An Assessment of Group Support Systems Experimental Research: Methodology and Results

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Published in
Journal of Management Information Systems
Volume 15, Number 3 (Winter) 1998-1999
Pages 7-149

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ABSTRACT

By mid 1998, approximately 200 different controlled experiments had been published in 230 articles in refereed journals or major conference proceedings, which examined processes and outcomes in computer-supported group decision making. This paper is a concise overview of what has been studied and how: the systems, independent, intervening, adaptation, and dependent variables, manipulated or measured, and experimental procedures employed. Part I of the paper categorizes the contextual and intervening factors. Part II analyzes 1582 hypotheses resulting from pairings of independent and dependent variables. The results show that the modal outcome for GSS systems compared to Face-to-Face (FtF) methods is "no difference," while the overall percentage of positive effects for hypotheses that compare GSS to FtF is a disappointing 16.6%. Experiments with seven to ten groups per treatment condition working on idea generation tasks and using GSS technology show an improvement to 29.0%. These results are moderated by technology, process structure, communication mode, group factors, task type, the number of experimental groups per treatment condition, and the type of dependent variable measured. The purpose of this paper is to aid the GSS researcher by presenting detailed results of what has been studied and found in previous experiments, along with a discussion of what needs to be studied.

Keywords: Experimental, group support systems (GSS), research, methodology and results.

In the mid-twentieth century, there were many studies of small group decision making, generally in the "Face-to-Face" (FtF) condition, which compared the decision making of individuals to that of groups, and which explored variables related to group effectiveness. Good reviews of this tradition in social psychology include those by Hare [40], Shaw [77], Steiner [81], and McGrath [55]. Generally, it was found that small groups, left to their own devices, suffered many process losses: "The degree to which actual productivity approaches potential productivity is a function of the appropriateness of its processes relative to the task demands" Steiner [81]. Among the key variables, which have been observed to influence the effectiveness of small group decision making, are leadership and structuring of the group process. For example, imposing certain structures for interaction on small FtF groups, such as a strict agenda,

[1] *ACKNOWLEDGMENTS:* This research was supported by grants from the National Science Foundation program on Coordination Theory and Collaboration Technology (NSF-IRI-9408805, NSF-IRI-90155236), from NJIT (SBR-421090), and from the State of New Jersey Commission on Science and Technology to the Center for Multimedia Research. This is a revised and expanded version of papers presented at the 1997 and 1999 Hawaii International Conferences on System Sciences. Among the many people who have contributed to the program of research, in addition to the co-authors, are Kenneth Johnson, Rosalie Ocker, Ajaz Rana, and Murray Turoff. Special thanks are extended to Robert Briggs, Jay Nunamaker, Jr., and Vladimir Zwass for their help with this manuscript.

which force "rational" decision making, or brainstorming [68] or Nominal Group Techniques [92], can improve process and outcomes. Particularly during the 1970's, there were also some experiments exploring the effects of media such as the telephone (audio-only) or video plus audio ("videoconferencing") on small group decision making [e.g. 78].

Experiments on Group Decision Support Systems (GSS) make their first explicit appearance in the literature in 1982, in the Turoff and Hiltz [85] article entitled, "Computer support for group versus individual decisions." Preliminary results of a series of controlled experiments at New Jersey Institute of Technology (NJIT) comparing the process and outcome of groups using Computer-Mediated Communication (CMC) versus FtF communication, and of unenhanced or "plain vanilla" CMC vs. CMC with the addition of various tools or structures to support group decision making, also appeared there. With the exception of some experiments on CMC at Carnegie Mellon [e.g., 53], there was relatively little other published experimental work until after the mid-80's, and one seldom saw the term, "GSS." However, major programs of research were underway at the, Claremont Graduate School, University of Arizona, University of California at Irvine, and University of Minnesota and at the, as well as at NJIT, which would soon produce a flow of theoretical papers, empirical results, and well-trained and productive young researchers.

DeSanctis and Gallupe's seminal paper, "A Foundation for the Study of Group Decision Support Systems" [21] has been extremely influential in providing a common framework for research on GSS. They defined GSS as combining "communication, computer, and decision technologies to support problem formulation and solution in group meetings" (p. 589). They also presented a "contingency" theory to help explain why GSS is not always beneficial; it would

depend upon whether the nature of the technology and structuring provided was appropriate for the group size (smaller vs. larger), the type of task, and the communication mode, of which they identified two: same place (FtF, or "decision room") and different place, or dispersed. They also touched on what would later become Adaptive Structuration Theory [e.g., 24, 70], with the statement, "The effectiveness of the technology depends on its appropriate design and use by the group" [21, p. 589].

Some important distinctions were later added to DeSanctis and Gallupe's [21] GSS theoretical framework. Johansen, [51, 52] and Ellis Gibbs, and Rein [27] provided a time and space taxonomy for the support of real time meetings to non-real time interactions (asynchronous CMC). This was further incorporated into a three dimensional (group size, group proximity, and time dispersion) taxonomy of environments by Dennis and associates [15]. For example, CMC can be same time (synchronous), or different-time (asynchronous); in many ways, these are totally different media, in terms of their effects on group communication processes. Pinsonneault and Kraemer [69] make a related distinction between Group Decision Support Systems, "GDSS" and "GCSS" or "Group Communication Support Systems," which they observed as having "similar impacts on some aspects of group processes and outcomes, but opposite impacts on other aspects" (p. 143). The term GSS is used more frequently than GDSS.

PART I METHODOLOGY

1.1 Introduction

In this exhaustive review of the literature, we located 200 different empirical studies that met our criteria for this analysis. First, the study had to be published in a refereed journal or conference proceeding; e.g., unpublished dissertations or conference presentations or book chapters are not included. Secondly, they were studies of groups, which we defined as

comprising at least three members. Simmel [79, 80], was the first to convincingly make the case that a dyad is fundamentally different than larger groups, because the triad is the smallest size aggregation in which there can be a "majority" which stands against a minority. Third, they used a computer-based GDSS or GCSS with at least minimal features designed to support group communication and decision making processes. Finally, the study was actually a controlled experiment: there were two or more conditions deliberately created and contrasted; other variables were controlled in some manner; and there was at least one independent and one dependent variable, which was measured and statistically analyzed.

Everything that we could locate, published in English and available by mid 1998, is included. A few studies fail to meet one or more of these criteria, but are cited heavily in the literature, or seem to be significant studies, so they are included as "non-conforming studies," and identified as such at the at the end of Appendix 1. Undoubtedly, there are a few studies that we missed, and, of course, more are being published almost weekly, so it is impossible to ever be completely "up to date."

There are several prior summaries of GSS studies, of which Benbasat and Lim [3] is the most comprehensive; others of note include [16, 38, 44, 56, 57, 69]. However, none of these prior summaries include more than about 50 studies, since they were made before the great flood of GSS publications in the mid-1990's. In addition, none of them use as comprehensive a framework for gathering information and putting it into a common terminology so that the procedures and results can be compared and statistically analyzed.

1.2 The Theoretical Framework

Theoretical frameworks are designed to aid in the understanding and the design of empirical investigations. A number of representative frameworks were utilized as the core from

which we originally extracted a comprehensive factors model, including DeSanctis and Gallupe [21], Jalassi and Beauclair [47]; Dennis George, Jessup, Nunamaker, and Vogel [15]; Pinsonneault and Kraemer [69]; Poole and DeSanctis [70]; Hiltz, Dufner, Holmes and Poole [42]; and Nunamaker, Dennis, Valacich, Vogel, and George [65]. This integrated framework was developed to provide complete coverage of factors present in the literature as a whole and has been previously published [34]. Since that time, we have refined the framework based on reviewers' suggestions about factors that could be placed differently in order to improve the logic of the model, and comparison of the initial theoretical model to the actual variables appearing in the empirical studies. The result appears as Figure 1, which will be only briefly explained here; see Fjermestad [29, 31] for a complete description. This integrated theoretical framework is conceptualized as consisting of four major categories of variables: Contextual or independent variables; Intervening variables; group Adaptation processes; and Outcomes. Of these, the Contextual and one of the Intervening variables that have been studied (methodology) will be summarized in Part I of this paper, along with the experimental methods and procedures that have been used; these are shaded in Figure 1. Part II will analyze the Adaptation and Outcome factors.

The Contextual factors are all external or driving variables that comprise the environment or conditions for the decision making task. It is from these that the "independent variables" manipulated in any given experiment are generally chosen. For any one experiment, they are (relatively) fixed or controlled. These include characteristics of the particular technology (GSS) being used, of the group, task, environmental, and organizational contexts.

Intervening factors, which also affect the group interaction, are derived from or added to the set of conditions created from the context of the group decision sessions. For example, the

methods used by the group may vary as to session length, number of sessions, and presence and role of a facilitator. These factors can change from session to session, if the "meeting" goes on over a period of time, and thus are somewhat dynamic, rather than static. The variables we have categorized as “intervening” are often treated as co-variates or moderator variables in the analysis of experimental results, but are sometimes treated as dependent variables.

The second set of dynamic factors is the Adaptation (adaptive structuration) or interaction process of the group. This includes such things as their level of effort, their attitude toward the GSS, and participation patterns. They are the variables that are controlled by the group on an individual or collective basis.

Finally, the Outcomes are the result of the interplay of the intervening factors and adaptation of the group with the contextual factors. These results or dependent variables include efficiency measures (e.g., calendar time to decision), effectiveness measures (e.g., decision quality), usability of the system and methods used, and subjective satisfaction measures.

Figure 1

1.3 The Studies and Their Categorization

The studies that are included in this analysis are included are listed in Appendix 1. Their accompanying methodological data are presented as Appendix 2, and results, comments, and conclusions of each experiment are presented as Appendix 3. The results of some experiments were presented in more than one paper; in fact, in a few cases, almost the same paper was published in two places. If the design of the study and the number and description of the subjects were exactly the same, the different papers were determined to be on a single experiment, and were given only one number. If the results of an experiment were first

published in a conference proceedings and subsequently published as a journal article, we refer to the journal as the "primary" (or definitive) publication, and to the conference proceedings as the "secondary" publication. On the other hand, some papers presented multiple experiments; in this case, the different experiments were given notations of "experiment 1," "experiment 2," etc. We thus have a total of 230 papers representing 200 different studies.

One problem in locating experimental studies is that GSS is an interdisciplinary field, spanning the boundaries of Information Systems, Management, Computer Science, Social Psychology, and Communication. There are 37 different journals and seven conference proceedings represented in the list of publications. The Hawaii International Conference on Systems Sciences (HICSS) is the most frequent forum for presentation of GSS studies; a total of 57 studies have appeared only in HICSS proceedings thus far, and another 23 were published there first, and subsequently in a journal. Seventeen papers have been published in *JMIS*, thirteen in *Small Group Research*, eleven each, in *Information & Management* and in *MISQ*. The complete list of outlets is shown in Table 1.

Table 1

We have previously mentioned that the "flood" of GSS studies is a phenomenon of the 90's. This is very apparent from the following count of journal (Table 2) and conference proceedings (Table 3) publications by year.

Table 2

Table 3

These experiments represent a large investment of time and money by a large number of researchers, funding organizations, and subjects. We suspect that the tremendous popularity of the World Wide Web and web browsers will see a new surge of interest in GSS, particularly of the distributed and asynchronous variety, now that "user friendly" GUI's and "multi-media" can be included in the group support systems. It is very important that the research community have a complete understanding of what has been studied thus far and what has been studied little or not at all; of "what we know and what we don't know" about GSS effectiveness, in order to design future studies that will optimally contribute to our knowledge of how to build and use these systems. That is the objective of our comprehensive analysis.

The major aspects of the methodology and findings of experiments on GSS have been put into a data base and organized into a large chart, (Appendix 2, An Assessment of Group Support Systems: Methodology; and Appendix 3, An Assessment of Group Support Systems: Results). Figures 2 to 4 are summary counts of the variables from Appendix 2; note the order of variables in these figures matches that in Figure 1. Figures 2 to 4 are organized into two primary sections: independent variables (labeled with an "I"), and moderator variables (the parameters of the experiment as listed by the researcher). All counts in these figures represent the number of experiments. For example: in Figure 2, Time Dispersion lists three groupings (synchronous, asynchronous, and synch/asynch) which total to 200; Task Support: Tool totals more than 200 because researchers generally used more than one tool in an experiment.

1.4 Method

All studies were categorized and coded by the authors and then put into a data base [35] which uses the experiment as the unit of analysis, and records and reports the results at the level of the individual hypothesis within each experiment, yielding a total of 1582 independent-

dependent variable pairings. The following information was recorded and stored in the data bases:

- Experiments classified by author number and experiment number.
- Journal: Journal, conference, and year.
- Design: Experimental design type (i.e. 2 X 1).
- Experiment parameters: group size, groups per treatment condition, total number of subjects, session lengths, number of sessions, etc.
- Contextual factors: established versus ad-hoc subjects, type of subjects (student, graduates, and professionals), leadership, facilitation, and culture.
- Technology characteristics: type of GSS/CMC, brand name, time (synchronous/asynchronous), proximity (decision room, distributed).
- Task characteristics: Task type, complexity, and task name.
- Independent Category: Independent variables grouped into 7 categories (context; group; method; process structure; task; task support; and technology).
- Independent variables: 347 variables from the 200 studies; 29 unique variables.
- Dependent Category: Represents 11 categories of dependent variables (consensus; effectiveness; efficiency; process gain, loss, and variables; roles; satisfaction; structuration; and usability).
- Dependent variables: Representing 946 dependent variables, before combining similar variables into categories, 120 unique dependent variables.
- Effect: 4 categories of results: 0- no effects; 1- positive effects i.e. GSS > FtF; 2- negative effects i.e. FtF > GSS; 3- no measures (researchers do not always report main effects); 4- other effects i.e. interaction effects.
- Outcome: Represents 97 different outcomes from the experiments.

1.5 What Has Been Studied: Contextual Factors

1.5.1 Technology

Task Support: Researchers have used task support as an independent variable 12 times. Of these, cognitive feedback (statistical) has been used seven times (Figure 2).

Task Support-Tools: The tools and procedures used are the fundamental cause of the expected changes in process and outcome; yet, most experiments seem to (falsely) assume that all GSS's are a standard "package" that will have the same effect.

Figure 2

The most frequently used task support tool is Brainstorming (44 studies) for idea generation, followed by voting (35) or some other form of ranking or preference rating (20 studies) for support of preference or decision making tasks. It is interesting to note that research on FtF groups suggests that Nominal Group Technique (NGT) is more effective than brainstorming for idea generation [92]. However, NGT and alternative structures such as Dialectical Inquiry have generally not been built into GSS software. Though such structures for interaction can conceivably be created solely through facilitator guidance or instructions to group members, the only way to assure that they are followed is to embody them in software. It appears that there has been a tendency for the first tool tried to be accepted uncritically by subsequent system designers.

A software-supported ability for a group to build a list and an imposed agenda are described for five studies each; none of the other specific tools have been used more than four times. In many instances the basic set of tools provided with the software was available for use by the subjects. Hiltz and Turoff [43], Nunamaker, Dennis, George, Martz, Valacich, and Vogel [63] and Dickson, Poole and DeSanctis [25] provide reviews of the tools available with EIES2, GroupSystems and SAMM, respectively.

Process Structure: There have been 68 experiments that have manipulated process structure. Of these, decision process has been investigated 25 times. Anonymity was used as an independent variable in 13 studies and proximity in nine studies. Overall, 138 out of 200 studies have used identified subjects, where as 27% (53 studies) used anonymous conditions.

The "level" of the GSS or CMC system is a rough coding of its sophistication in terms of GSS features, and follows the descriptions of "level 1" and "level 2" systems by DeSanctis and Gallupe [21]. The majority of the systems used (60.5%) are level 1 systems, and another 3.5%

compare level 1 and level 2 systems. Some of the CMC systems are actually just email and are not structured to keep an organized and searchable record of the group discussion, as a conference is, but if that was what was used, it is included. However, ten of the studies use CMC systems so "poverty stricken" that we have labeled them "level 0" because they do not provide even the minimal features that would facilitate a rich group discussion. The most restrictive and limited of these are systems with fixed screens designed with fields to be filled in to support highly structured decision making for a specific task. For instance, for a "choice dilemma" task, the screen might have a field for the short problem description, and a field for inputting a number between 1 and 10, which is the "answer" to the choice. At the bottom of the screen of these "level 0" CMC facilities there is often only a single line, or in some cases, only a half of a line, which is the entire space allowed to compose and send free text communication to other group members. "Chat" systems with split screens that allow one to view only a few lines of text, provide little or no editing, and display what everybody is typing as they type it, letter by letter, are also classified as "level 0." They give the users no control over what they see and what and when they send, nor do they support the communication of well thought out and edited contributions, or a reviewable transcript of the group discussion. Many of these "level 0" systems also send everything anonymously automatically, which is hardly conducive to responsible group discussion behavior. One wonders if these systems were designed to inhibit group discussion rather than to support it!

In addition to the type of system, proximity and time dispersion was classified. Figure 2 shows that by far the majority of studies to date (132 of the 200, or more than two-thirds) are in the Decision Room environment. An additional 19 studies used a condition with dispersed (two or more linked) decision rooms, and 24 studies compared a Face-to-Face with a dispersed

condition (most frequently CMC, synchronous or asynchronous). Only sixteen studies utilized a fully distributed (asynchronous; different times and places) condition, plus two more that compared synchronous with asynchronous time dispersion.

The majority of studies (70.5%) did not employ a group facilitator to help coordinate the interaction. In addition to contrasting facilitated with non-facilitated groups, one can purposely vary facilitator style, e.g., a technical facilitator or "chauffeur" vs. a process facilitator or a human facilitator vs. automated facilitation. Most studies using GSS simply confound facilitator presence and style with mode of communication. Nine experiments have examined facilitation as an explicitly manipulated factor.

Communication Mode: By far the most frequently manipulated variable is communication mode, studied in a total of 119 experiments, or about 60% of the total. The most common contrast is unsupported FtF groups vs. GSS supported FtF groups (55 studies). This is followed closely by 24 studies comparing groups communicating FtF vs. CMC. A problem in many of these studies is that the tools or processes built into the GSS or CMC or other type of computer-based system, are not available in any form to the FtF groups. Only six studies included a full range of three modes: the unsupported FtF or "baseline" groups; FtF groups that are given manual versions of the tools and processes (e.g., facilitation or an agenda or a decision process); and the computer-supported condition. This is the only way to avoid confounding the tools or processes or other supports, with the mode of communication.

The Group Support Systems used have been classified into three primary types: "DSS" (Decision Support Systems) GSS, or "CMC" (Computer-Mediated Communication). A DSS is designed to support an individual decision maker; six of the studies employed this sort of system, generally with one terminal available to the group to look at. "GSS" refers to a system primarily

designed for a "decision room" application or other synchronous (same time) situation, which allows communication to take place via audio and/or video media. The GSS consists of tools to enforce structure (e.g., anonymous brainstorming) on portions of the group's communication and deliberation, or to assist decision making (e.g., voting tools). The majority of the studies (67.5%) used a GSS.

CMC refers to a system designed primarily to support group discussion, such as a computer conferencing system, that may or may not have GSS tools included. A total of 59 studies (29.5%) used a CMC system.

Design: There have been only ten studies, which have compared GSS systems, or two or more tools within a specific system. In terms of specific software, the most frequently used system has been Arizona's GroupSystems (or its predecessors, EDS/EMS/EBS, PlexCenter, and Plexsys), used in 64 studies. Minnesota's SAMM was the platform for 18 experiments, while NJIT's EIES or EIES2 was used in ten published experiments, and unidentified or miscellaneous CMC's in 22. Though a variety of systems have been studied, almost half of the experiments used one of these three specific systems; thus there is a very real question of whether the findings thus far might be unduly dependent upon the characteristics of these specific systems.

1.5.2 Group

The group variables (see Figure 1) have been treated either as independent or as moderator variables and are labeled accordingly in Figure 3.

Figure 3

Group Size: Sixteen studies have used group size as a manipulated variable, with small vs. medium sized groups (e.g., 6 vs. 12) as the most frequent choice. Only one study varying group size used groups larger than 12.

Group composition is even more troublesome; only 11 (or 5.5%) of the groups were established rather than ad hoc, and over 90% use students as subjects. Twenty-four studies used group composition as an independent variable or co-variate. Members' degree of knowledge or skill related to the task is the most frequently studied (7 experiments). Such potentially important factors as gender composition and the use of established versus ad-hoc groups have been studied in only four and three experiments each, respectively.

Member Characteristics: These potentially include any attributes of individual members, such as their attitudes, personality traits, age, or previous experience with systems or tasks. Only five different member characteristics have been studied, and except for leadership, each has been used only in a single experiment.

Leadership: One very surprising finding is that out of the 200 studies reported there were 188 or 94% that did not have leaders for the groups. This is surprising since most real work groups have a team or project leader.

Subject Type: Undergraduates were used as the subjects in 73% of the experiments; 6.5% used professionals, and only 8% used solely graduate students. Remus [74] reported that undergraduate subjects made poorer decisions than did part-time MBA subjects (who were all professionals working on an MBA degree). This study is important because the objective of the technology is to improve effectiveness. Remus' study documents that it is the interaction of experience working with the technology that produces effective performance. The experienced

managers made less costly decisions, used more effective heuristics, and were less erratic than undergraduate students.

In another study [28] retired professionals were compared with active professionals, with and without technology (CMC versus no-CMC). An interaction effect between retired and CMC treatments (retired with CMC out performed any other combination of groups) was found. CMC groups were more satisfied with the group, the process, and had higher quality decisions. The fact that there can be an interaction between type of subject/user and the effectiveness of the technology emphasizes the need to experiment with a variety of types of subjects. The issue of the generalizability of the results of GSS experiments, when they are so heavily based on the use of students, as subjects will also be further explored at the end of this assessment.

In a more recent study, Briggs, Balthazard, and Dennis [4] suggest that there are no significant differences been executive managers and graduate business students in evaluating technology. However, the results do not shed any light on a comparison of decision making skills and effectiveness.

1.5.3 Task

Task is the primary reason for the group to exist. Poole, Siebold, and McPhee [72] suggested that it alone could account for 50% of the variance in group performance.

Type: McGrath [55] developed a task typology, which consists of eight different task types within four categories. The graphical representation of this typology differentiates tasks on two dimensions. The first dimension classifies tasks on the basis of outcome: intellectual (e.g., a decision) or behavioral (e.g., a "product" or action). The second dimension uses the type of behavior of group members (convergent or cooperative, vs. conflicting). This results in eight task types.

We re-coded task type to make the categorizations match the descriptions given by [55, 56]. It was interesting to note that some tasks had been described as belonging in two or three different categories, by different authors. What we see is that only 4 studies used Task type 1 (Planning), and only one used task type 6 (Mixed-motive, resolving conflicts of motive or interest). The most frequently used task type (used 104 times or 52%) is the preference or decision making task (type 4), for which the preference of the majority is taken as the correct answer because there is no objective measure of quality. The second most frequently used task type is creativity (generating ideas, brainstorming), employed in 39.5% of the experimental sessions. Intellective tasks were used 31% of the time. The intellective tasks include the hidden profile tasks that can also be labeled as decision making and cognitive conflict tasks. Given the laboratory settings of these studies, none used tasks purely in the "execute" quadrant, which includes psychomotor behaviors and contests or battles, though one experiment did have a performance aspect, flying paper airplane [2].

Task complexity has been varied in five experiments, while 30 have varied task type. The most frequent task type contrast chosen for experimental design is intellective versus decision making (preference) tasks, a contrast included in ten experiments.

1.5.4 Context

This includes environmental and organizational variables. Given that most studies have used students in U.S. universities, for a single session, it is not surprising to find that few context variables have been studied. Assessment of prior experience with a system was varied in 32 studies. Culture (e.g., Singaporean vs. American) has been looked at in nine experiments. Obviously, this is an area of great neglect.

Another surprising finding is that there were 17 studies that investigated the effects of experience in a GSS environment. This is important since it does take time and practice to become familiar with the task, technology and interaction [56]. Time pressure was also manipulated in two studies.

1.6 What Has Been Studied: Intervening Factors

The intervening variables include two major categories of variables: methods and summary constructs (summary constructs are beyond the scope of this paper, see [29]). Methods represent the basic tools that are available to the experimenter, such as experimental design, task implementation, session length, number of sessions, and training (Figure 4).

Figure 4

1.6.1 Method

Experimental Designs: Single independent variables (with 2-5 conditions) were used in 73 (36.5%) of the experiments. The 2 x 2 factorial design is the next most popular, accounting for 30.5% of the experiments, with various other factorial designs accounting for another 33%. In most studies, subjects served in only one experimental condition, but repeated measures designs were used in 24% of the experiments.

Training is the opportunity for the group to become familiar with the system itself, the tools to be used, the procedures to be followed, and the other group members, before being presented with a task to perform and generally a time limit in which to accomplish this task. Sixty-seven studies do not report on this important detail of the methodology at all. Another 74 mention that some sort of training was given, but no details are provided. A total of 11 studies

gave the group a practice task as part of their training. When training is reported, it generally is of very short duration; the mode is only 5 to 10 minutes. Only fifteen studies used a total of an hour or more of training before the group task was assigned.

The training variable is also notable because not a single study has specifically varied it to determine the effects of various types and amounts of training.

Number of Sessions: 73.5% of the experiments have involved the group members in only a single problem solving session; they thus had no opportunity to exhibit much "adaptive structuration" of their use of the system based on experience. Fifty-one studies have been longitudinal (two or more sessions lasting one week to one year in duration); specifically looking for possible changes over time. Our theoretical framework suggests that adaptive structuration will be an important process influencing the outcomes of technological support for group decision making; and such group learning and reshaping of the technology in use takes time to unfold. Experiments using longitudinal designs tend to show that groups require some experience in order to learn how to coordinate their interaction using technological supports, particularly if they are using spatially distributed or asynchronous modes of communication. For example, Chidambaram and colleagues [10] concluded on the basis of an early experiment using a longitudinal design that GSS groups need time to learn the system, and a later study [9] concluded that asynchronous GSS groups require more than four sessions to learn how to interact via the technology in ways that overcome its limitations. Hollingshead and colleagues [45], in an experiment lasting 13 weeks, found that FtF groups significantly outperformed CMC groups for the first five weeks, but not in the last four weeks. Thus, both theoretical expectations and empirical findings suggest that the results of single session studies, especially those lasting less than an hour total, will not be very generalizable to organizational use.

Number of Subjects: Many of the experiments suffer from a low level of statistical power because of the use of an inadequate total number of subjects, groups, and/or groups per cell. For example, 21 studies use a total of less than 50 subjects and 78 (38%) use a total of fewer than 20 groups. Almost 40% of the experiments fail to consistently provide a groups per cell size of five or larger, which might be considered a minimum to have a reasonable chance of detecting significant differences. Only 92 (or 46%) had at least 10 groups per cell, which generally provides fairly good statistical power (see Part II for a more detailed discussion).

Group Size: The modal group size is three; this is probably because one can obtain the largest number of groups with the smallest number of subjects, with this group size. Four is the next most popular, followed by group size five, probably for similar reasons; making a total of 40% of the experiments using group size of 4 or fewer members. Many experiments did not rigidly control group size; e.g., 23 studies reported a range of 3 to 8 subjects per group, 24 experiments reported a range of 4 to 8, and another 14 reported a range of 5 to 10. Altogether, only eight studies, or 4%, used group sizes 10 or larger, which might be considered a dividing line between small, and medium to large sized groups.

A second categorical ordering of group size is also shown in Figure 4. Groups of size 2 to 5 were used in 144 experiments (72%), size 6 to 10 subjects in 19 studies (9.5%), and groups of 11 and larger in only 3 studies. Yet, as we shall review near the end of this assessment, both theory and empirical evidence lead us to believe that GSS tools and processes can be most beneficial for medium to large sized groups, rather than for very small groups such as those with only 2, 3, or 4 members.

Task Implementation: This includes the specific tasks used, as well as the instructions and specific wording, and the amount of time allowed. Over 140 different tasks were used, but

some tasks have perhaps been over-used, such as the Foundation task (20 experiments). Figure 4 shows the most often used tasks. These eleven tasks have been used in a total of 92 instances. The advantage of using a task that has been studied in many other experiments is that one can make some indirect comparisons of results. The disadvantage of over-use of a specific task is that the body of findings from experiments may be an artifact of a narrow range of specific tasks on which they were based.

Session Length: Almost a fifth of the studies failed to report the length of the task, which is an important methodological detail. Of those reporting a session length or upper limit, 25.5% took less than half an hour. These tasks must have been extremely simple. Another 24.5% took between 31 and 60 minutes, and also could not be considered very complex tasks if they could be completed in such a short time. Four studies investigated task complexity [7, 37, 41, 97] and found that as task complexity increases, the decision quality and depth of analysis improve in groups using GSS. Thus, it is of concern that the majority of experiments studying the effects of GSS used short, simple tasks that are probably least likely to need or benefit from technological supports to the decision making process.

1.7 SUMMARY- METHODOLOGY: What Needs to Be Studied?

It must be emphasized that the following conclusions are based solely on GSS studies using controlled experiments (laboratory or field) as the methodology. We plan to do a similar survey of empirical studies using other methodologies (e.g., case studies, and surveys) in the future. Undoubtedly, such data will exhibit different patterns.

1.7.1 Gaps in the Experimental Research

The field of GSS is no longer new; all experiments published in the future should have strong methodology and documentation. This includes adequate cell sizes, training times, and descriptions of the specific task, system, tools, and facilitation used.

Table 4 summarizes our findings. The majority (90% of 230 papers) of experimental GSS studies have been published in 1990 or later. Unfortunately, the scope of this body of work, and its external validity/generalizability for "real" problem solving groups is weaker than would be hoped. And despite the relative recency of this body of work, most of it was done on what is already "outmoded" technology, given the increasing persuasiveness of graphical user interfaces (GUI's) such as Netscape™ and of hypertext and hypermedia systems embedded in the World Wide Web. This is not necessarily the “fault” of the experimenters, given the rapidly changing technology, lack of software, and academic equipment budgets, which often do not make it possible for research facilities to stay at the state-of-the-art. However, this situation does suggest that perhaps some earlier experiments (particularly ones in which ‘no difference” was found between FtF groups and GSS supported groups using what would now be considered “outmoded” systems) should be replicated using Web-based GSS or conferencing systems, to see if the newer systems are more effective.

Table 4

The vast majority of experiments have concentrated on only a few of the potentially important variables that should be studied. Notably, though a large proportion of future use of GSS will probably be in fully distributed (asynchronous) or mixed modes conditions, most of the experiments have been conducted in same time/same place "decision rooms."

The tasks on which research has been conducted are clustered heavily in the "preference" and "brainstorming/creativity" sectors of the McGrath [55] typology. This makes it difficult to obtain any objective measures of decision quality so that the relative effectiveness of different modes and tools can be assessed. Very few experiments have been conducted in the "difficult" task areas of planning, negotiation, and conflict; however, if a system is to be employed for the full range of group tasks that must be accomplished in long term, complex projects, these are necessary group tasks to support.

More worrisome than task type is the apparent lack of complexity of the tasks used in most experiments. Exactly 50% (100 out of 200) of the tasks took less than an hour total for the GSS groups to learn the technology, adapt to the group, and agree on a decision or course of action. Generally, one would imagine that if an organizational group feels that it needs technology to help support decision making, it would be because the task was complex and lengthy. If not, then acquiring and/or traveling to a special computer-based facility and learning how to use it would undoubtedly seem like more trouble than it is worth!

The nature of the individual subjects and the distribution of group sizes used in most GSS experiments are also of concern. Only 5.5% of the studies used established rather than ad hoc groups, and over 90% used students as the subjects. Using students has some advantages, since the relative homogeneity of the subjects removes a source of uncontrolled variance, and since most of them are familiar with computer keyboards and do not require extensive training to acquire the basic skills necessary to use a GSS. However, their motivation to maximize effort and quality of decision is questionable, and they may also tolerate with things that "real" users would never tolerate, because they are used to doing as they are told by their instructors.

Group Size, Task Characteristics, and GSS Effectiveness: In terms of group size, most experiments used groups of five or fewer subjects. Yet, we know that GSS is generally most helpful for larger sized groups. An Arizona study [20] comparing small (size 3), medium (9), and large (18) groups showed that the larger the group using the GSS, the better the performance and satisfaction of the group. Another pair of experiments using GroupSystems varied group size from 2 to 12 and concluded that the advantages of electronic brainstorming consistently become more pronounced as group size increases [36]. Every other study varying group size [1, 18, 19, 20, 36, 46, 86, 87, 89, 91, 96] also showed larger groups out-performing smaller groups using GSS.

One study [91] compared homogeneous to heterogeneous knowledge. The results suggested that greater performance gains were achieved for heterogeneous, large groups.

Two studies investigating task complexity [7, 37] found that as task complexity increases, the decision quality and depth of analysis improve in groups using GSS. Thus, the limited evidence which exists suggests that complex tasks and larger heterogeneous groups will benefit more from GSS, yet the experiments to date have mostly used small homogeneous groups with simple tasks.

