for your comment, and then send the comments to that new TOPIC.

5. When you are writing either private mail notes or comments to be added to your group's discussion remember to punch the RETURN key at the end of each line you type. If you do not you will find that, when you have sent your note, the lines of your text may have been truncated. In this case it will be difficult or impossible for others to interpret what you have said.

6. When writing NOTES remember that your text can be no longer than 99 lines. However, try to avoid NOTES that exceed one computer screen in length. In this way others will be able to see your entire message at once. This will be a particular benefit for those whose computer terminal do not allow them to stop the printout of a message and examine one screen at a time.

7. If you are writing more than one NOTE in a session on MEET remember that each NOTE is retained on your NOTEPAD until you erase it by typing 'N' to start a (N)ew note. Therefore, whenever you write either a private mail NOTE or a NOTE to add to a TOPIC your group is discussing, remember to check that you are starting on line #1. If not, type 'N' to erase the NOTE that is currently on your notepad. You will then be asked for a short title to your NOTE. This request for a title indicates that you are starting a new note.

8. When editing NOTES the following commands are available:

(N)ew note - use to erase a previous NOTE from the NOTEPAD and start a new one

- (G)oto - use to transfer you to the line in the text you wish to edit
 - (C)hange - use to change a word or phrase within a line of text
 - (D)elele - use to erase the line of text that is currently active
 - (S)howlines - use to get a print out of part or all of the text
 - (H)elp - use to get a listing of the editing commands
 - (L)eave - use when you have finished editing. This command will allow you to leave the editor so you can send the NOTE you have written
- Remember that you cannot edit the title of a note.
 - When you delete a line of text remember that all subsequent line numbers are automatically moved up. So if you delete line #4, for example, the line of text that was previously line #5 now becomes line #4.
 - If you wish to insert a line of text after, say, line #3, first (G)oto line #4 and type in the text you wish to add. You will not type over what was originally on line #4, it will simply be moved down to line #5.
 - If you stopped part way through your note to edit what you had already written, and wish to continue your NOTE, don't forget to (G)oto the line at the end of the text before typing in the rest of your NOTE.

9. When you wish to send a private mail message to another group member you will select the number of the mailbox of the person to whom you wish to send your NOTE. After you have typed this mailbox number check to make sure it is correct BEFORE you punch RETURN. Once you punch RETURN the NOTE is automatically sent and cannot be erased if you happen to send it to the wrong person. Similarly, when you send a comment to a CONFERENCE TOPIC check to make sure you are sending your comment to the correct TOPIC before you punch RETURN. Once the comment is sent it cannot be retrieved and sent to another TOPIC. Remember that if you select a TOPIC, read the comments that have been entered under that TOPIC headings, write a comment and send it, the comment will automatically be sent to the TOPIC you selected. If you wish it to be sent to another TOPIC, you must leave the TOPIC you are attending to and select a second TOPIC before you send the comment.

10. When you interact with MEET you may use upper or lower case letters.

11. If you run into any problems with the computer, or are confused about how to use MEET, please call me at 748-1222 (o) or 749-0469 (h).

GOOD LUCK AND HAPPY "MEET"ING!

INSTRUCTIONS

In the attached information package you should have received the following:

- o a background questionnaire
- o a list of handy hints for using MEET
- o a copy of the "Library Problem" your group will discuss. Please check that you do have each of these three components.

To participate in your computer conference you may sign-on at any computer terminal on campus. If you have access to a terminal and modem off-campus (e.g. at home, at an office) you can use the telephone lines to connect you terminal to Trent's VAX system (see me for details if you wish to use this option). Whether you sign-on to MEET from on or off campus, you may do so whenever is convenient for you, as long as you sign-on at least once a day. Before you get started, please read the description of the Library Problem carefully.

Remember that this is a study in computer-mediated communication. I am interested in how you make recommendations for improving the quality of the services provided by the Library when you "talk to each other" using computers. Given this, it is most important that you do NOT get together in person or phone each other to discuss the problems with the library. Please communicate with others in your group by computer only. You may find this difficult at times and, if so, please persist. I am interested in learning how you cope with any difficulties you experience.

During your discussion you may send private messages to other group members. I will also have a Mailbox and you may send mail messages to me if you have any questions about the library. I will act as a resource person for the group so that you will not have to approach the library staff with any requests for additional information. If you ask me for information I will send it in a private message to the person who requested it. I will not contribute the information directly to the conference.

When you begin your conference there will be only one discussion TOPIC called "GENERAL". You may conduct your entire discussion under this one TOPIC heading. Alternatively, you may find it convenient to generate new, more specific TOPICs as a way of organizing your discussion. In this case, simply send me a private mail message with the TOPIC heading(s) you wish to use, and I will add the additional TOPIC(s) for you.

Your group will have up to 2 weeks from today to make your recommendations. You may need only a couple of days to do this, or you may need longer. It will depend on how often everyone signs on and how quickly you get moving. Please sign-on at least once a day so you are not holding up your fellow group members. Remember that to be eligible to win the \$200 prize you will need to have your recommendations ready for presentation at the end of your conference. In addition, if your group wins the prize, the money will be distributed amongst participating members only. If you have not contributed to your group's discussion you will not be eligible for a share of the prize money.

To complete your participation, please return to OC 1.70 two weeks from today at the same time. At that time I will ask you to fill out a brief questionnaire about your

conferencing experiences. You will then receive your 4 research credits.

INSTRUCTIONS

In the attached information package you should have received the following:

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During your discussion you may send private messages to other group members. I will also have a Mailbox and you may send mail messages to me if you have any questions about the library. I will act as a resource person for the group so that you will not have to approach the library staff with any requests for additional information. If you ask me for information I will send it in a private message to the person who requested it. I will not contribute the information directly to the conference.

In your conference there will be 4 meeting TOPICs. These are:

ANALYSIS - The discussion under this TOPIC heading should focus on gaining a better understanding of the library and determining the precise nature of its problems.

ALTERNATIVES - Under this TOPIC heading your discussion should focus on generating as many different solutions to the library's problems as possible. Don't worry about whether the solutions are feasible, just add as many as you can think of.

EVALUATION - This TOPIC is where you will discuss the merits of all the possible solutions your group has come up with.

DECISION - This TOPIC should contain comments related to the selection of the specific recommendations your group wishes to submit to the Library Services Committee. Under this TOPIC heading you should conclude by writing up a brief, concise description of your recommendations so that they can be presented to the Committee.

For further descriptions of these 4 TOPICs see Comment #1 under each TOPIC heading.

Your group will have up to 2 weeks from today to make your recommendations. You may need only a couple of days to do this, or you may need longer. It will depend on

how often everyone signs on and how quickly you get moving. Please sign-on at least once a day so you are not holding up your fellow group members. Remember that to be eligible to win the \$200 prize you will need to have your recommendations ready for presentation at the end of your conference. In addition, if your group wins the prize, the money will be distributed amongst participating members only. If you have not contributed to your group's discussion you will not be eligible for a share of the prize money.

To complete your participation, please return to OC 1.70 two weeks from today at the same time. At that time I will ask you to fill out a brief questionnaire about your conferencing experiences. You will then receive your 4 credits.

INSTRUCTIONS

In the attached information package you should have received the following:

- o a background questionnaire
- o a list of handy hints for using MEET
- o a copy of the "Library Problem" your group will discuss. Please check that you do have each of these three components.

To participate in your computer conference you may sign-on at any computer terminal on campus. If you have access to a terminal and modem off-campus (e.g. at home, at an office) you can use the telephone lines to connect your terminal to Trent's VAX system (see me for details if you wish to use this option). Whether you sign-on to MEET from on or off campus, you may do so whenever is convenient for you, as long as you sign-on at least once a day. Before you get started, please read the description of the Library Problem carefully.

Remember that this is a study in computer-mediated communication. I am interested in how you make recommendations for improving the quality of the services provided by the Library when you "talk to each other" using computers. Given this, it is most important that you do NOT get together in person or phone each other to discuss the problems with the library. Please communicate with others in your group by computer only. You may find this difficult at times and, if so, please persist. I am interested in learning how you cope with any difficulties you experience.

During your discussion you may send private messages to other group members. I will also have a Mailbox and you may send mail messages to me if you have any questions about the library. I will act as a resource person for the group so that you will not have to approach the library staff with any requests for additional information. If you ask me for information I will send it in a private message to the person who requested it. In addition, I will play an active role in your conference. In this capacity I will send private mail messages to group members. I will also add comments and suggestions to the conference, to help you organize your discussion.

In your conference there will be a total of 4 meeting TOPICS. These TOPICS will be introduced one at a time and you will finish your discussion on one TOPIC before passing on to the next. At any time, you will be able to read the comments entered under previous TOPIC headings. However, you should only add comments to the most recent, active discussion TOPIC.

The four TOPICS in your conference, in the order in which they will appear, are:

ANALYSIS - The discussion under this TOPIC heading should focus on gaining a better understanding of the library and determining the precise nature of its problems.

ALTERNATIVES - Under this TOPIC heading your discussion should focus on generating as many different solutions to the Library's problems as possible. Don't worry about whether the solutions are feasible, just add as many as you can think of.

EVALUATION - This TOPIC is where you will discuss the merits of all the possible solutions your group has come up with.

DECISION - This TOPIC should contain comments related to the selection of the specific recommendations your group wishes to submit to the Library Services

Committee. Under this TOPIC heading you should conclude by writing up a brief, concise description of your recommendations so that they can be presented to the Committee.

For further descriptions of these 4 TOPICs see Comment #1 under each TOPIC heading.

Your group will have up to 2 weeks from today to make your recommendations. You may need only a couple of days to do this, or you may need longer. It will depend on how often everyone signs on and how quickly you get moving. Please sign-on at least once a day so you are not holding up your fellow group members. Remember that to be eligible to win the \$200 prize you will need to have your recommendations ready for presentation at the end of your conference. In addition, if your group wins the prize, the money will be distributed amongst participating members only. If you have not contributed to your group's discussion you will not be eligible for a share of the prize money.

To complete your participation, please return to OC 1.70 two weeks from today at the same time. At that time I will ask you to fill out a brief questionnaire about your conferencing experiences. You will then receive your 4 credits.

FEEDBACK TO BE PROVIDED TO SUBJECTS

Over the last few years a number of researchers have claimed that computer conferencing offers a viable alternative to face-to-face meetings. Some predict that by the end of the century as many as half the meetings now held in major organizations will be conducted via computer. In anticipation of this future, researchers have begun to compare the effectiveness of computer-mediated versus face-to-face communication. The general conclusion of these early studies is that computer conferencing has the potential to be a more effective vehicle for group discussion than face-to-face meetings. However, it is also acknowledged that this potential is usually not achieved in computer conferences that are unstructured in the sense that comments are entered chronologically and there is no conference moderator to keep the discussion focussed and moving towards resolution.

Within the literature there has been some discussion about ways of realizing the communication potential of computer conferencing and the consensus is that computer-mediated group discussion will be most effective in conferences that are structured. This structure may be achieved by software innovations that organize the discussion under topic headings, and/or by the active efforts of a conference moderator, who would encourage participation and ensure that conference participants engage in a thorough discussion of whatever topic they are assigned.

The purpose of this research is to test whether the kinds of structural variables just mentioned do increase the effectiveness of group discussion and decision making activities. It compares the communication processes and the quality of the decisions made by groups in three different computer conferencing conditions. In the first, the computer conference will be unstructured and comments will be entered chronologically, without the help of a group leader or moderator. In the second, the conference will be structured by the use of a software innovation. Thus, the discussion will be organized under topic headings which encourage group members to ANALYZE the problems with the library, generated ALTERNATIVE solutions to the problems, EVALUATE those solutions and then make a DECISION to accept a final set of recommendations. In the third condition, the computer conference will be structured using the same topic headings used in the second condition. In addition, a conference moderator will encourage participation, and provide positive feedback to group members when appropriate. She will also ensure that the discussion under each heading is as complete as possible by raising issues that have been ignored by group members, and by acting as a devils advocate to try and promote debate among group members. The topic headings chosen for this research reflect the discussion stages that have been associated with effective decision making in face-to-face group research.