1.7.2 What Needs to be Done

There is a need for future experiments to place more emphasis on the use of larger groups of non-student subjects, using more complex tasks over a longer period of time than has been typical. It is also time for more experiments to use a design which explores how factors such as group size and task type and complexity interact with specific types of tools and processes that can be provided by GSS, rather than simply comparing GSS to baseline or "manually supported" face-to-face groups.

More importantly, there have been no published experiments utilizing "anytime/anyplace" systems: the use of combined modes used by task groups, over a period of time. Likewise, state-of-the-art multimedia and/or Web-based systems need to be compared to the prior generations of "flat" text systems. In sum, despite over 200 experiments, there are whole domains of GSS that have been left unexplored.

Part II - Results

2.1 Introduction

In this part, we will summarize the findings of the experiments, in terms of the adaptation and outcome factors studied (listed in the unshaded portion of Figure 1), and the generalizations that can be made on the basis of variables for which numerous studies have been conducted. We analyze and summarize the findings of the body of experimental work on GSS by conducting statistical analyses on a database that includes 1582 hypotheses. The objective is not just to summarize what has been studied and learned in the past, but to point to potentially fruitful research directions in the field for the future. What areas have been relatively neglected and are in need of further study? What kinds of GSS configurations appear to have relatively better impacts than others, and to thus be promising for further development and study?

First we describe the methods used to conduct this analysis. Then we will look at the overall counts for what adaptive and outcome variables have been used (Figures 5 and 6). This is followed by a summary of results for the most frequent experimental design, which compares GSS to the non-supported FtF mode, in terms of the kinds of outcomes for which GSS's are more or less effective (Table 5). Then we ask, under what experimentally induced circumstances (corresponding to the shaded portions of Figure 1) is GSS most effective (Table 6)? The remaining tables and sections of analysis begin to explore the data that lie underneath Tables 5

and 6 by looking at the details of results for sets of independent and control variables for which there are a substantial number of studies: group proximity, anonymity, time dispersion, GSS levels, communication mode, group size, task type, session length and number of sessions. We will also examine several of the major hypotheses (Other and Interaction Effects) where the researcher tested something other than GSS > FtF. Finally, we recommend directions for future research.

2.2 Method: Analysis vs. Meta-Analysis

A meta-analysis works with percent of variance explained. Unfortunately this statistic is not reported in a large number of published studies. For this assessment, we strove to include all experimental results, even those which employed non-parametric tests. The unit of analysis is the hypothesis; results are included in our counts for "positive" or "negative" effects only if they were significant at least at the .05 level.

It must be noted at the outset that the statistical patterns discovered in this analysis do not "prove" causation. Because of the strategy of the analysis, hypotheses tested using poor methodological procedures (such as a small number of subjects or of groups, or an invalid operationalization of variables) are given the same weight as hypotheses tested using excellent experimental procedures. And, of course, there is the danger that apparent correlations are spurious, due to confounding with other variables. For example, we note that somewhat inexplicably, groups sized 6-10 result in substantially poorer outcomes than groups which are either smaller or larger. It could be that experiments utilizing this group size also were more likely to measure negative outcomes than other experiments, or were more likely to use too few subjects and groups to detect significant positive effects. Such patterns suggest areas for careful experimentation in the future and/or multivariate analysis of the experiments in our database.

2.3 Frequency with which Process and Outcome Variables Have Been Studied

For the analyses presented in this part, the database consisting of 1582 independent-dependent variable pairings was tabulated in terms of categories of the adaptation and outcomes factors that have been used in the experiments. Four hypotheses tested summary variables from the intervening factors category and these are included as part of the 1582 hypotheses.

2.3.1 Adaptation Factors

Figure 5 shows the total number of hypotheses tested in all the GSS experiments, which examined each of the types of variables classified as "Adaptation Factors." According to Adaptive Structuration Theory [22, 23, 70, 71], the effects of single elements (such as technology and task characteristics) do not determine group outcomes, but by a complex and continuous process in which the group appropriates those elements. These factors have been relatively ignored in GSS experiments; only recently have they been treated in a number of studies, with a total of 46 tested hypotheses appearing in the literature. The four dimensions of the construct have to do with how the system is transformed into rules of interaction and resources that are actually used: level of use, attitudes toward the GSS, level of consensus, and level of control. Measures of attitude toward the system and degree of comfort with it account for 27 of these hypotheses, with the other dimensions looked at very infrequently. The process variables have been examined in 146 instances. The most frequently studied ones are effects on participation equality and the related dimension of relative influence (98 hypotheses total). Process issues have been examined 44 times, with the concepts of social pressure and social information processing accounting for the majority of these.

Figure 5

Experimenters have been relatively optimistic about how GSS would affect process: they have studied process gains more frequently (142 tests of hypotheses) than process losses (71). Within the category of process gains, the most frequently studied phenomena have been effects on choice shifts (also called "risky shift" studies, because of the generally observed tendency for groups to make more risky decisions than individuals), with 30 hypotheses tested. The tendency of GSS to increase the number of critical comments made by group members has been examined 23 times. The most frequently studied process losses are production blocking, flaming, and evaluation apprehension, with 13, 15 and 19 hypotheses tested, respectively.

Intermediate role outcomes is a relatively new category set of dependent measures [98] and have been studied in 22 instances. Leadership roles and issues have been examined in only ten hypotheses.

2.3.2 Outcome Factors

Of all the dependent variables studied (Figure 6), it is natural that various aspects of group effectiveness have received the most attention (56%, 617 out of 1103 total outcome factor measures). Aspects of decision quality, such as overall quality, idea quality, etc. have most frequently been measured. Productivity (167 measures) has often been measured in terms of the numbers of ideas, alternatives, or comments generated. Surprisingly, creativity (assessed directly in contrast to counting the number of ideas generated- see Ocker, et al, [66, 67]) as an aspect of the quality of the group product has been studied very little, with only six tested hypotheses.

Communication has been measured in 162 instances. Of these, measures of the number of comments have been examined 148 times.

Figure 6

Various dimensions of subjective satisfaction are next most studied after effectiveness (280 times, or 25% of the hypotheses), including process satisfaction, decision satisfaction, general satisfaction, etc. Of the remaining outcome variables, efficiency (97 hypotheses) is most often measured in terms of decision time. Consensus has been studied much less frequently (67 times) than effectiveness or satisfaction. Finally, system usability as an outcome has been measured (42 instances) in a variety of ways, but most frequently as willingness to work together again (9 times).

2.4 Tests of Hypotheses

What are the results of all these tests of effects on dependent variables? In order to try to make sense of the findings, we have identified several sets of independent variables that have been explicitly tested or at least recorded quite frequently, the specific type of GSS used (synchronous, asynchronous, etc.), mode of communication, group size, and session length (which may be considered as a proxy for task complexity). For all studies testing hypotheses which compared GSS to face-to-face (FtF) communication modes, these independent variables have been cross-tabulated by all dependent variables combined, and for separate groups of dependent variables (satisfaction, consensus, efficiency, effectiveness, all structuration or process variables, and usability). The following sections present the results of these analyses.

The results for Table 5 are shown in terms of the proportion of studies comparing GSS to (unsupported) FtF which resulted in "positive" effects (GSS results were significantly better than FtF results, at the .05 level), "negative effects" (FtF was better than GSS), or no significant effects; as well as the number of studies using these variables for which no main measures were reported, or for which relationships other than contrasts between FtF and GSS groups were

tested (other effects and interaction effects). The columns labeled “Percent Positive Effects” or "Percent Negative Effects" are the ratio of significant “positive” or "negative" findings to the total number of "positive" plus “negative” plus “no effect” findings (i.e. the No Main Effect Measures and Other Effects & Interaction columns are not included). The “Ratio Positive/Negative Effects” column computes only the ratio of positive results to negative results; 1.0 would be equal, for instance, and numbers greater than 1.0 indicate that positive results are more likely than negative results in the body of completed experiments. In the discussions, in determining which variables have produced the most positive results, we must take both of these ratios into account.

2.4.1 Which Independent Variable Manipulations Have Most Frequently Resulted in Significant Differences Between GSS Supported and Unsupported Groups?

Table 5 shows the hypothesis counts for all of the independent variables. The first independent variable category examined is technology, following from Figure 1; 63% of all the hypotheses have been tested on some aspect of technology. The remaining 37% are divided among group (14%), task (13.5%), context (9%), and method, which account for less than 1%.

Table 5

The overall results, shown in the bottom row, indicate that there are 16.6% positive effects observed for all hypotheses tested in all GSS studies. Furthermore, negative effects very slightly out number positive effects (164 vs. 158, respectively), resulting in a ratio of positive/negative effects equal to approximately 1.0. The modal result is “no significant effects” observed, (628 out of the 950 hypotheses for which main effects for GSS vs. no GSS were reported). These are fairly discouraging results and suggest that a change in focus and/or methods of future GSS experiments would be advisable (see the discussion section at the end).

Communication mode represents 32.7% of the total hypotheses and 29.2% of all of the positive effects. Thus, ignoring the methods variables for which only four hypotheses measured main effects, "communication mode" is the answer to the question posed in the heading for this section.

Manipulations in process structuring have been examined primarily for the way they interact with technology, rather than for main effects (173 hypotheses). Section 2.5 of this part further discusses these other effects and interaction hypotheses.

The other Context Factors and Intervening Factors represent only 37% of the total hypotheses. These independent variable categories have resulted overwhelmingly in "no difference" and accounted for very few positive effects.

2.4.2 For Which Dependent Variables are the Results Most Positive?

In short, the answer to this question is the overall effectiveness of the group decision. Table 6 examines relative favorableness of results from the other direction, dependent variable categories. It gives the overall count by dependent variable (type and category) for the results of the tests of hypotheses.

Table 6

As we have noted above, for most dependent variables, disappointingly, "no significant difference" is the modal result. Negative effects are more prevalent than positive effects for many categories of dependent variables. Process gains were somewhat less likely with GSS than with FtF, as were outcomes categorized as "process issues" in Table 6, while process losses were just as likely to occur with GSS as without. Since GSS are generally intended specifically to increase process gains and decrease process losses, this is a most discouraging result.

The (important) exception to these dismal results is the key dependent variable of effectiveness, which accounts for almost 40% of the measures and yields 21.0% positive results with a positive ratio of 1.7. The structuration variables, which only account for 2.9% of the total number of hypotheses, have 25.0% positive effects and a positive ratio of 6.0. However, for consensus, GSS had a negative effect in 15.4% of the tests, compared to positive results for only two hypotheses, yielding 7.7% positive outcomes for consensus. It is obvious that the relative lack of ability to reach consensus is a problem for groups using GSS.

2.4.3 Comparisons Among GSS Technologies

Table 7 shows the results by communication mode and the specific type of GSS technology, using all dependent variables. The results, in general, show that CMC systems have yielded about the same proportion of positive effects in contrast to GSS systems, (17.6% and 16.2% for CMC and GSS, respectively). GSS systems have a higher ratio of positive/negative effects, 1.3 to 0.7 for the CMC systems. However, there appears to be no substantial differences among the GSS decision room systems, the synchronous CMC systems, and the asynchronous CMC systems in terms of relative outcomes, when all dependent variables are considered.

Table 7

2.4.4 Comparisons Among Process Structures

Table 8 shows comparisons of process structures for which there are a substantial number of studies. These include: Anonymity, Time Dispersion, Proximity, GSS level, and Facilitation.

Table 8

2.4.4.1 Anonymous vs. Identified Conditions

As pointed out by Valacich et. al. [88] and by McLeod [58], anonymity has different components or "types." In some cases, the group knows who the members are, but cannot identify individual contributions. In other cases, members do not even know who belongs to the group. Individual contributions may be simply "anonymous," or not attributable to any individual; or they may use "pen names" or "pseudonyms," in which case there is a kind of a "personna" to whom a series of contributions is attributed. These different forms of anonymity may have very different effects. The overview of results in Table 8 combines all of these different forms of anonymity. Overall, there is an advantage in favor of identified versus anonymous conditions; e.g., 19.1% and 16.7%, respectively. However, anonymity is one of those variables for which interaction effects are especially prominent. For example, drilling deeper into the data set (not shown in Table 8), the positive effects increase to 24% for anonymous groups working on idea generation tasks and decrease to 13% and 10%, respectively on intellective and decision making tasks. Conversely, under identified conditions, the highest positive effects are on decision making tasks (22.6%), while lower levels are observed on intellective tasks (9.6%) and on idea generation tasks (18.8%). Thus, the results suggest that anonymity may be best suited for creativity tasks, for which GSS outcomes are relatively better than other types of tasks. The intricacies of the effects of anonymity are beyond the scope of this paper, and are worthy of a separate analysis and summary (see Section 2.5).

2.4.4.2 Time Dispersion

Synchronous studies account for 91.5% (1447 out of 1582) of all the hypotheses examined and produced 16.7% positive effects. On the other hand, asynchronous hypotheses only account for 7.4% of the total and resulted in 20.3% of the positive effects. Thus, the probability of positive outcomes is slightly better for the asynchronous technologies.

2.4.4.3 Proximity

Decision room settings account for 64% of the hypotheses that have been tested, and have produced 18.2% positive results (compared to 16.6% positive results for all proximity modes combined) and a positive ratio of 1.3 (compared to an overall ratio of 1.0). Distributed settings account for the other one third (35.9%) of the hypotheses and yield only 14.1% positive results. In addition, distributed settings have almost twice as many negative effects as positive effects (0.6). Thus, results are relatively more favorable for decision room conditions than for the various types of distributed (synchronous or asynchronous) conditions.

Obviously, more research is needed in the asynchronous and distributed areas. With the millions of people using the Internet and the proliferation of Web-based GSS and CMC systems, this is the type of system that is most likely to be used in the future, whereas most of the studies have been on synchronous decision-room GSS.

2.4.4.4 Levels

The "level" of the GSS or CMC system is a rough coding of its sophistication in terms of GSS features, and follows the descriptions of "level 1" and "level 2" systems by DeSanctis and Gallupe [21]. The majority of the systems used (65%) are level 1 systems, and another 3.4% compare level 1 and level 2 systems. Some of the CMC systems are actually just email and are not structured to keep an organized and searchable record of the group discussion, as a conference is, but if that was what was used, it is included. However, nine of the studies use CMC systems so "poverty stricken" that we have labeled them "level 0" because they do not provide even the minimal features that would facilitate a rich group discussion. The most restrictive and limited of these are systems with fixed screens designed with fields to be filled in to support highly structured decision making for a specific task. For instance, if there were a

"choice dilemma" task, the screen might have a field for the short problem description, and a field for inputting a number between 1 and 10, which is the "answer" to the choice. At the bottom of the screen of these "level 0" CMC facilities there is often only a single line, or in some cases, only a half of a line, which is the entire space allowed to compose and send free text communication to other group members. "Chat" systems with split screens that allow one to view only a few lines of text, provide little or no editing, and display what everybody is typing as they type it, letter by letter, are also classified as "level 0." They give the users no control over what they see and what and when they send, nor do they support the communication of well thought out and edited contributions, or a reviewable transcript of the group discussion. Many of these "level 0" systems also send everything anonymously automatically.

The results are somewhat surprising, in that there is about the same 15% proportion of positive outcomes for level 0 systems as for level 1 systems; this may be because the problems for which the simple systems were constructed are also very simple. However, the level 1 systems have a much better ratio of positive to negative outcomes (0.9 vs. 0.5). Level 2 systems have slightly more positive results than less sophisticated systems, and definitely a better ratio (1.3). Thus, the consistent shift in the ratio of positive to negative significant results as the level of sophistication is worthy of note.

2.4.4.5 Facilitation

GSS groups that are facilitated have a markedly greater likelihood of producing favorable effects than unfavorable effects in comparison to non-facilitated groups (a ratio of 1.9 vs. 0.8). It is notable that this difference is produced not by a larger proportion of positive effects, but by a smaller proportion of negative effects, when a facilitator is present. Thus, it would seem that the main function of a facilitator might be to help the group to avoid process losses or to serve other

problems that might otherwise lead to negative outcomes from the use of GSS. This is further supported by [54] who reported that the effect size for computer supported facilitation is about twice the size as that for just facilitation alone.

2.4.5 Comparisons Among Group Factors

Table 9 presents results for two aspects of group composition that are frequently controlled and reported, group size and the type of subject used.

Table 9

2.4.5.1 Group Size

Trying to cross tabulate results by the size of the groups used is complicated by the fact that a large number of experiments allowed group size to vary, either deliberately or accidentally (because of "no shows," etc.) The categories which we used are experiments where the group size varied roughly between three and five members (small groups); 6-10 members (medium sized groups), and group sizes of 10-20 (larger groups).

The seminal theoretical framework by DeSanctis and Gallupe [21] used "small" vs. "large" groups as one of the primary contingency factors that must be taken into account in designing GSS, and subsequent GSS researchers appear to concur in the belief that the size of the group interacts with the types of communication technology and tools that will be helpful to support group processes. However, there is no agreed upon dividing line between "small," "medium" and "large" groups, and studies of larger groups (e.g., ten or more members) are logistically difficult because of the size of the GSS facilities needed and/or the total number of subjects required for an experiment utilizing larger group sizes. This circumstance, in addition to the disappointing fact that a substantial number of studies have not controlled group size

rigorously enough to fit into even a fairly broad category, means that we do not have very many hypotheses that have been tested for larger groups (only 25 total).

Nevertheless, there is a very striking difference in results reported associated with size of the groups. The smaller groups have 10.0% to 16.8% positive effects and as many positive effects for GSS as negative effects reported. For medium sized groups, the proportion of positive effects drops to about 9%, and there are less than half as many positive effects as negative effects. This difference between groups of 3 to 5 vs. groups of 6 to 10 would not be expected on the basis of current theoretical frameworks, and needs to be directly investigated.

When we move to the larger sized groups of 10 to 20 members, the predicted increase in utility of GSS as group size increases does indeed manifest itself. 36.4% of hypotheses about these larger groups resulted in GSS groups doing better than unsupported groups, and there were no negative effects observed. This may be one reason why field studies of GSS seem to give more positive results than laboratory studies; field studies are much more likely to be with larger groups.

2.4.5.2 Subject Type

Turning to the type of subject studied, we once again note that the types of groups that it is logistically easy to study (undergraduate students) are much more prevalent than the types of subjects who are most likely to be able to benefit (graduate students, who are likely to have had some work experience, or 'professionals," which in this context means anybody who has a job rather than being a student). When we look at the pattern of results, they are just about opposite to the pattern of subjects used. For groups composed solely of undergraduate students, only 15.8% of results were positive. Negative results were as likely as positive results. By contrast, for studies using graduate students, 44.4% of tests of hypotheses yielded slightly more positive

results for GSS, and positive results were 6.0 times as likely as negative results. However, care must be taken with this percentage since there are only 39 hypotheses in this category. For groups composed of professionals rather than students, results were overwhelmingly “no difference” (73%), with 13.5% positive and 13.5% negative. These latter percentages are based on only 7.8% of the hypotheses (123 out of 1582); so few that we really cannot say that we know very much about non-student users of GSS in terms of results from controlled experiments.

It should also be noted that we have done a poor job in controlling the subject type in our experiments. By simple inspection of Table 9 it can be seen that undergraduates have been mixed in with graduates, MBA's or both. It is quite possible that a mixed subject type can be responsible for group variations, which lead to more "no effect" results.

2.4.6 Comparisons Among Task Types

Both Hollingshead and McGrath [44] and Dennis, et. al., [16] suggest task type can moderate the effect of a GSS. Table 10 also reflects those observations. Compared to overall positive effects of 16.6 %, when organized by task type, the percentage increases to about 21% for task types 4 (decision making) and 5 (mixed motive), whereas it decreases to 11.3% for task type 3 (intellective). Though task type 2, idea generation, does not have a particularly high percentage of positive effects, it does have relatively few negative results, and thus an outstanding ratio of positive to negative effects (2.4). The best proportion of positive effects appears for task type 1, planning tasks, but this is based on very few studies and hypotheses and thus can be taken as suggestive of an area for future experimentation, at best.

Table 10

These results are then broken down according to whether they occurred for GSS type support or CMC type support, in the bottom portions of Table 10. Several unexpected results are observable when looking at the interaction of task type and system type in this manner. Though the overall proportion of positive effects is the same for the two types of systems, the pattern of variation around the mean differs. This is most striking for idea generation tasks: it is obvious that CMC systems are fairly effective when used with tasks requiring decision making. For all variations (CMC Synch, CMC Asynch, CMC Combined; this breakdown is not shown in the table) positive effects are close to 30.0% and are much more likely than negative effects. By contrast, for GSS systems, positive effects are only 16.6% and negative effects are more likely. Thus, results suggest that CMC is highly effective when used in decision making situations, as compared to GSS.

For mixed motive tasks, the pattern is the opposite: GSS systems appear much more effective than CMC systems, though the number of studies and hypotheses on which this contrast is based suggests that direct tests of such an association need to be carried out. For Intellective tasks, the differences are in the same direction, and though not as striking, are based on much more data; positive results for CMC systems are a low 7.9%, compared to 14.4% for GSS systems.

However, the results for GSS groups using idea generation tasks do not support the observations of [16, 32, 44], who suggest that task type moderates GSS use and that GSS groups perform better when using idea generation tasks. The positive effects percentage drops to 15.0% for GSS while it is 18.9% for CMC systems. The ratio of positive to negative effect is higher for GSS at 2.8 (vs. 1.4), however.

Further analysis, adding number of groups per treatment condition as a third dimension (see Table 12) reveals that of the 501 hypotheses examined for GSS groups using idea generation tasks, 52.9% (265/501) had six groups or less per cell. The positive effects drop to 9.4% for the studies which had six groups or less per cell, (with the vast majority of these experiments with small N's of groups per condition showing "no significant difference"), while for studies with 7 to 10 groups per cell the positive effects are increased to 29.0%. The results reported here support earlier assertions that statistical power is very important in GSS research [6, 30, 32]. The experiments which had at least 7 groups or more per cell support the observations of [16, 44] that GSS groups perform better when using idea generation tasks.

2.4.7 Comparisons Among Intervening Factors-Session Length

Session length (Table 11) can be considered a proxy for the overall complexity of the task being solved by the group. Many experiments reported variations in session length rather than holding it constant; however, we can make rough categories for the synchronous modes of GSS consisting of 10-30 minutes as the shortest sessions, 30-60 minutes as medium length "meetings," and one to two hours as longer meetings. After this, meeting length goes to the days to weeks range, for the asynchronous conditions.

Table 11

For all dependent variables combined, there are inconsistent changes in the proportion of outcomes for which GSS is significantly better than FtF groups. The highest positive effect (25.2%) is in the sessions with a length of less than a half-hour. For sessions between 30 and 59 minutes the percentage drops to a low of 9.4%. The positive effects then increase to 19.8% of results for sessions of 1-3 hours and 20.3% for asynchronous meetings. The best overall ratio of

positive to negative effects occurs when there is no limit placed on session length. Though based on a relatively small number of hypotheses, this suggests that even in experiments, GSS should more frequently be used as it would "naturally" be adapted by groups, that is, let the groups take as long as they need to finish. We know that generally groups are less efficient with GSS than FtF; if session length is cut off at what is needed for FtF groups to complete their task, then it seems obvious that this will often not be enough time for groups which are typing their ideas rather than speaking them, and that quality will thus suffer because of not enough time to complete the group processes.

2.4.8 Comparisons Among Intervening Factors-Groups per Treatment Condition

In a preliminary report [30] it was suggested that experiments with less than seven groups per treatment condition had a lower probability of observing a positive effect for GSS over FtF. Partial support for those results are reflected in the Groups per Treatment Condition portion of Table 11. Experiments with less than six groups per treatment versus 11 or greater yield 14.2% and 14.3% positive effects, respectively. The percentages increase to 22.3% for experiments with seven to ten groups per treatment condition.

There is no logical reason why a dip in significant positive effects should occur for the highest levels of statistical power (e.g., increasing groups per cell from 8 to 12); there is probably something about these very large studies that confounds the results. However, as seen by the results in Table 12, we have not been able to find an explanation for this anomaly.

Table 12

In order to determine if these observations are further moderated by task type and GSS type a detailed analysis is provided in Table 12. The results clearly suggest that for both GSS

(20.2%) and CMC (21.3%) technology conditions, higher positive effects occur in experiments with seven to ten groups per treatment condition. Further moderation also is observable by task type. When GSS technology is employed for use on idea generation tasks or decision making tasks the positive effects increase to 29.0% and 24.4%, respectively for studies with seven to ten groups per treatment condition. Similar findings are shown for CMC technology. The highest ratios of positive to negative effects (4.5 and 3.5) are also observable for this groups per treatment condition range.

2.5 Other Effects and Interaction Effects

This section is concerned with the analysis of the "other" 28% (438 out of 1582) hypotheses that did not test main effects of GSS technology. Table 13 is a cross tabulation of the independent / dependent variable pairings. 58.2% of these hypotheses tested effects of variables from the technology category. Of these, the most frequently examined was process structure, representing 173 hypotheses. Other Contextual Factors which contribute to this category are: Context (33 hypotheses), Task (60 hypotheses), Group (89 hypotheses), and Method (1 hypothesis). Drilling further down (Table 14), anonymity, decision process, levels, proximity, context, task, and group size deserve further discussion.

Tables 13 & 14

Anonymity: Hypotheses concerning differences between anonymous and identified groups have been tested 33 times. Twenty of these hypotheses have resulted in anonymous conditions being significantly better than identified conditions. Effectiveness (measured by number of comments, ideas, and comment types) and process gains (measured by clarifications and critical comments) represent the two largest counts of significant effects, 9 and 6,

respectively [12, 48, 50, 87, 95]. However, identified conditions have been significantly better than anonymous conditions 10 times, five of which measured effectiveness (measured by number of comments [59], perceived effectiveness [89], number of ideas [48], and decision quality [39]).

Decision Process: Decision process related hypotheses have been investigated 79 times (Table 13). More than 50% (40 out of 79) have examined effectiveness. Table 14 highlights the decision process details. Multiple questions versus single questions have recently been investigated [83]. The results suggest that multiple questions are significantly better than a single question.

Structured conflict has been studied by three investigative teams [33, 84, 90]. The results suggest that some form of conflict (Devil's advocacy or dialectical inquiry) is significantly better than non-conflict approaches.

One study [49] accounts for all of the collaboration hypotheses. The results suggest that collaboration is a very effective process for improving the overall group effectiveness.

Levels: Three experiments investigated hypotheses on GSS levels [26, 75, 94]. The evidence indicates that level-two GSS systems are more effective than level-one GSS systems.

Proximity: The results of distributed versus proximate systems are two to one in favor of distributed systems. Researchers [8, 11, 50, 89] have shown that quality has improved, more comments are generated, and more and higher quality ideas have been generated by distributed groups. Other studies, not classified as investigating proximity [66, 67] further suggest that distributed asynchronous CMC groups generate higher quality and more reports than do proximate face-to-face groups.

Context: Context variables have only recently been studied (5 of 8 studies were published in 1996 or 1997). Eleven of the 33 context hypotheses have dealt with culture [13, 60, 61, 93] The results suggest that Singaporeans tend to achieve higher levels of consensus [90], and Mexicans are more satisfied than Americans [60], while Americans are more effective at generating ideas and unique ideas [61].

Group Size: This category aggregates the group size independent variable. Studies have compared larger groups to smaller groups (see the bottom of Table 14). The results overwhelming show that larger group sizes are significantly better than smaller sizes.

Task: Of the three studies that have investigated task complexity [7, 37, 97], two studies report [37, 97] that GSS groups working on higher complexity tasks out perform GSS groups working on low complexity tasks. The business world is constantly faced with higher and higher task complexity as we move toward the next century. This is an area which demands further investigation. Similarly, task equivocality has been studied in 21 instances and is an area ripe for investigation.

Task type has been investigated in 31 instances by four researchers [45, 76, 82, 83]. The results suggest groups have higher levels of consensus when using intellective tasks compared to preference or decision making tasks.

2.6 SUMMARY and DISCUSSION- Results

How can networked computers be used to improve the process and outcomes of group meetings? For over a decade, this has been the Holy Grail sought by researchers. They have devised a variety of computer based tools and processes supported by software and/or human roles, and used with different combinations of communication modes; studied their effects for different types of groups and tasks; and have most typically assessed their success through

controlled experiments. Nunamaker, Dennis, Valacich, and Vogel [64] suggest that different technology configurations produce different and often conflicting results. Clearly, this is further supported in this analysis. Our objective was to present a detailed assessment of the empirical results for experimental studies of Group Support Systems (see Table 15 for a summary of the results). In particular, we are interested in summarizing the findings on the extent to which and conditions under which GSS is “better” or “worse” than unsupported face-to-face meetings.

Overall, the results suggest that there is an overwhelming tendency to find "no significant differences" between unsupported face-to-face modes and the types of group support systems that have been studied thus far. Less than one-fifth of the findings, overall, support hypotheses that GSS use is better than face-to-face methods (GSS > FtF). This is consistent for both CMC systems (using computer networks to connect participants in different locations, either synchronously or asynchronously) or for decision room GSS. Adding task type as an additional control variable, we observe more positive results when CMC systems with task type 4, and GSS with task type 2, are compared to face-to-face conditions.

Table 15

Thus, in accordance with DeSanctis and Gallupe [21] and similar to the observations made by Hollingshead and McGrath [44] and the results reported by Dennis, et. al. [16], task type does moderate GSS use. The results reported here suggest that GSS decision room technology has the highest probability of aiding groups performing idea generation tasks in comparison to other task types, provided that the study had sufficient statistical power of at least seven groups per cell. This may be because idea generation benefits from independent cogitation, and does not require a great deal of agreement, or other forms of social-emotional interaction.

CMC systems provide a less "rich" environment than do decision room GSS. Perhaps, the group members can have time to reflect and digest the decision alternatives before deciding on a final decision. This might help explain why CMC groups working on a decision task have more positive results.

Based on 200 experiments which span almost 30 years of research, we observe a 16.6% positive effect (see Table 5 and Table 15) due to GSS use over face-to-face methods. We will set this limit as our benchmark for interpreting the detailed results on the dependent category variables. Then, the overall results on the categories of dependent variables (Table 6) suggest that the use of GSS has relatively more positive impact on effectiveness (21.0%), process variables (18.8%), role outcomes (18.2%), and structuration (25.0%). Negative impacts are associated with efficiency (17.2%) which is mostly decision time. GSS groups take longer to complete their tasks than do FtF groups.

In addition to variations associated with the type of GSS and its interaction with task type, we note that results are significantly more positive, particularly in terms of effectiveness, when GSS is used on larger rather than small groups, and on more complex problems that can best benefit from computer support for analysis (as measured by the proxy for task complexity, total meeting time required). The irony, as noted in the first part of this review, is that most experiments have been on small groups doing simple tasks, probably because these are the easiest to study in terms of quickly running groups through experimental conditions to obtain "results."

Using these results as the starting point for future research, our objective is to find ways to improve the design and use of GSS. Field studies [14, 17, 73] tend to show that the use of GSS actually reduces meeting time, thus efficiency is improved. To summarize our results in

terms of an experimental design that would be most likely to generate relatively positive effects; it would:

- Use a "level 2" system with sophisticated analysis tools built in.
- Use subjects who are likely to be knowledgeable and motivated about the task; e.g., graduate students rather than undergraduates.
- Aggregate the subjects in medium to large sized groups—at least 6, 10 or more is even better.
- Make sure that there are sufficient groups per condition to provide adequate statistical power, at least 7 to 10 groups per treatment condition.
- Give the groups a facilitator and plenty of time (ideally, unlimited time).
- Use a task type that is most likely to benefit from GSS and is matched to the communication medium.
  - A planning task is especially likely to benefit from GSS.
  - If you have a decision (preference) task, use CMC, and if an intellective task, use decision room GSS.
- Measure structuration as an intervening variable and aspects of effectiveness as dependent variables; don't measure efficiency (time to completion) or satisfaction.

Obviously, this "recipe to produce significant positive results from GSS" would not result in systems that could be used for a wide range of task types and circumstances and desirable outcomes. Part of the research agenda for GSS in the future must be to tackle head-on some of the glaring weaknesses. How can the poor results for subjective satisfaction be improved for instance? What manipulations in how the systems are used (tools, interface, training, anonymity, process structures, facilitation, etc.) can substantially improve the ratio of positive process effects to negative process effects?

The implications of the modal finding of "no significant difference" are somewhat different for decision room GSS as compared to distributed CMC based systems. It makes no rational sense to build a decision room and bring people there to use it if the hardware and software will not produce results that are significantly different than would be obtained without using such a system. However, distributed meetings using CMC may be chosen by groups even if there is often "no significant difference" in process and outcomes compared to traveling to a

FtF meeting, because of the savings in travel time, convenience, and related costs. To some extent, one can turn our "no difference" results around and say that for distributed groups using CMC based systems, the results are likely to be at least as good or better than the results they would obtain by expending the time and money to travel to a meeting. This argues for further development of distributed asynchronous systems, which fit in well with the work styles of already "wired" professionals, who use email and the World Wide Web to accomplish many of their non-meeting work tasks.

We also encounter many studies which did not report all of the parameters of the experiments (missing values are recorded as a "?" in the chart appendices and as not reported in the databases). Additionally, researchers studying interaction hypotheses often excluded reporting their main effects values. These values can be of great benefit to researchers doing meta-analysis and other categorical analysis in the future. Table 16 is a list of what researchers should include in their published results for experiments. It is up to editors and reviewers to catch and enforce the reporting of the information.

Table 16

2.6.1 What Needs to be Studied?

Studies of mixed media are only one of many areas of GSS research begging for attention. Though the overall results of experimental studies reported in this paper might seem to be discouraging, we strongly agree with Briggs and his colleagues [5] that GSS research is far from "dead." GSS research is much nearer its beginning than its end, with 1001 (important) unanswered questions [1, page 4]. If researchers learn the lessons summarized in this paper in terms of what is already known and what experimental procedures need to be followed and reported to obtain results that will contribute substantially to the field, the next generation of

experiments will be very rewarding. Furthermore, Nunamaker [62] provides several recommendations for further research including more work in distributed settings and virtual reality.

Many recent studies are examining the effects of different GSS structures and tools, which is beyond the scope of this paper. But, clearly, those issues need to be addressed. Of particular interest is the open question of whether new GSS systems integrating the ease of use of the "point and click" web based interfaces and multi-media features will improve the functionality and usability of GSS systems, and thus increase the likelihood of positive outcomes in comparison to unsupported face-to-face groups. Based upon the results reported in this paper, it would also make sense to investigate combined modes of communication and decision making. For example, on a more complex task that requires both idea generation and decision making, groups might be started in a decision room using face-to-face interaction to "get to know" one another. They might then use a decision room GSS to generate ideas. Then, using CMC, the groups could gather more information in order to assess different options and reach a solution to the problem. Several experiments like this are in progress (e.g., Ocker, Fjermestad, Hiltz, and Johnson, [66]). The results do tend to support a combined mode approach.

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Table 1
Group Support System Publications

Year	Journal	Conference	Total by Year
1970	1		1
1981	1		1
1982	1		1
1986	2		2
1987	2	2	4
1988	7		7
1989	2	5	7
1990	13	10	23
1991	8	12	20
1992	10	8	18
1993	18	10	28
1994	20	9	29
1995	14	12	26
1996	27	6	33
1997	11	4	15
1998	9	5	14
In Press	1		1
Total	147	83	230

Table 2
Journal Counts

Journal	Total
Academy of Management Journal	2
Accounting Management & Information Technology	1
ACM Transactions on Office Information Systems	1
Behavior & Information Technology	3
British Journal of Social Psychology	1
Communications of the ACM	1
Communication Research	2
Computers in Human Behavior	8
Computer Supported Cooperative Work Journal	8
Decision Science	4
Decision Support Systems	5
Group Decision and Negotiation	5
Human Computer Interaction	3
Human Communication Research	3
Information & Management	11
IEEE Transactions on Communication	1
IEEE Transactions on Systems Man Cybernetics	3
International Journal of Human-Computer Studies	3
International Journal of Man-Machine Studies	1
Information Systems Research	8
Journal of Management Information Systems	17
Journal of Applied Psychology	4
Journal of End User Computing	2
Journal of Information Science	2
Journal of Information Systems	1
Journal of Management	1
Journal of Organizational Computing	2
Journal of Personality and Social Psychology	1
Journal of Research on Computing in Education	1
Management Communication Quarterly	2
Management Information Systems Quarterly	11
Management Science	6
Omega International Journal of Management Science	1
Organizational Behavior and Human Decision Making	6
Organizational Science	2
Small Group Research	13
Social Psychology Quarterly	1
Journal Totals	147

Table 3
Conference Proceedings Counts

Conference Proceedings	Total
Computer Human Interaction	1
Computer Supported Cooperative Work	5
Hawaii International Conference System Sciences	57
International Conference on Decision Support Systems	4
International Conference on Information Systems	13
Proceedings Academy of Management	1
Proceedings Collaborative Work, Social Communication *Information*	1
Working Paper	1
Conference Totals	83

Table 4
Summary of Findings on Methodology

Findings Based on the 200 Experiments
Contextual Factors
Group Proximity- 66% use decision rooms
12.5% were dispersed
Anonymity- 69% were identified
Facilitation- 70% did not use a facilitator
Communication mode- 67.5% used GSS technology; 29.5% used CMC technology
Group Composition- 73% used undergraduates
Leadership- 94% did not use a leader
Group Type- 95% used ad-hoc groups
Task Type- 52% used decision making tasks; 39.5% used idea generation tasks
Intervening Factors
Number of Sessions- 73.5% used a single session
Training- 33.5% of the studies did not report any information about training
Session Length- 25.5% were less than 30 minutes in duration; 50% were less than 1 hour
20% of the studies did not report the session length
Experimental Design- 21% were 2 X 1; 30.5% were 2 X 2
Groups per Treatment Condition- 31% used less 7 groups; 46% used at least 10 groups
Subject per Group- 72% used between 2 and 5 subjects per group
Total Number of Groups- 38% used less than 20 groups; 38% use between 21 and 40 groups

Table 5
FtF vs. GSS Assessment Results: Counts for All Experiments on Independent Variables

(Unit of Measurement is the Hypothesis)

Independent Variable Categories	Total Count	No Significant Effect	Positive Effect GSS > FtF	Negative Effect FtF > GSS	No Main Effect Measures	Other Effects & Interaction Effects	Percent Positive Effects	Ratio Positive/ Negative Effects
Technology								
Task Support	41	18				23	..	..
Process Structure	380	177	13	5	12	173	6.7	2.6
Design	44	19				25	..	..
Communication Mode	531	198	139	139	21	34	29.2	1.0
Technology Total	996	412	152	144	33	255	21.5	1.1
Group	223	97	2	4	31	89	1.8	0.5
Task	214	56	1	11	86	60	1.5	0.1
Context	138	62	3	5	35	33	4.3	0.6
Method	11	1			9	1	100.0	1
Totals	1582	628	158	164	194	438	16.6	1.0

Table 6
FtF vs. GSS Assessment Results: Counts for All Experiments on Dependent Variables

(Unit of Measurement is the Hypothesis)

Dependent Variable Category	Total Count	No Significant Effect	Positive Effect GSS > FtF	Negative Effect FtF > GSS	No Main Effect Measures	Other Effects & Interaction Effects	Percent Positive Effects	Ratio Positive/ Negative Effects
Adaptation Factors								
Structuration	46	17	6	1	9	13	25.0	6.0
Process Variables	146	61	18	17	18	32	18.8	1.1
Process Issues	44	16	4	8	9	7	14.3	0.5
Process Gains	142	62	14	14	12	40	15.6	1.0
Process Losses	71	26	9	10	9	17	20.0	0.9
Role Outcomes	22	5	2	4	4	7	18.2	1.0
Sub Total	471	187	53	54	61	116	18.0	1.0
Outcome Factors								
Efficiency	97	22	10	26	18	21	17.2	0.4
Effectiveness	617	230	73	44	75	195	21.0	1.7
Satisfaction	280	133	18	29	33	67	10.0	0.6
Consensus	67	30	3	6	3	25	7.7	0.6
Usability	42	25	1	3	4	9	3.4	0.3
Sub Total	1103	440	105	108	133	317	16.1	1.0
Intervening Factors								
Summary Variables	8	1		2		5	..	..
Total	1582	628	158	164	194	438	16.6	1.0

Table 7
Comparisons Among GSS Technology

(Unit of Measurement is the Hypothesis)

Technology	Total Count	No Significant Effect	Positive Effect GSS > FtF	Negative Effect FtF > GSS	No Main Effect Measures	Other Effects & Interaction Effects	Percent Positive Effects	Ratio Positive/ Negative Effects
Communication Mode								
CMC	521	176	55	82	84	124	17.6	0.7
DSS	32	8	5	4	4	11	29.4	1.3
GSS	1029	444	98	78	106	303	15.8	1.3
Totals	1582	682	158	164	194	438	16.6	1.0
GSS Technology								
GSS Same Place	889	357	93	59	109	271	18.3	1.6
GSS Different Place	20	5	2	7		6	14.3	0.3
GSS Synch DR/Dist	128	74	8	14		32	8.3	0.6
GSS Synch/Asynch	18	16		2				
GSS Sub Total	1055	452	103	82	109	309	16.2	1.3
CMC Synch Level 0	71	23	7	13	18	10	16.3	0.5
CMC Synch DR	98	22	12	13	21	30	25.5	1.0
CMC Asynchronous	117	38	13	13	20	33	20.3	1.0
CMC Synch Distributed	241	93	23	43	26	56	14.5	0.5
CMC Sub Total	527	176	44	82	85	129	17.6	0.7
Totals	1582	628	158	164	194	438	16.6	1.0

DR: Decision Room; Dist: Distributed
Synch: Synchronous
Asynch: Asynchronous

Table 8
Comparisons among Process Structures
(Unit of Measurement is the Hypothesis)

Process Structures	Total Count	No Effect	Positive Effect GSS > FtF	Negative Effect FtF > GSS	No Main Effect Measures	Other Effects & Interaction	Percent Positive Effects	Ratio Positive/ Negative Effects
Anonymity								
Anonymous	376	154	42	55	32	93	16.7	0.8
Anonymous/Identified	147	95	2	5		45	2.0	0.4
Identified	1059	379	114	104	162	300	19.1	1.1
Totals	1582	628	158	164	194	438	16.6	1.0
Time Dispersion								
Asynchronous	117	38	13	13	20	33	20.3	1.0
Synchronous	1447	574	145	149	174	405	16.7	1.0
Synch/Asynch	18	16		2			..	..
Totals	1582	628	158	164	194	438	16.6	1.0
Proximity								
Distributed	568	235	52	83	64	134	14.1	0.6
Decision Room	1014	393	106	81	130	304	18.2	0.6
Totals	1582	628	158	164	194	438	16.6	1.0
Levels								
Level 0	75	26	7	13	18	11	15.2	0.5
Level 1	1028	435	100	114	94	285	15.4	0.9
Level 1/ Level 2	54	13	5	2	11	23	25.0	2.5
Level 2	425	154	46	35	71	119	19.6	1.3
Totals	1582	628	158	164	194	438	16.6	1.0
Facilitation								
Chauffeur	5	2	2	1			40.0	2.0
Facilitator	372	174	37	19	37	105	16.1	1.9
Moderator	36	16	4			16	20.0	..
No Facilitator	1160	433	111	144	157	315	16.1	0.8
User Driven	4	2				2	..	..
Other	5	1	4				80.0	..
Totals	1582	628	158	164	194	438	16.6	1.0

Note: The "/" means there is a comparison between both sides of the /.

Table 9
Comparisons among Group Factors
(Unit of Measurement is the Hypothesis)

Group Factors	Total Count	No Significant Effect	Positive Effect GSS > FtF	Negative Effect FtF > GSS	No Main Effect Measures	Other Effects & Interaction Effects	Percent Positive Effects	Ratio Positive/ Negative
Subjects per Group								
2 or 3 or Not Reported	68	17	3	10	3	35	10.0	0.3
3 or 4 or 5 or 3 to 5	1075	437	113	121	127	277	16.8	1.0
6 to 10	186	80	10	26	25	45	8.6	0.4
10 to 20	25	7	4		4	10	36.4	..
Multiples	121	30	17	6	26	42	32.1	2.8
Overlapping Sizes	107	57	11	1	9	29	25.9	20.0
Totals	1582	628	158	164	194	438	16.6	1.0
Subject Type								
Graduates	39	13	12	2	0	12	44.4	6.0
Graduates or Under	132	45	13	8	25	41	19.7	1.6
G/U/MBA	4	3	1				25.0	..
High School or Local	5	1		1		3	..	..
MBA	61	15	2	14	9	21	6.5	0.1
Professional	123	54	10	10	27	22	13.5	1.0
Undergraduates	1142	462	107	125	126	322	15.4	0.9
Undergraduates or MBA	76	35	13	4	7	17	25.0	3.3
Total	1582	628	158	164	194	438	16.6	1.0

Multiples: Group size was typically an independent variable. Studies compared sizes of i.e. 3, 9, 18.
Overlapping: Group sizes were not vigorously controlled. Sizes may range as follows: 3 to 8, 6 to 16, or 8 to 24.

Table 10
Comparisons Among Task and GSS Technology and Task Type
(Unit of Measurement is the Hypothesis)

McGrath's Primary Task Type	Total Count	No Effect	Positive Effect GSS > FtF	Negative Effect FtF > GSS	No Main Effect Measures	Other Effects & Interaction Effects	Percent Positive Effects	Ratio Positive/ Negative Effects
No Real Task	4	4					..	..
Planning	11	1	2		4	4	66.7	..
Idea Generation	545	258	51	21	48	167	15.5	2.4
Intellective	292	123	24	65	7	73	11.3	0.4
Decision Making	604	199	69	59	109	168	21.1	1.2
Mixed Motive	77	26	9	10	19	21	24.3	0.9
Multiple Task Types	49	17	3	9	15	5	10.3	0.3
Total	1582	628	158	164	194	438	16.6	1.0
GSS (GSS and DSS) Combined by Task Type								
Planning	11	1	2		4	4	66.7	..
Idea Generation	501	233	44	16	48	160	15.0	2.8
Intellective	161	63	16	32	5	45	14.4	0.5
Decision Making	332	139	34	32	40	87	16.6	1.1
Mixed Motive	28	6	7	2	3	10	46.7	3.5
Multiple Task Types	22	10			9	3	..	..
GSS Combined Total	1055	425	103	82	109	309	16.2	1.3
CMC Combined by Task Type								
No Real Task	4	4					..	..
Idea Generation	44	25	7	5		7	18.9	1.4
Intellective	131	60	8	33	2	28	7.9	0.2
Decision Making	272	60	35	27	69	81	28.7	1.4
Mixed Motive	49	20	2	8	8	11	6.7	0.3
Multiple Task Types	27	7	3	9	6	2	15.8	0.3
CMC Combined Total	527	176	55	82	85	129	17.6	0.7
Total	1582	628	158	164	194	438	16.6	1.0

Table 11

Comparisons Among Intervening Factors- Session Length
and
Group per Treatment Condition
(Unit of Measurement is the Hypothesis)

	Total Count	No Significant Effects	Positive Effect GSS > FtF	Negative Effect FtF > GSS	No Main Effect Measures	Other Effects & Interaction Effects	Percent Positive Effects	Ratio Positive/ Negative Effects
Session Length								
10 to 29 minutes	227	69	35	35	46	42	25.2	1.0
30 to 59 minutes	447	217	27	44	3	156	9.4	0.6
60 to 180 minutes	447	167	52	44	70	114	19.8	1.2
CMC sessions	117	38	13	13	20	33	20.3	1.0
Rounds	12	1		3		8	..	..
No Limit	18	6	4	1	7		36.4	4.0
Not Reported	314	130	27	24	48	85	14.9	1.1
Totals	1582	628	158	164	194	438	16.6	1.0
Groups per Treatment Condition								
Less than 6 Groups	542	262	49	35	60	136	14.2	1.4
7 to 10 Groups	476	169	63	50	64	130	22.3	1.3
11 & up	560	195	46	79	70	170	14.3	0.6
Not reported	4	2				2	..	..
Totals	1582	628	158	164	194	438	16.6	1.0

Table 12

Comparisons Among Group per Treatment Condition and Task Type by GSS

(Unit of Measurement is the Hypothesis)

Groups Per Treatment Condition	Total Count	No Significant Effects	Positive Effect GSS > FtF	Negative Effect FtF > GSS	No Main Effect Measures	Other Effects & Interaction Effects	Percent Positive Effects	Ratio Positive/ Negative Effects
Groups per Treatment Condition by GSS Type (GSS/CMC)								
GSS								
Less than 6 Groups	415	208	37	28	34	108	13.5	1.3
7 to 10 Groups	340	129	46	27	43	95	20.2	1.7
11 & up	296	113	20	27	32	104	12.5	0.7
Not reported	4	2				2	..	..
CMC								
Less than 6 Groups	127	54	12	7	26	28	16.4	1.7
7 to 10 Groups	136	40	17	23	21	35	21.3	0.7
11 & up	264	82	26	52	38	66	16.3	0.5
Totals	1582	628	158	164	194	438	16.6	1.0
Groups per Treatment Condition by GSS type and Task Type								
Idea Generation Tasks								
GSS Less than 6 Groups	265	145	16	9	20	75	9.4	1.8
GSS 7 to 10 Groups	182	60	27	6	28	61	29.0	4.5
GSS 11 & up	54	28	1	1		24	3.3	1.0
CMC Less than 6 Groups	None							
CMC 7 to 10 Groups	25	13	5	4		3	22.7	1.3
CMC 11 & up	19	12	2	1		4	13.3	2.0
Decision Making Tasks								
GSS Less than 6 Groups	102	50	11	10	10	21	15.5	1.1
GSS 7 to 10 Groups	74	27	11	7	12	17	24.4	1.6
GSS 11 & up	152	60	12	15	18	47	13.8	0.8
CMC Less than 6 Groups	73	22	11	4	25	11	29.7	2.75
CMC 7 to 10 Groups	46	4	7	2	13	20	53.8	3.5
CMC 11 & up	153	34	17	21	31	50	23.6	0.8

Table 13
Other Effects & Interaction Effects
Hypotheses Counts
Independent Variable Categories and Dependent Variables Categories
(Unit of Measurement is the Hypothesis)

		Dependent Variable Categories											
Independent Variables	**Total**	**Consensus**	**Effectiveness**	**Efficiency**	**Process**	**Process**	**Process**	**Process**	**Role**	**Satisfaction**	**Structruation**	**Summary**	**Usability**
	Count				**Gain**	**Loss**	**Issues**	**Variables**	**Outcome**			**Variables**	
Technology	255	14	12	12	31	7	4	11	5	31	10	3	8
Task Support	23	1	9	1	3		1	1	2	2	1	1	1
Process Structure	173	7	88	7	26	6	2	6	1	21	4	1	4
Anonymity	29	2	13		5	2		1	1	2	1		2
Comprehensiveness	7	1	4	1	1								
Decision Process	79	1	40	2	15	4	1	4		9	1	1	1
Facilitation	5	2	2								1		
Levels	11	1	8							1	1		
Process	16		10	3						3			
Proximity	20		10	1	5		1	1		1			1
Restrictiveness	5		1							4			
Information	1									1			
Design	25	3	10	2	2	1		3		2			2
Communication Mode	34	3	14	2			1	1	1	6	4	1	1
	33	2	14	1	1			4	1	9	1		
Task	60	9	11	5	1	3	3	11	2	11	2	2	
Group	89		49	3	7	7		6		16			1
Group Composition	43		19	2	4	3		5		10			
Group Size	35		25	1	3	3				3			
Leadership	8		4			1		1		2			
Member Characteristics	3		1							1			1
Method	1										1		
Totals	438	25	195	21	40	17	7	32	7	67	13	5	9

Table 14
Other Effects & Interaction Effects Hypotheses Counts
Process Structure and Task Independent Variable Categories Details
(Unit of Measurement is the Hypothesis)

		Dependent Variable Categories											
Independent Variables	**Total**	**Consensus**	**Effectiveness**	**Efficiency**	**Process**	**Process**	**Process**	**Process**	**Role**	**Satisfaction**	**structuration**	**Summary**	**Usability**
Process Structure and Task	**Count**				**Gain**	**Loss**	**Issues**	**Variables**	**Outcomes**			**Variables**	
Anonymity													
Anonymity > Identified	20	1	9		6	1		1					2
Identified > Anonymity	10	1	5			1			1	1	1		
Other	3				1			1		1			
Decision Process													
Structured Conflict	14		7	1	1		1	1		2			1
Collaboration	19		13	1	4	1							
Multiple > Single (Questions)	11		6		5								
Interacting > Nominal	6		3					1		1	1		
Other	28	1	11		5	3		2		6		1	
Levels													
Level 1 > Level 2	2		2										
Level 2 > Level 1	9	1	6							1	1		
Proximity													
Distributed-GSS > Proximate-GSS	11		7	1	3								
Proximate-GSS >Distributed-GSS	5		2				1			1			1
Task													
Task Complexity	3		2	1									
Task Equivocality- High > Low	13	2	2				1	1		3	2	1	
Task Equivocality-Other	8	1	1	3			1			1		1	
Task Type	31	5			1			5	1	1			
Group Size													
Larger > Smaller	31		24	1	1	3				2			
Other	4		1		2					1			

Table 15
Summary of Results

Results	Percentage Positive Results
Positive results (GSS > FtF)	16.6
No effects (GSS = FtF)	66.1
Independent Variables	
Technology	21.5
Communication mode	29.2
Dependent Variables	
Structuration (GSS > FtF)	25.0
Effectiveness (GSS > FtF)	21.0
Consensus (GSS > FtF)	7.7
Communication Mode	
GSS (GSS > FtF)	16.2
CMC (GSS > FtF)	17.6
Process Structure	
Anonymity (GSS > FtF)	16.7
Identified (GSS > FtF)	19.1
Anonymity X Task type	
Anonymity- Idea generation (GSS > FtF)	24.0
Identified- Decision making (GSS > FtF)	22.6
Group Factors	
3 to 5 subjects per group (GSS > FtF)	16.8
Undergraduates as subjects (GSS > FtF)	15.4
Task Type	
Idea generation (GSS > FtF)	15.5
Intellective (GSS > FtF)	11.3
Decision making (GSS > FtF)	21.1
GSS Technology X Task type	
GSS X Idea generation (GSS > FtF)	15.0
CMC X Decision making (GSS > FtF)	28.7
Intervening Factors	
Session length- 10 to 29 minutes (GSS > FtF)	25.2
Groups per treatment condition-	
Less than 6 groups (GSS> FtF)	14.2
7 to 10 groups (GSS > FtF)	22.3
11 groups and up (GSS > FtF)	14.3
Groups per treatment condition X GSS type X Task type (GSS > FtF)	
GSS- Idea generation tasks, Less than 6 groups	9.4
GSS- Idea generation tasks, 7 to 10 groups	29.0
CMC- Idea generation tasks, 7 to 10 groups	22.7
GSS- Decision making tasks, Less than 6 groups	15.5
GSS- Decision making tasks, 7 to 10 groups	24.4
CMC- Decision making tasks, Less than 6 groups	29.7
CMC- Decision making tasks, 7 to 10 groups	53.8

Results	Ratio Positive/Negative
Process Structures	
Level 0	0.5
Level 1	0.9
Level 2	1.3

Table 16

Experimental Parameters

Contextual	Intervening	Independent & Dependent Variables	Statistical Values
Technology	Method: Case or experiment	Independent variables	All main effects
Task tools	Design type	Dependent variables	All interaction effect
Technology type	Training: Time, procedures		All treatment means
Technology brand name	Order of treatments & variables		Power
Process Structure	Number of sessions		
Proximity	Session lengths		
Time dispersion	Number of groups		
Anonymity	Number of subject per group		
Level	Number of groups per cell		
Facilitation	Total number of groups		
Group	Total number of subjects		
Group size	Reward for participating		
Group composition			
Member characteristics			
Group type			
Leadership			
Environment (Culture, experience, time pressure, etc)			
Task			
Task characteristics			
Task type			

Figure 1
THEORETICAL FRAMEWORK FOR ANALYZING GROUP SUPPORT SYSTEMS

INPUT	PROCESS		OUTPUT
CONTEXTUAL FACTORS	**INTERVENING FACTORS**	**ADAPTATION FACTORS**	**OUTCOME FACTORS**
1. TECHNOLOGY: . Task Support (Tools): Agenda, electronic brain storming, voting, cognitive feedback, etc. . Process Structures: Anonymity, time, proximity, settings, procedures, control & structure; e.g. sequential Vs parallel process; levels 1, 2, and or 3, structural features-restrictiveness, comprehensiveness, agenda setting NGT, DI, DA, facilitator, chauffeur, moderator. . Communications Mode: FtF, CMC, GSS, DSS, text, graphics, voice, image, sound, and video. . Design: Room configuration, interface, embeddability, extensibility, flexibility , functionality & usability. 2. GROUP: . Group characteristics: Size and salience, ad-hoc, established. . Composition: Heterogeneity, organizational & job tenure, shared norms, member status, history & experience, subject type (student, MBA, professional, etc.). . Leadership: Formal leadership, style, attitude, skills, power, and organizational position . Member characteristics: Attitudes, values, power, personal beliefs, age, sex, preferences, self confidence, skills demographics, personality traits, initial quality, & experience (systems & tasks). . Meeting structure: Clarity of objective, specific work norms. . Initial levels: Cohesiveness, task understanding, consensus, and agreement . Group Structures: Styles of interacting, knowledge & experience with structures, perceptions of others knowledge. 3. TASK: . Type: Generate, choose, negotiate, and execute; gain/loss . Characteristics: . Structure: Structured to unstructured . Equivocality: High to low .Analyzability: High to low . Complexity: High to low . Importance: High to low . Enjoy ability: High to low . Predictability: High to low . Source: Internal to external . Degree of task knowledge . Degree of agreement on values 4. CONTEXT: . Environment: Competition, uncertainty, time pressure, evaluative tone. . Organizational: Information system, age, goals, reward structure, organizational size, etc. . Cultural: American, British, Chinese, Hawaiian, Singaporean, etc.	1. METHODS: . Experimental design . Task implementation . Session length . Number of sessions . Order (order of treatment or task) . Training: technology, group process and task . Rewards for participants 2. SUMMARY VARIABLES RESULTANT COMMUNICATION DIMENSIONS: . Bandwidth . Media richness . Social presence GROUP MEMBER PERCEPTION & PROBLEM SOLVING: . Nature and utilization of task performance strategies . Level and utilization of member knowledge & skill . Level & coordination of member effort . Task: importance, visibility, understanding, & commitment . Individual: values, personal needs, level of interest, and degree of frustration . Psychological differences . Biases ORGANIZING CONCEPTS: . Information processing systems . Consensus generating systems . Behavior motivation & regulation OPERATING CONDITIONS . Modalities available . Changes in task, rewards, norms & division of labor Shaded Areas are the areas present in Part I this paper and the unshaded in Part II. Adapted from Fjermestad, 1998 and Fjermestad and Hiltz, 1997	1. GROUP ADAPTATION PROCESS: Structuration . Social technology . Structural features . General spirit . Faithful/Ironic . Rules, resources- use, attitude, control, and consensus . Comfort, respect Process Variables . Participation . Consensus generating . Normative regulation . Effectiveness, Influence . Level of effort Process Issues . Diffusion of responsibility . Deindividuation . Pressure to consensus . Coordination 2. PROCESS GAINS/LOSSES: Process Gains . Synergy, learning memory . Clarity, Choice shift Process Losses . Free riding . Evaluation apprehension . Attenuation blocking . Information overload . Flaming . Dominance 3. INTERMEDIATE ROLE OUTCOMES . Role assumption by technology . Actual roles of participants Task-related & group-building: recorder, gatekeeper, follower, information/opinion seeker, information/opinion giver, proceduralist, motivator, explainer, evaluator . Values	1. EFFICIENCY MEASURES: . Decision time . Number of decision cycles . Time spent in activities . Time spent waiting for responses . Time to consensus 2. EFFECTIVENESS MEASURES: . Communication . Number of comments . Idea Quality . Decision quality . Decision confidence . Process quality . Creativity/Innovation . Level of understanding . Task Focus . Depth of Evaluation . Commitment to results 3. SATISFACTION MEASURES: . Participation . Cohesiveness . Conflict management . Influence . Confidence . Attitude . General satisfaction . Decision Satisfaction 4. CONSENSUS: . Decision agreement . Commitment 5. USABILITY MEASURES: . Learning time . Willingness to work together again . System utilization . Number of errors . Design Preference

Figure 2
FACTORS MODEL
CONTEXTUAL FACTORS
(Unit of measures is experiment)

4.1 TECHNOLOGY

Task Support (I)-12

Task Tools (General).....5
Cognitive Feedback.7

Process Structure (I)- 68

Anonymity.....13
Proximity.....9
Procedure.....2
Levels.....4
Restrictiveness.3
Decision Process...25
Facilitation 4
Process.....4
Comprehensiveness...2
Information Dist....2

Communications Mode (I) 119

FtF/CMC other.....6
FtF/EBS.....6
FtF/GSS.....55
FtF/GSS/D-GSS/A-GSS.7
GSS/Manual/Baseline.6
FtF/CMC.....24
FtF/DSS.....5
FtF/EBB/EWS.....2
FtF/Audio/Video.7
Web-based.....2

Task Support: Tools

Agenda.....8
Brainwriting.....6
Alternative Gen....3
Group Outliner.....6
Group Writer.....4
HyperCard.....1
Idea Generator.....9
Topic Commenter....5
Lists.....6
Question.....4
Ranking.....20
EBS.....44
EDS.....3
Voting.....35
Issue Analyzer.....3
SIAS.....2
SAST.....1
Standard Package..13
ShareEditor.....3
MCDM/AHP.....6
Policy.....2
Screens.....8
Other.....28
None.....54

Process Structure

Group Proximity

Dispersed..... 25
Decision Room.132
FtF/Dispersed..24
DR/Dispersed...19

Time Dispersion

Synchronous....182
Asynchronous....16
Synch/Asynch.....2

Anonymity

Anonymity (A)...53
Identified (I).138
A/I.....9

Levels

Level 0.....10
Level 1.....121
Level 2.....62
Level 1 vs 2....7

Facilitation

Facilitator.....50
No Facilitator...141
M/F.....5
F/C.....1
F/AF.....1
F/U.....1
NF/F.....1

Automated F (AF)
Chauffeur (C)
Facilitator (F)
Moderator (M)
No Facilitator (NF)
User Driven (U)

Note: The A/≅ means there is a comparison between both sides of the /.