The results of this study are expected to show that both the effectiveness of groups' discussion and the quality of their recommendations are likely to increase across conditions. Relative to the other two conditions, those in the unstructured conditions are expected to conduct discussion that are disjointed and lacking in direction. They are also expected to make recommendations of poorer quality and to be less satisfied with both their recommendations and the discussion processes that preceded them. Those in the topic heading plus moderator condition, on the other hand, are expected to make the best recommendations, to be most satisfied with their discussion and final recommendations. They are expected to analyze the problems

with the library in more depth, to generate more suggestions for improving the services offered by the library, and to evaluate the alternatives in a more objective fashion. These results, if confirmed, are expected to contribute to the future design and implementation of computer conferencing systems in organizations.

INSTRUCTIONS TO JUDGES

In this study I asked 30 groups of first year students to discuss problems with the Bata Library and make recommendations for improving the quality of the services offered by the Library. They were given background information about the hours of operation of the Library, the Library budget breakdown, and the number of full- and part-time staff in the Library. They could request additional information about the Library as needed.

Attached are 30 sheets of paper containing the recommendations made by each of the groups. I am interested in your judgement of the quality of these recommendations on the following three dimensions: economic feasibility, creativity and workability (or the degree to which the recommendations will reduce the problems in the Library).

Would you please read each set of recommendations and, considering the recommendations as a package, give the group a grade between 0% and 100% on each of the three dimensions. Hence, you would give a grade for the degree to which you think the recommendations are economically feasible for the library at this time. You would also give a grade for the creativity of the recommendations as a whole. And, finally, you would give a grade for the degree to which you think the recommendations, taken together, would actually solve the problems you see with the Library.

Thank you for your time and help!

LIBRARY TASK

The Bata Library at Trent serves approximately 3300 full-time and 2300 part-time students. It contains a collection of more than 400,000 books and 3030 periodicals. It has a staff of 37, including 10 Librarians, and, during the academic year, its hours of operation are:

Monday-Thursday	8:00 am - 12 midnight
Friday	8:00 am - 8:00 pm
Saturday	10:00 am - 6:00 pm
Sunday	11:00 am - 8:00 pm

The Library Budget is part of the overall Operating Budget for the University. For the past four years the Library has been granted an annual budget of \$1,996,541 and this sum has been divided into four categories: Acquisitions (books, periodicals, maps, government documents etc.), Staffing (including benefits such as Medical, Dental and Pension Plans), Automation, and Non-Staff Expenses (including office supplies, stamps, light bulbs, etc.). Last year, the total Library budget was divided into these categories as follows:

<u>Amount</u>	<u>Category</u>	<u>% of Total Budget</u>
\$587,000	Acquisitions	29%
\$1,101,290	Salaries	60%
\$155,000	Automation	8%
\$63,251	Non-Staff Expenses	3%

The Library Budget has remained constant, at \$1,996,541, for the past four years. The Library has requested increases but, because the University's Operating Budget as a whole has not increased, these requests have been denied. Given inflation and a fixed budget, the purchasing power of the Library has decreased steadily over the past four years. This has meant that the Library has been able to purchase fewer books and subscribe to fewer periodicals each year. It has also meant that the Library cannot easily hire additional staff. This budgetary situation is unlikely to change in the near future because there are expected to be increasing demands on the University's Operating Budget from elsewhere in the University.

In the past students have complained that the selection of books and periodicals available in the Library is inadequate and that the Library hours on Fridays and weekends are too limited. Last year these complaints came to a head and there was a formal student protest in the foyer of the Library. The student support at that protest has been taken seriously by the Library Administration and they are trying to determine whether it is possible to make changes in Library Policy that will allow them to be more effective in meeting student needs. You are asked to assume the role of a Library Task Force and to make recommendations to the Library Services Committee for improving the quality of the services the Library can provide for Trent students. You may change the way in which the Library budget is allocated to each of the four major categories described above, but you should assume that the current total budget for the Library will remain unchanged.

APPENDIX B

EXAMPLES OF THE MODERATOR'S INPUT IN THE ACTIVELY STRUCTURED CONFERENCES

EXAMPLES OF DISCUSSION SUMMARIES

1. You have done a great job of identifying problems with the library and have come up with many ideas. If I can summarize, you seem to have come up with the following problems:

- 1) Too few books and too much competition for those books the library does have
- 2) Library hours are too restrictive, especially on weekends
- 3) Unavailability of journals, especially in psychology
- 4) Inability to renew books
- 5) Line-ups to use reference computer terminals too long
- 6) Reserve table too small
- 7) Photocopiers too scarce and too often broken.

2. Now you have started to evaluate some of the solutions that have been mentioned.

The evaluation so far looks as follows:

- 1) One negative vote for the idea of allowing food and drink in the library
- 2) One negative vote for the idea of approaching the local community for donations
- 3) One negative vote for the idea of handing out questionnaires to find out students' perceptions of the best hours of operation
- 4) One negative vote for the idea of a mandatory requirement that all students put in a number of hours working in the library
- 5) One positive vote for the idea that students in certain courses, or under certain circumstances, be required for service in the library.

You are doing exactly what you should be doing. Keep going along the same

lines.

EXAMPLES OF COMMENTS INTENDED TO PROMOTE DISCUSSION

1. Shelley has summarized the recommendations nicely. Now, how about a bit of padding. For instance, what hours of operation would you recommend for the library?
2. Andy has started the evaluation process. What do the rest of you think? Any thoughts on Andy's idea of reorganizing the library into separate disciplines? Do you think this is a good idea? How would it work given the layout of the Bata Library? Anyone else have comments on the coop programme suggested by Karen?
3. Hi Bernard: I'm delighted you managed to sign-on this morning. That's a great start. Don't be afraid to be the first to jump into the conference. Once a couple of people have their say, the thing can take off. So be the first and call the tune!

EXAMPLES OF SUPPORTIVE COMMENTS INTENDED TO ENCOURAGE PARTICIPATION

1. Debbie: Laura has now signed on as well so there are four of you. Amy has not signed on and may not. A number of the groups are losing one of their members. Don't be concerned; it doesn't put you at a disadvantage. Four people working together can do a really good job. Keep it up!
2. So far you have generated four possible solutions in the ANALYSIS section. This is a great start. Let's see if you can generate some more solutions over the next day or two.
3. Hi Angela: It's great to have you with us! Don't worry about jumping in late, the discussion is still in the early stages and there is still plenty of room for you to make a real contribution. So, make up for lost time and make a difference!
4. Hi Marcy: I just wanted to commend you for holding the fort and advancing the discussion while you are waiting for the others to sign-on. I know it can be very frustrating when you feel there are few people out there listening. However, do persist because I have found some groups do start slowly but then they pick up a real momentum. When that happens you will have the satisfaction of having been there first!
5. Hi Monica: I see you are still on your own in the group. Don't give up. I expect the others will sign-on in the next couple of days. In the meantime, I thought you'd like to get some feedback so you know there is someone else out there.
6. Hi: This is just to let you know that the computer will be down on Friday from 5:00 pm until midnight. So, if you were planning to sign-on then - DON'T!
7. Hi: If the rest of your group has not signed on by Monday, what say we go on a kneecapping raid! I have spoken to the others and I think I can guarantee Kim

will sign-on and probably Julie. Rob may sign-on. I talked to Suzanne yesterday and she talked about her participation so far. I found that a little odd!" Maybe she's doing something we don't know about. Anyway, thanks for your patience.

Mine has just about run out!

8. Hi everyone: You guys are really getting into this and are churning out ideas at a frantic rate.

EXAMPLES OF COMMENTS RELATED TO PROCEDURE

1. One think you might like to consider is whether you want to go with all the solutions you have come up with, or whether you want to choose only some of them and make a strong coherent package.
2. Hi Andrea: I just received a mail message from you that looks like it should have been sent to the CONFERENCE ROOM where the group discussion is being held. Remember, public comments that everyone needs to see should go to the conference and private letters should go to the MAILROOM. Perhaps you have figured this out already. If not, I just wanted to bring it to your attention. Keep up the good work!
3. OK, we've just about got input from everyone on the final recommendations. Tara is ill and so won't be able to contribute at this stage. Perhaps one of you could now pull the comments together to come up with a final set of recommendations. I think anyone who hasn't had their say by now must be assumed to agree with what's going on.
4. Time is starting to run a little short. You do have a number of solutions so you can get going. Since Karen's idea is quite novel, take a look at her last comment in ALTERNATIVES before you decide what to do with her suggestion. Good luck with this chapter.

EXAMPLES OF COMMENTS RELATED TO THE INTRODUCTION OF NEW TOPIC HEADINGS

1. I think you have all done a marvellous job of identifying the problems in the library. It seems to me that you have just about exhausted them. So it's time to move on and consider some solutions to the problems. From now on you should add comments to the new topic I will add - ALTERNATIVES. You may reread some of the ANALYSIS comments but try to write comments to be sent to ALTERNATIVES. Consider the analysis phase done with!
2. I just read the few late comments that had been added to the ANALYSIS section. In those comments you seemed to be playing the with idea of taking money from staff salaries in order to boost the automation budget (Comment added to ALTERNATIVES topic).
3. The discussion about whether automation would help or hinder this problem is probably something that should be looked at in EVALUATION. I have received a number of information requests from a number of you, so I'll let you digest my replies for a day or so. Then, I think we might move on to looking at solutions. How does that sound?
4. Since it is nearing the end of the week I think I should introduce ALTERNATIVES now so you can be off and running on solutions at the beginning of next week. So, take a final run at ANALYSIS if you want. However, it seems to me you are about ready to start looking at solutions.
5. Yes, I agree with you Mike - time is running out and you are moving towards the end rapidly. I have added the final topic - DECISION - where you should summarize those recommendations you all find acceptable.

6. I think you are just about done with this topic. You have a large number of problems identified and you are starting to come up with some solutions already. So, it's time to be moving on. I will now summarize the problems you have identified and send the summary to ALTERNATIVES so you will have it available for reference.
7. I'll introduce the next topic - ALTERNATIVES - early next week but, before you start thinking about solutions, can you isolate the causes of the library's problems?
8. I will add the next topic now because I won't be able to sign-on until late tomorrow and I don't want to hold you up. However, I think it would be worth your while to finish up here first.
9. Mixed into the discussion so far is also at least one proposed solution - a greater number of copies of articles put on reference. This should be saved for the next topic where you start to talk about alternatives. For now, hold on to that thought!
10. During your analysis of the library's problems you suggested a solution or two. The major one had to do with using computers to help find books and other information in the library. A second had to do with providing staff with comprehensive policy guidelines. I'm restating them here, under ALTERNATIVES, so they don't get lost in the shuffle.

APPENDIX C

SCORING PROCEDURES AND THE DERIVATION OF INDICES

1 Scoring Procedure for Computer Experience Measure

Computer experience was assessed by summing the scores obtained in Questions 1 through 9, Section B of the Background Questionnaire. The scoring key for each of these nine questions is as follows:

Question 1 - 0 points if subjects reported no knowledge of computers, 1 point if they reported having a little knowledge, and 2 points if they reported having a lot of knowledge.

Question 2 - 1 point if subjects checked off one method for learning how to use computers, and 2 points if they checked off both methods.

Question 3 - The number of points corresponded to the number of computer programming courses taken plus the number of non-programming courses taken in which computers were used.

Question 4 - One point was given for each computer system listed.

Question 5 - 0 points if subjects reported no work experience with computers, 1 point if they reported having some experience, and 2 points if they reported having considerable experience.

Question 6 - For each of the types of computer use listed subjects were given 0 points if they reported no experience, 1 point if they considered themselves novices, 2 points if they checked the intermediate skill level, and three points if they considered themselves to be experts. The scores for

each type of computer use were then summed for a total skill level score.

Question 7 - Subjects were given 0 points if they had no experience using computers for recreational use, 1 point if they reported some experience and two points if they reported considerable experience.

Question 8 - One point was given for each place of access checked by subjects.

Question 9 - For each type of recreational activity, subjects were given 0 points if they never used computers for that activity, 1 point if they spent under one hour per week on that activity, 2 points if they spent one to three hours per week on that activity, and 3 points if they spent more than 3 hours per week on that activity. Subjects' scores for each type of recreational use were summed to get an estimate of the total time spent per week using computers for recreational purposes.

2. Scoring Procedure for Attitudes Towards Computers

Subjects' attitudes towards computers were assessed on the semantic differential in Question 10, Section B, of the Background Questionnaire. For each of the 22 adjective pairs, subjects were asked to place a check mark in the column that they felt best described computers. Half the adjective pairs were scored in a positive direction, with a high score representing a positive attitude towards computers. These were: dull-stimulating, complicated-simple, weak-powerful, hindering-helpful, disgusting-pleasing, threatening, unthreatening, impersonal-personal, bossy-obedient, cold-warm, dominant-submissive, and slow-fast. For each these adjective pairs subjects were given a score corresponding to the score at the top of the column they had checked.

The other 11 adjective pairs were scored in a negative direction, with a high score representing a negative attitude towards computers. These were: adaptable-unadaptable, fun-dreary, easy-difficult, personalizing-depersonalizing, precise-inexact, intelligent-simpleminded, humanizing-dehumanizing, patient-impatient, effective-ineffective, enjoyable-unpleasant, and controllable-uncontrollable. For each of these adjective pairs the scoring was reversed so that they were also scored in a positive direction. Thus, for each pair subjects were given a score of eight minus the score at the top of the column they had checked. Thus scores ranged from one to seven, but in the opposite direction. The neutral point (a score of 4) was therefore preserved.

When the scores had been calculated for each adjective pair, the 22 scores were summed. The resultant total score indicated the degree to which subjects had a

positive (or negative) attitude towards computers.

3. Scoring Procedure for Indices of Task Difficulty and Task Interest

Subjects' perceptions of the Library task were assessed using the semantic differential in Question 5 of the Post-Decision Questionnaire. Following Shaw (1981) four of the adjective pairs assessed task difficulty and six assessed task interest. The adjective pairs for task difficulty were: complex-simple, general-specific, easy-difficult, and straightforward-confusing. The last two pairs were scored in a positive direction with a high score indicating that subjects perceived the task to be difficult. For each of these pairs of adjectives subjects were given a score corresponding to the number at the top of the column they had checked. The first two pairs were scored in the opposite direction with a high score indicating an easy task. For these pairs of adjectives the scoring was reversed with subjects being given a score of eight minus the number at the top of the column they had checked. Following this, a total task difficulty score was calculated for each subject by summing the scores on each of the four adjective pairs related to task difficulty.

The scoring procedure for task interest was similar to that for task difficulty. The six adjectives tapping task interest were: interesting-boring, enjoyable-unenjoyable, unimportant-important, non-absorbing-absorbing, relevant-irrelevant, and dull-stimulating. Of these the third, fourth and sixth pairs were scored in a positive direction and the first, second and fifth pairs were scored in a negative direction. As above, the scoring procedure first reversed the scores for the first, second, and fifth pairs of adjectives and then summed the scores for each adjective pair. The result was a total task interest score, with high scores indicating that subjects' perceived the task to be interesting.

4. Derivation of OPA Indices

For the proportion of the group discussion devoted to analysis, alternatives, evaluation and decision, OPA indices were derived to assess the extent to which the temporal fluctuations observed in the data matched those predicted by sequential movement through each of the four major stages of effective group decision making. A number of different OPA indices are outlined in Thorngate and Carroll (1987). The one used here was the Index of Ordinal Fit (IOF). This was calculated in three stages:

- 1) For each of the four types of communication, the predicted ordinal relations between the proportion of the discussion devoted to that type of communication in each of the four time periods were expressed as relationships between pairs of time periods. For example, for sentences classified as analysis, it was hypothesized that the proportion of the discussion devoted to analysis of the Library's problems would be greatest during the first quarter of the discussion and would decline thereafter. Thus, for analysis it was predicted that:

$$H_{\text{Analysis}}: \quad T1 > T2 > T3 > T4$$

Similarly, for the other alternatives, evaluation and decision sentences respectively it was predicted that:

$$H_{\text{Alternatives}}: \quad T1 < T2 > T3 > T4$$

$$H_{\text{Evaluation}}: \quad T1 < T2 < T3 > T4$$

$$H_{\text{Decision}}: \quad T1 < T2 < T3 < T4$$

Expressing these relationships as a series of relationships between pairs of categories they become:

$$H_{\text{Analysis}}: \quad T1 > T2, T1 > T3, T1 > T4$$

	$T2 > T3, T2 > T4$
	$T3 > T4$
$H_{\text{Alternatives}}$	$T1 < T2$
	$T2 > T3, T2 > T4$
	$T3 > T4$
$H_{\text{Evaluation}}$	$T1 < T2, T1 < T3$
	$T2 < T3$
	$T3 > T4$
H_{Decision}	$T1 < T2, T1 < T3, T1 < T4$
	$T2 < T3, T2 < T4$
	$T3 < T4$

Hence, for the proportion of the group discussion devoted to analysis and decision six ordinal relationships were predicted, and for the proportion devoted to alternatives and evaluation four ordinal patterns were predicted. With four time periods, there are a total of six possible ordinal relationships for each of the four types of communication. Therefore, for communication related to analysis and final decisions all possible ordinal patterns were predicted, and for communication related to alternatives and evaluation four of the six possible ordinal patterns were predicted.

2) For each of the four types of communication, the pattern observed in the proportion of the discussion devoted to that type of communication across time periods was compared to the predicted patterns. For each, the number of hits and the number of misses were calculated.

3) For each group, and for each type of communication, OPA indices were calculated according to the following formula:

$$\text{IOF} = \frac{(\# \text{ Hits} - \# \text{ Misses})}{\# \text{ Predicted Ordinal Relations}}$$

5. Scoring Procedure for the Measure of the Extent to Which Subjects Perceived their Computer Conferencing Experiences to be Positive

Subjects' computer conferencing experiences were assessed on a 17 item, 7-point rating scale in Question 10 of the Post-Decision Questionnaire. In Question 10 the rating scale ranged from -3 to 0 to +3. However, to avoid dealing with negative numbers a constant of four was added to each rating so that the scaled values ranged from 1 to 7.

Eight of the 17 items were scored in a positive direction with a high score indicative of a positive computer conferencing experience. These were items: 1, 5, 6, 8, 11, 13, 16, and 17. For each of these items subjects were given a score equal to the number they had circled plus four.

The other nine items were scored in a negative direction with a high score indicative of a negative computer conferencing experience. These items were: 2, 3, 4, 7, 9, 10, 12, 14, and 15. For each of these items the scoring was reversed so that a high score represented a positive conferencing experience. Hence, for each of these items subjects were given a score equal to four minus the number they had circled.

When scores had been obtained for each of the 17 items, a total score was calculated by summing the 17 scores. This score indicated the extent to which subjects reported positive experiences with computer conferencing.

APPENDIX D

STATISTICAL TABLES

TABLE D-1: Number of Log-ons per Week for Subjects in Each of the 30 Groups

Condition	Group	Member	Week #1	Week #2	Total
SS	1	1	4	1	5
		2	4	7	11
		3	3	4	7
		4	5	5	10
		5	4	3	7
					Group Total= 40
	2	1	5	7	12
		2	2	3	5
		3	1	1	2
		4	3	3	6
		5	8	3	11
					Group Total= 36
	3	1	0	1	1
		2	8	6	14
		3	1	1	2
		4	2	2	4
		5	0	5	5
					Group Total= 26
	4	1	1	3	4
		2	4	2	6
		3	2	1	3
		4	0	2	2
		5	3	1	4
					Group Total= 19
	5	1	4	3	7
		2	2	2	4
		3	0	0	0
		4	4	3	7
		5	3	3	6
					Group Total= 24
	6	1	2	1	3
		2	0	0	0
		3	2	5	7
		4	2	2	4
		5	1	4	5
					Group Total= 19
	7	1	3	2	5
		2	2	1	3
		3	5	2	7
		4	3	4	7
		5	3	14	17
					Group Total= 39

TABLE D-1 (Cont'd): Number of Log-ons per Week for Subjects in Each of the 30 Groups

Condition	Group	Member	Week #1	Week #2	Total
SS	8	1	0	3	3
		2	5	4	9
		3	6	3	9
		4	4	4	8
		5	0	0	
					Group Total= 29
	9	1	3	5	3
		2	25	14	29
		3	4	8	12
		4	3	8	11
		5	2	2	4
					Group Total= 79
	10	1	5	7	12
		2	0	3	3
		3	0	0	0
		4	2	2	4
		5	0	1	1
					Group Total= 20
PS	1	1	0	4	4
		2	8	12	20
		3	2	2	4
		4	5	5	10
		5	2	2	4
					Group Total= 42
	2	1	1	5	6
		2	2	2	4
		3	8	3	11
		4	1	9	10
		5	3	2	5
					Group Total= 36
	3	1	1	3	4
		2	6	3	9
		3	2	4	6
		4	2	4	6
		5	0	0	0
					Group Total= 25

4

MICRO

TABLE D-1 (Cont'd): Number of Log-ons per Week for Subjects in Each of the 30 Groups

Condition	Group	Member	Week #1	Week #2	Total
PS	4	1	6	13	19
		2	3	5	8
		3	0	0	0
		4	3	5	8
		5	4	4	8
					Group Total= 43
	5	1	4	2	6
		2	3	1	4
		3	2	0	2
		4	1	2	3
		5	4	1	5
					Group Total= 20
	6	1	4	4	8
		2	3	8	11
		3	6	5	11
		4	12	2	14
		5	0	0	0
					Group Total= 44
	7	1	0	0	0
		2	2	4	6
		3	2	13	15
		4	7	7	14
		5	4	4	8
					Group Total= 43
	8	1	2	3	5
		2	5	5	10
		3	2	0	2
		4	3	4	7
		5	1	3	4
					Group Total= 28
	9	1	0	0	0
		2	0	0	0
		3	2	3	5
		4	1	3	4
		5	0	5	5
					Group Total= 14

TABLE D-1 (Cont'd): Number of Log-ons per Week for Subjects in Each of the 30 Groups

Condition	Group	Member	Week #1	Week #2	Total
PS	10	1	2	3	5
		2	4	10	14
		3	0	0	0
		4	1	3	4
		5	4	6	10
		Group Total=			
AS	1	1	5	2	7
		2	3	1	4
		3	1	4	5
		4	2	3	5
		5	6	4	10
		Group Total=			
	2	1	0	1	1
		2	5	3	8
		3	2	0	2
		4	9	5	14
		5	6	6	12
		Group Total=			
	3	1	6	2	8
		2	5	2	7
		3	4	3	7
		4	5	7	12
		5	0	4	4
		Group Total=			
	4	1	4	5	9
		2	4	4	8
		3	2	1	3
		4	2	2	4
		5	2	4	6
		Group Total=			
	5	1	0	3	3
		2	0	6	6
		3	1	1	2
		4	5	4	9
		5	1	2	3
		Group Total=			