Communication Mode

DSS.....6
CMC.....59
GSS.....135

I: Independent Variable
The rest are Moderator Variables

Design (I) 10

Design-GSS System

CMC-General.....22
GSS-General.....13
COSY.....3
CaptureLab.....3
Co-Op.....2
Converse.....2
DECAID.....3
DSS-General.....5
EDS/EMS/EBS.....11
EIES/EIES2.....10
GroupLink..... 4
GroupSystems....45
Nick.....2
OptionLink.....3
Perceptronics....1
PlexCenter.....2
Plexsys.....6
Sage.....7
SAMM.....18
Shr-Edit.....3
TCBWorks.....1
VisionQuest.....14

Figure 3
FACTORS MODEL
CONTEXTUAL FACTORS
(Unit of measures is experiment)

4.2 GROUP

Group Size (I) - 16

2,4,6.....1
3,9..... 2
3,9,18.....1
4,7..... 1
4,8..... 1
4,8,12.....1
5,10.....1
5,6,7,8,9,10..... 1
6,12..... 4
Other..... 1
Sub-Groups.....2

Group Composition (I) - 25

Group Composition General.....…6
Gender..... 4
Established/Ad-hoc.....3
Member Status/Position..... 5
Knowledge/Skill..... 7

Member Characteristics (I) - 10

Attitudes.....1
Personality.....1
Preferences..... 1
Other..... 1
Leadership..... 6

Moderator Variables

Group Type

Ad Hoc.....189
Established.....11

Group Composition (Subject Type)

Professionals..... 13
Graduate Students..... 7
Under graduates.....146
MBA Students 9
Grad/Under grads/MBA.....9
Grads/Under grads..... 14
High School/Local..... 2

Leadership

Assigned Leader..... 2
Elected Leader..... 4
Group Leader (GL)..... 2
Moderator..... 1
GL/NL..... 1
Leader/NL..... 2
No Leader (NL).....188

4.3 TASK

Task Characteristics (I) - 49

Task Complexity..... 5
Task Equivocality..... 3
Task Structure…….... 1
Task.....11
Task Type..... 30

Task Type (M)

Type 0..... 1
Type 1.....4
Type 2.....79
Type 3.....62
Type 4.....104
Type 5.....…11
Type 6..... 1

I: Independent Variable
M: Moderator Variable

4.4 CONTEXT

Environment (I) - 32

Culture..... 9
Environment.....1
Evaluative Tone..... 2
Experience.....17
Time Pressure..... 2
Organizational..... 1

Figure 4
FACTORS MODEL
INTERVENING FACTORS
(Unit of measures is experiment)

5.1 METHOD

Method (I)

Experiment.....200
Order.....3
Training.....1

Number of Sessions

1...147
2....27
3.....9
4....10
5.....1
7....1
13....1
14....1
NR.....2

Task Implementation (Major ones)

Foundation.....20
Mock Jury 10
Tourism.....8
School of Business.8
Choice Dilemma.....7
PC Imports.....7
Internat Studies...7
PVVI.....7
Parking Problem....7
Lost in " "......6
Parkway Drug.....5

Training

Not Reported.....67
Training Mentioned.....74
Practice Task....11
None.....6
5 to 10 min.....14
11 to 20 min.....7
21 to 50 min.....12
60 to 90 min.....10
120+ min.....5

Session Length

< 15 min.....16
16 < 30 min.....35
31 < 60 min.....49
1 < 2 hr.....32
2 < 3 hr.....9
1 year..... 1
1 week.....3
2 weeks.....8
3 weeks.....3
5 weeks.....2
Not Reported.....40
No Limit.....2
Number Rounds.....2

Experimental Design

1 X 2..42
1 X 3..25
1 X 4...4
1 X 5...2
2 X 2..61
2 X 3..24
2 X 4..5
2 X 6..1
2 X 7..1
2 X 8..1
3 X 3..4
3 X 4..4

2 X 2 X 2.....17
2 X 2 X 7.....1
3 X 2 X 2.....4
4 X 2 X 3.....1
4 X 4 X 4.....1
2 X 2 X 3 X 2.....1
2 X 2 X 4X 2X 13...1

Design Type

Anova.....71
Factorial.....71
Incomplete Factor..2
Repeated Measures.48
Quasi Factorial....3
Counter Balanced...1
Latin Square.....4

Groups per Cell

1.....6
2-3.....7
3-4....12
4-5....18
5-6....20
6-8.....4
7-10...10
NR.....1
8-10...27
10.....18
10-12..19
12-15..23
15-20..21
20+....11
Mixed...3

Group Size
(Subjects per group)

2.....6
3....46
3-8..23
4....27
4-8..24
5....29
6.....6
10.....4
10+.....4
Mults..15
NR.....2
5-10...14

2 to 5.....144
6 to 10.....19
11+.....3
Other Mixed 16
As IV's.....16
Not reported.....2

I: Independent Variable; The rest are Moderator Variables

Total Number of Groups

3-7.....9
8-10.....10
11-15.....19
16-20.....38
21-30.....36
31-40.....40
41-60.....27
61-100.....14
100+.....6
NR.....1

Total Subjects

17- 50.....21
51- 80.....44
81-100.....23
101-120.....24
121-160.....29
161-220.....15
221-300.....30
301-400.....6
401-654.....6
NR.....2

NR: Not Reported

Figure 5
FACTORS MODEL
ADAPTATION FACTORS
(Unit of measures is hypothesis)

1. Group Adaptation Process Measures- 236

Structuration- 46	**Process Variables- 146**	**Process Issues- 44**
Attitude.....11 Challenge.....4 Comfort.....16 Control.....5 Faithful.....3 Decision-Phases.....2 Respect.....3 Support.....1 Training.....1	Composing & Editing....2 Task Behaviors.....6 Influence (General).....39 Group Behaviors....4 Influence Equality.....11 Level of Effort.....7 Influence Peer Related...6 Social-Emotional..13 Influence Self Rated.....6 Other.....7 Participation Equality...36 Influence-First Advocacy...9	Avoidance.....6 Coordination.....2 Deindividuation.....3 Social Preference.....2 Social Information.....11 Social Pressure.....11 Social Presence.....9

2. Process Gains/Losses Measures- 213

3. Intermediate Role Outcomes- 22

Process Gains- 142	**Process Losses- 71**	**Roles- 22**
Clarifications.....14 Communication .General.....12 Comments-Type.....11 Critical Comments.....23 Synergy.....5 Change in Understanding.....9 Choice Shift.....30 Information Exchange.....7 Information Credibility.....3 Information Sharing.....10 Information Learned.....5 Common Information.....5 Unique Information.....3 Collective Control.....2 Learning.....3	Production Blocking.....13 Deviation.....1 Disinhibition.....3 Dominance.....10 Evaluation Apprehension.....19 Flaming.....15 Free Riding.....6 Perceived Interruptions.....1 Other..... 3	Decision Influence.....2 Leadership.....10 Personalization.....1 Status Influence.....5 Task Orientation.....4

Figure 6
FACTORS MODEL
OUTCOME FACTORS
(Unit of measures is hypothesis)

1. EFFICIENCY Measures- 97

Consensus Time..……8
Decision Cycles..……9
Decision Time……..……70
Negotiation Time…….2
Perceived Time..…….5
Perceived Efficiency……1
Decision Time-iterations…….2

4. CONSENSUS Measures- 67

Consensus.....……...26
Compromise.....…….2
Consensus Change..……..……..16
Post-Meeting Consensus…….12
Pre-Meeting Consensus……6
Residual Disagreement…… 2
Polarization……3

5. USABILITY Measures-42

Design Preference…….…….....6
Ease of Use.....…….……..4
Interface.....……..…4
System Usage...…….……...1
System Satisfaction……...8
Usefulness.....…….……....4
Willingness to work again……9
Comments on System.……..…6

3. SATISFACTION Measures- 280

Satisfaction- 209

Acceptance.....……...1
Affective Reward.....…….……2
General Satisfaction.……65
Satisfaction Other..……..…22
Decision Satisfaction…..……..…40
Satisfaction System..…….……...3
Decision Scheme.....…….…….…4
Process Satisfaction.……71
Design Satisfaction..……..…1

Conflict Management- 56

Fun.....……..…2
Cohesiveness.....……..23
Commitment.....…..……....4
Conflict Management…….……12
Conflict Other.....……..11
Group Development…….4

Participation - 15

Perceived Participation…..……..…13
Perceived Preference..……2

2. EFFECTIVENESS Measures-617

Decision quality- 218

Decision Quality……..88
Idea Quality…..23
Deviation……...….2
Quality...……...46
Discussion..…….….8
Learning…….2
Effectiveness……..8
Meeting Quality..3
Other.....……....15
Creativity.....…6
Judgment Accuracy…..3
Performance..…11
Comprehensiveness…..2
Decision Quantity……1

Communication- 162

Communication……...14
Number Comments…….…63
Questions.……..19
Supportive……15
Arguments..……19
Percent.....……..7
Other.....……...25

Productivity- 167

Number-Alternatives. ….33
Number Unique Ideas..…53
Depth of Evaluation..……8
Number Errors…….2
Number Ideas ……54
Commonness…....1
Assumptions…....5
Conservatism..……1
Productivity....…....9
Implementation….1

Perceived- 70

Decision Confidence…….……..18
Depth of Evaluation……...2
Task Focus.....…….…….…5
Task/Communication. Fit..……1
Quality.....……14
Idea Diversity...……..…..2
Performance.....…….…5
Communication Quality……....1
Effectiveness...……20
Skill Utilization.……2

Appendix 1

Studies Included in the Analysis

(Papers with the same number share the same method and parameters.)

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Non-conforming studies

22 Chidambaram & Kautz, 1993: One group per cell; No statistics.
27 Connoly, Routheaux, & Schneider, 1993: Individuals pooled into groups.
52 Ellis, Rein, & Jarvenpaa, 1989, 1990: One group per cell.
53 Eveland & Bikson, 1988: One group per cell; No statistics.
67 Griffith & Northcraft, 1994: Two subjects per group.
86 Jarvenpaa, Rao, & Huber, 1988: One group per cell.
95 Kinney & Dennis, 1994: Two subjects per group.
96 Kinney & Watson, 1992: Two subjects per group.
109 Mcleod & Elston, 1995: No Statistics.
126 Rao, 1994, 1995: No real task; discussion only.
143 Smith, Hayne, & Connole, 1992: No statistics.
146 Smith & Vanecek, 1988: Two subjects per group.
161 Tryan, George, & Nunamaker, 1992: No statistics.
166 Valacich, Paranka, George, & Nunamaker, 1994: Two subjects per group.

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AUTHORS	TECHNOLOGY	EXPERIMENTAL DESIGN	GROUP SUBJECT Variables	TASK/TYPE	NUMBER of SESSIONS/ SESSION LENGTH
1 Adrianson & Hjelmquist, 1991	CMC: COM, Level 1, Decision room, distributed, Tools: Ranking; Training?	2 X 2 X 2 Repeated measures Mode of Communication: FtF, CMC Problem Type: Human relations Technical ranking Experience Experienced,Inexperienced COM users	16 groups; 4 groups per cell; 4 subjects per group; 65 total subjects; Professional.	Forest Ranger & Lost in the Arctic, Decision-making, Intellective, Type 4,3	2 sessions, one F-t-F and 1 CMC. FR FtF 75 min FR CMC 80 min LA FtF 60 min LA CMC 90 min
2 Aiken, Krosp, Shirani, & Martin, 1994	GSS: GroupForum, Level 2 decision room, anonymous, facilitator, Tools: brainstorming, Training: 5 min.	2 x 2 quasi factorial Communication: Verbal, GSS Group size: Small, Large	10 groups; 2 or 3 groups per cell; 6 small groups of 7 to 9 subjects and 4 large groups (size 50 & 63 for verbal and two size 41 for GSS); 243 total subjects; Undergraduates.	Tourism Task & Parking problem, Idea generation, Type 2	1 session, 15 minutes
3 Aiken, Vanjani, & Paolillo, 1996	GSS: Unknown, Level 1, Decision room, Tools: pool writing vs. Gallery writing, Training ?	2 X 2 Repeated measures GSS Tool: Pool Writing, Gallery Writing Task: Parking, Security	9 groups; 4 and 5 groups per cell; 9 or 10 subject per group; 88 total subjects; Undergraduates, MIS	Parking Problem, Security Problem, Idea generation Type 2	2 sessions, session length not reported.
4 Anson, Bostrom, & Wynne, 1995	GSS: GroupSystems, Level 2, Decision room, Facilitator, Tools: issue consolidation, topic commentor; Training: practice task &systems demo.	2 X 2 Factorial Technology: GSS, No-GSS Facilitation: Facilitator, No Facilitator	48 groups; 12 groups per cell; 6 or 7 subjects per group; 319 total subjects; Undergraduates.	Strategy Design and Implementation (paper planes), Planning & performance, Type 1 & 8	1 session, training plus 90 minutes planning task and 5 minutes execution.
5 Archer, 1990	CMC: CoSy, Level 2, asynchronous, Group Moderator/Leader; Distributed, Tools: None Training: yes	4 X 4 X 4 Repeated Measures Communication Mode: FtF, FtF-NGT, CC-Asynch, CC-NGT Cases: 4 cases Order: 4 order	4 groups; 2 groups per cell; 4 or 5 subjects per group; 18 total subjects; MBA Students.	Case studies on IS, Decision-making, Type 4	4 Asynch sessions, each 2 weeks long.
6 Beauclair, 1989	GSS: Not Reported, Level 2, Decision room, Tools: EBS, voting, Training: Yes.	2 X 2 Factorial Brain storming: FtF, GSS Voting: FtF, GSS	20 groups; 5 groups per cell; 3 to 5 subjects per group; 86 total subjects; Undergraduates	Case of student misconduct; Idea generation; type 2	1 session, time not reported.

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7 Benbunan-Fich & Hiltz, 1998	CMC: EIES, Level 2, Asynchronous, Tools: Question, Training: Yes	2 X 2 Factorial Communication mode: FtF, CMC Teamwork: Individuals, Groups	20 groups: 5 groups per cell; 4 to 6 subjects per group; 136 total subjects; undergraduates-CIS	Jane's Case ethical scenario; Intellective; Type 3	Asynchronous: 2 weeks; FtF two hours.
8 McGrath & Arrow, & Associates, 1996;	CMC: GroupLab, Level 1, Distributed, Synchronous, Non-Anonymous, Tools: None, Training:?	2 X 7 Repeated measures Comm Mode: FtF, CMC Sessions: 7 sessions Repeated measures on both factors. Task is nested with session).	30 groups, 15 groups per cell; 3 or 4 subjects per group; 119 total subjects; Undergraduates, Psychology	Customsoft Task-type 2; Group naming- type 4 Madison Electric-type 3, 4; Genesis Candidates- type 3, 5;Ehrhart's Brewery-type 4; Moromark office- type 3; Rogers-Rhodes- type 4; Kelly credit- type 4; College drama- type 4;Mt Hood- type 2,4. 14 sessions, each 2 hours.	
9 Briggs, Balahazard, & Dennis, 1996	GSS: EMS, Level 2, Decision room, Tools: EBS, Idea organizer, Vote, Training: 1 hr.	2 X 2 Factorial GSS Design: Keyboard-interface, Pen-interface Subject Type: Professionals, Graduate students	84 total subjects; Other information not reported; Executives and Graduate students-business	Growth of Tucson; Decision making, Cognitive conflict; Type 4, 5	1 session, 1.5 hours.
10 Bui & Sivasankaran, 1990	GSS: Co-Op, Level 1, Decision Room, Laboratory, Facilitator, Tools: MCDM; Training ?	2 X 2 Repeated Measures GSS Type: GSS, No GSS Task Complexity: High vs Low	24 groups; 12 groups per cell, 4 cells, 3 subjects per group, 72 total subjects; Graduates.	Al Kohbari & Energy International, Intellective, Type 3	1 session
11 Bui, Sivasankaran, Fijol, & Woodbury, 1987	GSS: Co-Op, Level 1, Decision room, Laboratory, Facilitator, Tools: MCDM; Training ?	2 x 1 GSS Type: FtF Shared system Distributed system	12 groups; 6 groups per cell; 3 subjects per group; 36 total subjects; Graduates.	Case Study: Generate criteria & select best manager, Idea generation & Intellective, Type 2,3 1 session length not reported.	
12 Burk & Aytes, 1998 Experiment 1	GSS: GroupLink, Level 1, Distributed, staggered-synchronous, Tools: none, Training:?	3 X 4 Communication mode: FtF, Synchronous, Staggered- synchronous Experience: 4 sessions	33 groups; 11 groups per cell, 127 subjects; 3 or 4 subjects per group; undergraduates-business	Complex Project Development; Decision making, Type 4	4 sessions, 60 min. each.

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12 Burk & Aytes, 1998 Experiment 2	GSS: Rapport, Level 1, Distributed, Tools: Groupwriting, Training:?	3 X 4 Communication mode: Video, audio, combined (audio in3 sessions, video in the last session) Experience: 4 sessions	29 groups; 10 groups per cell; 3 or 4 subjects per group; 111 total subjects; undergraduates-business	Complex Project Development; Decision making, Type 4	4 sessions, 75 min. each.
13 Burke & Chidambaram, 1995; Burke & Chidambaram, 1994	GSS: GroupLink, Level 1, Decision room, distributed-synchronous, distributed-asynchronous, Tools: Communication & GroupWriter, Training: on the system features.	3 X 3 Repeated measures GSS: FtF-GSS, Distributed-Synchronous-GSS, Distributed-Asynchronous-GSS Time: 3 sessions	9 groups; 3 groups per cell; 4 subjects per group; except 2 groups in FtF-GSS; 30 total subjects; Undergraduates.	Policy Manual for Training, Unstructured, Idea generation & Decision-making, Type 2 & 4	3 sessions each 1 hr. over a two week period.
14 Burke, Chidambaram, & Lock, 1995	GSS: GroupLink, Level 1, Decision room, distributed-synchronous, distributed-Asynchronous, Tools: GroupWriter, Training: ?	3 X 4 Repeated measures GSS: FtF-GSS, Distributed-Synchronous-GSS, Distributed-Asynchronous-GSS Time: 4 sessions	33 groups; 11 groups per cell; 3 or 4 subjects per group; 127 total subjects; Undergraduates.	Policy Manual for Training, Un-structured, Idea generation & Decision-making, Type 2 & 4	4 sessions over a 4 week period.
15 Burke & Chidambaram, 1996	GSS: GroupLink, Level 1, Decision room, synchronous, asynchronous, Tools: GroupWriter, Training: ?	3 X 1 ANOVA Communication Mode: GSS-FtF, GSS-Synch, GSS-semi-Asynch	33 groups; 11 groups per cell; 3 to 5 subjects per group; 127 total subjects; Under grads, business.	Complex project development case-prepare policy manual; Type 2,3,5	4 hour sessions over a 4 week period
16 Carey & Kacmar, 1997	CMC: Vaxnotes, Level 1, Synchronous, Distributed, Anonymity, Tools: None, Training: Yes	2 X 2 Repeated measures on task and comm mode Communication mode: FtF CMC Task complexity: Simple, Complex	22 groups; 11 per cell; 5 subjects per group; 55 total subjects; MBA	Changing Flat Tire, simple: Intellective, Type 3; Investment Decision Task;Complex, Intellective, Type 3	2 sessions, either FtF or CMC on simple task, then reverse comm mode on complex task, length: avg 9-47 min.

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17 Cass, Heintz, & Kaiser, 1991 & 1992	GSS: SAMM, Level 1, Decision room, dispersed-synchronous, No-facilitation, Tools: agenda, ranking, voting, Training: 30 min with practice task.	2 X 2 Factorial GSS: GSS, No-GSS Proximity: FtF, Dispersed	134 groups; groups per cell: 28, 34,36,36; 3 or 4 per group; 502 total subjects; Undergraduates & Grads.	The Foundation Task, Preference allocation, Type 4.	1 session; max tine 82 min; average time 27.2 min.
18 Chidambaram, 1996	GSS: GroupSystems, Level 2, Decision room; Anonymous; Facilitator; Tools: EBS, Issue analyzer, Voting; Training: ?	2 X 4 Repeated measures Comm Mode: GSS, FtF Experience: 4 sessions	28 groups; 14 groups per cell; 5 subjects per group; 140 total subjects; Undergraduates-business	PVVI Task; Decision making; Type 4	4 sessions, 90 min.
19 Chidambaram, Bostrom, & Wynne, 1990, 1991; Chidambaram & Bostrom, 1993	GSS: Plexsys, Level 2, Decision Room, Facilitator, Tools: EBS, Issue Analysis, Voting; Training ?	2 X 4 Repeated Measures GSS Type: GSS, Manual Number of Sessions: 4	14 groups; 7 groups per cell; 5 subjects per group; 140 total subjects; Undergraduates.	PVVI Cases, Decision Making, Type 4	4 90 min sessions
20 Chidambaram & Jones, 1993	GSS: GroupSystems, Level 2, Decision Room, Synchronous, Facilitator, Anonymity, Tools: EBS, Discussion, Voting; Training: system and training task.	2 X 2 X 2 Repeated Measures Computer support: EMS, no-EMS Communications medium (CM): FtF, Audio-Conferencing; Repeated measures on CM with two tasks.	12 groups; 6 groups per cell; 3 or 4 subjects per group; each cell had 3 3's and 3 4's; 42 total subjects; Undergraduates.	PVVI Cases, Decision Making, Type 4.	2 sessions, length not reported.
21 Chidambaram & Kautz, 1993	GSS: GroupSystems, Level 2, Decision room, Anonymity, Tools: Idea generation, evaluation, choice; Training: ?	2 X 2 Factorial Design Support: GSS, No-GSS Ethnic Diversity: Low, High	4 groups; 1 group per cell; 3 to 6 subjects per group; 17 total subjects; Undergraduates Hawaiian, Chinese, Japanese, Filipino, Caucasian	PVVI Cases, Decision Making, Type 4	1 session; length not reported

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22 Clapper & Massey, 1995	GSS: VisionQuest, Level 1, Decision room, Facilitator, Tools: Brainwriting, Training ?	2 X 1 Communications Mode: GSS, FtF with co-variates: pre-discussion elements on a set of individual lists Unused, shared, or unshared	18 groups; 9 groups per cell; 3 or 4 subjects per group; 70 total subjects; undergraduates.	AIDS on Campus, Idea generation, Type 2	1 session; less than 1 hour.
23 Clapper, McLean, & Watson, 1991	GSS: GroupSystems, Level 2, Decision room, Facilitator, Tools: Topic Commentor, Training: Yes	3 X 2 Factorial Communication Mode: FtF, GSS, D-GSS Task Type: Intellective, Judgmental	12 groups; 2 groups per cell; 4 subjects per group; 48 total subjects; Undergraduates.	Mock Jury Task, Two versions: Intellective-Type 3 Judgmental- Type 4	1 session, 1 hour.
24 Clapper, McLean, & Watson, 1998	GSS: GroupSystems, Level 2, Decision room, distributed, Tools: Topic Commenter, Training: ?	3 X 2 Factorial Communication Mode: FtF, GSS-DR, GSS-Dist Task Type: Intellective, Judgment	48 groups; 8 groups per cell; 4 subjects per group (1 participant & 3 confederates); 48 total subjects; undergraduates-psychology	Mock Jury Task, Intellective, Type 3 Preference, Type 4	1 session, length 45 min.
25 Connolly, Jessup, & Valacich, 1990	GSS: Plexsys, Level 1, Decision Room, Tools: EBS; Training: 10 Min.	2 X 2 Factorial Anonymity: Anonymous, Identified Evaluative Tone: Critical, Supportive	24 groups; 6 groups per cell; 4 subjects per group; 96 total subjects; Undergraduates.	Parking Problem, Idea generation & evaluation, Type 2	1 30 min session
26 Connolly, Routheaux, Schneider, 1993	GSS: GroupSystems, Level 0, Decision room, Anonymous, Tools: Group Outliner; Training: ?	3 X 1 Idea seeding: rare, common, baseline (Process Structure)	3 groups; 1 group per cell; 16 or 17 pooled subjects per group; 50 total subjects; Undergraduates-management.	College budget Task, Intellective, Type 3	1 session, up to 40 minutes
27 Daly, 1993	GSS: CSCW design, Level 1, Decision Room, Group leader, Tools: 4-windows; Training: yes.	2 X 1 Communication: GSS, FtF.	64 groups; 32 groups per cell; 4 subjects per group; 256 total subjects; Undergraduates- Accounting	Collective Induction, Intellective, Type 3	1 session; Average time: GSS-55 min., FtF- 31 min.
28 Daily & Steiner, 1998	GSS: VisionQuest, Level 1, Decision room, Facilitator, Tools: rating, Training:?	3 X 2 X 2 Repeated measures on task Communication mode: FtF, GSS Culture: Multicultural, Culturally homogeneous Tasks: 3 tasks	12 groups; 6 groups per cell; 4 or 5 subjects per group; 53 total subjects; undergraduates & MBA, Hispanic and US.	Expansion of Campus Parking, Expand Campus Activities Center, Reduce Crime, Idea generation, Type 2	3 sessions, each 45 min.

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29 Daily, Whatley, Ash, & Steiner, 1996	GSS: VisionQuest, Level 2, Decision room, Facilitators, Tools: Rating, Training: ?	2 X 2 X 3 Repeated Measures Comm Mode: GSS, FtF Cultural diversity: Heterogeneous, Homogeneous Sessions: 3 sessions	12 groups; 6 groups per cell; 4 or 5 subjects per cell; 53 total subjects; Undergraduates & Graduates - business; Hispanic & Anglos.	Campus Parking, Campus Activities, Reducing Campus Crime Tasks; Idea generation; Type 2	3 sessions, 60 min. Each, one month apart.
30 Davey & Olson, 1998	GSS: VisionQuest, AT, NEGO, Level 2, Decision room, Tools: AHP, LP, MOLP, Training: Yes	3 X 1 GSS Design: VisionQuest, AT, NEGO	33 groups; 11 groups per cell; 3 subject per group; 99 total subjects; undergraduates-MIS	Investment Decision Task; decision making, conflict, Type 4,5	1 session, length 1.5 hours.
31 Dennis, 1993, 1996	GSS: GroupSystems, Level 2, Decision room, Anonymity, Tools: Group outliner, Voting, Training: 2 hrs.	2 X 1 Comm Mode: GSS, FtF	14 groups; 7 groups per cell; 10 subjects per group; 140 total subjects; Undergraduate-business	University Admissions; Hidden Profile Task; Distributed information; Decision making; Cognitive conflict; Type 3, 4 & 5 1 session, 30 min.	
32 Dennis, 1996	GSS: GroupSystems, Level 2, Decision room, Anonymity, Tools: Group outliner, Quick vote, Training: ?	2 X 1 Comm Mode: FtF, GSS	21 groups; 10, 11 groups per cell; 6 subjects per group; 126 total subjects; Undergraduates-business; Established	University Admissions; Hidden Profile Task; Distributed informa-tion; Decision making; Cognitive conflict; Type 3,4 & 5	1 session, 30 min.
33 Dennis, Aronson, Heninger, & Walker, 1996	GSS: GroupSystems, Level 2, Decision room, Facilitator, Tools: EBS, Training: ?	2 X 2 Factorial Task decomposition: single, Multiple (3) Time decomposition: 1 30 min period, 3 10 min periods	40 groups; 10 groups per cell, 10 subjects per group; 400 total subjects; Undergraduates, management.	Improve Environmental Task, idea generation, Type 2	1 session, 30 min or 3 10 min sub-sessions.
34 Dennis, Easton, Easton, George, & Nunamaker, 1990	GSS: Plexsys, Level 1, Decision Room, Facilitator, Tools: EBS, IA, Voting; Training ?	2 X 1; Group Type: Established, Ad hoc	11 groups; 5 and 6 groups per cell; 4 or 5 subjects per group; 55 total subjects; Undergraduates.	The Parkway Drug Case, Intellective, Type 3	1 20 min session.

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35 Dennis, Hilmer, Taylor, & Polito, 1997; Dennis, Hilmer & Taylor, 1998	GSS: TCBWorks, Level 2, Decision room, anonymity, Tools: Vote, Training: Yes.	2 X 2 Repeated measures Comm Mode: FtF, GSS Process Structure-information distribution: Majority/minority, Uniform	17 groups; 8 or 9 groups per cell; 10 subjects per group; 150 total subjects; Undergraduate-business	University Admissions and Standard Computer; Hidden Profile Task; Distributed information; Decision making; Cognitive conflict; Type 3,4 & 5; 2 sessions, 25 min. Each.	
36 Dennis & Valacich, 1993	GSS: GroupSystems, Level 1, Decision Room, Tools: EBS, Anonymity; Training 5 min.	2 X 2 factorial with 2 task Support: EBS, Nominal Group size: 6 or 12 members	32 groups; 8 groups per cell; 6 and 12 subjects per group; 276 total subjects; Undergraduates, business.	Tourist and Improve campus security tasks, Idea generation, Type 2	1 15 min. session for each task.
37 Dennis & Valacich, 1994; Dennis, Valacich, & Nunamaker, 1991 Experiment 1	GSS: GroupSystems, Level 2, Decision room, Anonymity, Facilitator, Tools: EBS, Training: Yes	4 x 1 Group size: Intact-18, Nominal-18, Sub-group-9, Sub-group-3. No-incentive- Groups	27 total groups; 12 groups of 3, 10 groups of 9, 5 groups of 18; 43 individuals ;259 total subjects; Undergraduates-business	Consequences Task; Idea generation; Type 2	1 session, 30 min.
37 Dennis & Valacich, 1994; Dennis, Valacich, & Nunamaker,1991 Experiment 2	GSS: GroupSystems, Level 2, Decision room, Anonymity, Facilitator, Tools: EBS, Training: Yes	3 X 1 Group size: Intact-12, Nominal-12, Sub-group-4. Incentive- Groups	12 groups; 7 groups of 12,5 groups of 4; 60 individuals; 164 total subjects; Undergraduates-business	Consequences Task; Idea generation; Type 2	1 session, 30 min.
38 Dennis, Valacich, Carte, Garfield, Haley, & Aronson, 1997	GSS: GroupSystems, Level 2, Decision room, Tools: EBS, Training: ?	2 X 2 Repeated Measures Idea generation technique: Multiple dialogue, Single dialogue Task: Tourist, Campus security	20 groups; 10 groups per cell; 10 subjects per cell; 200 total subjects; Undergraduate-business	Tourist and Improve campus security tasks, Idea generation, Type 2	2 sessions, 15 min. Each
39 Dennis, Valacich, Connolly & Wynne, 1996; Experiment 1	GSS: EBS, Level 1, Decision room, no-Facilitation, Tools: EBS, split screen; Training: ?	2 X 1 Process Structuring: Single, Multiple	18 groups; 9 groups per cell; 8 or 9 subjects per group; 153 total subjects; MBA students.	Video Store Information System Design, Idea generation Type 2	1 session: Single question condition 1 45 min session,; Multiple: 3 15 min sessions.

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39 Dennis, Valacich, Connolly & Wynne, 1996; Experiment 2	GSS: GroupSystems, Level 1 Decision room, Tools: EBS, Training?	2 X 1 Process Structuring: Single, Multiple	9 groups; 4 or 5 groups per cell; 8 subjects per group; 72 total subjects; Professionals	Leadership in the Community, Idea generation, Type 2	1 session; Single question condition 1 30 min session; Multiple: 3 10 min sessions.
40 Dennis, Valacich, & Nunamaker, 1990;Valacich, Dennis,& Connolly, 1994, Experiment 1	GSS: GroupSystems, Level 1, Decision Room, Facilitator, Tools: EBS; Anonymity, Training yes.	3 X 1; Group size: small (3), medium (9), large (18)	17 groups; 7 small groups, 5 groups in medium and large, total 156; An additional 43 used as the nominal pool; Undergraduates, business students.	PC Imports Problem, Idea generation, Type 2	1 session, 30 min,
41 DeSanctis, D'Onofrio, Sambamurthy, & Poole, 1989	GSS: SAMM, Level 2, Decision Room, Tools: Alternatives, Ranks, Voting; Training: up to 48 minutes and a practice problem.	3 X 2 Factorial with control Comprehensiveness: Specific alone, Coupled, Integrated Restrictiveness: Higher, Lower Specific: Social judgment; Coupled: SA+ Consensus; Integrated: both	56 groups; 9 or 10 groups per cell; 3, 4 or 5 subjects per group; 239 total subjects; Undergraduates.	The Foundation Task, Preference, Type 4	1 session; length not reported.
42 Dickson, DeSanctis, Poole, & Limayem, 1991	GSS: SAMM, Level 1, Level 2, Decision room, Tools: communication, multi-criteria model; Training: 30-40 minutes, practice task	2 X 1 Support: Level 1, Level 2	30 groups; 15 groups per cell; 3 to 5 subjects per group; 101 total subjects; Undergraduates-Business.	The Foundation Task, Preference, Type 4	1 session; length
43 Dickson, Partridge, & Robinson, 1993; Dickson, Lee, Robinson, & Heath, 1989	GSS: SAMM, Level 2, Decision Room, Tools: alternatives, Ranks, Voting; Training: None, Facilitated.	2 X 2 Factorial Support Mode: Facilitator, Chauffeur Guide Roles: A, B. The Facilitator and chauffeur exchanging roles. Groups were formed based on a pre-consensus score (>. 40 or <.15).	36 groups; 9 groups per cell; 3 subjects per group; 108 total subjects Graduates (MBA).	The Foundation Task, Preference, Type 4	1 session 2.0 hr.

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44 Dubrovsky, Kiesler, & Sethna, 1991	CMC: CMS ERCMAIL, Level 1, Distributed, Synchronous and FtF. Tools: ? Training: CMC practice with E-mail.	2 X 2 Repeated measures Communication condition: FtF, CMC Task: 4 tasks, 2 High-status tasks, 2 Low-status tasks Member status: status composition controlled	24 groups; 6 groups per cell; 4 subjects per group; 96 total subjects; 2 MBA's and 1 undergraduate in each group.	Choice dilemma, Decision-making, 4 tasks; 2 Freshman (low) , 2 MBA (high) level; Type 4	4 sessions; one FtF and one CMC; two tasks in each session. Length less than 1 hr.
45 Dubrovsky, Clapper, & Ullal, 1996	CMC: SomCof, Level 1, Distributed, Synchronous, Tools: Distinct windows, Training: Yes	2 x 1 Internal Status Distinct Window, non-distinct	18 groups; no cells; 3 subjects per group; 54 Total subjects; Undergraduates-Management	Choice-Dilemma Tasks, Type 4	1 session; 15 min. to unlimited.
46 Dufner, Hiltz, Johnson, & Czech, 1995: Dufner, Hiltz, & Turoff, 1994	CMC: EIES 2, Level 2, Distributed, Asynchronous, Moderator, Tools: List, Vote, Training: 2.5 hrs.	2 X 2 Factorial Tools: Tools, no tools Sequential: Sequenced, non-sequenced	31 groups; 6 to 9 groups per cell; 3 to 8 subjects per group; 119 total subjects; Graduates and undergraduates.	The Foundation Task, Preference, Type 4 Training task: Paint Vendor Selection	1 FtF training session and 1 asynchronous experimental session over 5 business days. Subjects log-on once/day.
47 Easton, George, Nunamaker, & Pendergast, 1990	GSS: EMS, Level 1 & 2, Decision Room, Facilitator, Tools: EBS, EDS; Training ?	2 X 1 EBS-IA-Voting EDS-Discussion-Issue-Voting	10 groups; 5 groups per cell; 6 subjects per group; 60 total subjects; Undergraduates.	Video/Video Management Case, Idea generation & Intellective, Type 2,3	1 session 30 min, extended 30 min longer if consensus is not reached.
48 Easton, Vogel, & Nunamaker, 1989	GSS: EMS, Level 1, Decision room, Facilitator, Identified, Tools: SIAS; Training ?	3 X 1 No decision support (US), manual support (MS), & computer support (AS)	18 groups; 6 groups per cell; 4 subjects per group; 72 total subjects; Undergraduates.	PC Problem, Idea generation, Type 2	1 session, max length 90 min.
49 Easton, Vogel, & Nunamaker, 1992;	GSS: PLEXSYS, Level 2, Decision room, Facilitator, Anonymous & identified, Tools: SIAS, vote; Training?	2 X 1 GSS type: SIAS, I-SIAS SIAS: Stakeholder Identification & Assumption Surfacing; I-Interactive	12 groups; 6 groups per cell; 4 subjects per group; 48 total subjects; Undergraduates.	PC Problem, Idea generation, Type 2	1 session, max length 90 min.
50 El-Shinnawy & Vinze, 1997	GSS: Unknown, Level 1, Decision room, Anonymity, Tools: none, Training: ?	2 x 2 Factorial Communication Mode: FtF, CMC Culture: US, Singapore	48 groups; 12 groups per cell; 6 subjects per group; 144 total subjects; MBA US & Singaporean	Pentium Problem, Decision making, Type 3	1 session, length 1 hour.