TABLE D-1 (Cont'd): Number of Log-ons per Week for Subjects in Each of the 30 Groups

Condition	Group	Member	Week #1	Week #2	Total
AS	6	1	4	5	9
		2	0	0	0
		3	1	2	3
		4	2	3	5
		5	3	4	7
					Group Total= 24
	7	1	0	2	2
		2	2	5	7
		3	6	5	11
		4	5	0	5
		5	1	1	2
					Group Total= 27
	8	1	8	5	13
		2	0	0	0
		3	1	2	3
		4	1	2	3
		5	0	4	4
					Group Total= 23
	9	1	6	4	10
		2	0	0	0
		3	3	3	6
		4	0	0	0
		5	8	5	13
					Group Total= 29
	10	1	1	3	4
		2	5	6	11
		3	0	3	3
		4	3	3	6
		5	1	3	4
					Group Total= 28

TABLE D-2: Frequency Distribution of Participation Rates for Computer Conferencing Subjects

Classification	# Logons	Number of Subjects	Percent of Subjects
<hr/>			
Non-Participants			
	0	16	10.67
Occasional Participants			
	1 - 2	12	8.96
	3 - 4	21	15.7
Regular Participants			
	5 - 9	53	39.85
	10 and Over	33	24.8
Total		150	100
<hr/>			

TABLE D-3: Frequency Distribution of Participants Contributing Different Proportions of Their Group Discussions

Percent of Discussion	Number of Subjects	Percent of Subjects
1 - 10	25	16.67
11 - 20	40	26.67
21 - 30	29	19.33
31 - 40	18	12
41 - 50	8	5.33
51 - 60	4	2.67
61 - 70	2	1.33
71 - 80	1	.67

TABLE D-4a): Proportion of Statements in Conference Discussions Read by All Group Members

Source of Variation	df	SS	MS	F
Between groups	2	.046	.023	.523
Within groups	27	1.189	.044	(p = .5988)
Total	29	1.235		

TABLE D-4b): Means and Standard Deviations for the Proportion of Group Discussions Read by Participants in Three Computer Conferencing Conditions

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	.238	.219
Passively Structured Conferences	10	.29	.21
Actively Structured Conferences	10	.194	.2

TABLE D-5a): Proportion of Statements in Conference Discussions Read by the Majority of Group Members

Source of Variation	df	SS	MS	F
Between groups	2	.085	.042	1.996
Within groups	27	.574	.021	(p = .1555)
Total	29	.658		

TABLE D-5b): Means and Standard Deviations for the Proportion of Group Discussions Read by Participants in Three Computer Conferencing Conditions

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	.819	.133
Passively Structured Conferences	10	.793	.103
Actively Structured Conferences	10	.695	.188

TABLE D-6: Problems Encountered Using Computers: Factor Loadings of Individual Problem Items on each of Three Orthogonal Problem Dimensions.

NATURE OF PROBLEM	FACTOR 1	FACTOR 2	FACTOR 3
Lack of access to computer terminal	-.200	.233	.552*
Lack of assistance with MEET	.037	.772*	-.041
Instructions difficult	-.009	.824*	.143
Computer conferencing complicated	.783*	.183	-.002
Lack of computer experience	.144	.772*	.209
Typing skills	.281	-.169	.532*
Lack of face-to-face contact	.877*	-.113	.114
Dislike of communicating via computer	.83*	.066	.086
Lack of time	.071	.114	.734*
Lack of motivation	.35	.206	.415

* Factor loading >.5.

TABLE D-7: Percentage of Participants Mentioning Different Reasons for Computer Conference Participation

REASONS FOR PARTICIPATION	SUBJECTS MENTIONING REASONS	
	NUMBER	PERCENT
None	11	8.462
Interested in project	25	19.231
Interested in using computers	24	18.462
Interested in task	28	28.538
Learning opportunity	5	3.846
Simplicity of MEET	2	1.538
Opportunity to meet people	4	3.077
Receiving responses to comments	6	4.615
To get credits/win \$200	8	6.154
Mail feature of MEET was fun	11	8.462
Lack of face-to-face contact	2	1.538
Peer pressure	3	2.308
Organization using TOPIC headings	1	.769

TABLE D-8: Percent of Participants who Encountered Significant Problems Related to Using Computers

NATURE OF PROBLEM	% FOR WHOM PROBLEM WAS SIGNIFICANT (Score > 1)
Access difficulties	22.213
Lack of assistance learning MEET	4.412
Instructions difficult	4.412
Computer conferencing complicated	29.412
Lack of computing experience	11.765
Typing skills	10.294
Lack of face-to-face contact	60.294
Dislike of computer communication	36.029
Lack of time	65.441
Lack of motivation	20.588

TABLE D-9: Percent of Participants Endorsing Factors Facilitating Group Discussion

FACTORS FACILITATING GROUP DISCUSSIONS	SUBJECTS ENDORSING FACTOR (N=70)	
	NUMBER	PERCENTAGE
Freedom to sign-on at own convenience	20	28.57
Discussion easy to organize	5	7.14
Able to reflect on ideas	5	7.14
Easy to disagree with others	7	10.00
The nature of the problem	2	2.86
Lack of face-to-face contact	18	25.71
Knowledge possessed by others in group	1	1.43
Enthusiasm of others	5	7.14
Coordination easier with small group	1	1.43
Mail notes made it easy to clarify issues	2	2.86
Properties of MEET	3	4.29
Prior friendship with others in group	1	1.43

TABLE D-10: Percent of Participants Endorsing Factors Inhibiting Group Discussion

FACTORS INHIBITING GROUP DISCUSSIONS	SUBJECTS ENDORSING FACTOR (N=78)	
	NUMBER	PERCENTAGE
Problems with MEET	4	5.13
Lack of immediate feedback	15	19.23
Lack of non-verbal feedback	3	3.85
Hard to coordinate and direct discussion	19	24.36
Hard to build momentum	5	6.41
Lack of knowledge about the Library	2	2.56
Preference for face-to-face contact	4	5.13
Lack of participation by others in group	11	14.10
Too time consuming	5	6.41
Lack of social contact	6	7.69
Lack of access to computer terminals	1	1.28
Evaluation apprehension	1	1.28
TOPIC headings confusing	2	2.56

TABLE D-11a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Sentences Generated During Group Discussions

Source of Variation	df	SS	MS	F
Between groups	2	117927.8	58963.9	5.113*
Within group	27	311388.2	11532.896	(p=.0131)
Total	29	429316		

TABLE D-11b): Means and Standard Deviations for the Number of Sentences Generated
During Group Discussions in Three Computer Conferencing Conditions

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	202.5	122.263
Passively Structured Conferences	10	269.8	96.611
Actively Structured Conferences	10	355.7	101.571

**TABLE D-12a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Sentences Generated During Group Discussions With
Outliers Removed**

Source of Variation	df	SS	MS	F
Between groups	2	182039.139	91019.5	10.921***
Within groups	25	208359.575	8334.383	(p = .0004)
Total	27	390398.714		

**TABLE D-12b): Means and Standard Deviations for the Number of Sentences Generated
During Group Discussions in Three Computer Conferencing Conditions (Without
Outliers)**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	8	153.375	67.088
Passively Structured Conferences	10	269.8	96.611
Actively Structured Conferences	10	355.7	101.571

TABLE D-13a): ANOVA Summary Table for Computer Conferencing Condition Differences in the Number of Task Relevant Sentences Generated During Group Discussions

Source of Variation	df	SS	MS	F
Between groups	2	43641.867	21820.933	2.805
Within groups	27	210013.6	7778.281	(p=.0782)
Total	29	253655.467		

TABLE D-13b): Means and Standard Deviations for the Number of Task Relevant Sentences Generated During Group Discussions in Three Computer Conferencing Conditions

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	155.4	110.508
Passively Structured Conferences	10	200.2	75.859
Actively Structured Conferences	10	248.8	73.268

**TABLE D-14a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Task Relevant Sentences Generated During Group
Discussions With Outliers Removed**

Source of Variation	df	SS	MS	F
Between groups	2	84292.032	42146.016	8.86**
Within groups	25	118924.075	4756.963	(p=.0012)
Total	27	203216.107		

**TABLE D-14b): Means and Standard Deviations for the Number of Task Relevant
Sentences Generated During Group Discussions in Three Computer Conferencing
Conditions (Without Outliers)**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	8	111.875	51.85
Passively Structured Conferences	10	200.2	75.859
Actively Structured Conferences	10	248.8	73.268

TABLE D-15a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Task Relevant Sentences Generated by Five Group Members
During Their Group Discussions (Without Outliers)

Source of Variation	df	SS	MS	F
Between groups	2	35307.032	17653.516	4.036*
Within groups	25	109345.075	4373.803	(p=.0303)
Total	27	144652.107		

TABLE D-15b): Mean and Standard Deviations for the Number of Task Relevant
Sentences Generated by Five Group Members During Their Discussions in Three
Computer Conferencing Conditions (Without Outliers)

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	8	111.875	51.85
Passively Structured Conferences	10	200.3	75.725
Actively Structured Conferences	10	170.3	65.759

**TABLE D-16a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Task Relevant Sentences Generated by Group Members in
the MAILROOM**

Source of Variation	df	SS	MS	F
Between groups	2	2288.467	1144.233	.681
Within groups	27	45354.5	1679.796	(p=.5145)
Total	29	47642.967		

**TABLE D-16b): Means and Standard Deviations for the Number of Task Relevant
Sentences Exchanged in the MAILROOM by Groups in Three Computer Conferencing
Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	52.6	29.549
Passively Structured Conferences	10	32	18.655
Actively Structured Conferences	10	47.3	61.792

**TABLE D-17a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Proportion of Group Discussions Devoted to Task Relevant
Communication**

Source of Variation	df	SS	MS	F
Between groups	2	.011	.006	1.472
Within groups	27	.105	.004	(p=.2473)
Total	29	.116		

**TABLE D-17b): Means and Standard Deviations for the Proportion of the Group
Discussion Devoted to Task Relevant Sentences Communication in Three Computer
Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	.742	.023
Passively Structured Conferences	10	.739	.021
Actively Structured Conferences	10	.699	.014

**TABLE D-18a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Problems Identified**

Source of Variation	df	SS	MS	F
Between groups	2	73.4	36.7	3.084
Within groups	27	321.3	11.9	(p = .0622)
Total	29	394.7		

**TABLE D-18b): Means and Standard Deviations for the Number of Problems Identified
by Groups in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	5.9	2.726
Passively Structured Conferences	10	9.0	3.232
Actively Structured Conferences	10	9.4	4.222

**TABLE D-19a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Solutions Generated**

Source of Variation	df	SS	MS	F
Between groups	2	280.067	140.033	4.57*
Within groups	27	827.4	30.644	(p=.0195)
Total	29	1107.467		

**TABLE D-19b): Means and Standard Deviations for the Number of Solutions Generated
by Groups in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	12.6	5.502
Passively Structured Conferences	10	19.7	6.499
Actively Structured Conferences	10	14.1	4.408

**TABLE D-20a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Solutions Evaluated**

Source of Variation	df	SS	MS	F
Between groups	2	101.267	50.633	2.56
Within groups	27	534.1	19.781	(p = .096)
Total	29	635.367		

**TABLE D-20b): Means and Standard Deviations for the Number of Solutions Evaluated
by Groups in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	8.3	3.592
Passively Structured Conferences	10	11.8	5.731
Actively Structured Conferences	10	7.6	3.688

TABLE D-21a): ANOVA Summary Table for Computer Conferencing Condition Differences in the Number of Recommendations Made

Source of Variation	df	SS	MS	F
Between groups	2	48.867	24.433	1.78
Within groups	27	370.6	13.726	(p = .1878)
Total	29	419.467		

TABLE D-21b): Means and Standard Deviations for the Number of Recommendations Made by Groups in Three Computer Conferencing Conditions

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	4.7	4.296
Passively Structured Conferences	10	7.8	3.882
Actively Structured Conferences	10	5.9	2.767

TABLE D-22a): ANOVA Summary Table for Computer Conferencing Condition Differences in the Number of Problems Identified (Without Outliers)

Source of Variation	df	SS	MS	F
Between groups	2	68.814	34.407	2.735
Within groups	25	315.9	12.636	(p = .0851)
Total	27	384.714		

TABLE D-22b): Means and Standard Deviations for the Number of Problems Identified by Groups in Three Computer Conferencing Conditions (Without Outliers)

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	8	5.75	2.964
Passively Structured Conferences	10	9	3.232
Actively Structured Conferences	10	9.4	4.222

TABLE D-23a): ANOVA Summary Table for Computer Conferencing Condition Differences in the Number of Solutions Generated (Without Outliers)

Source of Variation	df	SS	MS	F
Between groups	2	339.214	169.607	5.68**
Within groups	25	746.5	29.86	(p = .0093)
Total	27	1085.714		

TABLE D-23b): Means and Standard Deviations for the Number of Solutions Generated by Groups in Three Computer Conferencing Conditions

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	8	11.25	5.23
Passively Structured Conferences	10	19.7	6.499
Actively Structured Conferences	10	14.1	4.408

**TABLE D-24a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Solutions Evaluated (Without Outliers)**

Source of Variation	df	SS	MS	F
Between groups	2	109.929	54.964	2.635
Within groups	25	521.5	20.86	(p = .0915)
Total	27	631.429		

**TABLE D-24b): Means and Standard Deviations for the Number of Solutions Evaluated
by Groups in Three Computer Conferencing Conditions (Without Outliers)**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	8	7.75	3.845
Passively Structured Conferences	10	11.8	5.731
Actively Structured Conferences	10	7.6	3.688

TABLE D-25a): ANOVA Summary Table for Computer Conferencing Condition Differences in the Number of Recommendations Made (Without Outliers)

Source of Variation	df	SS	MS	F
Between groups	2	43.25	21.625	1.638
Within groups	25	330.00	13.2	(p = .2145)
Total	27	373.25		

TABLE D-25b): Means and Standard Deviations for the Number of Recommendations Made by Groups in Three Computer Conferencing Conditions (Without Outliers)

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	8	4.75	4.234
Passively Structured Conferences	10	7.8	3.882
Actively Structured Conferences	10	5.9	2.767

**TABLE D-26a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Procedural Sentences**

Source of Variation	df	SS	MS	F
Between groups	2	6060.6	3030.3	32.255***
Within groups	27	2536.6	93.948	(p=.0001)
Total	29	8597.2		

**TABLE D-26b): Means and Standard Deviations for the Number of Procedural Sentences
Generated by Groups in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	14.7	6.255
Passively Structured Conferences	10	33.0	11.585
Actively Structured Conferences	10	49.5	10.416

**TABLE D-27a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Procedural Sentences (Without Outliers)**

Source of Variation	df	SS	MS	F
Between groups	2	5261.339	2630.67	26.334***
Within groups	25	2497.375	99.895	(p=.0001)
Total	27	7758.714		

**TABLE D-27b): Means and Standard Deviations for the Number of Procedural Sentences
Generated by Groups in Three Computer Conferencing Conditions (Without Outliers)**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	8	15.125	6.686
Passively Structured Conferences	10	33.0	11.585
Actively Structured Conferences	10	49.5	10.416

**TABLE D-28a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Proportion of the Group Discussion Devoted to Procedural Issues**

Source of Variation	df	SS	MS	F
Between groups	2	.196	.098	8.056**
Within groups	27	.328	.012	(p=.0018)
Total	29	.524		

**TABLE D-28b): Means and Standard Deviations for the Proportion of Group Discussions
Devoted to Procedural Issues in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	.098	.015
Passively Structured Conferences	10	.136	.009
Actively Structured Conferences	10	.285	.058

TABLE D-29a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Procedural Sentences Generated by Five Group Members
Alone

Source of Variation	df	SS	MS	F
Between groups	2	498.867	249.433	3.122
Within groups	27	2157	79.889	(p=.0603)
Total	29	2655.867		

TABLE D-29b): Means and Standard Deviations for the Number of Procedural Sentences
Generated by Five Group Members in Three Computer Conferencing Conditions

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	9.3	5.926
Passively Structured Conferences	10	15.4	11.692
Actively Structured Conferences	10	5.5	8.236

**TABLE D-30a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Procedural Sentences Generated by Five Group Members in
the MAILROOM**

Source of Variation	df	SS	MS	F
Between groups	2	1581.067	790.533	2.23
Within groups	27	9572.8	354.548	(p=.127)
Total	29	11153.867		

**TABLE D-30b): Means and Standard Deviations for the Number of Procedural Sentences
Generated in the MAILROOM by Five Group Members in Three Computer Conferencing
Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	18.4	27.196
Passively Structured Conferences	10	25.0	17.062
Actively Structured Conferences	10	7.4	5.739

**TABLE D-31a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Procedural Sentences Generated by Five Group Members in
the MAILROOM (Without Outliers)**

Source of Variation	df	SS	MS	F
Between groups	2	1726.404	863.202	6.403**
Within groups	25	3370.275	134.811	(p=.0057)
Total	27	5096.679		

**TABLE D-31b): Means and Standard Deviations for the Number of Procedural Sentences
Generated in the MAILROOM by Five Group Members in Three Computer Conferencing
Conditions (Without Outliers)**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	8	10.625	8.052
Passively Structured Conferences	10	25.0	17.062
Actively Structured Conferences	10	7.4	5.739

**TABLE D-32a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Proportion of Sentences Classified According to the Functional Coding
Scheme**

Source of Variation	df	SS	MS	F
Between groups	2	.045	.022	1.914
Within groups	27	.316	.012	(p = .167)
Total	29	.361		

**TABLE D-32b): Means and Standard Deviations for the Proportion of Sentences
Classified According to the Functional Coding Scheme for Groups in Three Computer
Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	.786	.111
Passively Structured Conferences	10	.881	.072
Actively Structured Conferences	10	.838	.133

**TABLE D-33a): ANOVA Summary Table for Computer Conferencing Condition
Differences in OPA Indices Related to Analysis of the Decision Problem**

Source of Variation	df	SS	MS	F
Between groups	2	.068	.034	.713
Within groups	27	1.282	.047	(p=.4992)
Total	29	1.35		

**TABLE D-33b): Mean OPA Indices for the Proportion of the Group Discussion Devoted to
Analysis of the Decision Problem for Groups in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	.82	.269
Passively Structured Conferences	10	.933	.211
Actively Structured Conferences	10	.9	.161

**TABLE D-34a): ANOVA Summary Table for Computer Conferencing Condition
Differences in OPA Indices Related to Generating Solution Alternatives**

Source of Variation	df	SS	MS	F
Between groups	2	1.5	.75	3.05
Within groups	27	6.639	.246	(p = .0639)
Total	29	8.139		

**TABLE D-34b): Mean OPA Indices for the Proportion of the Group Discussion Devoted to
Generating Solution Alternatives for Groups in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	.173	.182
Passively Structured Conferences	10	.699	.126
Actively Structured Conferences	10	.566	.158

**TABLE D-35a): ANOVA Summary Table for Computer Conferencing Condition
Differences in OPA Indices Related to Evaluating Solution Alternatives**

Source of Variation	df	SS	MS	F
Between groups	2	.086	.043	.194
Within groups	27	5.99	.222	(p = .8245)
Total	29	6.076		

**TABLE D-35b): Mean OPA Indices for the Proportion of the Group Discussion Devoted to
Evaluating Solution Alternatives for Groups in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	.54	.556
Passively Structured Conferences	10	.633	.399
Actively Structured Conferences	10	.667	.445

**TABLE D-36a): ANOVA Summary Table for Computer Conferencing Condition
Differences in OPA Indices Related to Deciding on Final Recommendations**

Source of Variation	df	SS	MS	F
Between groups	2	.07	.035	1.122
Within groups	24	.686	.029	(p = .313)
Total	26	.756		

**TABLE D-36b): Mean OPA Indices for the Proportion of the Group Discussion Devoted to
Deciding upon Final Recommendations for Groups in Three Computer Conferencing
Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	.848	.271
Passively Structured Conferences	10	.967	.105
Actively Structured Conferences	10	.96	.126

TABLE D-37a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Supportive Sentences Generated During Group Discussions

Source of Variation	df	SS	MS	F
Between groups	2	2762.6	1381.3	4.013*
Within groups	27	9294.6	344.244	(p = .0298)
Total	29	12057.2		

TABLE D-37b): Means and Standard Deviations for the Number of Supportive Sentences
Generated During Discussions by Groups in Three Computer Conferencing Conditions

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	19.5	13.681
Passively Structured Conferences	10	26.8	17.574
Actively Structured Conferences	10	42.5	23.167

**TABLE D-38a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Proportion of Group Discussion Devoted to Supportive Communication**

Source of Variation	df	SS	MS	F
Between groups	2	.002	.001	.456
Within groups	27	.047	.002	(p = .6387)
Total	29	.048		

**TABLE D-38b): Means and Standard Deviations for the Proportion of Group Discussions
Devoted to Supportive Communication in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	.102	.041
Passively Structured Conferences	10	.097	.046
Actively Structured Conferences	10	.114	.037

**TABLE D-39a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Supportive Sentences Generated by Five Group Members**

Source of Variation	df	SS	MS	F
Between groups	2	291.8	145.9	.548
Within groups	27	7193	266.407	(p = .5846)
Total	29	7484.8		

**TABLE D-39b): Means and Standard Deviations for the Number of Supportive Sentences
Generated by Five Group Members in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	19.5	13.681
Passively Structured Conferences	10	26.8	17.574
Actively Structured Conferences	10	25.1	17.413

**TABLE D-40a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Negative Sentences Generated by Group Members**

Source of Variation	df	SS	MS	F
Between groups	2	125.067	62.533	.712
Within groups	27	2372.8	87.881	(p = .4999)
Total	29	2497.867		

**TABLE D-40b): Means and Standard Deviations for the Number of Negative Sentences
Generated by Group Members in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	8	9.129
Passively Structured Conferences	10	3.4	3.098
Actively Structured Conferences	10	7.4	13.066

**TABLE D-41a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Supportive Sentences Exchanged by Groups in the
MAILROOM**

Source of Variation	df	SS	MS	F
Between groups	2	2509.267	1254.633	2.951
Within groups	27	11477.7	425.1	(p = .0693)
Total	29	13986.967		

**TABLE D-41b): Means and Standard Deviations for the Number of Supportive Sentences
Exchanged in the MAILROOM by Groups in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	33.4	16.701
Passively Structured Conferences	10	28.1	23.009
Actively Structured Conferences	10	49.6	21.609

**TABLE D-42a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Personalized Greetings Used During Group Discussions**

Source of Variation	df	SS	MS	F
Between groups	2	1302.367	651.433	2.942
Within groups	27	5977.8	221.4	(p = .0698)
Total	29	7280.667		

TABLE D-42b): Means and Standard Deviations for the Number of Personalized Greetings Used in Group Discussions in Three Computer Conferencing Conditions

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	13.9	13.519
Passively Structured Conferences	10	18.5	12.765
Actively Structured Conferences	10	29.6	17.846

**TABLE D-43a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Personalized Greetings Generated by Five Group Members
During Their Discussions**

Source of Variation	df	SS	MS	F
Between groups	2	300.067	150.033	.682
Within groups	27	5942.9	220.107	(p = .5143)
Total	29	6242.967		