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51 El-Shinnawy & Vinze, 1998	GSS: MeetingRoom, Level 1, Distributed, synchronous Anonymous, Tools: EBS, voting, Training: Yes	2 X 2 X 2 Factorial Group composition: Flexible-cohering, assertive-directing Communication mode: FtF, GSS	33 groups; 4 or 5 groups per cell; 5 subjects per group, some 6; 168 total subjects; undergraduates-business and graduates-MBA; Established groups	The strategy Task, Judgment, Type 4; Pentium Problem, Intellective, Type 3	1 session, length 2 hours.
52 Ellis, Rein, & Jarvenpaa, 1990; Ellis, Rein, & Jarvenpaa, 1989	GSS: NICK: Level 1, EBS & EWS, Decision Room, Assigned leader, Tools: ? Synchronous, Training: ?	3 X 3 Repeated Measures Greco-Latin GSS type: EBB, EWS, Control-Paper Task: Project Interaction, Technology Transfer, Technology Impact	3 groups; 1 group per cell; 7 subjects per group; 21 total subjects; Professionals.	The STP Tasks, Planning, Idea generation, Intellective, Type 1, 2, 3	3 1 hr sessions for each of the 3 tasks; total of 9 hours.
53 Eveland & Bikson, 1988	CMC: RandMail, Level 1, Distributed, Asynchronous, Field, Tools: None; Training ?	2 X 2 CMC: CMC, No CMC Subjects: Retired, Not Retired	4 groups; 1 group per cell; 20 subjects per group; 79 total subjects; Professionals.	Pre-Retirement Planning Task Decision-making & Mixed-motive, Type 4, 6	1 year study.
54 Fjermestad, Hiltz, Turoff, Ford, Johnson, Czech, Ocker, Ferront, & Worrell, 1995	CMC: EIES 2, Level 2, Asynchronous, Distributed, Moderator, Leader, Tools: List, Question, Vote, Training: 2 hours.	2 X 2 Repeated measures Decision Approach: DI (15), CC (16) Experience: Task 1, Task 2	31 groups; 15 and 16 groups per cell; 4 to 7 subjects per group; 160 total subjects; Graduates and Undergraduates.	PVVI Cases, Decision-making Type 4	2 asynchronous experimental sessions each up to 12 days.
55 Galegher & Kraut, 1994; 1990	CMC: ICoSy, Level 1 Asynchronous, Distributed, No facilitator, Identified, Tools: ? Training ?	3 X 2 Counter Balanced Design Project: Divisible (Lay-off) Integrative (Personnel) Communications Modality: FtF, CMC, CMC + phone	39 groups; 13 groups per cell; 3 subjects per group; 117 total subjects; MBA students.	Lay Off Task, Personnel Problem Task Intellective & Decision -making, Type 3 & 4	2 experimental sessions each 2 weeks long.
56 Gallupe, 1990 Experiment 1	GSS: DECAID, Level 2, Decision room, Tools: Idea generation, ranking voting; Anonymous, Training yes.	2 X 1 Technology: GSS, No-GSS	18 groups; 9 groups per cell; 3 subjects per group; 54 total subjects; Undergraduates, Business.	Canada Continuous Forms -Bonanza Business Case, Decision making, Type 4	1 session, average of 57 min.

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56 Gallupe, 1990 Experiment 2	GSS: Plexsys, Level 2, Decision Room, Anonymous, Tools: Idea generation, ranking, voting; Training yes.	2 X 1 Technology: GSS, No-GSS	20 groups; 9 groups per cell; 4 to 5 subjects per group; 93 total subjects; Undergraduates, Business	KOMCO- MIS Steering Committee Case, Rank ordering, Judgment, & Decision-making, Type 4	1 session, average of 57 min.
57 Gallupe, Bastianutti, & Cooper, 1991	GSS: GroupSystems, Level 1, Decision Room, Anonymous, Tools: EBS, Training: 5 min	2 X 2 Factorial Task Structure-Process: Nominal, Interacting GSS: Electronic, Non-Electronic	40 groups; 10 groups per cell; 4 subjects per group; 160 total subjects; Undergraduates and MBA students.	Thumbs Problem, Idea generation, Type 2	1 session; 15 minutes
58 Gallupe, Cooper, Grise, & Bastianutti, 1994; Experiment 1	GSS: GroupSystems, Level 1, Decision Room, Anonymous, Tools: EBS, Training: 5 min Technology Structure: 5-sec Delayed keyboard	3 X 1 Brainstorming Method: Verbal (V), Electronic (EBS), Delayed-EBS (D-EBS) V and EBS data from Gallupe, et al, 1991	25 groups; 10 groups in V and EBS; 5 groups in D-EBS; 4 subjects per group; 100 total subjects; Undergraduates & MBA students.	Thumbs Problem, Idea generation, Type 2	1 session; 15 minutes
58 Gallupe, Cooper, Grise,& Bastianutti, 1994; Experiment 2	GSS: GroupSystems, Level 1, Decision Room, Non-anonymous, Tools: EBS, Training: 5 min	2 X 1 Method: EBS, Verbal (V) Technology Structure: Turn taking (non-parallel entry)	20 groups; 10 groups per cell; 4 subjects per group; 80 total subjects; Undergraduates-business.	Features of the University Library Task, Idea generation, Type 2	1 session; 15 minutes.
58 Gallupe, Cooper, Grise,& Bastianutti, 1994; Experiment 3	GSS: GroupSystems, Level 1, Decision Room, Non-anonymous, Tools: EBS, Training: 5 min	3 X 2 Repeated measures Technology Structure: Normal, Turn Taking, First-in Technology: EBS, Non-EBS Counter balanced design	30 groups; 10 groups per cell; 4 subjects per group; 120 total subjects; Undergraduates-business.	Features of the University Library Task, The Tourism Task, Type 2	2 session; 15 minutes each.
59 Gallupe, Dennis, Cooper, Valacich, Bastianutti, & Nunamaker, 1992 Experiment 1	GSS: GroupSystems, Level 1, Decision Room, Tools: EBS; Training: 5 min.	3 X 2 X 2 Repeated Measures Group size: 2, 4, & 6 per group Technology: Electronic (EBS), Non-Electronic (BS) Task: Tourism, Security	30 groups; 10 groups per cell; 2, 4, 6 subjects per group, 120 subjects; Undergraduates.	Tourism & Security Problem, Idea generation, Type 2	2 sessions; 15 min each.

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59 Gallupe, Dennis, Cooper, Valacich, Bastianutti, & Nunamaker, 1992 Experiment 2	GSS: GroupSystems, Level 1, Decision Room, Tools: EBS; Training: 5 min.	2 X 2 X 2 Repeated Measures Group size: 6 & 12 Technology: EBS & BS Task: Tourism, Security	24 groups; 8 groups per cell; 6 & 12 subjects per group; 144 subjects; Undergraduates.	Tourism & Security Problem, Idea generation, Type 2	2 sessions; 15 min each.
60 Gallupe, DeSanctis, & Dickson, 1988	GSS: DECAID, Level 1, Decision Room, Facilitator, Tools: Alternative generation, Ranking, voting; Training yes.	2 X 2 Factorial GSS: GSS, No-GSS Task Complexity: High vs. Low	24 groups; 6 groups per cell; 3 subjects per group, 84 total subjects; Undergraduates.	Bonanza Business Forms, Problem Finding High & Low complexity, Decision-making. Type 4	1 session, 1.2 hr.
61 Gallupe & McKeen, 1990	GSS: DECAID, Level 1, Decision Room, Remote, Tools: Ranking; Training yes.	2 X 2 Factorial GSS: GSS, No-GSS Proximity: FtF, Remote	18 groups; 4 or 5 groups per cell; 3 subjects per group, 60 total subjects; Undergraduates.	Canada Continuous Forms-Bonanza Business Forms Case, Ranking, Decision-making, Type 4	1 session, 60 min.
62 George, Dennis, & Nunamaker, 1992	GSS: EMS, Level 1, Decision Room, Facilitation, Tools: EDS, voting; Training.	2 X 1 Facilitation: Facilitated (GSS-F), User-driven (GSS)	12 groups; 6 groups per cell; 4 or 5 subjects per group; 50 total subjects; Undergraduates	Parkway Drug Case, Idea generation & Intellective, Type 2, 3	1 session; maximum length 50 min.
63 George, Easton, Nunamaker, & Northcraft, 1990	GSS: PLEXSYS-EBS, Level 1, Decision room, Facilitator, Tools: EBS, IA, Voting; Training yes.	2 X 2 X 2 Quasi-Factorial GSS type: GSS, FtF Leadership: Leader, No Leader Anonymity: Anonymous, Identified	30 groups; 6 groups per cell; 6 subjects per group; 180 total subjects; Undergraduates.	Parkway Drug Case, Idea generation & Intellective, Type 2,3	1 30 min session.
64 Ghani, Supnick, & Roony, 1991	CMC: brand-Unknown, Level: 1 Synchronous, Distributed, Anonymous, Tools: ranking; Training yes.	2 X 1 Repeated Measures CMC: CMC, FtF	20 groups; 10 groups per cell; 3 subject per group; 59 total subjects; Undergraduates.	Lost in Arctic, Intellective, Type 3	1 session, training CMC, FtF, 45 min.

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65 Glasson, Atkinson, Chang, & Whitely, 1994	GSS: MeetingWare, Level 2 Decision room, Facilitator, Tools: Basic set, Training: Guided.	2 X 2 X 2 Repeated measures Support: FtF, GDSS Session: 1, 2 Case: A, B	32 groups; 4 groups per cell; 5 subjects per group; 80 total subjects; Undergraduates.	Computer Books by Mail Case, Idea generation, Intellective, Type 2,3	2 sessions, 100 min each.
66 Gopal, Bostrom, & Chin, 1993, 1992	GSS: GroupSystems, OptionFinder, Level 1, Decision Room, Facilitator, Tools: ? Training: Practice task	2 X 2 Repeated measures GSS: GroupSystems, OptionFinder Task (meeting): Parking Problem, Residence Problem	31 groups; 15 and 16 groups per cell; 5 to 9 subjects per group; 234 subjects; Undergraduates.	Parking Problem, Idea generation, Type 2; Residence Hall problem, Decision-making, Type 4	2 sessions, one for each task; two weeks apart
67 Griffith & Northcraft, 1994	CMC: Vax based CMC, Level 1, Synchronous, Distributed, No-Facilitator, Tools: none, Training: none	2 X 2 X 2 Factorial Media: CMC, Manual Documentation: Documentation, None Anonymity: Anonymous, Identified	29 groups,; 10 to 12 groups per cell; 2 subjects per group; 180 total subjects; Undergraduates.	Job Negotiation Task, Negotiation, Type 5	1 session, 1 hour.
68 Gundersen, Davis, & Davis, 1995	DSS: Expert Choice, Level 2, Decision room, chauffeured, Tools: AHP, Training: No.	2 X 1 Comm Mode: DSS, FtF	268 groups; 134 groups per cell; 2 or 3 subjects per group; 365 total subjects; Undergraduates & Graduates.	Employee Promotion Task; Decision making; Type 4	1 session, less than 60 min.
69 Herschel, 1994 Herschel & Wynne, 1991	GSS: GroupSystems, Level 1, Decision room, Facilitator, Anonymity, Tools: EBS, vote, Ranking, Training: 30 min.	5 X 1 Gender Composition: Female, Skewed Female, Balanced, Skewed male, Male	61 groups; 5 to 16 groups per cell; 4 or 5 subjects per group; 281 total subjects; Undergraduates; Established groups.	Lost at Sea, Intellective, Type 3	1 session; 1 hour and 30 minutes.
70 Hightower & Sayeed, 1995	GSS: EDS, Level 1, Decision room, Tools: voting, Training: yes	2 X 2 X 2 Factorial Communication Mode: GSS, FtF Information Load: Low, High Information Distribution: 60% shared, 33% shared	31 groups; 4 groups per cell; 3 subjects per group; 93 total subjects; Undergraduates.	Market Manager Selection Task, Intellective, Type 3	1 session; 30 min.

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71 Hightower & Sayeed, 1996	GSS: EDS, Level 1, distributed, synchronous, Anonymity, Tools: None; Training?	2 X 2 X 2 Factorial Comm Mode: FtF, GSS Information Distribution: 33% Common; 66% Common Pre-discussion: Conflict, Non-conflict	29 groups; 3 or 4 groups per cell; 3 subjects per group; 87 total subjects; Undergraduates	Murder Mystery Task; Intellective; Type 3	1 session, length not reported.
72 Hiltz, Johnson & Turoff, 1986; Turoff & Hiltz, 1982; Experiment 1	CMC: EIES, Level 1 Synchronous, Distributed, Tools: None, Training .5 hours.	2 X 2 Repeated measures GSS type: FtF, CMC Problem type: Human relations, Technical ranking	16 groups; 8 groups per cell; 5 subjects per group; 80 total subjects; Undergraduates.	Forest Ranger & Lost-in-Arctic, Decision-making, Intellective, Type 4,3	1 session consisting of two tasks; Total time 2.5 hours.
73 Hiltz, Johnson & Turoff, 1991; Turoff & Hiltz, 1982; Experiment 2	CMC: EIES, Level 1, Field, Synchronous, Distributed, Tools: Ranking, Training: 1.0 hr	2 X 2 Factorial Leader: Designated leader, No Leader Statistical Feedback: Statistical feedback, No feedback	24 groups; 6 groups per cell; 5 subjects per group; ;120 total subjects; Ad-hoc Professionals.	Lost-in-Arctic, Intellective, semi-structured, Type 3	1 session 2 hrs.
74 Hiltz, Turoff, & Johnson, 1989	CMC: EIES, Level 1, Synchronous, Distributed, Tools: Basic set, Training: a practice problem	3 X 1 Communications Mode: FtF, CMC-Regular signatures, CMC-Pen Names	18 groups; 6 groups per cell; 5 subjects per group; 90 total subjects; Professionals.	The Inside Gamble, The Retail Plunge, Choice dilemma, Decision-making, Type 4	1 session consisting of two tasks; No time limit.
75 Ho & Raman, 1991	GSS: SAMM, Level 1, Decision Room, Tools: Basic set; Training: 45 min	3 X 2 Factorial design Support: GSS, Manual, Baseline Elected Leadership: Elected leader, No elected leader	48 groups; 8 groups per cell; 5 subjects per group; 240 total subjects; Undergraduates.	The Foundation Task, Preference task, Type 4	1 session; No stated time limit
76 Ho, Raman, & Watson, 1989	GSS: SAMM, Level 1, Decision room, No-Facilitator, Anonymity-permitted, Tools: standard set; Training: 45 minutes.	3 X 1 Anova Communication mode: GSS, baseline, manual	48 groups; 16 groups per cell; 5 subjects per group; 240 total subjects; undergraduates-Singaporean	The Foundation Task, Preference, Type 4	1 no

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77 Hollingshead, McGrath, & O'Connor, 1993; McGrath, 1993	CMC: OIM, Level 1, Distributed, Synchronous, Non-anonymous, No facilitation, Tools: none; Training: ?	2 X 2 X 4 X 2 X 13 Media: CMC, FtF Change in Media: CMC-to-FtF, FtF-to- CMC in week 7 & 8 Task Type: 4 different task Types Group Composition changes: members shift for two weeks Time: 13 weekly sessions	22 groups; 11 groups per cell; 3 or 4 subjects per group, 74 total subjects; Undergraduates-psychology.	Illinois Guides Task, Moromark Office Task, Alcohol Problem, Church Secretary Task, Church Service Task, Investment Task, Mystery Task, Arbitration Task, Leadership Task, Scheduling Task, Type: 2, 3, 4, 6 Coded as 9 for multiple 13 two hour sessions.	
78 Huang, Raman, & Wei, 1993	GSS: SAMM (1.4), Level 1, Decision room, No Facilitator, Tools: Standard set; Training: Yes, practice task	2 X 2 Factorial Support: Baseline, GSS Task: Intellective, Preference	32 groups; 8 groups per cell; 5 subjects per group; 160 total subjects; Singapore undergraduates.	International Studies Task, Intellective, Type 3; The Foundation Task, Preference, Type 4	1 session; length not reported.
79 Huang, Wei, Tan, & Raman, 1997	GSS: SAMM, Level 2, decision room, Tools: Agenda, Training No.	2 X 2 Factorial Comm Mode: GSS, FtF Task Type: Intellective, Preference	32 groups; 8 groups per cell; 5 subjects per group; 160 total subjects; Undergraduates	Admission into Inter-national Studies, Intellective, Type 3; The Foundation Task; Preference, Type 4	1 session, 2.5 hours
80 Huang, Wei, Watson, Lim, & Bostrom, 1996	GSS: Sage, Level 2, Distributed, Tools: ?, Training: ?	2 X 2 Factorial Comm Mode: GSS, FtF Process: Shared construct, No-shared construct	48 groups; 12 groups per cell; 5 subjects per group; 240 total subjects; Undergraduates-IS	PVVI-Problem of Geographic Diversity, Decision making; Type 4	1 session, not reported.
81 Hwang, Guynes, 1994	GSS: SAMM, Level 2, Decision Room, Facilitator, Tools: Agenda, list, vote, Training: 30 min.	2 X 2 Factorial Mode: Manual, GSS Group Size, Smaller (3), Larger (9)	32 groups; 16 groups per cell; 3 or 9 subjects per group; 192 total subjects; Undergraduates.	Information Systems Cases, Judgmental task, Type 4	1 session, 1 to 2 hours.
82 Hymes & Olson, 1992	CMC-ShrEdit, Level 1, Decision Room, Tools: Share editor; Training: Warm up task 15 min.	3 X 1 Interacting Serial, Interacting Parallel, Nominal	29 groups; 10 groups per cell; 4 subjects per group; 116 total subjects; Subjects were recruited from the local community.	Eskimo Hunter Problem, Brainstorming task, Generate list of items, Type 2	1 session 15 min.

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83 Iz, 1992	GSS: ? Level 2 Decision room, Tools: Ranking, preference; Training ?	2 X 2 Factorial design GSS treatment GSS1-Ranking & Preference GSS2-without Ranking & Preference Management Decision Making Experience: level 1, 2	24 groups; 6 groups per cell; 3 subjects per group; 72 total subjects; MBA students.	Production Planning task with 3 conflict-ing objectives, Decision-making Type 4	Number of sessions and length were not reported.
84 Iz & Jelassi, 1990	DSS: MCDM, Level 2, Decision room, Tools: heuristic, vote, Training: Yes	2 X 2 Process structure: formal, informal Member characteristics-skill: Strong -LP, weak-LP	23 groups; 6 groups per cell; 3 subjects per group; 72 total subjects; undergraduates-business	Aggregate Planning Problem; Decision making, Type 4	1 session, length 90 min.
85 Jarvenpaa, Rao, & Huber, 1988	GSS: NICK, Level 1 & 2. Decision Room, No Facilitator, Field, Tools:? Training ?	3 X 3 Repeated Measures Greco-Latin GSS type: EBB, EWS, Control Task: 3 tasks	3 groups; 1 group per cell; 7 subjects per group, 21 total subjects; Professionals.	Design Tasks, Unstructured. Type 2	3 1 hr. sessions on each task.
86 Jessup, Connolly, & Galegher, 1990	GSS: PlexCenter, Level 1 Decision Room, Facilitator, Anonymous, Tools: EBS, Training: 10 min.	2 X 1 Anonymity: Identified, Anonymous	20 groups, 10 groups per cell; 4 subjects per group; 80 total subjects; Undergraduates.	Parking Problem, Idea generation, Type 2	1 30 min session
87 Jessup, Egbert, & Connolly, 1996	GSS: Iclass, Level 1, Decision room, Tools: EBS Training: yes.	4 X 1 Task-Structure-Process: Solo No-collaboration, Pooled, Interacting-Low Collaboration (L-C), Interacting-High Collaboration (H-C)	14 groups; cell sizes of 7,7,30 and 12 individuals; 3 subjects per group (L-C, H-C); 54 total subjects; Undergraduates, Business	Parking Problem, Idea generation & evaluation, Type 2	1 session, 40 min.
88 Jessup & Tansik, 1991	GSS: PlexCenter, Level 1, Decision room, Facilitator, Tools: EBS, Training 1.0 hr.	2 X 2 Factorial Anonymity: Anonymous, Identified Proximity: FtF, Dispersed	20 groups; 5 groups per cell, 4 subjects per group; 80 total subjects; Undergraduates, business.	Parking Problem, Idea generation, Type 2	1 30 min session;

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89 Joyner & Tunstall, 1970	DSS: Concord, Level 1, Decision room, Tools: Brainstorming, Policy; Training: on tools and GSS.	2 X 2 X 2 Repeated measures Augmentation: Computer, Non-computer Strategy: Brainstorm, Policy (Task Complexity) simple task, complex task Order: Task order	40 groups; 5 groups per cell; 5 subjects per group; 200 total subjects; High school students.	Smoking problem, Marriage problem, Idea generation, Type 2,4	2 40 min sessions.
90 Kahai, Avolio, & Sosik, 1995	GSS: GroupSystems, Level 1, Decision room, Facilitator, Anonymous, Tools: EBS, Idea organizer, Training 15 min.	3 X 2 Factorial Anonymity: No anonymity, Source anonymity, participant anonymity Issue Controversiality: High, low	58 groups; 8 to 10 groups per cell; 4 subject per group; 231 total subjects; Under grads and Grads	AIDS task; Intellective; Type 3	1 session; 40 min. 10 min with IO; 20 min EBS; 10 min with IO.
91 Karan, Kerr, Murthy, & Vinze, 1996; Experiment 1	GSS: VisionQuest, Level 2, Decision room, Anonymous, Tools: None; Training: ?	2 X 1 Comm Mode: GSS, FtF	20 groups; 10 groups per cell; 4 subjects per group; 80 total subjects; Undergraduates-business; Established.	Audit Judgment Task; Decision making; Type 4	1 session, average-30 min.
91 Karan, Kerr, Murthy, & Vinze, 1996; Experiment 2	GSS: VisionQuest, Level 2 Decision room, Anonymous Tools: None; Training: ?	2 X 1 Anonymity: Anonymity, No-anonymity. (The anonymous groups came from experiment 1).	20 groups; 10 groups per cell; 4 subjects per group; 40 total subjects; Undergraduates-business; Established.	Audit Judgment Task; Decision making; Type 4	1 session, average-30 min.
92 Kerr & Murthy, 1994	GSS: VisionQuest, Level 1, Distributed, synchronous, anonymous, Tools: None, Training:?	3 X 1 Communication Mode: FtF, GSS, individually	10 groups; 5 groups per cell; 4 subject per group; 14 individuals; 54 total subjects; undergraduates-business	Flowchart-Auditing, Intellective, Type 3	1 session, length not reported.
93 Kim, Hiltz & Turoff, 1998	CMC: EIES, Level 2, Asynchronous, Tools: question, list, Training: 1 hours plus on-line	2 X 2 Factorial Process Structure: Sequential, Parallel Leadership: Leader, No-leader	47 groups; 12 groups per cell; 3 to 5 subjects per group; 212 total subjects; Graduates-business	Investment Club Task, Semi-structured, Intellective, Decision Making, Type 3, 4	Asynchronous- 2 weeks.

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94 Kinney & Dennis, 1994	CMC: Unknown, Level 1, Distributed, Synchronous, Tools: Group Outliner, split screen, Training: Yes	2 X 2 X 2 Repeated measures with control Communication mode: audio/video, CMC Feedback: immediate, delayed Task equivocality: high, low	42 groups; `8 groups per cell 2 subjects per group; 168 total subjects; undergraduates-business	University Admission Task (Hidden profile), High equivocality, SAT questions, Low equivocality, Type 3	2 sessions, one for each task. Length of session was dependent on condition- from 9 to 32 min (avg).
95 Kinney & Watson, 1992	CMC: Unknown, Level 1, Distributed, Synchronous, Tools: split screen, Training: Yes	3 X 2 Repeated measures Communication mode: FtF, telephone, CMC Task equivocality: high, low	120 groups; 40 groups per cell; 2 subjects per group; 240 total subjects; undergraduates-business	Foundation Task, High equivocality, Type 4; GRE, Low equivocality, Type 3	2 sessions, 1 for each task. Length of session was dependent on condition- from 7 to 30 min (avg).
96 Lam, 1997	GSS: CAH, Level 2, Decision room, No facilitator, not anonymous, Tools: messages, decision aid- MCDM, voting, Training ?	2 X 3 Factorial Communication mode: FtF, GSS Task structure: additive, disjunctive, conjunctive	36 groups; 12 groups per cell; 3 subjects per group; 216 total subjects; Professionals- practicing managers	Consolidated Commodities; decision making; Type 4	1 session, no time limit.
97 Lewe, 1996	GSS: GroupSystems, Level 2, Decision room, Facilitator, Tools: EBS, categorizer, voting, Training ?	3 X 2 Factorial Support: GSS, Structured FtF, manual FtF Group size: 6,12	40 groups; 6 or 8 groups per cell; 6 or 12 subjects per group; 360 total subjects; Students- German.	Waste Problem, Idea generating; Decision-making, Type 2,4	1 session, 60 min.
98 Lewis, 1987	GSS: Facilitator, Level 2, Decision room, Tools: NGT, Cross-Impact, Training: an orientation	3 X 1 GDSS, Booklet, Control	30 groups; 10 groups per cell; 3 subjects per group; 90 total subjects; Undergraduates.	University Financial Problem, Decision-making, Type 4	1 session, length not reported.
99 Lim & Benbasat, 1997	CMC: Meeting Place, Level 1, Synchronous, not anonymous, Facilitator, Tools: none, Training: yes. Rewards: $30, & performance bonus ($20-50)	2 X 2 Factorial Design tool: present, absent; Communications mode: FtF, GSS	40 groups; 10 groups per cell; 3 subjects per group; 120 total subjects; undergraduates	Representativeness bias task; group judgment- Intellective, Type 3	1 session, length not reported.

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100 Lim, Raman, & Wei, 1994, 1990	GSS: SAMM, Level 1, Decision Room, Anonymity, Tools: Agenda, Training?	2 X 2 Factorial Technology supports: GSS, No-GSS Elected Leadership: Leader, No-leader	32 groups; 8 groups per cell, 5 subjects per group; 160 total subjects; Undergraduates.	The Foundation Task, Preference, Type 4	1 session, average time 30 minutes;
101 Limayem, Lee-Patridge, Dickson, & DeSanctis, 1993	GSS: SAMM, Level 2, Decision Room, Tools: Basic set; Training a warm-up task.	3 X 1 Control-FtF (18) Human Facilitation-GSS-F (18) Automated Facilitation-GSSAuto-F(17)	53 groups; 18, 18, and 17 groups per cell; 3 to 6 subjects per group; 265 total subjects; undergraduates & MBA.	The Foundation Task, Preference, Type 4	1 session, up to 2.0 hrs.
102 Liou & Chen, 1994, 1993	GSS: GroupSystems, Level 2, Decision room, Facilitator, Tools: EBS, Idea organization, vote, GroupOutliner, Training ?	2 X 1 GSS design (Tools): EBS, Idea Organization	7 groups; 3 or 4 groups per cell; 4 subjects per group; 28 total subjects; Undergraduate- computer science	Expert student advising system; Idea generation, Decision making; Type 4 & 2	1 session, 75 min average time.
103 Losada, Sanchez, & Nobel, 1990	GSS: CaptureLab, Level 1, Decision room, No Facilitator, Tools: Shared Public Screen, GroupAnalyzer, Training: ?	2 X 2 Factorial Technology: GSS, FtF Feedback; Yes, No The feedback was only after task 1.	34 groups, 8 or 9 groups per cell, 3 to 6 subjects per group; 151 total subjects; Engineer/business students; Intact groups	Ranking task; Type 2; In-Basket Simulation Task, Intellective; Type 3	2 sessions; session 1 30 min; session 2 50 min.
104 Loy, Pracht, & Courtney, 1987	DSS: GISMO, Level 2, Decision room, Tools: None, Training: Yes.	2 X 2 Factorial Communication Mode: DSS, FtF Process: NGT, Interacting group (IG)	12 groups; 3, 4, 4, 5, groups per cell; 4 subjects per group; 64 total subjects; Undergraduates-business	Business Management Laboratory Game; Semi-structure; Decision making; Type 4	1 session, 45 min.
105 Mark, Haake, & Streitz, 1997	GSS: Dolphin, Level 1, Decision room, Tools: none, Training: 40 min.	2 X 1 Design: Hypermedia, Non-Hypermedia	16 groups; 8 groups per cell; 3 subjects per group; 48 total subjects; Students	Library of the future; Planning, Creativity, Decision-making, Cognitive conflict, Type 1,2,3,4,5	1 session, 60 min. 20 min. brainstorming, 40 min. structuring & developing their ideas.

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106 Massey & Clapper, 1995	GSS: VisionQuest, Level 1, Decision room, Anonymous, Tools: Brainstorming; Training: ?	2 X 1 Repeated measures Comm Mode: GSS, FtF Task Type (nested): Define problem, Generate solutions	18 groups; 9 groups per cell; 3 or 4 subjects per group; 70 total subjects; Undergraduates.	AIDS College Task, ill-structured; Define problem then generate solution. Type 2, 4	2 sessions each 1 hour with a break in between
107 McGuire, Kiesler, & Siegel, 1987	CMC: Converse, Level 0, Distributed, No facilitator, Tools: None, Training: 10 min.	2 X 2 X 3 X 2 Repeated Measures-Latin Square Mode: FtF, CMC Task Type: gain, loss Choice: Pre-discussion, Group, Post-discussion Problem Order: First, Second	15 groups; 8 and 7 groups per cell; 3 subjects per group; 48 total subjects; Professionals.	Multi-attribute risk choice problems, Decision-making, Type 4	1 session, 4 choice problems, each 10 minutes.
108 McLeod & Elston, 1995	GSS: VisionQuest, Level 1, Decision room, anonymous, No-Facilitator, Tools: Comment Cards, Training: yes	2 X 1 Anonymity: Anonymous (12), Identified (11)	22 groups; 11 or 12 per cell; 4 subjects per group; 92 total subjects; Undergraduates.	Personal Injury Jury Task, Decision-Making Type 4	1 session; 40 min.
109 McLeod & Liker, 1992 Experiment 1; Austin, Liker, & McLeod, 1993	GSS: CaptureLab, Level 1-Low Structure, Decision Room, No-Facilitation, Tools: Outline program, Training: 10 min,	2 X 1 EMS (17) Manual (17) Established groups.	34 groups; 17 groups per cell; 4 to 5 subjects per group; 78 total subjects; Graduates and Undergraduates, business and engineering;	Project Planning Task, Evaluative, Type 4	1 session, 30 minutes.
109 McLeod & Liker, 1992 Experiment 2	GSS: CaptureLab, Level 1-Low Structure, Decision Room, No-Facilitation, Training: some; Tools: HyperCard.	2 X 1 EMS (17) Manual (17) The same subjects were used as in experiment 1. Established groups.	34 groups; 17 groups per cell; 4 to 5 subjects per group; 78 total subjects; Graduates and Undergraduates, business and engineering;	Tampa Pump & Valve, case; Generative, Type 2	1 session, 50 minutes
110 Mejias, Shephard, Vogel, & Lazaneo, 1997; Mejias, et. al., 1996	GSS: Group System (Dos), Level 2, Decision room, Facilitator, Tools: EBS, categorizer, ranking, Training: ?	2 X 2 X Factorial (6 cells) Support: GSS-Anonymous, GSS-Identified, FtF Cultures: Mexican, US	42 groups; 6 or 7 groups per cell; 11 (avg) subjects per group; 469 total subjects; Undergraduates.	Idea generation task, Type 2	1 session, 60 min.