**TABLE D-43b): Means and Standard Deviations for the Number of Personalized
Greetings Generated by Five Group Members in Discussions in Three Computer
Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	13.4	13.64
Passively Structured Conferences	10	18.5	12.765
Actively Structured Conferences	10	21	17.645

**TABLE D-44a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Integrative Sentences Generated During Group Discussions**

Source of Variation	df	SS	MS	F
Between groups	2	3260	1630	3.012
Within groups	27	14611.5	541.167	(p = .0659)
Total	29	17871.5		

**TABLE D-44b): Means and Standard Deviations for the Number of Integrative Sentences
Generated During Group Discussions in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	20.5	21.65
Passively Structured Conferences	10	45.5	25.834
Actively Structured Conferences	10	28.5	22.077

**TABLE D-45a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Number of Integrative Sentences Generated by Five Group Members
During Their Discussions**

Source of Variation	df	SS	MS	F
Between groups	2	3752.267	1876.133	3.544 *
Within groups	27	14293.1	529.374	(p= .043)
Total	29	18045.367		

**TABLE D-45b): Means and Standard Deviations for the Number of Integrative Sentences
Generated by Five Group Members During Their Discussions in Three Computer
Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	20.5	21.65
Passively Structured Conferences	10	45.5	25.834
Actively Structured Conferences	10	23.3	21.261

TABLE D-46: Correlation Matrix for Intercorrelations Between 3 Indices of Decision Quality for Each Judge

	JUDGE 1	JUDGE 2	JUDGE 3
	EcFeas Creat Work	EcFeas Creat Work	EcFeas Creat Work
EcFeas Creat Work			
JUDGE 1			
EcFeas	1.0		
Creat	.86**	1.0	
Work	.81**	.92**	1.0
JUDGE 2			
EcFeas	1.0		
Creat	.91**	1.0	
Work	.87**	.95**	1.0
JUDGE 3			
EcFeas	1.0		
Creat	.97**	1.0	
Work	.98**	.97**	1.0

** $p < .01$.

TABLE D-47: Correlation Matrix for Interjudge Reliability in Judgements of Decision Quality

	JUDGE 1	JUDGE 2	JUDGE 3
JUDGE 1	1.0		
JUDGE 2	.71**	1.0	
JUDGE 3	.812**	.799**	1.0

** $p < .01$.

TABLE D-48a): ANOVA Summary Table for Computer Conferencing Condition Differences in Decision Quality

Source of Variation	df	SS	MS	F
Between groups	2	4537.216	2268.608	6.096**
Within groups	27	10047.34	372.124	(p=.0065)
Total	29	14584.555		

TABLE D-48b): Means and Standard Deviations for Judged Decision Quality in Three Computer Conferencing Conditions

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	39.411	30.395
Passively Structured Conferences	10	67.889	11.017
Actively Structured Conferences	10	62.156	8.436

TABLE D-49a): ANOVA Summary Table for Computer Conferencing Condition Differences in Academic Standing

Source of Variation	df	SS	MS	F
Between groups	2	.373	.187	.566
Within groups	147	48.46	.33	(p = .5689)
Total	149	48.833		

TABLE D-49b): Means and Standard Deviations for Academic Standing of Participants in Three Computer Conferencing Conditions

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	50	4.18	.482
Passively Structured Conferences	50	4.1	.614
Actively Structured Conferences	50	4.22	.616

**TABLE D-50a): ANOVA Summary Table for Computer Conferencing Condition
Differences in Number of Visits to the Library in the Past Month**

Source of Variation	df	SS	MS	F
Between groups	2	47.708	23.854	.6
Within groups	145	5767.339	39.775	(p = .5503)
Total	147	5815.047		

**TABLE D-50b): Means and Standard Deviations for the Number of Visits to the Library
Made by Participants in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	49	8.02	6.884
Passively Structured Conferences	50	6.82	5.252
Actively Structured Conferences	49	8.02	6.679

TABLE D-51a): ANOVA Summary Table for Computer Conferencing Condition Differences in Perceptions of Task Difficulty

Source of Variation	df	SS	MS	F
Between groups	2	17.677	8.838	.503
Within groups	124	2178.26	17.567	(p=.6059)
Total	126	2195.937		

TABLE D-51b): Means and Standard Deviations for Perceptions of Task Difficulty of Participants in Three Computer Conferencing Conditions

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	42	16.214	4.159
Passively Structured Conferences	42	15.738	4.237
Actively Structured Conferences	43	15.302	4.178

**TABLE D-52a): ANOVA Summary Table for Computer Conferencing Condition
Differences in Perceptions of Task Interest**

Source of Variation	df	SS	MS	F
Between groups	2	76.171	38.086	2.34
Within groups	124	2018.538	16.279	(p = .1006)
Total	126	2094.709		

**TABLE D-52b): Means and Standard Deviations for Perceptions of Task Difficulty of
Participants in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	42	32.524	4.82
Passively Structured Conferences	42	34.357	3.449
Actively Structured Conferences	43	33.884	3.711

TABLE D-53a): ANOVA Summary Table for Computer Conferencing Condition Differences in the Number of Active Group Members

Source of Variation	df	SS	MS	F
Between groups	2	.267	.133	.275
Within groups	27	13.1	.485	(p = .7618)
Total	29	13.367		

TABLE D-53b): Means and Standard Deviations for the Number of Active Members in Groups in Three Computer Conferencing Conditions

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	4.5	.707
Passively Structured Conferences	0	4.3	.675
Actively Structured Conferences	10	4.5	.707

**TABLE D-54a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Proportion of Females in Groups**

Source of Variation	df	SS	MS	F
Between groups	2	1174.093	587.046	1.41
Within groups	27	11240.102	416.3	(p = .2615)
Total	29	12414.195		

**TABLE D-54b): Means and Standard Deviations for the Proportion of Females in Groups
in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	65.5	19.069
Passively Structured Conferences	10	76.67	16.885
Actively Structured Conferences	0	80.17	24.499

**TABLE D-55a): ANOVA Summary Table for Computer Conferencing Condition
Differences in Decision Quality of Groups Who Did Submit Recommendations**

Source of Variation	df	SS	MS	F
Between groups	2	558.686	279.343	1.977
Within groups	24	3390.615	141.276	(p = .1604)
Total	26	3949.301		

**TABLE D-55b): Means and Standard Deviations for Decision Quality of Groups in Three
Computer Conferencing Conditions Who Did Submit Recommendations**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	7	56.302	16.622
Passively Structured Conferences	10	67.889	11.017
Actively Structured Conferences	10	62.156	8.436

**TABLE D-56a): ANOVA Summary Table for Computer Conferencing Condition
Differences in Participants' Level of Satisfaction with Their Group's Decision Making
Processes**

Source of Variation	df	SS	MS	F
Between groups	2	52.051	26.025	2.913
Within groups	123	1098.806	8.933	($p = .0581$)
Total	125	1150.857		

**TABLE D-56b): Means and Standard Deviations for Participants' Level of Satisfaction
with Their Group's Decision Making Processes in Three Computer Conferencing
Conditions**

Condition	Number of Participants	Mean	Standard Deviation
Self-Structured Conferences	42	8.714	3.248
Passively Structured Conferences	41	9.732	2.802
Actively Structured Conferences	43	10.256	2.896

TABLE D-57a): ANOVA Summary Table for Computer Conferencing Condition Differences in Participants' Level of Satisfaction with Their Group's Decision Making Processes (Without Outliers)

Source of Variation	df	SS	MS	F
Between groups	2	38.856	19.428	2.415
Within groups	114	917.144	8.045	(p = .0939)
Total	116	956		

TABLE D-57b): Means and Standard Deviations for Participants' Level of Satisfaction with Their Group's Decision Making Processes in Three Computer Conferencing Conditions (Without Outliers)

Condition	Number of Participants	Mean	Standard Deviation
Self-Structured Conferences	33	8.818	2.8
Passively Structured Conferences	41	9.732	2.802
Actively Structured Conferences	43	10.256	2.896

TABLE D-58a): ANOVA Summary Table for Computer Conferencing Condition Differences in Participants' Level of Satisfaction with The Outcome of Their Group Discussion

Source of Variation	df	SS	MS	F
Between groups	2	19.033	9.516	1.677
Within groups	122	692.279	5.674	(p = .1912)
Total	124	711.312		

TABLE D-58b): Means and Standard Deviations for Participants' Level of Satisfaction with The Outcome of Their Group Discussion in Three Computer Conferencing Conditions

Condition	Number of Participants	Mean	Standard Deviation
Self-Structured Conferences	41	10.707	2.657
Passively Structured Conferences	41	11.634	2.083
Actively Structured Conferences	43	11.395	2.372

**TABLE D-59a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Degree to Which Conferencing Experiences were Perceived to be
Positive**

Source of Variation	df	SS	MS	F
Between groups	2	644.829	322.415	1.279
Within groups	121	30498.163	252.05	(p = .282)
Total	123	31142.992		

**TABLE D-59b): Means and Standard Deviations for the Degree to which Computer
Conferencing Experiences were Perceived to be Positive by Participants in Three
Computer Conferencing Conditions**

Condition	Number of Participants	Mean	Standard Deviation
Self-Structured Conferences	42	78.881	15.846
Passively Structured Conferences	39	82.949	17
Actively Structured Conferences	43	84.163	14.818

TABLE D-60: Item-Total Correlations for Computer Conferencing Experiences Questionnaire

ITEM	ITEM-TOTAL CORRELATION
------	------------------------

Focus of Discussion	.595**
Frustration Entering Comments	-.537**
Lack of Social Interaction	-.624**
Confusion about Expectations	-.501**
Free Expression of Ideas	.292**
Easy to Follow Discussion	.638**
Structure Rigid	-.552**
Group Members Supportive	.374**
Artificiality	-.620**
Hard to Get to Know Others	-.476**
Good Access to Information	.130
Organizational Difficulties	-.643**
Quick Responses to Commen	.537**
Hard to Reach Consensus	-.431**
Lack of Leadership	-.664**
Typing Not Restrictive	.633**
Strong Group Spirit	.692**

df=122

* p<.05

** p<.01

TABLE D-61: Summary Table for Factor Analysis on Computer Conferencing Experiences

EXPERIENCE	FACTOR				
	1	2	3	4	5
Focus of Discussion	-.68*	.47	.108	-.195	.014
Frustration Entering Comments	.697*	-.091	.268	-.168	-.097
Lack of Social Interaction	.212	-.13	.773*	-.058	-.084
Confusion about Expectations	-.078	-.445	.433	.021	-.069
Free Expression of Ideas	-.056	.069	-.142	-.073	.87*
Easy to Follow Discussion	-.56*	.339	-.162	-.345	.198
Structure Rigid	.715	-.052	.304	-.006	.047
Group Members Supportive	-.017	.614*	.104	.355	.265
Artificiality	.405	-.053	.667*	.058	-.075
Hard to Get to Know Others	.004	-.113	.675*	.326	.019
Good Access to Information	.016	.151	-.051	.716*	-.16
Organizational Difficulties	.17	-.712*	.25	.089	.207
Quick Responses to Comments	-.282	.57*	.042	-.053	.397
Hard to Reach Consensus	.021	-.412	.233	.522*	.25
Lack of Leadership	.219	-.72*	.209	.008	.081
Typing Not Restrictive	-.303	.22	-.64*	.149	.012
Strong Group Spirit	-.136	.706*	-.296	.034	.21

* = Factor Loading >.05.

**TABLE D-62a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Degree to Which Participants Perceived Their Conferences to be
Frustrating**

Source of Variation	df	SS	MS	F
Between groups	2	2.83	1.415	1.455
Within groups	121	117.709	.973	(p = .2375)
Total	123	120.539		

**TABLE D-62b): Means and Standard Deviations for the Degree to which Participants in
Three Computer Conferencing Conditions Experienced Frustration During Their
Conferences**

Condition	Number of Participants	Mean	Standard Deviation
Self-Structured Conferences	42	-.2	.895
Passively Structured Conferences	39	.173	1.195
Actively Structured Conferences	43	-.046	.853

**TABLE D-63a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Degree to Which Participants Experienced a Lack of Social Contact in
Their Conferences**

Source of Variation	df	SS	MS	F
Between groups	2	1.107	.554	.55
Within groups	121	121.859	1.007	(p = .6785)
Total	123	122.967		

**TABLE D-63b): Means and Standard Deviations for the Degree to which Participants in
Three Computer Conferencing Conditions Experienced a Lack of Social Contact During
Their Conferences**

Condition	Number of Participants	Mean	Standard Deviation
Self-Structured Conferences	42	.062	.883
Passively Structured Conferences	39	-.154	1.059
Actively Structured Conferences	43	.036	1.06

**TABLE D-64a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Degree to Which Participants Felt Free to Express Ideas During Their
Conferences**

Source of Variation	df	SS	MS	F
Between groups	2	.181	.09	.09
Within groups	121	121.931	1.008	(p = .9142)
Total	123	122.112		

**TABLE D-64b): Means and Standard Deviations for the Degree to which Participants in
Three Computer Conferencing Conditions Felt Free to Express Ideas During Their
Conference**

Condition	Number of Participants	Mean	Standard Deviation
Self-Structured Conferences	42	-.2	.895
Passively Structured Conferences	39	.173	1.195
Actively Structured Conferences	43	-.046	.853

**TABLE D-65a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Degree to Which Participants Experienced a Sense of Group Cohesion
During Their Conferences**

Source of Variation	df	SS	MS	F
Between groups	2	8.936	4.468	4.742*
Within groups	121	113.998	.942	(p = .0104)
Total	123	122.934		

**TABLE D-65b): Means and Standard Deviations for the Degree to which Participants in
Three Computer Conferencing Conditions Experienced a Sense of Group Cohesion During
Their Conference**

Condition	Number of Participants	Mean	Standard Deviation
Self-Structured Conferences	42	-.38	1.013
Passively Structured Conferences	39	.134	.95
Actively Structured Conferences	43	.225	.947

**TABLE D-66a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Degree to Which Participants Experienced Time Pressure During
Their Conferences**

Source of Variation	df	SS	MS	F
Between groups	2	1.24	.62	.617
Within groups	133	133.76	1.006	(p = .5413)
Total	135	135		

**TABLE D-66b): Means and Standard Deviations for the Degree to which Participants in
Three Computer Conferencing Conditions Experienced Time Pressure During Their
Conference**

Condition	Number of Participants	Mean	Standard Deviation
Self-Structured Conferences	45	.078	.162
Passively Structured Conferences	47	.131	.128
Actively Structured Conferences	44	.06	.156

**TABLE D-67a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Degree to Which Participants Preferred Face-to-Face Communication**

Source of Variation	df	SS	MS	F
Between groups	2	1.041	.52	.517
Within groups	133	133.959	1.007	(p = .5976)
Total	135	135		

**TABLE D-67b): Means and Standard Deviations for the Degree to which Participants in
Three Computer Conferencing Conditions Preferred Face-to-Face Communication**

Condition	Number of Participants	Mean	Standard Deviation
Self-Structured Conferences	42	-.123	.978
Passively Structured Conferences	47	.076	1.004
Actively Structured Conferences	44	.045	1.028

**TABLE D-68a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Degree to Which Participants Felt Intimidated by the Computer**

Source of Variation	df	SS	MS	F
Between groups	2	1.858	.929	.928
Within groups	133	133.142	1.001	(p = .3979)
Total	135	135		

**TABLE D-68b): Means and Standard Deviations for the Degree to which Participants in
Three Computer Conferencing Conditions Were Intimidated by the Computer**

Condition	Number of Participants	Mean	Standard Deviation
Self-Structured Conferences	42	.091	1.133
Passively Structured Conferences	47	.071	1.079
Actively Structured Conferences	44	.169	.734

TABLE D-69: Summary Table for Factor Analysis on Different Roles Played by Individual Group Members

ROLE CHARACTERISTICS	FACTOR 1	FACTOR 2
Talked the Most	.734*	.287
Most Concerned About Group Feelings	.198	.849*
Had the Best Ideas	.785*	.14
Most Knowledgeable about the Library	.781*	.133
Best Organizer	.643*	.44
Most Fun to Work With	.188	.836*
Most Valuable Group Member	.798*	.236
Most Argumentative	.503*	.455

* Factor Loading > .5.

**TABLE D-70a): ANOVA Summary Table for Computer Conferencing Condition
Differences in the Degree to Which Task Leaders Emerged During Group Discussions**

Source of Variation	df	SS	MS	F
Between groups	2	606728.6	303364.3	1.771
Within groups	27	4626834.6	171327.207	(p= .1894)
Total	29	5232563.2		

**TABLE D-70b): Means and Standard Deviations for the Degree to Which Task Leaders
Emerg ed in Group Discussions in Three Computer Conferencing Conditions**

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	797.3	408.73
Passively Structured Conferences	10	1096.6	498.018
Actively Structured Conferences	10	1101.3	314.482

TABLE D-71a): ANOVA Summary Table for Computer Conferencing Condition Differences in the Degree to Which Socio-Emotional Leaders Emerged During Group Discussions

Source of Variation	df	SS	MS	F
Between groups	2	556249.267	278124.633	1.412
Within groups	27	5318934.1	196997.559	(p=.2611)
Total	29	5875183.367		

TABLE D-71b): Means and Standard Deviations for the Degree to Which Socio-Emotional Leaders Emerged in Group Discussions in Three Computer Conferencing Conditions

Condition	Number of Groups	Mean	Standard Deviation
Self-Structured Conferences	10	930.6	534.388
Passively Structured Conferences	10	1092.8	395.959
Actively Structured Conferences	10	759.3	385.537

TABLE D-72: Pearson Product Moment Correlations Between Quality and Satisfaction Measures of Group Decision Making Performance

	Quality	Process Satisfaction	Outcome Satisfaction
Quality	1		
Process Satisfaction	.318**	1	
Outcome Satisfaction	.33**	.518**	1

** $p < .01$.

df=123

TABLE D-73: Pearson's Product Moment Correlations Between Indices of Group Discussion Thoroughness and Decision Quality

	Total Vol	Task Vol	Task Vol (5)	Number Probs.	Number Solns	Number Eval	Number Recs.	Quality
Total Vol	1							
Task Vol	.97**	1						
Task Vol(5)	.81**	.90**	1					
Number Probs.	.55**	.51**	.38**	1				
Number Solns	.57**	.60**	.68**	.47**	1			
Number Eval	.48**	.51**	.61**	.25	.87**	1		
Number Recs	.41*	.361	.365*	.23	.65**	.69**	1	
Quality	.27	.21	.14	.27	.44*	.364*	.74**	1

* $p < .05$. ** $p < .01$

df=28

**TABLE D-74: Pearson Product Moment Correlations Between Indices of
Decision Process Emphasis and Decision Quality**

	Proc. Vol.	Proc. Vol.	Proc. Mail (5)	OPA/ ANAL	OPA/ ALT	OPA/ EVAL	OPA/ DEC	Quality
Proc. Vol.	1							
Proc. Vol. (5)	.28	1						
Proc. Mail	-.26	.04	1					
OPA/ANAL	.096	-.04	.26	1				
OPA/ALT	.27	.10	.09	.07	1			
OPA/EVAL	.19	.23	.04	.09	.36	1		
OPA/DEC	.38*	.27	.15	.26	.09	.35	1	
Quality	.46*	.27	-.23	.14	.24	-.15	.25	1

* $p < .05$, ** $p < .01$

df= 28

**TABLE D-75: Pearson Product Moment Correlations Between Indices of
Communication-Based Group Cohesion and Judged Decision Quality**

	Total Greet.	Greetings (5)	Total Positive Volume	Positive Volume (5)	Integrative Volume	Quality
Total Greetings	1					
Greetings (5)	.96**	1				
Total Positive Volume	.65**	.54**	1			
Total Positive Volume (5)	.55**	.56**	.89**	1		
Integrat. Volume	.24	.28	.32	.45*	1	
Quality	.28	.25	.29	.25	.55**	1

* $p < .05$, ** $p < .01$.

df=28

TABLE D-76: Pearson's Product Moment Correlations Between Indices of Group Discussion Thoroughness and Satisfaction Indices

	Process Satisfaction	Outcome Satisfaction
Total Communication Volume	.273**	.159
Total Task Volume	.19	.109
Task Volume by 5 Group Members	.1	.053
Number of Problems Identified	.198*	.189
Number Solutions Generated	.086	.145
Number Solutions Evaluated	.137	.136
Number of Recommendations Made	.36**	.326**

* $p < .05$. ** $p < .01$

df = 119

**TABLE D-77: Pearson Product Moment Correlations Between Indices of
Decision Process Emphasis and Satisfaction Measures**

	Process Satisfaction	Outcome Satisfaction
Total Volume of Procedural Communication	.203*	.2*
Volume of Procedural Communication by 5 Group Members	.105	.11
OPA for Analysis	.177	.336**
OPA for Alternatives	.197*	.039
OPA for Evaluation	.017	.14
OPA for Decision	.312**	.294**

* $p < .05$. ** $p < .01$

df= 119

TABLE D-78: Pearson Product Moment Correlations Between Indices of Communication-Based Group Cohesion and Satisfaction Measures

	Process Satisfaction	Outcome Satisfaction
Total Volume of Personalized Greetings	.337**	.327
Total Volume of Supportive Communication	.458**	.269**
Volume of Supportive Communication by 5 Group Members	.435**	.257**
Volume of Integrative Communication	.311**	.267**

* $p < .05$, ** $p < .01$

df = 119

TABLE D-79: Pearson Product Moment Correlations Between Experiential Factors and Measures of Quality and Satisfaction

	Quality	Process Satisfaction	Outcome Satisfaction
Frustration	-.041	-.258**	-.157
Cohesion	.347**	.555**	.432**
Lack of Social Contact	-.023	-.219*	-.207
Freedom of Expression	.052	.072	.026

* $p < .05$. ** $p < .01$

df = 118

TABLE D-80: Regression of Five Experiential Factors on Judged Decision Quality

df	R	R²	Adj. R²	Std. Error
123	.36	.13	.101	20.539

ANALYSIS OF VARIANCE TABLE

Source of Variation	df	SS	MS	F
Between groups	4	7495.582	1873.896	4.442**
Within groups	119	50200.231	421.851	(p = .0022)
Total	123	57695.813		

BETA COEFFICIENT TABLE

Parameter	Value	Std. Err.	Std. Value	t-value	Probability
Intercept	56.464				
Frustration	-.899	1.871	-.041	.48	.6318
Cohesion	7.646	1.852	.353	4.127***	.0001
Lack of Social Contact	-.586	1.852	-.027	.317	.7522
Freedom of Expression	1.166	1.859	.054	.628	.5315

TABLE D-81: Regression of Five Experiential Factors on Process Satisfaction

df	R	R ²	Adj. R ²	Std. Error
122	.671	.45	.431	2.314

ANALYSIS OF VARIANCE TABLE

Source of Variation	df	SS	MS	F
Between groups	4	516.077	129.019	24.098***
Within groups	118	631.777	5.354	(p=.0001)
Total	122	1147.854		

BETA COEFFICIENT TABLE

Parameter	Value	Std. Err.	Std. Value	t-value	Probability
Intercept	9.544				
Frustration	-.767	.211	-.249	3.64***	.0004
Cohesion	1.757	.209	.574	8.403***	.0001
Lack of Social Contact	-.727	.212	-.234	3.425***	.0008
Freedom of Expression	.258	.21	.084	1.231	.2207