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111 Mejias, Vogel & Shepherd, 1997	GSS: GroupSystems, Level 2, decision room, Anonymity Tools: ? Training: ?	2 X 2 X 2 Factorial Comm Mode: GSS, FtF Anonymity: Identified, Anonymous Culture: US, Mexican	42 groups; 7 groups per cell (6 cells); 10 to 12 subjects per group (Est.) 469 total subjects; Undergraduates-business & engineering;	Task: Not reported; Idea generation, Type 2	1 session, 30 min.
112 Mennecke, 1997	GSS: VisionQuest, Level 2, Decision room, Tools: comment card, voting, Training: Yes	2 X 2 Factorial Decision making process: Structured, unstructured Group size: Size 4, size 7	32 groups; 8 groups per cell; 4 or 7 subjects per group; 178 total subjects; undergraduates-business	School of Business Task; Hidden Profile Task, Intellective, Distributed Info; Intellective, Decision-making, Cognitive conflict, Type 3,4 & 5 1 session, length 60 min.	
113 Mennecke, Hoffer, & Valacich, 1995	GSS: GroupSystems, Level 1, Decision room, Tools: Topic Commentor; Training: yes.	2 X 2 Factorial Group Type: Ad-hoc, Established GSS: GSS, No-GSS	64 groups; 15-17 groups per cell; 4 subjects per group; 256 total subjects; Undergraduates- Speech Communication.	School of Business Task, Hidden Profile Task, Intellective Decision-making, Cognitive conflict, Type 3 & 4 & 5	1 session, 1 hour.
114 Miranda & Bostrom, 1995,1994	GSS: GroupSystems, Level 2, Decision room, Facilitation, Tools: ? Training yes.	2 x 4 Repeated Measures Support: GSS (13) , manual (12) Sessions: 1-4	25 groups; 12 or 13 groups per cell; 6 or 7 subjects per group; 162 total subjects; Undergraduates, management course.	PVVI Case, Decision making, Type 4	4 sessions, length not reported.
115 Niederman & DeSanctis, 1995	GSS: SAMM, Level 2, Decision room, Tools: Basic set; Training: Yes.	2 X 1 Process Structure: Group process approach, Structure argument approach	29 groups; 14 & 15 groups per cell; 3 to 8 subjects per group; 123 total subjects; Under grads; established groups.	Minnesota Merchan-dising Task; Idea generation, decision making; Type 2, 4	1 session, 2 hours.
116 Ocker & Fjermestad, 1998	CMC: Web-EIES, Level 2, Distributed, asynchronous, Tools: none, Training 2 hours, Elected leader.	3 X 1 Communication mode: FtF, Asynchronous, Combined (FtF-asynch-FtF)	27 groups; 8,8, 11 groups per cell; 4 to 7 subjects per group; 130 total subjects; Graduates- MIS	Computerized Post Office Task (CPO), Creativity, Decision-making, Cognitive conflict, Type 1, 2, 3,4,5	FtF: 2 sessions two weeks apart, 1 to 2.5 hrs each. Asynch: two weeks Combined: FtF two weeks apart & asynch.

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117 Ocker, Fjermestad, Hiltz, & Turoff, 1997; Ocker, et. al., 1998	CMC: EIES-2, Level 2, Distributed, asynchronous, Designated leader, Tools: None; Training: 2 hours	4 X 1 Comm Mode: Synchronous-CMC, Asynchronous-CMC, FtF, Combined (FtF and Asynchronous-CMC)	42 groups, 10 & 12 groups per cell; 4 to 7 subjects per group; 194 total subjects; Graduate-IS	Automated Post Office Planning, Creativity, Decision-making, Cognitive conflict, Type 1,2,3,4,5	FtF, Synch & Combined: 2 sessions two weeks apart, 1 to 2.5 hrs each. CMC (asynch and combined): two weeks
118 Ocker, Hiltz, Turoff, & Fjermestad, 1995, 1996	CMC: EIES2, Level 2, Distributed, Asynchronous, Tools: Question/Response, IBIS; Designated leader, Training: 1-2 hrs.	2 X 2 Factorial Mode: CMC, FtF Structure: Process, no-process	41 groups; 10 or 11 groups per cell; 5 to 7 subjects per group; 205 total subjects; Graduates- MBA, MS.	Automated Post Office Planning, Creativity, Decision-making, Cognitive conflict, Type 1,2,3,4,5	FtF: 2 sessions, two weeks apart, 1 to 2.5 hrs each. CMC: two weeks
119 Olaniran, 1994	CMC: Quickmail, Level 1, Decision room, synchronous, Tools: None; Training: yes FtF groups used NGT.	4 X 1 Comm Mode: FtF, CMC, FtF/CMC, CMC/FtF Note: The task consists of idea generation and evaluation	48 groups; 12 groups per cell; 3 subjects per group; 144 total subjects; Undergrads Communication	Dormitory Task; Idea generation, Decision Making; Type 2, 4	1 session, 50 min.
120 Olaniran, 1996	CMC: Profs, Level 1, Decision room, Tools: grammar-checker; Training: ?	2 X 2 Repeated measures Comm Mode: FtF, CMC Task: Two tasks, randomly assigned	38 groups; 19 groups per cell; 3 subjects per group; 116 total subjects; Undergraduates- communication	Graduate Admissions-score; Grammar-Checker Task; Decision making; Type 4	2 sessions, 3 hours each, 3 weeks apart.
121 Olson, Olson, Meader, 1995	CMC: ShrEdit, Level 1, Distributed, Synchronous Tools: shared editor, Training: 1.5 hrs.	2 x 1 Technology: ShrEdit + Audio (GSS+Audio), ShrEidt + Video (GSS+Video)	36 groups; 18 groups per cell; 3 subjects per group; 108 total subjects; MBA's; Existing groups	Automated Post Office (APO) Task, Decision Making, Type 1,2,3,4,5	1 session; 1.5 hours
122 Olson, Olson, Storrosten, & Carter, 1992	CMC: ShrEdit, Level 1, Decision Room, Tools: shared editor, Training: 1.5 hrs.	2 X 1 Supported (GSS), Unsupported (FtF)	38 groups, 19 groups per cell; 3 subjects per group; 114 total subjects; MBA students.	Automated Post Office Planning, Creativity, Decision-making, Cognitive conflict, Type 1,2,3,4,5	1 session, 1.5 hrs.

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123 Quaddus, Tung, Chin, Seow, & Tan, 1998	CMC: HIVIEW, Level 2, Synchronous, Tools: Comments, weights, Training: Yes.	3 X 2 Repeated measures Inquiry: DA, DI, C Task: Resource, Strategic C data was from another experiment DA: Devil's advocacy; DI: Dialectical Inquiry; C: Consensus	20 groups; 10 groups per cell; 5 or 6 subjects per group; 116 total subjects; undergraduates-Singaporean; Ad-hoc	Foundation Task, Preference, Type 4; Strategic Planning, generate, Type 2	2 sessions, one task for each session, length not reported.
124 Raman, Tan, & Wei, 1993	GSS: SAGE, Level 2, Decision room, Dispersed, Tools: ? Training: warm-up task. Note: The analysis compares Mode within task (t-tests only).	2 X 2 Factorial Task: Preference (Foundation), Intellective (International) Communications Medium: GSS, Dispersed GSS (D-GSS)	45 groups; 11 groups per cell; 5 subjects per group; 225 total subjects; Undergraduates, computer science.	The International Studies Program Task, Intellective, Type 3 The Foundation Task. Decision-making, Type 4	1 session, length not reported.
125 Rao, 1995, 1994	CMC: VAX/VMS-Phone, Level, 1 Synchronous, Distributed Non-anonymous, No-Facilitation, Tools: None; Training: yes.	3 X 1 Conferencing Mode: Telephone, CMC, CMC with signals	39 groups; 13 groups per cell; 3 subjects per group; 117 total subjects; Graduates, $10.00 plus bonus.	Harvard Business Case: Benetton Clothing, Convey information, Task type 0	1 session, telephone groups 15 minutes; CMC groups 45 minutes.
126 Reagan-Cirincione, 1994, 1992	GSS: Policy PC, Level 2, Decision Room, Facilitation, Tools: Specify, Training ?	2 X 1 Repeated Measures; Repeated measures of judgments: 1. Individual estimates, 2. Three iterative group estimates; No control groups.	16 groups; 8 groups per cell; 4 or 5 subjects per group; 71 total subjects; Undergraduates.	Average teachers salary, The baseball team performance, Cognitive conflict, Type 5	2 sessions up to two weeks apart; session 1: < 30 min; session 2:< 2 hrs.
127 Reinig, Briggs, Shepherd, Yen, & Nunamaker, 1995; 1996	GSS: GroupSystems, Level 1, Decision room, Facilitation? Tools: EBS, Graphic-display, Training?	4 X 3 Factorial Competition: None, Low, High Goal Difficulty: None, Low, Average, High	55 groups; 4 to 6 groups per cell; 5 subjects per group; 275 total subjects; Undergraduates-Computer	Modified School of Business Task, Hidden Profile, Type 2	1 session, 40 min.

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128 Rhee, Pirkul, & Barhkin, 1995	CMC: E-Mail, Level 1, Synchronous, Distributed, Anonymous, Tools: Payoff matrix; Training: up to 25 minutes.	2 X 4 Repeated measures Medium: CMC, FtF Sessions, 4 sessions	20 groups; 10 groups per cell; 3 subjects per group; 60 total subjects; Undergraduates-business.	Transfer-pricing, Negotiation Task, Type 5 & 6	4 sessions; average time 12 to 42 minutes.
129 Roy, Gauvin, & Limayem, 1996	GSS: GroupSystems, Level 1, Decision room, Anonymity, Tools: Topic Commenter, Training: Yes- Warmup Task	3 X 1 Display Type: Screen at end, Constant screen, No public display (none)	41 groups; 12 or 13 groups per cell; 5 or 6 subjects per group; 231 total subjects; Undergraduate-business	The Knife Task, Idea generation, Type 2	1 session, length not reported.
130 Sambamurthy & Associates, 1990; 1992; 1991; 1993	GSS: SAMM: Level 1 & 2, Decision Room, No Facilitator, Identified, Tools: STA & level 1; Training: 1 hour.	2 X 1 GSS Level: GSS 1 (20), GSS 2 (19)	39 groups, 19 or 20 groups per cell; 5 subjects per group; 188 total subjects; Undergraduates. Management.	Tidewater College Case, Strategic planning, Decision-making, Type 4	2 sessions, 1 was training; Experimental Session 2.5 hrs.
131 Savicki, Kelley & Lingenfelter, 1996	CMC: Peagasus Mail, Level 1, Asynchronous, Tools: none Training: 1 hour	3 X 1 Gender composition: Males only, Females only, Mixed	6 groups; 2 groups per cell; 6 subjects per group; 36 total subjects; Undergraduates-Psychology	Morality scenarios rating, preference, Type 4	1 asynchronous session 3 weeks long.
132 Savicki, Kelley, & Lingenfelter, 1996	CMC: Pegasus Mail, Level 1, Asynchronous, Tools: none, Training: Yes	3 x 2 Factorial Group Composition: Female-only, Male-only, Mixed; Task type: Decision making, Intellective	12 groups; 2 groups per cell; 4 to 6 subjects per group; 62 total subjects; undergraduates-psychology	Lovers scenario, Decision making, Type 4; Fallout Shelter, Intellective, Type 3	Asynchronous- 4 weeks.
133 Savicki, Kelly, & Oesterreich, 1998	CMC: Pegasus Mail, Level 1, Asynchronous, Non-anonymous, Tools: none, Training: Yes	3 X 2 Factorial Group composition: Male-only, female-only, Mix; CMC instructions: standard, group encouraging	12 groups; 2 groups per cell; 4 to 6 subjects per group; 69 total subjects; undergraduates-psychology	Lovers scenario, Decision making, Type 4	1 session, asynchronous, 3 weeks.
134 Sengupta & Te'eni, 1993; 1991	GSS: Unknown, Level 1, Decision room, No Facilitator, Scribe, Tools: feedback, Training: 10 to 20 min.	2 X 4 Repeated Measures Cognitive feedback: feedback, no feedback Blocks of Trials: 4 blocks of 10 trials each	30 groups; 15 groups per cell; 3 subjects per group; 90 total subjects; Graduates & Undergraduates.	Job applicant screening, Ranking, Cognitive conflict, Type 5	1 session, 50 to 90 min.

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135 Sharda, Barr, & McDonnell, 1988	DSS: IFPS, Level 2, Group based, Decision room, single terminal, Tools: ? Training yes.	2 X 8 Repeated Measures DSS: DSS, No-DSS Sessions: 8 weekly periods	32 groups; 16 groups per cell; 3 subjects per group; 96 total subjects; Undergraduates.	The Executive Game, a semi-structured problem, Decision-making, Type 4	1 practice session, 7 weekly sessions; total of 8 sessions.
136 Shepherd, Briggs, Reinig, & Yen, 1995; Experiment 1	GSS: GroupSystems, Level, Decision room ,Anonymous, Facilitator, Tools: Brainstorming, Training: None reported	3 X 1 Social Comparison (Cognitive feedback): No Feedback, Graph, Graph with no baseline	36 groups; 12 groups per cell; 5 subjects per group; 180 total subjects; Undergraduates.	School of Business Task, Hidden Profile Task, Intellective, Decision-making, Cognitive conflict, Type 3,4 & 5	1 session; 90 minutes
136 Shepherd, Briggs, Reinig, & Yen, 1995 Experiment 2	GSS: GroupSystems, Level, Decision room ,Anonymous, Facilitator, Tools: Brainstorming, Training: None reported	3 X 1 Social Comparison (Cognitive feedback): No Comparison, Low-Salience, High-Salience	57 groups; 19 groups per cell; 5 subjects per group; 285 total subjects; Undergraduates.	School of Business Task, Hidden Profile Task, Intellective, Decision-making, Cognitive conflict, Type 3,4 & 5 1 session; 90 minutes	
137 Sia, Tan, & Wei, 1996	GSS: Sage, Level 1, Decision room, Facilitator, Tools: Agenda, Training GSS features & warm-up task.	2 X 2 Factorial Screen Type: Common Public Screen (CPS); Individual Screens (IDS) Task Type: Intellective, Preference	44 groups; 11 groups per cell; 5 subjects per group; 120 total subjects; Undergraduates.	International Studies Task; The Foundation Task; Intellective; Preference; Type 3 and 4	1 session; length not reported
138 Sia, Tan, & Wei, 1996	GSS: Sage, Level 2, Decision room, distributed, Tools: window, Training ?	2 X 2 X 2 Factorial Proximity: Proximate, Distributed Anonymity: Anonymous, Identified Process: With arguments, Without arguments	104 groups; 13 groups per cell; 5 subjects per group; 520 total subjects; Undergraduates-IS	Expected Value Task; Decision making; Type 4	1 session, length not reported.
139 Sia, Tan, & Wei, 1997	GSS: SAGE & SAMM, Level 1, Decision room, Tools: Agenda, Training: 45 min.	2 X 2 Factorial Design: Icon-based, Text-based Task: Intellective, decision making	32 groups; 8 groups per cell; 5 subjects per group; 160 total subjects; undergraduates-Singaporean	International Studies, Intellective, Type 3; Foundation Task, Preference, Type 4	1 session, no time limit.

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140 Siegel, Dubrovsky, Kiesler, & McGuire, 1986 Experiment 1	CMC: Converse, Level 1, Synchronous, Distributed, No-facilitator, Tools: none, Training ?	3 X 3 repeated measures Communication mode: FtF, Computer Anonymous, Computer Non-anonymous Task: (1,2,3)	18 groups; 6 groups per cell; 3 subjects per group;, 54 total subjects; Students & paid subjects.	Choice-Dilemma Problems, Decision-making, Type 4	3 sessions, 20 min each.
140 Siegel, Dubrovsky, Kiesler, & McGuire, 1986 Experiment 2	CMC: Converse, Level 1, Synchronous, Distributed, No-facilitator, Tools: Cursor control; Training: yes.	2 X 2 repeated measures Communication mode: Simultaneous, Sequential Task: (1,2)	12 groups; 6 groups per cell; 3 subjects per group; 36 total subjects; Undergraduates.	Choice-Dilemma Problems, Decision-making, Type 4	2 sessions, 30 min each.
140 Siegel, Dubrovsky, Kiesler, & McGuire, 1986 Experiment 3	CMC: Converse & Computer mail, Level 1, Synchronous & Asynchronous, No facilitator, Tools: none; Training: yes.	3 X 3 repeated measures; Latin square Communications mode: FtF, Simultaneous, Computer mail Task: (1,2,3)	18 groups; 6 groups per cell; 3 subjects per group; 54 total subjects; Undergraduates.	Choice-Dilemma Problems, Decision-making, Type 4	3 sessions, 30 min each.
141 Silver, Cohen, & Crutchfield, 1994; Experiment 2	CMC: Unknown, Level 0, Distributed, Synchronous, No Facilitator, Anonymous? Tools: None, Training: yes.	2 X 1 Status: Differentiated (SD), undifferentiated (SU)- based on survival ability score	22 groups; 11 groups per cell; 4 subject per group; 88 total subjects; Undergraduates.	Winter Survival, Idea generation, Type 2	1 session; length not reported.
142 Smith, Hayne, Connole, 1992	GSS: EDS, Level 2, Decision room, facilitator, Tools: ? Training: Yes.	2 X 1 Comm Mode: FtF, GSS	4 groups; 2 groups per cell; 3 to 5 subjects per group; total subjects-unknown; Undergraduates-business; Established groups	Decision, Decisions; Decision making; Type 4	1 session, less than 15 min.
143 Smith & Hayne, 1997	GSS: EDS, Level 2, Decision room, Distributed, No-facilitation, Tools: idea generation, proposal making, voting, Training: Yes. Incentives.	2 X 1 quasi experimental Comm Mode: GSS*, FtF * No verbal discussion was permitted. Time pressure was manipulated-faster decision higher incentives.	10 groups; 6 & 4 groups per cell; 4 or 5 subjects per group; 44 total subjects; Undergraduates-business & Graduates; Established.	Decision, Decisions; Decision making; Type 4	I session; less than 20 min.
144 Smith & Vanecek, 1990, 1989	CMC: EIES, Level 1, Asynchronous, Tools: None; Training ?	2 X 1 Technology: CMC (7), FtF (10)	17 groups; 7 or 10 per cell; 4 or 5 subjects per group; 82 total subjects; Professionals.	Murder Mystery, Intellective Type 3	CMC-2 weeks; FtF 1.75 hr

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145 Smith & Vanecek, 1988	CMC: MUSIC, Level 1, Decision room, Non-simultaneous, Tools: None; Training yes.	2 X 1 Communications mode: CMC, FtF	66 groups; 33 groups per cell; 2 subjects per group; 132 total subjects; Undergraduates.	Murder Mystery, Intellective, Type 3	1 session 2 hrs.
146 Spears, Lea, & Lee, 1990; Lea & Spears, 1991	CMC: Topmail, Level 1, Synchronous, Distributed & FtF, Anonymous, No facilitator, Tools: None, Training: yes.	2 X 2 Factorial Immersion: Group, individual De-Individuation: Distributed/anonymous, FtF/anonymous	16 groups; 4 groups per cell; 3 subjects per group; 48 total subjects; Undergraduates.	Controversial policy issues, Cognitive-conflict, Type 5	1 session consisting of 4 tasks, each 10 minutes.
147 Smolensky, Carmody, & Halcomb, 1990	CMC: Unknown, Level 0, Distributed, Synchronous, Tools: 3 screens, Training: yes, Eysenck Personality Inventory	2 X 2 Randomized Block Group Structure: Reacquainted (Established), non-acquainted (Ad-hoc) Task Type: Type 3, Type 4	20 groups; 5 groups per cell; 3 subjects per group; 60 total subjects; Undergraduate, psychology.	Fallout Shelter-Choice Dilemma; Type 4 Moon Survival; Intellective; Type 3	1 session, 40 min.
148 Sosik, Avolio, & Kahai, 1998	GSS: GroupSystems, Level 2, Decision room, anonymity, Tools: EBS, Training: Yes.	2 X 2 Factorial Leadership: transactional, transformational; Anonymity: Identified, anonymous	36 groups; 9 groups per cell; 4 or 5 subjects per group; 159 total subjects; undergraduate-business	Center for Commercial Competitiveness, Idea generation, Type 2	1 session, 20 min.
149 Steeb & Johnston, 1981	GSS: Perceptronics, Level 2 Decision Room, Facilitator, Tools:? Training 30 min.	2 X 1 Technology: Aided, Unaided	10 groups; 5 groups per cell; 3 subjects per group; 60 total subjects; Grad Students, $30 prizes.	Policy Scenario Cognitive conflict, Judgment, Type 5	1 session 3 hours.
150 Straus, 1996	CMC: ECS, Level 1, Synchronous, Distributed, Anonymous, Tools: None, Training ?	2 X 2 Factorial Communications Mode: CMC, FtF Information distribution: Equal, Unequal	54 groups; 13 to 14 groups per cell; 3 subjects per group; 162 total subjects; Undergraduates, management.	Lost -in-Arctic (simplified) Intellective, Type 3	1 session; 45 min.
151 Straus, 1997	CMC: Email, Level 1, Distributed, Synchronous, Non-anonymous, Tools: none, Training: Yes	2 X 3 repeated measures on task Communication mode: FtF, CMC Task: idea generation, Intellective, judgment	72 groups; 12 groups per cell; 3 subject per group; 243 total subjects; undergraduates-psychology	Physical Environment Task, Idea generation, Type 2; Complex Logic, Intellective, Type 3; Basketball Bribe Case, Judgment, Type 4	3 12

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152 Straus & McGrath, 1994	CMC: Unknown, Level 0, Synchronous, Distributed, Anonymous, Tools: None, Training: yes.	2 X 3 Repeated Measures Media: CMC, FtF Task Type: Idea generating, Intellective, Judgment	72 groups; 36 groups per cell; 3 subjects per group; 240 total subjects; Undergraduates.	Improving the Environment Task, Idea generation, Type 2; Complex logic Task, Intellective, Type 3; Cheating Task, Judgment, Type 4 1 session consisting of 3 tasks, 12 min. each.	
153 Tan, Raman, & Wei, 1994; Tan, Wei, Raman, 1991; 1991	GSS: SAMM, Level 1, Decision room, No Facilitator, Anonymous, Tools: Agenda; Training: yes.	3 X 2 Factorial Support: Baseline, Manual, GDSS Task Type: Intellective, Preference	68 groups; 11 and 12 groups per cell; 5 subjects per group; 380 total subjects; Undergraduates, Singaporean, computer science.	International Studies task, Intellective, Type 3; Foundation Task, Preference, Type 4	1 session; length not reported.
154 Tan, Teo, & Wei, 1995	GSS: SAGE, Level 2, Decision room, Tools: idea gathering, idea evaluation, consensus monitor, Training: Yes	2 X 1 Design: consensus monitor- single use, multiple use	22 groups; 11 groups per cell;5 subjects per group; 110 total subjects; undergraduates-Singaporean	The Foundation Task, Preference, Type 4	1 session, length not reported.
155 Tan, Wei, & Watson, 1993	GSS: SAGE, Level 0, Decision room, Distributed, Facilitator, Tools: Idea-gathering; Training: yes practice task	3 X 2 Factorial Modes: FtF, GSS, D-GSS Task Type: Intellective, Preference	72 groups; 12 groups per cell; 4 subjects plus 1 confederate per group; 288 total subjects; Undergraduates, Singaporean, computer science.	Mock Jury Task, Intellective, some guidelines, Type 3; Preference, No guidelines, Type 4	1 session, time not limited; 8 rounds max or when agreement reached.
156 Tan, Wei, Watson, Clapper, & McLean, in press (1999)	CMC: Unknown, Level 1, Decision room, distributed, Tools: None, Training: 10 min.	3 X 2 X 2 Culture: Individualism (US), Collectivism (Singapore) Task Type: Intellective, Preference Communication mode: DR-CMC, Dist-CMC, FtF	119 groups; 8 groups per cell US, 12, 11 groups Singapore; 1 subject and 3 confederates per group = 4 subjects per group; 119 total subjects; Undergraduates- US & Singaporean	Mock Jury Task, Intellective, Type 3 Preference, Type 4	1 session, maximum of 8 rounds, length not reported.
157 Tan, Wei, Watson, & Walczuch, 1998	CMC: Unknown, Level 1, Decision room, No anonymity, Tools: none, Training: Yes	2 X 2 X 2 Factorial Culture: Singapore, US Task Type: Intellective, Preference Communication mode: FtF, CMC	93 groups; 10 to 12 groups per cell; 5 subjects per group, 1 confederate; 93 total subject; Undergraduates-Singaporean, US	Mock Jury Task, Intellective, Type 3 Preference, Type 4	1 session, eight rounds.

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158 Toth, 1994	CMC: Unknown, Level 0, Synchronous, Distributed, No Facilitator, Tools: graph; Training: Yes	3 X 1 Repeated Measures Mode: Text, Text + graph, Graph + avg.	11 groups; 3 or 4 groups per cell; 3 subjects per group; 33 total subject; Undergraduates.	Risky Shift, 12 hypothetical scenarios; Preference task, Type 4.	1 session; 60 to 100 min.
159 Tung & Heminger, 1993	GSS: GroupSystems, Level 2 Decision Room, Facilitator, Tools: Basic set; Training ?	3 X 1 Decision Approach: DI, DA, Consensus	12 groups; 4 groups per cell; subjects per group not reported; total number of subjects not reported; Undergraduates.	Business Case, Decision-making, Type 4	1 session; length not reported
160 Tyran, George, & Nunamaker, 1993	GSS: GroupSystems, Level 1, Decision room, Facilitator, Tools: Group outliner; Training: None	3 X 1 Mode: Baseline, Manual, EMS	15 group; 5 groups per cell; 3 or 4 subjects per group; 57 total subjects; Undergraduates.	Analysis Specification Document, identify software code defects, Intellective, Type 3	1 session, 45 minutes individual review and 45 minutes group meeting; total 1.5 hours.
161 Valacich, Dennis, Connolly, 1994 Experiment 2	GSS: GroupSystems, Level 1, Decision Room, Facilitator, Tools: EBS; Anonymity, Training yes. Reward: yes	3 X 1; Group size: small (4), medium (8), large (12)	19 groups; 6 or 7 groups per cell; 4, 8 or 12 subjects per group; 156 total subjects; An additional 120 used as the nominal group pool. Under grads.	PC Problem, Idea generation, Type 2	1 session, 30 minutes.
161 Valacich, Dennis, Connolly, 1994 Experiment 3	GSS: GroupSystems, Level 1, Decision Room, Facilitator, Tools: EBS; Anonymity, Training yes.	2 X 1 Group size: medium (6), large (12)	10 groups; 5 groups per cell; 6 or 12 subjects per group; 90 total subjects; An additional 90 used as the nominal group pool; Under grads.	Tourism Problem, Idea generation, Type 2	1 session 15 minutes.
161 Valacich, Dennis, Connolly, 1994 Experiment 4	GSS: GroupSystems, Level 1, Decision Room, Facilitator, Tools: EBS; Anonymity, Training yes.	2 X 2 Repeated measures Technology structure: Open, blocked Task: Tasks 1, 2 (counterbalanced)	8 groups; 4 groups per cell; 9 subjects per group; 72 total subjects; Undergraduates.	Tourism Problem, Environmental Problem, Idea generation, Type 2	2 sessions, each 15 minutes.

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162 Valacich, Dennis, & Nunamaker, 1992	GSS: EMS, Level 1, Decision room, Anonymous, Tools: EBS; Facilitator, Training yes	2 X 2 Factorial Anonymity: Anonymous, identified Group size: Small (3), Medium (9)	20 groups; 5 groups per cell; 3 or 9 subjects per group; 126 total subjects; Undergraduates.	PC Problem, Idea generation, Type 2	1 session, 30 min,
163 Valacich, George, Nunamaker, & Vogel, 1994	GSS: EMS, Level 1, Decision room, Distributed, Anonymous, Tools: EBS; No Facilitator Training yes	2 X 2 Factorial Group Size: 4,8 members Proximity: Same room (Same-GSS), Distributed (D-GSS)	22 groups; 5 groups per cell; 4 or 8 subjects per group; 128 total subjects; Undergraduate-business.	The PC Problem Idea generation, Type 2	1 session; length 30 minutes.
164 Valacich, Wheeler, Mennecke, Wachter, 1995; Valacich, et. al.,1993	CMC: OptionLink, Level 0 Decision room, Anonymous, Tools: none, Training: practice task	6 X 2 Factorial Group Size: 5,6,7,8, 9,10 Knowledge: Homogeneous, Heterogeneous (in regard to distribution of task-relevant information)	48 groups; 4 groups per cell; 5 to 10 subjects per group; 360 total subjects; Undergraduates, computer science.	School of Business Task, Hidden Profile Task, Intellective, Decision-making, Cognitive conflict, Type 3, 4 & 5	1 session, 10-20 min. To read task; up to 20 minutes.
165 Valacich, Mennecke, Wachter, Wheeler, 1994	CMC: Email, Level 1, Distributed, Synchronous, Tools: none, Training ?	4 X 2 Repeated measures on task and communication mode. Communication mode: FtF, telephone, videophone, CMC Task: Preference, Intellective	45 groups; 12 groups per cell; 2 subjects per group; 91 total subjects; Undergraduates-business	Legislative Dilemma, High equivocality, Preference task, Type 4; Physician Location Problem, Low equivocality, Intellective, Type 3	2 sessions, subjects completed each task; length 30 min, 20 min. as a dyad.
166 Valacich, Paranka, George, & Nunamaker, 1993	GSS: GroupSystems, Level 1, Decision Room/Distributed, Synchronous, Anonymous, Facilitator ? Tools: Brainwriting, Training: 10 min & practice task	2 X 2 Factorial Proximity: Decision Room, Distributed Communication mode: Verbal, Electronic	20 groups; 5 groups per cell; 5 subjects per group; 100 total subjects; Undergraduates-business.	Air Quality Task, Idea generating, Type 2	1 session, 20 min.
167 Valacich & Schwenk, 1995	CMC: OptionLink, Level 1, Decision room, Synchronous, Anonymous, Tools: list, vote; Training: yes.	2 X 3 Factorial Communications Medium: Verbal, CMC Decision Method: DA, DI, Expert	42 groups; 7 groups per cell; 5 subjects per group; 220 total subjects; Undergraduates.	Parkway Drug Case, Intellective, Type 3	1 session, less than 1 hour in length.

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168 Valacich, Schwenk, 1995	CMC: OptionLink, Level 1, Decision room, Synchronous, Anonymous, Tools: list, vote; Training: yes.	3 X 2 Factorial Group Composition: Artificial, Intact, CMC Decision Aid: Objective, Carping	51 groups; 7 groups per cell; 5 subjects per group; 250 total subjects; Undergraduates.	Parkway Drug Case, Intellective, Type 3	1 session, up to 40 min.
169 VanSchaik & Sol, 1990	DSS: Unknown, Level 2, Decision room, No facilitator, Two training periods, Tools: ?	2 X 2 X 7 Repeated Measures Computer Support: DSS, No DSS Structure (Strategy): Structure, No Structure Periods of Play: 7	23 groups; 5 or 6 groups per cell; 3 or 4 subjects per group; 80 total subjects; Professional managers.	Management game, Decision-making, Type 4	7 sessions with a max of 1.5 hrs.
170 Venkatesh & Wynne, 1991	GSS: GroupSystems, Level 1, Decision room, Facilitator, Identified, Tools: Ranking, Training:?	3 X 1 Structuring: GSS, GSS-CH, GSS-GH CH: Combined Heuristic; GH: General Heuristic	45 groups; 15 groups per cell; 4 or 5 subjects per group; 209 total subjects; Undergraduates.	Parasol Assembly Problem, Complex, stimulating & chal-lenging, Intellective, Type 3	1 session; up to 2 hours.
171 Walther, 1995, 1992; Walther & Burgoon, 1992	CMC: COSY, Level 1, Asynchronous, Identified, No Facilitator, Tools: None; Training: Yes	2 X 3 Repeated Measures Technology: CMC, FtF Task (time): 3 task over 3 time periods	32 groups; 16 groups per cell; 3 subjects per group; 96 total subjects; Undergraduates.	Faculty Hiring Task, Writing Assistance Software Task, PC Problem; Loosely-structured decision making tasks; Type 4	3 sessions over a 5 week period. FtF-meet 3 times for up to 2 hours; CMC 3 on-line sessions.
172 Warkentin, Sayeed, & Hightower, 1997	CMC: MeetingWeb, Level 1, Asynchronous, Tools: none, Training:?	2 X 1 Communication Mode: FtF(11), Web-Asynch (13)	24 groups; 11 and 13 groups per cell; 3 subjects per group; 72 total subjects; undergraduates	Murder Mystery Task; Intellective; Type 3	FtF groups had 1 session lasting 25 min.; CMC groups had 3 weeks.
173 Watson & Associates, 1988; 1989; 1992; 1991	GSS: SAMM, Level 1, Decision room, Tools: Basic set; Training: 20 min.	3 X 1 GSS type: GSS (28), Manual (26), Baseline (27)	81 groups; 26, 27 or 28 groups per cell; 44 groups of 3 and 38 groups of 4 subjects per group; 284 total subjects; Undergrads and Graduate- business.	The Foundation Task Preference, Type 4	1 session, length not reported.

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AUTHORS	TECHNOLOGY	EXPERIMENTAL DESIGN	GROUP SUBJECT Variables	TASK/TYPE	NUMBER of SESSIONS/ SESSION LENGTH
174 Watson, Ho, & Raman, 1994	GSS: SAMM, Level 1, Decision room, No-Facilitator, Anonymity-permitted, Tools: standard set; Training: 20 minutes.	3 X 2 Factorial Support Structures: Baseline, Manual-Agenda, GSS Cultures: US, Singaporean	130 groups; US- 82 groups: 26, 27, 29 groups per cell; 3 or 4 subjects per group; 287 total subjects; SI-48 groups: 14,15, 16 groups per cell; 5 subjects per group; 255 total subjects. Grand total: 542 subjects; Grad and undergraduates.	The Foundation Task, Preference, Type 4	1 session; length not reported.
175 Weisband, 1992	CMC: MM Mail, Level 1, Decision Room (FtF), Synchronous, No-facilitator, Training: Command lists, Tools: none.	2 X 2 X 2 Repeated measures, Latin-square Discussion: early, not early Assignment: self-selected, random Communications mode: FtF, CMC	24 groups; 12 groups per cell; 3 subjects per group; 72 total subjects; Graduates and Undergraduates.	Choice Dilemma tasks, Decision-making, Type 4	1 session; length not reported.
176 Weisband, Schneider, & Connolly, 1995 Experiment 1	CMC: CMC, Level 1, Large Room, Synchronous, No-facilitation, partial anonymity, Training: general familiarity, Tools: none.	2 X 2 repeated measures Mode: FtF, CMC Subject Status: MBA, Undergrade Member status: status composition controlled (2 MBAs and 1 undergraduate in each group).	18 groups; 6 or 12 groups per cell; 3 subjects per group; 59 total subjects; Undergraduates receive extra credit.	Ethical Decision Marketing Tasks: Market software & marketing profiles. Type 5	Two 1 hour sessions a week apart. Design Note: Subjects do an individual decision before the groups decision.
176 Weisband, Schneider, & Connolly, 1995 Experiment 2	CMC: CMC, Level 1, Large Room, Synchronous, No-facilitator, Anonymous, Training: general familiarity, Tools: Divide screen	2 X 2 X 2 Repeated Measures Mode: FtF, CMC Group composition: Graduate majority, Undergraduates majority Member Status:: High (2 MBA, 17 groups), Low (1 MBA, 18 groups)	35 groups; 17 or 18 groups per cell; 3 subjects per group, 105 total subjects; MBA and under graduates, course credit.	Ethical Decision Marketing Tasks: Market software & marketing profiles. Type 5	Two 1 hour sessions a week a part. Design Note: Subjects do an individual decision before the groups decision.
176 Weisband, Schneider, & Connolly, 1995; Weisband, 1994; Experiment 3	CMC: CMC, Level 1, Large Room, Synchronous, No-facilitator, Anonymous, Identified, Training: general familiarity, Tools: None	4 X 2 X 3 Quasi-Factorial Communication Mode: FtF (27), Computer Identified (CI) (20), Computer Anonymous (CA) (27), Computer Mislabeled (CM) (12) Group composition: High, Low; Task: Task 1, Task 2 Task 3 (Random).	87 groups; 12 to 27 groups per cell; 3 subjects per group; 105 total subjects; 2 MBA=s (high) & and 1 undergraduates (low) in each group, Course credit.	Ethical Decision Marketing Tasks: Market software, marketing profiles & pornographic issue. Type 5	3 sessions in one day, time not reported.

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AUTHORS	TECHNOLOGY	EXPERIMENTAL DESIGN	GROUP SUBJECT Variables	TASK/TYPE	NUMBER of SESSIONS/ SESSION LENGTH
177 Wheeler, Mennecke, & Scudder, 1993	GSS: VisionQuest, Level 2, Decision Room, Facilitator, Tools: ranking, rating, Brainwriting, voting, & scoring; Training: 70 min.	2 X 2 Factorial Group composition: HPO, LPO Restrictiveness: R, NR HPO- High Procedure Order; LPO- Low Procedure Order; R- Restrictive, NR- nonrestrictive	28 groups; 7 groups per cell; 5 subjects per group; 140 total subjects; Undergraduates.	School of Business Task, Hidden Profile Task, Intellective, Decision-making, Cognitive conflict, Type 3,4 & 5	1 session, up to 2.5 hrs.
178 Wheeler & Valacich, 1996	GSS: VisionQuest, Level 1 & 2, Decision room, facilitator, Tools: Brainwriting, voting, ranking, agenda, Training: yes.	2 X 2 X 2 Factorial Comm Mode: GSS Level 1, GSS level 2 Facilitated: Facilitator, No-facilitator Training: Low, High on a heuristic	96 groups; 12 groups per cell; 5 subjects per group; 480 total subjects; Undergraduate-business	School of Business Task; Hidden Profile Task,Intellective, Distributed Info; Intellective,Decision-making, Cognitive conflict, Type 3,4 & 5	1 session, 2.5 hours.
179 Wilson & Jessup, 1995	GSS: VisionQuest, Level 1, Synchronous, Anonymous, No Facilitator, Tools: BrainWriting, Training Yes.	2 X 2 Factorial Anonymity: Anonymous, Identified Member Status: equal, unequal	18 groups; 4 or 5 groups per cell; 4 or 5 subjects per group; 75 total subjects; Professionals.	Insurance fraud case, Idea generating, Type 2.	1 session, 30 min.
180 Winniford, 1991	GSS: EDS, Level 1 Decision Room, Synchronous, Tools: EDS, Voting; Training: Warm-up task 30 min.	2 X 2 Factorial Group Support: Manual, GSS Group Size: Large (10), Small (5)	16 groups; 4 groups per cell; 5 or 10 subject per group; 117 total subjects; Undergraduates.	Product Mix Task, Decision Making, Type 4.	1 session length not reported.
181 Wood & Nosek, 1994	GSS: Vision Quest, Level 1 Decision room, Non-Anonymous, Facilitator, Tools: Standard set; Training: Practice task	2 x 2 Repeated measures Technology: GSS, Manual Task: More complex (MC), Less complex (LC)	16 groups; 8 groups per cell; 7 to 10 subjects per group; 132 total subjects; MBA and Undergraduates.	Pharmaceutical company pricing problem-(LC), Census Case (MC) Intellective, Type 3	1 session; up to 2 and ½ hrs.

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182 Yellen, Winniford, & Sanford, 1995	GSS: VisionQuest, Level 1, Decision Room, No-Facilitator, Tools: Brainwriting, Rating, Voting; Training: ?	2 X 2 Repeated Measures Psychological Type: Introverts, Extroverts; Technology: GSS, No-GSS	12 groups; 6 groups per cell; max of 8 subjects per group; 72 total subjects; Undergraduates, computer science.	The Foreman in the Blind, Judgment, Type 4; I Never Make Big Mistakes, judgment, Type 4	2 sessions, FtF, GSS, each 30 min.
183 Zigurs, Poole, & DeSanctis, 1988	GSS: SAMM, Level 1, Decision room, Anonymous, Tools: Ranking, Voting; Training: 20 min.	2 X 1 Comm Mode: GSS, Structured manual	32 groups; 14 groups per cell, and 4 baseline groups; 3 or 4 subjects per group; 112 total subjects; Undergraduates.	Admission into International Studies Task, Intellective, Type 3	1 session.
184 Zigurs, Wilson, Sloane, Reitsma, & Lewis, 1994	GSS: RSS, Level 2, Decision room, Tools: Simulation models, Training: on software	5 X 1 Models: No-model, Restricted, Private, Shared, & Joint-chauffeured	35 groups; 6 to 8 groups per cell; 3 subjects per group; 105 total subjects; undergraduates.	River Simulation Task, Cognitive conflict, Type 5	1 session, 2 hours in duration, includes training.

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AUTHORS	DEPENDENT MEASURES - OUTCOMES	COMMENTS - GROUP PROCESS ADAPTATION	CONCLUSIONS
1 Adrianson & Hjelmquist, 1991	**Comm Mode / Task / Group Comp** FtF > CMC / Ns / Ns Satisfaction: FtF > CMC / Ns / Ns Consensus: FtF > CMC / Ns / Ns Quality: Ns / Ns / Ns Participation-Equality: Ns / Ns / E > I Dominance: Ns / Ns / Ns Opinion shift: FtF > CMC / Ns / Ns Decision Satisfaction: FtF > CMC / Ns / Ns Personality Type: Ns / Ns / Ns E: Experienced; I: Inexperienced	Experienced users were as active in the CMC as they were in the FtF condition. Interactions: Experience and Comm Mode with Consensus: Task Type 4 FtF > CMC Task Type 3 Ns Quality: Task Type 4 E > I Task Type 3 Ns	No difference in problem solving between FtF and CMC. Task difference between FtF and CMC; in human relations problem- FtF has greater conformity and opinion change.
2 Aiken, Krosp, Shirani, & Martin, 1994	**Comm Mode / Group Size** Production Blocking: FtF > GSS / Large > Small Evaluation Apprehension: FtF > GSS / Large > Small Satisfaction: GSS > FtF / Small > Large	There are several interaction effects: apprehension greatest in large verbal groups; large GSS groups were the most satisfied. Anonymity and mode were confounded, also analysis was at the individual as unit instead of group. Group size was not controlled.	Electronic brainstorming is superior to verbal communication in large groups for idea generation. There were no significant differences between the technologies in the smaller groups.
3 Aiken, Vanjani, & Paolillo, 1996	**Task Support-tools / Task Type** Process Satisfac: G > P / No Measures Preference: G > P Number Comments: P > G Quality Comments: Ns Unique Comments: Ns G: Gallery Writing; P Pool writing	Groups using pool writing (non-anonymous, all can write at the same time, but all can not see the comments at the same time) generated more comments than gallery writing (anonymous, submit and view at the same time).	Gallery writing groups are significantly more satisfied with the process and preference than pool writing groups. Conversely, pool writing groups generate more comments than gallery writing groups.
4 Anson, Bostrom, & Wynne, 1995	**Comm Mode** Performance: Ns Cohesion: GSS-F, FtF-F, GSS > FtF Process Perceptions: GSS-F, FtF-F, GSS > FtF GSS-F; Facilitated GSS FtF-F: Facilitated FtF;	All GSS groups appropriated the more restrictive tool faithfully. However, 14 of 24 groups faithfully appropriated the consolidate tool; 5 groups discarded the tool. Facilitator attitudes and training/skills may have been a moderating factor. 6 of 11 facilitators expressed negative attitudes toward facilitating in the GSS setting. High group variability was reported.	Both the GSS and facilitation interventions were found to improve cohesion and process outcomes compared to baseline groups. The results suggest that a high quality facilitator could significantly improve outcomes compared to no facilitator at all.
5 Archer, 1990	**Comm Mode** Decision Quality: Ns Num. Alternatives: NG > FtF, CMC Perceived Satisfaction: Ns Interaction effects Decision Time: CMC > FtF (observation) NG: Nominal Group	Assignment to groups was based upon high intra-group heterogeneity and low inter-group differences in educational characteristics. Participants were also observed to adopt a coping mechanism for dealing with the large numbers of alternatives to the complex problems (AST).	Decision quality did not depend on the meeting methodology used. It is suggested that business decision quality will not degrade if CMC is used. Groups varied widely in their satisfaction with meeting technique and communications mode.
6 Beauclair, 1989	**Process Structure Decision-Process** EBS / Voting Participation: Ns / Ns Quality interaction: Ns / Ns Satisfaction: Ns / Ns	The author suggests that GDSS is not very effective when introduced without a specific goal or target audience, nor does it appear necessarily useful or effective when used with groups that do not have a vested interest in the task or among ad-hoc groups.	The results show that there were no significant differences between EBS and FtF brainstorming and computer voting and manual voting.
7 Benbunan-Fich & Hiltz, 1998	**Comm Mode** **Group** Learning perception: Ns Ns Actual learning: Ns Ns	When actual learning (final grade) was covaried with GPA' CMC conditions performed lower than FtF conditions. This is true only for individual conditions.	The results suggest that CMC use in a learning environment can be as effective as traditional FtF groups, if Collaborative learning is valid.

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8 McGrath & Arrow, 1996; Cummings, Schlosser, & Arrow, 1996; Lebie, Rhoades & McGrath, 1996; Berdahl & Craig, 1996; Bouas & Arrow, 1996	**Comm Mode / Environment-Exp / Sessions** Outcome Quality- Integrative complexity: Ns / CMC > FtF Interaction Planning: FtF > CMC / Ns Composing & Edition: FtF > CMC / Ns Essay production: CMC > FtF / Ns Social-emotional: FtF > CMC / Ns Participation Equality: CMC > FtF / Ns Cohesiveness: FtF > CMC / FtF > CMC	Essay integrative complexity increases significantly over time for CMC groups above that of FtF groups. This may partly be explained by a larger number of scribes. There were interaction effects on social-emotional communications. There were more significant variations in FtF groups than CMC groups in the interaction categories over time. The increased equality of participation of CMC groups over FtF groups is only transitory- no significant differences over time. Cohesiveness decreased over time in both FtF and CMC groups. In the reconfigured groups (starting with week 8) CMC increased cohesiveness steadily while FTF group remained high. Support for AST.	The results suggest as CMC groups become more familiar with task, technology, and group the more the members participate in creating the essay, and the more complex the essay becomes. CMC severely limits the amount that member can communicate with other members within a given time interval. The change in cohesiveness from week 8 on is
9 Briggs, Balthazard, & Dennis, 1996	**Design / Group Composition** Usability: Keyboard > Pen / Ns Cohesion: Ns / Execs > Grad	An interesting note: The graduate students, being more familiar with technology, blame the technology, where as the Execs blame themselves.	Executives and graduate students do not evaluate EMS technology differently despite large social differences.
10 Bui & Sivasankaran, 1990	**Comm Mode / TaskComp / Interaction** Decision Quality : Ns / Ns / H-GSS > H-FtF Decision Time: GSS > FtF / H > L / L-GSS > L-FtF Satisfaction: Ns / Ns / L-FtF > L-GSS Note: Hypotheses were on the interaction effects	The results can be interpreted as a Structuration effect. The higher the complexity the more time it took to reach a decision and the better the decision; satisfaction went from low to equal. GSS reduced influence of dominant members: more equal participation.	GSS enhances decision quality as complexity increases.
11 Bui, Sivasankaran, Fijol, & Woodbury, 1987	**Process Structure-Proximity** Decision Correctness: D-GSS > GSS Decision Quantity: Ns Baseline Criteria: GSS > D-GSS Decision Speed: D-GSS > GSS Satisfaction: Ns Design Preference: Ns D-GSS: Distributed GSS; Note: Single terminal GSS	FtF groups spent less time in a read phase but more time in an input phase than did the distributed groups. In general, 50% of the distributed groups were satisfied with the final results as compared to 67% of the FtF groups.	Distributed groups in a GSS environment had better decision quality and speed than FtF GSS groups.
12 Burk & Aytes, 1998 Experiment 1 & 2	**Comm Mode** **Experience** Cohesiveness: Ns Ns Process satisfaction: Ns Ns	All results are based on the combined experiments. FtF groups had higher cohesiveness than the CMC groups after the first session in experiment 1.	Cohesiveness and process satisfaction increased significantly for all conditions over the four sessions.
13 Burke & Chidambarm, 1995; Burke & Chidambarm, 1994	**Comm Mode / Environment-Exp** **Processes** Cohesiveness: Ns / Ns S1: S2: & S3: Ns Leadership: FtF > D-GSS, A-GSS S1: Ns S2: FtF > A-GSS; FtF > D-GSS S3: FtF > A-GSS Coordination: FtF > D-GSS, A-GSS S1: D-GSS > FtF S2: FtF > D-GSS S3: FtF > D-GSS, A-GSS Social presence: Ns / Ns / No Participation Equ: Ns / Ns / Session Performance: Ns / Ns / Effects	FtF groups report greater leadership effectiveness in session 2 & 3 vs. asynchronous groups and in session 2 vs. synchronous groups. Coordination in FtF groups significantly improved over time. In this study, perceived improvements in leadership and coordination have no effect on performance, cohesiveness, and participation.	FtF-GSS groups experience more effective leadership and coordination competence over time compared to distributed groups. However, no differences were reported in performance, cohesiveness, and perceived equality of participation.

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14 Burke, Chidambaram, & Lock, 1995	**Comm Mode Environment Inter** Cohesion: Ns Ns Ns S1: GSS > D-GSS, A-GSS S2: GSS, D-GSS > A-GSS S3: & S4: Ns Conflict Management: Ns Ns Ns S1: GSS > A-GSS S2: GSS > A-GSS S3: & S4: Ns Process Satisfaction: Ns Ns Ns D-GSS: Dist-GSS; A: Asynch-GSS	The results support AST. The authors reported that D-GSS groups learned to interact via the technology in ways which counteracted the environmental limitations. It is suggested that A-GSS groups will require more than four sessions to overcome the limitations. Note: the implementation of A-GSS was not fully described.	The study found no differences among treatments in their overall patterns of development. In the early session A-GSS groups experience lower levels of perceived conflict management than GSS groups. Over time all conditions showed some improvement, some at faster rates.
15 Burke & Chidambaram, 1996	**Environment-Experience Comm Mode** **Dependent Var S1 S2 S3 S4 Overall** Social Presence G>D>A G>D,A G>S,A G>D,A Ns Comm. Effect G>D,A G>D,A G>S,A G>A Ns Comm. Interface G>D,A G>D,A G>S,A G>D,A Ns Performance D>A,G G: GSS; A: Asynch-GSS; D: Dist-GSS S1-S4: Session 1 to 4	The primary hypotheses being tested were the profiles: They did not change across the groups and sessions. The Asynchronous groups were assigned a specific one hour period each week to use the system rather than using it at their own convenience.	Distributed groups can perform well in time-constrained situations despite the relatively diminished bandwidth, media richness, and social presence. For each session GSS-FtF groups reported greater social presence, communication effectiveness and satisfaction. However, performance results suggest that richer media may not be more productive for some tasks.
16 Carey & Kacmar, 1997	**Comm Mode Task Complexity** Decision time: CMC > FtF Ns Decision quality: FtF > CMC no measures Satisfaction: FtF > CMC Simple > Complex Perceived Info load: CMC > FtF Simple > Complex Contributing comments: FtF > CMC Ns Social comments: CMC > FtF Ns	Interaction between communication mode and task complexity.	The results suggest that simple tasks can be successfully accomplished using CMC. CMC groups also took longer and were less satisfied with the process and had higher perceived information over load than FtF groups.
17 Cass, Heintz, & Kaiser, 1992, 1991	**Comm Mode Proximity Interaction** Discussion quality: FtF > GSS F > D No Discussion effectiveness: FtF > GSS Ns No Discussion outcome: FtF > GSS Ns No Solution satisfaction: Ns Ns Yes G: GSS, D-GSS: Dist-GSS; D-FtF: Dist-FtF	None of the GDSS groups went back to review the results of earlier discussions. In general GDSS groups viewed the GDSS as a hindrance that diverted attention from the meeting. All GDSS groups were instructed; the computer use was optional.	Four different satisfaction measures found GDSS groups were less satisfied than Non-GDSS groups. The authors suggest that although GDSS can be used in dispersed settings, there may be serious impediments to user acceptance.
18 Chidambaram, 1996	**Environment-Experience** **Dependent Var S1 S2 S3 S4** Cohesiveness F > G F > G G > F G > F Process Percpt. F > G Ns G > F G > F Outcome Sat. Ns Ns G > F G > F G: GSS; F: FtF Overall: No measures	This study examined how intragroup relational links evolve over a period of time with repeated use of a GSS. Observations support Social Information Processing Theory, which suggests that relational intimacy may take longer to develop in computer-supported groups, but that repeated use can help groups affiliate.	Computer-supported groups, given adequate time, will exchange enough social information to develop strong relational links. Attitudes of GSS users changed over time from highly negative to somewhat positive; outcomes improved more slowly.

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19 Chidambaram, Bostrom, & Wynne, 1990, 1991; Chidambaram & Bostrom, 1993	**Comm Mode** **Environment-Exp** Manage conflict: Ns S-1 & 2 FtF > GSS S-3 Ns S-4 GSS > FtF Cohesiveness: Ns S-1 & 2 FtF > GSS S-3 & 4 GSS > FtF Num Alternatives: GSS > FtF s-1 Ns S-2,3,4 GSS > FtF Interaction: FtF*Session Decision Quality: Ns Sessions Ns	GSS groups need time to learn the system (system opacity). Anonymity was possible in GSS groups. Time may have a role in Adaptive Structuration. GSS groups had more equal participation & task focus. Manual groups show a significant decline across session for the number of alternatives generated and erratic changes in decision quality. Conversely, GSS groups remain fairly consistent in number of alternatives and a non-significant trend for increased decision quality. Groups adapt over time; the system prevents interaction until adaptation is learned.	The ability to manage conflict and cohesiveness were initially higher in Manual groups; after session 3 there was a reversal. This suggest the need for more long term studies. GSS groups faithfully appropriate the use of GSS structures. However, it may take longer for the GSS groups to achieve increases in quality than increases in quantity.
20 Chidambaram & Jones, 1993	**Comm Mode** **Proximity** **Inter** Media Perceptions Social presence FtF > GSS DR > Dist Yes Comm. effectiveness Ns DR > Dist Yes Comm. interface Ns DR > Dist Yes Performance Quality Ns Ns No Quality process GSS > FtF Ns No Num Alternatives GSS > FtF Ns No DR: Decision Room; Dist: Distributed	The results indicate that there are significant interaction effects: Social presence-FtF No-GSS > GSS Communication effectiveness-Dist GSS > No-GSS Communication interface-Dist No-GSS > GSS. The authors suggest that these results may be due to adaptive Structuration. Note: Distributed groups used audio-conferencing.	GSS significantly improves the number of alternatives and the quality of the decision process in both FtF and Dist (AC) settings (no effects on decision quality). Groups using both GSS and AC report higher levels of communication effectiveness than AC alone without reducing the social presence of the medium. In the FtF setting, GSS groups report lower social presence than FtF groups.

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21 Chidambaram & Kautz, 1993	**Comm Mode Context-Culture** **LD-FtF**: Leader emerged, conflict, discussion on problem definition; Low decision quality, cohesive-ness, & conflict mgt. **HD-FtF**: High level of conflict; missed communications, Low decision quality, cohesiveness, & conflict mgt. **LD-GSS**: Leader emerged, High decision quality **HD-GSS**: Highest decision quality, cohesiveness and conflict management. LD: Low Diversity; HD: High Diversity	The authors suggest that the anonymity in the GSS groups was one of the most effective structures available in the technology. This conclusion is not supported by the experimental procedures. The study reported that the FTF groups required more time (no mention of this in GSS groups). The study supports AST.	The study suggests several GSS technology structures which can increase impact when dealing with diversity: anonymity, simultaneity, electronic display, and process structuring.
22 Clapper & Massey, 1995	**Comm Mode** Decision Quality: Used > unused; GSS = FtF Shared> Unshared; GSS = FtF Odds Ratio (Quality/performance)with co-variate	The effect of using a GSS was overwhelmed by the impact of the task-related information that the group members possessed prior to the group activity.	The results provide strong evidence for the importance of understanding the nature of the task-related information that individuals bring to the group.
23 Clapper, McLean, & Watson, 1991	**Comm Mode Task Type** Number of Rounds to Consensus: D-GSS > FtF Ns Interaction: Intellective D-GSS > Judgment FtF D-GSS: Distributed GSS GSS: Normal GSS	Group process was severely constrained in all modes. A wheel communications network was adopted; subjects could not directly communicate with one another; communications went to a public display. Note: The study uses 3 confederates and one subject. The study demonstrates AST in that there are differences between the technology supported and FtF groups.	The authors suggest that communicating through a leaner medium (D-GSS and GSS) significantly lessens the power of the group to influence an individual group member.
24 Clapper, McLean, & Watson, 1998	**Comm Mode** **Task Type** Rounds to consensus: GSS-Dist > GSS-DR > FtF; Ns Majority influence: GSS-Dist, GSS-DR > FtF; Ns Perceived information: FtF > GSS Ns GSS-Dist: Distributed, GSS-DR: GSS-Decision room	FtF groups working on the judgment task took significantly fewer rounds than dispersed GSS groups working on intellective tasks.	The results indicate that the GSS significantly lessened the ability of group majority to influence an individual member, regardless of task type.

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25 Connolly, Jessup, & Valacich, 1990	**Process Structure-Anonymity Environment-Eval Tone** Total comments: A > I Ns Number of ideas: Ns C > S Quality: Ns Ns Critical comments: A > I C > S Decision Satisfaction: Ns S > C Process Satisfaction: Ns S > C System Satisfaction: Ns Ns Note: Not all dependent variables are reported here	Effectiveness was highest in groups in the critical evaluative tone condition. A: Anonymous I: Identified C: Critical Evaluative Tone S: Supportive Evaluative Tone	Greater output results when anonymous or critical support conditions are present. Stimulation during idea generation can improve effectiveness.
26 Connolly, Routheaux, Schneider, 1993	**Process Structure-Idea Seeding** Number of ideas: Ns Unique ideas: Ns Commonness of Ideas: Rear, Baseline > Common	The authors also reported that the subjects tended to generate relatively common ideas early in the experiment and relatively rare ideas later.	No significant differences were found in individual subjects when seeded with common or rare ideas.
27 Daly, 1993	**Comm Mode** Decision Quality: Ns Number of decision errors: CMC > FtF Comments/Speaking Turn: FtF > CMC Decision Time: CMC > FtF	The results are consistent with the position that CMC provides a marginal fit, when groups must evaluate proposed solutions to Intellective tasks. CMC groups detect and correct less errors than FtF groups. Both conditions improved as a function of the number of trials (AST). The CMC error level may be associated with the double entry required by the system.	There were no differences in the number of correct solutions between CMC and FtF groups. CMC groups generated more inconsistent hypotheses, had fewer comments and required more time than FtF groups.
28 Daily & Steiner, 1998	**Comm Mode Context-Culture** Perceived contribution: GSS > FtF Ns Number ideas: GSS > FtF MC > H Commitment to decision: Ns Ns Personal influence: Ns Ns	Interaction effects: Multicultural (MC) groups using a GSS produced a significantly higher number of ideas than culturally homogenous (H) groups using a GSS.	The results suggest that a GSS may offer a conducive environment for improving group decision making. GSS and MC groups produced a greater number of ideas than FtF or H groups.

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29 Daily Whatley, Ash, Steiner, 1995	**Comm Mode** **Context-Culture** Number ideas: GSS > FtF Hetero > Homo Decision Quality: Ns Ns Interaction: Number of Ideas-GSS X Hetro > GSS X Homo Hetero: Heterogeneous; Homo: Homogenous	Culturally diverse groups can provide a wider range of thought and a greater number of alternatives to posed problem than culturally homogenous groups.	Groups using GSS, regardless of cultural makeup, developed a significantly higher number of non-redundant, realistic ideas than groups that did not. This was also observed for heterogeneous vs. Homogeneous groups.
30 Davey & Olson, 1998	**Design** Decision quality: Ns Effectiveness of DSS: VQ > AT User satisfaction: VQ > AT, NEGO Number of alternatives: AT > VQ, NEGO Number of preference Changes: VQ > AT Decision time: AT > VQ, NEGO	The easiest system to use was VisionQuest. NEGO was considered "messy."	There were no overall significant differences in decision quality among the 3 systems.
31 Dennis, 1996, 1993	**Comm Mode** Total information: GSS > FtF Common information: GSS > FtF Unique information: GSS > FtF Perceived information use: FtF > GSS Information learned: FtF > GSS % available Optimal Dec.: Ns Decision quality: Ns Decision time: Ns Consensus change: Ns Satisfaction: Ns Pressure to conform: Ns Cohesiveness: FtF > GSS Information usage: FtF > GSS Information credibility: FtF > GSS	The use of GSS clearly improved (by 50%) the information exchange process in group decision making. This had no overall effect on the decision quality.	GSS groups exchange more information than FtF groups but, FtF showed more learning, higher cohesiveness, greater information usage and higher information credibility than GSS groups.

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32 Dennis, 1996	**Comm Mode** Information exchange: Ns Information learned: FtF > GSS Decision Quality: Ns Cohesiveness: FtF > GSS	Regardless of treatment, subjects exchanged a greater proportion of common information than unique information. Both GSS and non-GSS groups exchanged only a small portion of the available information. Both made poor decisions because they lacked sufficient information and failed to effectively use shared information.	Only about half of the groups exchanged sufficient information to be able to identify the optimal choice, regardless of medium. GSS groups were less likely to use shared information, possibly because anonymity reduced the informa-tion credibility or the GSS impaired members ability to integrate the newly received information into their existing base.
33 Dennis, Aronson, Heninger, & Walker, 1996	**Process Structure Context-Time Pressure** Num unique ideas: Mult > Single; Ns Idea quality (judged) Total quality: Mult > Single; Ns Mean quality: Ns; Ns Total quality ideas: Mult > Single; Ns Perceived Measures Effectiveness: Mult > Single; Mult > Single Satisfaction: Mult > Single; Mult > Single Idea Diversity: Ns; Mult > Single Sufficient Time: Mult > Single; Mult > Single	There were significant interaction effects. Single question/Multi-time groups reported lower effectiveness and satisfaction. It did not matter whether those working on the decomposed task did so simultaneously or sequentially. Subjects in the multiple question/multi-time period condition did feel greater time pressure, but this did not result in their working faster or generating more ideas. The authors suggest that while social phenomena have tended to dominate prior GSS research, cognitive factors are also important. Decomposed task: The task is broken down into a series of questions, each focusing on one aspect of the task. Intact Task: All parts of the task presented simultaneously.	Groups which were presented with a decomposed task generated 40% more ideas than those which were given intact tasks with greater total quality of ideas. This is attributed to the ability of task decomposition to refocus members' attention more evenly across the entire task space. Organiz-ational groups generating ideas should decompose the task into several sub-categories before beginning to work. However, when the solution space for a task is small or when the task is complex, decomposition may not be appropriate.
34 Dennis, Easton, Easton, George, & Nunamaker, 1990	**Group Composition** Total Comments: Ns Uninhibited comments: Established > Ad hoc Process comments: Established > Ad hoc Participation Equality: Ad hoc > Established Direct conflict: Ns Indirect conflict: Ad hoc > Established Perceived task focus: Ad hoc > established Decision quality: Ns	Established groups had significantly higher variances. Decision quality was higher in established groups, but not significantly. In Ad hoc groups conflict was associated with the lower level of decision quality. Established groups have significantly larger variances than Ad hoc groups. Ad hoc groups are much more similar to each other in terms of group processes.	Established groups: greater amount of communication, more process oriented communication and more uninhibited comments, and less equality of participation than Ad hoc groups. There are differences between established and Ad hoc groups.

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35 Dennis, Hilmer, Taylor, & Polito, 1997; Dennis, Hilmer & Taylor, 1998	**Comm Mode Process** **Structure** Common information: Ns Ns Unique information: GSS > FtF Ns Comm. info recalled: Ns Ns Unique infor recalled: FtF > GSS Ns Information learned: FtF > GSS Ns Time: GSS > FtF Ns Decision quality: Ns Ns Satisfaction: FtF > GSS MM > Uni Apprehension: FtF > GSS Ns Info credibility: FtF > GSS Ns Perceived Thought-I: FtF > GSS Ns Perceived Thought-Others: FtF > GSS Ns	Interaction effects: 1. Majority/minority (MM) perceived themselves and others to have thought less about the information than the Uniform (Uni) groups. 2. Uni groups using GSS recalled less unique and common information than others. 3. MM groups using GSS recalled more common information. 4. MM groups using GSS made better decision than FtF MM groups. Uni FtF group made better decision than Uni GSS groups.	In MM groups the use of GSS improved decision making, and the use of information. Without the GSS the majority dominated. The GSS provided parallelism, anonymity, and group memory. Uniform groups using GSS exchanged more information than without the GSS, but thought less about the information, took longer, and made a sub-optimal decision.
36 Dennis & Valacich, 1993	**Comm Mode Group** **Size** Number Ideas: Ns 12 > 6 Satisfaction: GSS > N Ns Evaluation Apprehend: GSS > N Ns Synergy-stimulation: GSS > N Ns Sufficient time: GSS > N Ns Production blocking: Ns Ns Free riding: Ns Ns N: Nominal	Larger E groups generated more unique ideas per person than smaller E groups, smaller N groups generated more ideas than larger N groups. Evaluation apprehension was high in all groups, but significantly higher in small N groups.	Large E groups generated more ideas than large N groups, no differences were observed between small groups. The results were attributed to minimal process losses (production blocking, evaluation apprehension, and free riding while enabling process gains (synergy and avoidance or redundant ideas) and higher levels of process satisfaction.