TABLE D-82: Regression of Five Experiential Factors on Outcome Satisfaction

df	R	R ²	Adj. R ²	Std. Error
121	.515	.265	.24	2.101

ANALYSIS OF VARIANCE TABLE

Source of Variation	df	SS	MS	F
Between groups	4	185.888	46.472	10.533***
Within groups	117	516.219	4.412	(p=.0001)
Total	121	702.107		

BETA COEFFICIENT TABLE

Parameter	Value	Std. Err.	Std. Value	t-value	Probability
Intercept	11.207				
Frustration	-.373	.192	-.154	1.946	.054
Cohesion	1.063	.19	.443	5.585***	.0001
Lack of Social Contact	-.52	.193	-.214	2.698**	.008
Freedom of Expression	.081	.19	.034	.426	.671

TABLE D-83: Pearson Product Moment Correlations Between Experiential Factors and Indices of Group Discussion Thoroughness

	Frustration	Group Cohesion	Lack of Social Contact	Freedom of Expression
Total Volume	064	299**	-.222*	-.027
Total Task Volume	063	242*	-.19	-.065
Task Volume by 5 Group Members	086	163	-.198	-.087
Number Problems Identified	119	338**	-.167	.073
Number of Solns Generated	168	169	-.206*	.037
Number of Solns Evaluated	095	091	-.165	.056
Number of Recommendations	-.046	.235*	-.144	-.019

* $p < .05$, ** $p < .01$

df=122

TABLE D-84: Pearson Product Moment Correlations Between Experiential Factors and Indices of Decision Process Emphasis

	Frustration	Group Cohesion	Lack of Social Contact	Freedom of Expression
Total Procedural Volume	.091	.198 *	-.153	-.068
Procedural Volume by 5 Group Members	.042	.023	-.245 *	-.057
Procedural Volume in Mailroom	.163	.142	.039	-.054
OPA/T1	-.047	.056	-.119	-.131
OPA/T2	.038	-.041	-.017	.081
OPA/T3	-.088	.048	-.072	.03
OPA/T4	-.083	.237 *	-.153	.064

* $p < .05$, ** $p < .01$.

df=122

TABLE L-85: Pearson Product Moment Correlations Between Experiential Factors and Indices of Decision Process Emphasis

	Frustration	Group Cohesion	Lack of Social Contact	Freedom of Expression
Total Supportive Volume	.023	.407**	-.221*	.11
Supportive Volume by 5 Group Members	.047	.38**	-.238*	.121
Total Number of Personalized Greetings	-.013	.411**	-.035	.051
Integrative Volume	-.079	-.031	-.006	.03

* $p < .05$, ** $p < .01$

df = 122

TABLE D-86: Pearson Product Moment Correlations Between Experiential Factors and the Volume of Different Types of Communication Generated by Individual Group Members

	Frustration	Group Cohesion	Lack of Social Contact	Freedom of Expression
Total Task Relevant Volume	.027	.113	-.17	-.138
Total Procedural Volume	.027	-.103	-.137	.226*
Total Procedural Volume in Mailroom	.275	-.17	-.082	.065
Total Supportive Volume	.036	.183	-.244*	-.124
Total Volume of Personalized Greetings	-.067	.26**	-.119	-.107

* $p < .05$, ** $p < .01$.

df = 122

APPENDIX E:

EXAMPLES OF SENTENCES CLASSIFIED ACCORDING TO

DIFFERENT CONTENT CATEGORIES

TABLE E-1: Examples of Sentences Classified as Task Relevant

1. The Library should get some more photocopiers or even add copy vendor slots to the existing ones.
2. The next question is what kind of fundraiser would make a difference for the Library?
3. I've been told by a student on the library staff that one of the reasons it takes so long for books to be reshelfed is the lack of space on the shelves.
4. Even though the library hours are not sufficient as they are currently, I feel that if we decreased them even more, then there would be more money left over from the SALARIES allotment in the budget.
5. My chief complaint about the library is its lack of good research material for essays.
6. The main topics that I feel should be addressed are Library hours, computerized catalogues, and repairs on the photocopiers.
7. Although if you did thin the full time employees and hire more student assistants to do work (i.e. sorting books, signing out books, etc), that might aid in the full time staff being available to help students.
8. When books, journals, etc. are overdue are the fines always collected?
9. I'm not quite sure what the librarians' hours are, but by using students for the majority of the work, and by working with more staff members during busy periods of each day, more work could be achieved and circulation would be faster.
10. Librarians are most likely paid a proper wage but what about the student employees?

TABLE E-2: Examples of Sentences Classified as Procedural

1. I'll send a note to Barb requesting the divisions into main topic headings for "funds" and "space".
2. Do we want to summarize our suggestions now, or wait until Sunday? We only have a few days left. If you like I can do them on Sunday. (2)
3. Maybe we could list everybody's alternative ideas in point form and come to some kind of vote as to which ones we decide to use.
4. I think we need some more headings rather than just 'General'.
5. Cindy, would you contact B. Carroll for more information.
6. For the purpose of this group coming to an agreement I suggest that we need not chose simply a few of the suggestions to put forward but rather use all of them
7. What I would like to know is how do we get this proposal together?
8. I have sent Barbara a letter asking to account for the salary figures, which some of us have questioned.
9. It sounds like everyone is in agreement on the fine system and photocopy cards so I think maybe it's time to put the finishing touches on them and finalize any problems regarding these matters so that we can submit them into the decision section.
10. I went ahead and put Cam's idea regarding senior staffing into decision. I hope this was OK????

TABLE E-3: Examples of Sentences Classified as Supportive

1. I fully agree with the point Jean raised in our 'conference' last week, remember, we had coffee and donuts!
2. Becky, you are really good at putting suggestions in point form but I think it is unfair to expect you to do all the work.
3. I think Brad has come up with one of our best ideas yet.
4. I think we are on our way to success with some of these ideas.
5. Keep up the great work!!!!
6. You have certainly put a lot of work into this project and you deserve most of the credit.
7. I'm so glad you signed-on and are participating in the discussion.
8. Andy baby, that's a great idea!
9. Think of some amazing suggestions and then we can split the reward 50/50 if we win.
10. This is my first log-in and your letter made me feel very welcome.

TABLE E-4: Examples of Sentences Classified as Negative

1. I think the idea of making super libraries by uniting ours with other institutions is the worst idea since the splitting of the atom.
2. You are holding up the group by not participating. You may not care but others do, so get your ass in gear!!!
3. It's Tuesday the 24th and I'm getting worried because I haven't received any letters or suggestions.
4. Start pulling your weight!
5. The idea that costs would increase by having trained personnel to teach students to use a library computer system is inaccurate.
6. Are you nuts. I think your idea is crazy!!
7. As for everyone else (not including you), I think they're sleeping through this
8. I hate your comment!!
9. I don't believe cutting back on staff is the answer.
10. You will need to repeat your message as it was too long and since I couldn't stop it I have no idea what you said.

TABLE E-5: Examples of Sentences Classified as Analysis

1. Other problems do exist such as the need for the library to become computerized, the need for an increase in hours on Friday, Saturday, and Sunday, as well as lack of space and rather poor organization.
2. My biggest problem with the library is that it takes too long for the books to be reshelved for use again.
3. There is not enough new material and usually what is new material isn't the most useful.
4. When the push for essays, etc., is on it is impossible to find any books because a few people have taken out all the books on a particularly subject.
5. Another problem is that the library is not open in the evenings on weekends
6. The library is extremely inefficient, which is the root of all its problems
7. I think a problem with the library is that people don't really know how to use it well.
8. People tend to take a book or journal and wander off to a corner, read it, and then leave it there making it impossible to find.
9. I think a major problem the library faces is that it is disorganized and it is almost impossible to find things you are looking for without getting help
10. The two problems I see are line ups at the reserve desk and lack of materials.

TABLE E-6: Examples of Sentences Classified as Alternatives

1. Make sure that when the fundraising idea is first raised that there is a lot of publicity about it.
2. Another possible idea I had was to ask all students to donate approximately three or four dollars when paying their fees next year.
3. I believe the University needs to be lobbied in order to increase the budget, due to ever-increasing inflation rates.
4. Relocating these references to the area left by the departing administration offices would solve this problem.
5. I think there should be a sign up at the end of the reserve section that says "If all copiers are being used, line up here to wait for first available machine"
6. The library should incorporate an overnight loan system for reserve readings and books.
7. Would it not be nice if we could have more students working in the library, thereby doing the work that the normal staff does and cutting down on the costs of salaries.
8. There is a library down-town and I believe one at SSFC, could we have access to their materials so that we don't spend money on books that are available.
9. The idea that the library hours are too short could be looked into by sending out questionnaires on this topic asking students what kind of hours would be better.
10. Why doesn't someone just burn down Bata Library, turn the Cat's Ass into a study hall, use the money from the non-existent Library's budget to purchase shuttle buses, and use these t cart Trent students to Toronto from Peterborough and back - let U of T worry about it.

TABLE E-7: Examples of Sentences Classified as Evaluation

1. I think your idea for making more study space is very good, except for the fact that there would be a considerable amount of money involved in building a place to move the offices to.
2. I feel that the proposal for co-op students to earn a credit in our library would only lead to too much controversy.
3. The idea for volunteers is a great one and I'm sure there are lots of people out there who would have spare time on their hands, and would like to help out.
4. The \$10 idea is not a bad one, but what happens a few years down the road when the budget is once again too small for the Library - will the students be forced into paying \$20 and \$30 for the use of the Library.
5. I think Dave is right about our lack of information in the library, however, I disagree that this should be a reason for not installing the computerized filing system.
6. If the library did switch its system totally to computers, fewer staff would be necessary in the card cataloging areas and they could be put into the areas of sorting and reshelving books.
7. In response to the comment on a sponsorship program ... I think it is a great idea. That way the library can increase the number of new books required at half the cost. And with the money that they are saving, the library can either purchase more books, or hire more staff to ease the sorting etc. (3)
8. We need more than just an increase in funds, we need a change in the way the budget is mapped out.
9. The idea of increasing the hours the library is open cannot be done without outside help.
10. I realize this idea is far from polished and who even knows if it would work, but hell it's original and we're not the ones to decide what's gonna work anyway

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TABLE E-8: Examples of Sentences Classified as Decision

1. During our meeting, members have expressed the need for new copy machines, as the current machines don't meet the demands of the entire student body.
2. I agree that your idea should be tabled with the rest.
3. Since John has lambasted the idea of firing staff and hiring students, I say we scrap it.
4. We all seem to have great individual suggestions but we should start combining them to make a single solution ready for Tuesday before time runs out.
5. The ideas for fundraising seem to be agreeable to everyone.
6. I suggest to the Library Services Committee that a fund raising campaign through the Alumni Association be instigated to raise the necessary funds needed to improve library services.
7. I vote yay to: new contracts without benefits, reorganizing physical space in the library, and soliciting moneys from the city.
8. Now I think we must try to formulate a clear and concise recommendation for this point.
9. If no one has committed our topics to the decision section by 4:30 tomorrow (that's Tuesday), I volunteer to be the sucker that gets stuck!!
10. I know you're all sick of me by now, but we have to decide if we're going to use the idea of sharing between the Queen's Library and ours.

TABLE E-9: Examples of Personalized Greetings

1. Paula: Hi, this is Michelle
2. Bonjour, mes belles amies
3. Have fun, Paul
4. Hey, Paul, how are you?
5. Hello!
6. Chop, chop for now, Spam
7. Sy-en-arah, Cori
8. Hi Mike, how's it goin'?
9. OK, Cam here
10. Gotta go for now, we'll see ya, Svenn

END

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FIN