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37 Dennis & Valacich, 1994; Dennis, Valacich, & Nunamaker, 1991 Experiment 1	**Group Size** Number unique ideas: 18 > 9 > 18 nominal > 3 Total quality: 18 > 9 > 18 nominal > 3	Process gains can arise from synergy. The results suggest that smaller groups had more multiple monologues than larger groups.	Intact groups generated more ideas with higher quality than individuals working alone or in smaller sub-groups. The differences are attributed to reduced blocking, and different social processes.
37 Dennis & Valacich, 1994; Dennis, Valacich, & Nunamaker, 1991 Experiment 2	**Group Size** Number unique ideas: 12 > 12 nominal > 4 Total quality: 12 > 12 nominal > 4		
38 Dennis, Valacich, Carte, Garfield, Haley, & Aronson, 1997	**Process Structure Task** Number unique ideas: Mult-D > Single-D No-Idea quality Mult-D > Single-D Measures Idea novelty Mult-D > Single-D Interaction effect: treatment X order; treatment X task. Mult-D: Multiple dialogue; Single-D: Single dialogue	Eleven dialogues were used, one more than the number of subjects in a group. The use of dialogues, in theory, would reduce procedural factors that encourage a narrow range of idea generation. Groups generated less ideas in the second session, suggesting fatigue or loss of motivation	Electronic brainstorming groups using multiple dialogues produced more ideas and more high quality ideas than groups using single dialogues.
39 Dennis, Valacich, Connolly, & Wynne, 1996; Experiment 1	**Process Structure-Decision Process** Number Unique Ideas: Mult > Single Total Quality: Mult > Single Mean Quality: Ns Number Good Ideas: Mult > Single Unique Ideas by category Inputs: Mult > Single Outputs: Mult > Single Storage: Mult > Single Perceived Effectiveness: Ns General Satisfaction: Ns	In experiment 1 subjects in the single question condition generated ideas equally across all subcategories, while subjects in the multiple question condition generated more ideas in all 3 categories. However, in experiment 2 the single question subjects focused primarily on one category, while multiple questions produced 2-3 times as many ideas in all categories.	The results suggest that decomposition leads to more ideas. The authors suggest that the reported difference can be attributed to the ability of time constraints to increase the rate of idea generation, and the ability of problem decomposition to refocus members' attention more evenly across the entire problem

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39 Dennis, Valacich, Connolly, & Wynne, 1996; Experiment 2	**Process Structure-Decision Process** Number Unique Ideas: Mult > Single Total Quality: Mult > Single Mean Quality: Ns Number Good Ideas: Mult > Single Unique Ideas by category Elected Officials: Ns Business Leaders: Mult > Single General Public: Mult > Single Perceived Effectiveness: Ns General Satisfaction: Ns		
40 Dennis, Valacich, & Nunamaker, 1990; Valacich, Dennis, Connolly, 1994; Experiment 1	**Group Size** Performance- # of ideas: 18 > 9 > 3 Quality: 18 > 9 > 3 Decision Confidence: 18 > 9 & 3 Comments per person: Ns Satisfaction: 18 > 3	The data supports the law of diminishing returns. Per-person participation levels did not decrease as group size increased. Larger groups adapt differently to the technology- formal structure. There was a greater amount of process satisfaction in the larger groups.	Performance increased with group size. Larger groups were more satisfied with the process than smaller groups due to process losses: air time, production blocking, evaluation apprehension, free riding and cognitive inertia.
41 DeSanctis, D'Onofrio, Sambamurthy & Poole, 1989	**Process Structure Comprehensiveness Restrictiveness** Consensus: C > S, I Ns Decision time: I > C > S Ns I: Integrated; S: Specific; C: Coupled	Restrictiveness: no effects The results suggested that spirit and general attitude as well as structure are important GSS features. The integrated feature did not improve consensus, it may have been too complex.	The benefits of heuristics are likely to be enhanced if general heuristic is added. General heuristic are more comfortable and easier to understand than integrated ones.
42 Dickson, DeSanctis, Poole, & Limayem, 1991	**Process Structure-Levels** Post-meeting consensus: Ns	Two level 2 groups had post-meeting consensus lower than their pre-meeting consensus. This suggests that the groups adapt differently to the group, task, and technology- AST.	No significant post-meeting consensus differences were reported between level 1 and level 2 GSS groups. The authors suggest that a level 2 GSS is too complex when used in a user-driven mode.
43 Dickson, Partridge, & Robinson, 1993; Dickson, Lee, Robinson, & Heath, 1989	**Process Structure-Facilitation** Post-meeting consensus: Chauffeured > Facilitated	There were no differences between the guides. The results suggest that groups achieve higher post-meeting consensus when supported by a less restrictive and less structured mode- a chauffeured mode.	Chauffeur-driven supported group achieved significantly higher post-meeting consensus than did facilitator-driven groups.

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44 Dubrovsky, Kiesler, & Sethna, 1991	**Comm Mode** Decision time: CMC > FtF Total comments: Ns Number of proposals: CMC > FtF Disinhibition: CMC > FtF Participation Equ: CMC > FtF First Advocates: CMC > FtF Choice Shift: Ns	CMC reduced status effects. There is also an interaction between status and expertise. This is reduced in CMC. The results suggest that participation changes as a consequence of technology. Attitudes and use also shift.	CMC reduces the effects of social context cues and perceived expertise. CMC tends to increase equality of participation and disinhibition.
45 Dubrovsky, Clapper, & Ullal, 1996	**Task Support-Tools** Decision influence: High-status > Low-status Persuasive influence: High-status > Low-status Total Comments: Ns Uninhibited remarks: Ns Note: Not all dependent variables are reported here	The results suggest that subjects using distinct windows (larger and labeled as facilitator) had significantly greater influence on the group decision and a persuasive influence (attitudes)than subjects using non-distinct windows (smaller and labeled as participant)	Technology can be used to change the effect of status. CMC in theory equalizes participation and influence. By employing an distinct window artifact, status effects are altered.
46 Dufner, Hiltz, Johnson, & Czech, 1995; Dufner, Hiltz, & Turoff, 1994	Perception Measures **Task Support Process Structure** Discussion quality Tools > No-tools Ns Media Richness Tools > No-tools Ns Satisfaction Tools > No-tools Ns	No-tools groups experienced more confusion attributed to "log-in" lag than tools groups. The tools (list and vote) provided structure enabling the groups to monitor their progress.	Providing tools in distributed CMC improves perceived group outcomes over no-tools. The presence or absence of sequential procedures has no effects.
47 Easton, George, Nunamaker, & Pendergast, 1990	**Process Structure-Levels** Decision Quality: EDS > EBS (p <0.062) Number of Alts: EBS > EDS Satisfaction: Ns Consensus: Ns EDS: Level 2; EBS: Level 1	There is a technology task fit. For tasks that lead to convergence a electronic conversation provides for a clear focus. For divergent tasks (brainstorming) list generators (EBS) improve performance. The results suggest support to AST.	The results suggest that there is a task technology fit. EDS aids in decision quality, EBS aid in generation of alternatives.
48 Easton, Vogel, & Nunamaker, 1989	**Decision Process Process Structure-Decision Process** Number of Alternatives: GSS, FtF-P > FtF Participation Equality: GSS, FtF-P > FtF Process Satisfaction: GSS > FtF **Decision Outcomes:** Quality: GSS, FtF-P > FtF Time: GSS, FtF-P > FtF Decision Satisfaction: GSS > FtF FtF-P FtF With Process; GSS has process; FtF, Nothing	Groups exposed to structure had more alternatives w/o rehashing old ideas. Participation was greater with structure. US had more uninhibited comments; AS, MS stuck to the agenda. Groups supported by structure (AS, MS) produced higher quality decisions, had more ideas, and took longer. Groups supported by computer structure were more satisfied and had less conflict.	AS, MS had higher quality decisions, a greater number of ideas, and a more even distribution of participation than US. AS had a higher level of satisfaction with decision & process.

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49 Easton, Vogel, & Nunamaker, 1992	**Decision Process: Process Structure-Decision Process** Quantity of Alternatives: I-GSS > GSS Participation Equality: I-GSS > GSS Satisfaction: GSS > I-GSS **Decision Outcome:** Decision Quality: Ns Time: Ns Satisfaction: GSS > I-GSS I-GSS:I-SIAS Interactive-GSS;GSS:SIAS Chauffeured GSS	The I-SIAS group resisted in removing duplicate items from the list and spent on more voting; both could lead to a decrease in process satisfaction. I-SIAS groups were less likely to consolidate their ideas and were more frustrated with the voting phase.	Interactive GSS groups generated a greater number of unique ideas and had more even participation than did non-interactive groups. I-SIAS groups were less satisfied with the process and the decision outcome.
50 El-Shinnawy & Vinze, 1997	**Comm Mode** **Culture** Polarization: FtF > GSS S > US Persuasiveness: Ns Ns Novelty: FtF > GSS Ns Validity: Ns Ns	FtF and Singaporean groups exhibited significantly higher polarization (a shift toward risk) than GSS or US groups.	The effect of medium on group process varied by culture. The effect of persuasiveness was most pronounced in US groups.
51 El-Shinnawy & Vinze, 1997	**Comm Mode Group Composition** **Task** Polarization: FtF > GSS Ns J > I Persuasive Arguments: Ns Ns I > J J: Judgment task; I Intellective Task	There are also interaction effects (Task X Comm Mode). FtF groups performing the intellective task generate more persuasive arguments than GSS groups. GSS groups have more persuasive arguments than FtF groups on the judgment task. FtF groups experience more polarization on judgment tasks than do GSS groups. Lower polarization is better.	Polarization is significantly lower in GSS groups than in FtF groups. No significant differences were found for persuasive arguments. There are task-Communication mode interactions suggesting that task type is critical when making a choice regarding the medium used to complete the task.
52 Ellis, Rein, & Jarvenpaa, 1990; Ellis, Rein & Jarvenpaa, 1989	**Comm Mode** **Task** Communication: EBB > EWS > C Ns Quality: EBB > EWS > C Process Satisfaction: EWS > EBB Comments: EWS > EBB, Control EBB: Electronic Black Board- Level 1; EWS: Electronic Workstation-Level 2; Control: Face-to-face	Groups had leaders who were assigned based upon experience. The leader effect was not measured, but was reported to have an effect. Leadership effected how the group used the technologies. Teams used the technology differenly; AST.	EWS > Communication and EBB > Focus. Needs for teaching interaction skills, and for providing process models to aid understanding software design. Electronic massaging aided in equality of participation.

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53 Eveland & Bikson, 1988	**Comm Mode Group** **Comp** Communication (all media): CMC > FtF Quality: CMC > FtF Satisfaction: CMC > FtF Number Messages: Retired > Not Retired	CMC did schedule FtF meetings; the no-CMC had more unscheduled meetings. CMC developed different structures, ones that took advantage of electronic media, fluctuating leadership; No-CMC had a consistent set of leaders. CMC had more contact. CMC groups generally more satisfied with process and outcomes.	CMC had more equal participation, more contact, and had higher levels of communication in all channels. The CMC groups require a heavy member investment to learn the technology and assistance during the learning process.
54 Fjermestad, Hiltz, Turoff, Ford, Johnson, Czech, Ocker, Ferront, Worrell, 1995	**Process Structure** **Environment-Exp** **Group Performance Decision Process** Number of days: DI > CC; Ns Num Comments: DI > CC; Ns Effectiveness: Ns; Ns Depth of evaluation: Ns; Ns **Group Perception** Acceptance: Ns; Ns Depth of Evaluation: CC > DI; Ns Willingness: CC > DI; Ns	The DI groups expend a greater effort than CC groups as indicated by the asynchronous meeting time and number of comments, but gain very little in terms of effectiveness and group perceptions. There were no learning effects and no interaction effects reported.	There were no significant differences in decision effectiveness between DI and CC groups. CC groups report greater decision acceptance, depth of evaluation and willingness to work together again than do DI groups.
55 Galegher & Kraut, 1994; 1990	**Time series data:** **Comm Mode** Number of days worked: CMC > FtF Total time in communication: CMC > FtF **Performance:** Quality of projects: Ns Impression of quality: FtF > CMC Social Communications: FtF > CMC Impression of process: FtF > CMC CMC: CMC and CMC + phone	CMC coordination difficulties increased as the due date became closer. CMC based groups had greater difficulty in coordinating and understanding their work; CMC groups also took longer to finish their projects. FtF groups did earlier and more complete planning.	CMC groups had to work harder and communicate more; were less committed to the group; were less satisfied with their work; but had the same quality as FtF groups.
56 Gallupe, 1990 Experiment 1	**Comm Mode** Decision Quality: Ns; Best_M > GSS; Groups > Avg Member Process Satisfaction: Ns; Best_M > FtF Confidence: Ns; Best_M > FtF	There appears to be no differences in quality between GSS and No-GSS groups. No-GSS groups appear to have greater satisfaction and confidence than do GSS groups. The lower decision quality of the GSS groups in comparison to the best member was attributed to anonymous input & communication facilitation. The group did not recognize the best member's solution.	Best members out perform their GSS groups. GSS use suppresses the contributions of the group's best member. Factors, which may be responsible for this are: pressures to conform, difficulty in judging individual solutions, and low confidence in competent members.
56 Gallup, 1990 Experiment 2	**Comm Mode** Decision Quality: Ns; Best_M > GSS; Groups > Avg Member Process Satisfaction: Ns; Best_M > FtF Confidence: Ns		

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57 Gallupe, Bastianutti, & Cooper, 1991	**Comm Mode** **Process Structure** Number of ideas: GSS > FtF Ns Process Satisfaction: Ns I > N Confidence: Ns I > N Difficulty: FtF > GSS Ns Comfort: Ns I > N Participation-Perc: Ns Ns Motivation: Ns I > N Apprehension: Ns N > I Opportunity: Ns I > N More ideas: Ns I > N I: Interacting; N: Nominal	Keyboarding may contribute to the effects of electronic vs non-electronic. Electronic groups were anonymous. This may also have contributed to the main effects. GSS may also have built in memory and processing effects (retrieval and visual information processing). GSS increases productivity as does the nominal technique; Technology and group type interactions were reported on: difficulty, participation, and apprehension.	Both nominal and interacting Electronic groups produced more ideas than non-electronic groups. Interacting electronic groups found the task easier, participated more, and were more comfortable.
58 Gallupe, Cooper, Grise, & Bastianutti, 1994; Experiment 1	**Comm Mode** Number of ideas: GSS > Delayed-GSS, FtF Subjective Keyboard speed: GSS > Delayed-GSS Note: GSS, & FtF data from Number 33	The 5 second delay in the keyboard speed (Delayed-GSS) was sufficient to reduce productivity of GSS groups to the level of verbal groups. FtF and Delayed-GSS rated the task more difficult than GSS. In experiment 2, GSS groups took more time and may have been frustrated. In Experiment 3, normal GSS groups out performed normal FtF groups. No effects for satisfaction or free riding.	The major advantage that GSS has over verbal brainstorming is that it allows for simultaneous and uninterrupted production of ideas. Restricting GSS by keyboard delays or tampering with the parallel entry via turn-taking or first-in eliminates the superiority of GSS when compared to FtF. When parallel entry, getting-the-floor, and anonymity of GSS are eliminated, GSS can be inferior to FtF brainstorming.
58 Gallupe, Cooper, Grise, & Bastianutti, 1994; Experiment 2	**Comm Mode** Number Ideas: GSS > FtF Production Blocking: GSS > FtF Process Satisfaction: Ns Free-riding: GSS > FtF Evaluation Apprehension: Ns Note: GSS, FtF: used turn taking, no parallel entry		
58 Gallupe, Cooper, Grise, & Bastianutti, 1994; Experiment 3	**Process Structure** **Comm Mode** **Interact** Number ideas: N > T, F Ns Yes Production Blocking: T > N, F Ns No Apprehension: T > N, F Ns No Process Satisfaction: Ns Ns Ns Free riding: Ns Ns Ns N: Normal T:Turn-taking; F: First-in; Tech: GSS, FtF		

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59 Gallupe, Dennis, Cooper, Valacich, Bastianutti, & Nunamaker, 1992 Experiment 1	**Comm Mode** **Group Size** Number ideas & Quality: GSS > FtF 4, 6 > 2 Quality Ideas: GSS > FtF 4, 6 > 2 Production Blocking: FtF > GSS 4, 6 > 2 Evaluation Apprehension: FtF > GSS Ns Process Satisfaction: Ns Ns	There are many interaction effects with group size and technology. The advantages of GSS become pronounced as anonymity increases; Number and quality of ideas is greater in GSS than FtF; Size improves both in GSS; Production blocking lower in GSS; Satisfaction was higher in GSS and increased as group size increased. The results suggest that anonymity reduces inhibitory effects- large groups do better if anonymous.	Larger GSS groups generate more ideas, unique, and of higher quality, and were more satisfied than FtF groups. Parallel entry and anonymity aid to improve performance and satisfaction in GSS groups. The benefits are magnified as group size increases.
59 Gallupe, Dennis, Cooper, Valacich, Bastianutti, & Nunamaker, 1992 Experiment 2	**Comm Mode** **Group Size** Number ideas & Quality: GSS > FtF 12 > 6 Quality Ideas: GSS > FtF 12 > 6 Production Blocking: FtF > GSS Ns Evaluation Apprehension: FtF > GSS Ns Process Satisfaction: GSS > FtF Ns		
60 Gallupe, DeSanctis, & Dickson, 1988	**Comm Mode** **Task Complexity** Decision Quality: GSS > FtF High > Low Nm of Alternatives: GSS > FtF Ns Decision Confidence: Ns Ns Consensus: FtF > GSS Ns Process Satisfaction: FtF > GSS Ns Conflict: GSS > FtF Ns	The results are paradoxical in nature. GSS imposed an agenda on group, acted as group memory. Faithful use of GSS. GSS groups had increased negative sentiment- Cognitive overload?	GSS groups had better quality but less satisfaction and confidence than the FtF groups. As complexity increased the number of alternatives and decision quality improved in GSS groups.
61 Gallupe & McKeen, 1990	**Comm Mode** **Proximity** Decision Quality: Ns Ns Decision Speed: GSS > FtF D-GSS > FtF Choice Shift: An interaction Confidence: Ns Ns Process Satisfaction: Ns FtF > D-GSS	The increased decision time in the GSS groups suggests that there may be an interface problem or a greater level of complexity, which first must be overcome. The choice shift interaction suggests that GSS may even out participation especially in remote situations-AST.	GSS had increased Decision time. No effect on Quality; Remote groups less satisfied with process than FtF groups. No significant effects on decisions between conditions.

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62 George, Dennis, & Nunamaker, 1992	**Process Structure-Facilitation** Number of Alternatives: Ns Decision Quality: Ns Consensus: GSS > GSS-F (p< 0.06) Satisfaction: Ns *Co-variate analysis with number of alternatives Decision Quality: GSS-F > GSS Consensus: GSS > GSS-F * Reported in Data-base tables	The results suggest that User-driven processes provide greater information richness to the group than the processes imposed by facilitation. The groups were established groups with leaders. The results indicate that the leadership role did not effects the decision quality.	The results revealed no difference between facilitated and user-driven GSS groups. This suggests that GSS have equifinality.
63 George, Easton, Nunamaker, & Northcraft, 1990	**Comm Mode** **Leadership** **Anonymity** Decision Quality: Ns Ns Ns Num of Alternatives: Ns Ns Ns Decision Time: GSS > FtF Ns Ns Consensus: FtF > GSS Ns Ns Participation Equal: GSS > FtF Ns Ns Uninhibited Comments: Ns Ns Ns Satisfaction: Ns Ns Ns	Anonymous groups with leaders were more satisfied with the group process as were non-anonymous without leaders. Several interaction effects which could be due to adaptation. A leader in manual groups and no leader in GSS led to the most equal participation.	GSS groups were less likely to reach consensus, took more time, and had greater levels of participation than manual groups.
64 Ghani, Supnick, & Roony, 1991	**Comm Mode** Flow (Enjoyment/Concentration): CMC > FtF Perceived Challenge: CMC > FtF Perceived level of skills: Ns Control: Ns	The results may be partially due to the fact that CMC technology was relatively novel to most subjects. CMC groups reported higher levels of both concentration and enjoyment than FtF groups.	The lower social presence in (anonymous) CMC may have helped group members concentrate and focus on a limited stimulus field. CMC groups also have had a higher perceived challenge than FtF groups.
65 Glasson, Atkinson, Chang, & Whiteley, 1994	**Comm Mode** Decision quality: GSS > FtF Num. individual ideas: Ns Group number of ideas: GSS > FtF Preference for Mode: GSS > FtF	The authors suggest that the tools in the GDSS may account for the enhanced quality (outlier and automatic recording).	The use of a GDSS for systems design improves the quality of the outcome in comparison to manual methods. Groups prefer to work with the GDSS over the manual methods.

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66 Gopal, Bostrom, & Chin, 1993, 1992	**Comm Mode** **Task-Type** Task-outcome: Na Meeting 1 > Meeting 2 Task-Attitude: Na Meeting 1 > Meeting 2 Technology: Ns Task: Ns AST variables: comfort, respect, challenge, ease of use, usefulness, and compatibility.	The results suggest that during the first meeting the group effort is devoted to learning the technology. During the second meeting the GSS is incorporated into the group's work.	AST does provide a convincing des-cription of the GSS process. Pre-meeting attitudes are very influential. Longitudinal studies are needed; certain variables appear to differ from the first to second meeting.
67 Griffith & Northcraft, 1994	**Comm Mode** **Anonymity** **Task Support** Decision Quality: FtF > GSS I > A No-Doc > Doc Pay-off: Maximization of individual outcome interaction effects: Media*Documentation I: Identified, A: Anonymous, Doc: Documentation; No-Doc: No Documentation	Media*anonymity interaction was almost significant suggesting that being more psychologically distant from your negotiation partner results in less beneficial agreements. The presence of documentation lowers the performance; documentation reduces communication. AST.	Results indicated a significant main effect for medium, features (documentation and anonymity), and an interaction effect. All yield lower negotiation performance.
68 Gundersen, Davis, & Davis, 1993	**Comm Mode** Outcome: DSS > FtF Decision time: DSS > FtF Process satisfaction: DSS > FtF Decision confidence: Ns Commitment: Ns	The outcome (selection of employee for promotion) was significantly different for those groups with DSS support and no DSS support. Groups with the DSS spent a considerable amount of time in the beginning of the session deciding upon the criteria to consider and the weighting to provide for each attribute. FtF groups did not do this.	DSS groups take more time to reach a decision and are more satisfied with the process than FtF groups.
69 Herschel, 1994; Herschel & Wynne, 1991	**Gender Composition** Number of ideas: Ns Decision quality: Ns Decision time: Ns Attitudes: Ns	No direct test of the hypothesis that GSS with anonymity increases gender equality.	The authors suggest that the use of GSS may offer the potential for creating a fair group process by empowering individuals in groups who might otherwise have been disadvantaged because of the nature of group composition

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70 Hightower & Sayeed, 1995	**Comm Mode Group Composition** **Task** **Complexity** Biased Discussion: CMC > FtF 60% > 33% Ns Interaction effect: Load by Mode sig.	Biased discussion is defined as the tendency to focus on only a portion of the available infor-mation. The average total number of statements made by the FtF groups was 90 vs. only 68 for CMC. Content coding shows CMC groups used a much higher proportion of statements devoted to procedural matters and found it more difficult to coordinate their efforts.	Biased discussion was found to occur to a greater degree when (1) CMC was used rather than FtF discussion;(2) when information load was higher and the Comm Mode. Mode was CMC; and (3) when the majority of the available information was known by all group members. CMC was less efficient and effective.
71 Hightower & Sayeed, 1996	**Comm Mode Process** **Structure** **Info Dist** **Decision** **Process** Information exchange: FtF > GSS Ns Con > Non Unique information: FtF > GSS Ns Con > Non	Conflict groups with less common information had more diverse discussions and gained more unique information.	Biased discussion occurred to a greater extent when the communications mode was GSS, and the group members were not in conflict prior to the discussion.
72 Hiltz, Johnson & Turoff, 1986; Turoff & Hiltz, 1982, Experiment 1	**Comm Mode Task** **Type** Communication: FtF > CMC Mostly IPA: tension release- FtF > CMC interactions Task oriented- CMC > FtF Asking- FtF > CMC Participation Equality: Ns Dominance: FtF > CMC Consensus: FtF > CMC Quality: Ns	CMC groups presented a greater number of opinions than FtF. There were more task type communication associated with decision quality in CMC groups. FtF groups were more likely to generate a dominatent individual or leader than CMC groups based upon the equality of participation results.	Decision quality is the same in both groups. Asking opinions appears to help CMC groups and hinder FtF groups. CMC can effectively support decision making when structured to provide aids suitable to the problem at hand.

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73 Hiltz, Johnson, & Turoff, 1991; Turoff & Hiltz, 1982, Experiment 2	**Leadership** **Task Support** Inter Quality: DL > NDL Ns Y # of comments: NDL > DL NSF > SF N * Collective Q: Ns NSF > SF N Consensus: Ns Ns Y Satisfaction: Ns Ns N DL: Designated Leader; NDL: No DL; SF Statistical Feedback; NSF: No SF; * Not in Database	Statistical feedback groups had a decreased quality. Leadership has a high correlation With quality. Human leadership or computer feedback had a significant effect on the ability of a group to reach consensus. Group effects dominate.	Directed leadership more effective in eliciting quality. Raw data as a feedback is detrimental to quality.
74 Hiltz, Turoff, & Johnson, 1989	**Comm Mode** Participation: Ns Disinhibited Behavior: Ns Deinidividuation: Ns Conservatism: Ns	The use of Pen-names does produce on the average higher levels of participation. CMC-Pen name groups had a consistent tendency to make more conservative choices. Conservatism appears to increase more in CMC-Pen groups across the 3 tasks.	The use of Pen-names may result in an increase toward "deindividuation" which may encourage greater participation and greater quality of participation.
75 Ho & Raman, 1991	**Comm Mode** **Leadership** Post-meeting consensus: FtF > GSS Ns Equality of influence: Ns Ns Influence of EL: Ns Ns	Anonymity features cancel the effects of structure. The cultural differences (Singaporean) may explain the difference. The data suggests that computer support reduces equality of influence.	Manual groups had significantly higher post-meeting consensus than GSS groups. No effects for elected leadership or influence of leader. Support in the form of structure may undermine leadership.
76 Ho, Raman, & Watson, 1989	**Comm Mode** Post meeting consensus: M > GSS Equality of influence: Ns Interaction effects: Pre-/post- consensus: B > GSS > M M: Manual (FtF with support); B: Baseline (FtF with no support)	The results suggest Singaporean groups are different from American groups used in Watson et al 1988. The difference is attributed to cultural differences. The anonymity feature in the GSS allowed the dominant Singaporean member to take control without direct confrontation.	Manually supported groups displayed higher levels of post meeting consensus than GSS groups. Post-meeting consensus is significantly correlated with pre-meeting consensus in baseline groups. No significant differences in equality of influence.

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77 Hollingshead, McGrath, & O'Connor, 1993; McGrath, 1993	Performance **Comm Mode** Negotiation task: FtF > CMC Intellective task: FtF > CMC Generate task: Ns Decision task: Ns Media Change: New-CMC > Old-CMC Composition change: FtF > CMC Perception & Satisfaction Perceived performance Week 1: CMC < FtF Satisfaction Week 1 & 2: FtF > CMC Media Change: CMC-to-FtF > FtF-to-CMC	FtF groups significantly outperformed CMC groups in the first 5 weeks, but not in last 4 weeks. When FtF and CMC groups were switched, the New-CMC > Old-CMC on performance. When returned to normal, Ns. CMC groups reported that the CMC medium inhibited their task performance over the 13 weeks.	Differences in task performance reduce over time as groups adjust to the information richness of the medium. FtF groups out perform and are generally more satisfied than CMC groups in the first few weeks. After the third week there are no more significant differences. Caveats: CMC groups are not likely to improve performance relative to FtF on Intellective, negotiation or generate tasks. CMC groups need time to adjust and are more negative. Composition effects CMC groups.
78 Huang, Raman, & Wei, 1993	**Comm Mode** **Task Type** **Interaction** II GSS > FtF I > P GSS-I > rest NI FtF > GSS P > I FtF-P > rest II: Informational Influence; NI: Normative Influence I: Intellective; P: Preference	For preference tasks, in GSS groups, the use of NI is likely to be attenuated by a SAMM type GSS. This leads to the reduction of the number of attempts to convince others on the basis of personal views. As a result members are more likely to stick to their own opinions without compromise and therefore it is more difficult to arrive at a group solution	The mode of influence that predominates in group discussion depends on task type. Intellective leading to heavier use of informational attempts and preference to normative attempts. Technology (GSS) can moderate this. GSS has the potential to encourage the use of II in Intellective tasks and attenuate the use of NI in preference tasks.
79 Huang, Wei, Tan, Raman, 1997	**Task Type: Intellective Preference** Information influence: GSS > FtF Ns Normative influence: Ns FtF > GSS Influence distribution: FtF > GSS GSS > FtF Consensus: Ns Ns Decision Satisfaction: Ns Ns Process Satisfaction: FtF > GSS Ns	The hypotheses tested interaction effects, no main effects were reported.	The task type affects GSS effects on information exchange and participation equality.

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80 Huang, Wei, Watson, Lim, & Bostrom, 1996	**Comm Mode** **Process Structure** **Decision Process** Media richness: FtF > GSS SC > No-SC Social presence: FtF > GSS Ns SC: Social construct (a goal)	The hypotheses being tested were interaction effects: No-SC: Media richness FtF > GSS Social presence FtF > GSS CMC: Media richness SC > No-SC Social presence SC > No-SC	The results suggest that with No-shared SC, FtF medium was richer that the GSS medium. Under a shared SC condition, GSS medium is transformed into a richer medium, similar to FtF. Media richness theory may hold for new or non established group, but not for existing or established groups.
81 Hwang & Guynes, 1994	**Group Size** **Comm Mode Interaction** (Not reported) LM vs LC SC vs LC Decision Time: Ns LC > SC No. Alternatives: Ns LC > SC Process Satisfact: Ns Ns Decision Satisfac: Ns Ns Decision Quality: LC > LM Ns L: Large (9), S: Small (3), C: Computer, M: Manual	Data on number of alternatives not normalized for group size. Analysis and hypothesis did not follow ANOVA model. No data and analysis presented on small manual groups.	LC groups had more alternatives than SC groups, had better decision quality, but require more time. LC groups did reduce decision time and increase the number of alternatives, compared to LM groups (ns). The study found a limited set of positive factors in favor of computer support.
82 Hymes & Olson, 1992	Process **Structure** Number of Unique Ideas: Nominal, IP > IS Ns between N and IP IP: Interacting Parallel IS: Interacting Serial	IS group had loss due to production blocking. Nominal groups produced ideas at a rate of 11.5/min versus 9.9 for IP.	Parallel input of ideas in a brain-storming session improves efficiency. The results suggest that input blocking can result from large group size and task type.
83 Iz, 1992	**Task Support-Tools** **Group Composition** Preference: GSS1 > GSS2 Ns Confidence: GSS1 > GSS2 Ns Compromise: GSS1 > GSS2 Ns Time: Ns Ns	Managerial decision making experience was insignificant with respect to the dependent measures. GSS1-Tools- Ranking and preference GSS2-No-Tools	Consensus ranking augments multi-objective optimization techniques.

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84 Iz & Jelassi, 1990	**Process Structure** / **Skill** Decision time: IF > F / S-LP > W-LP Number iterations: IF > F / S-LP > W-LP Decision quality: F > IF / Ns Decision confidence: F > IF / Ns	Skill in the use of linear programming had no effects on the results. IF: Informal approach; F: Formal approach S-LP: Strong LP skill; WlLP: weak LP skill	The results suggest that groups using a formal preference aggregation step have higher decision quality, in less time, with more confidence than groups using an informal approach.
85 Jarvenpaa, Rao, & Huber, 1988	**Comm Mode** **Task** Meeting Thoroughness: Control > EBB > EWS No Equality of part.: Ns Measures Equity: Ns Quality: EBB > EWS > Control Satisfaction: Ns, a team effect	EWS groups have cognitive overload, There is an interaction between technology and group. EBB: Level 1 EWS: Level 2	Positive effects on thoroughness of information exchange were found in EBS meetings. EWS meetings provided mixed results. Significant team differences were found.
86 Jessup, Connolly, & Galegher, 1990	**Process Structure-Anonymity** Solution Clarifications: A > I Critical Comments: A > I Questions- Solutions: A > I Total comments: A > I Solutions: Ns Supportive comments: Ns Comments on system: Ns Comments on group: Ns Critical Arguments: Ns	Both groups could be considered to be anonymous since there was only one 40 min session. It can be inferred that the groups did not have sufficient time to get acquainted and become a team.	Anonymous groups generated more comments, were more critical and were more likely to embellish ideas than identified groups. Anonymity can reduce inhibitions in communication.

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87 Jessup, Egbert, Connolly, 1996	**Process Structure** **Process** Total comments: H-C > L-C, Pooled, Solo Number of ideas: H-C > L-C, Pooled, Solo Original ideas: H-C > L-C, Solo; Effective idea gen: L-C > Solo; Critical comments: H-C, L-C, Pooled > Solo Supportive comments: H-C, L-C, Pooled > Solo Subjective Time: Pooled, Solo > H-C, L-C Decision Satisfaction: Ns Process Satisfaction: Ns System Satisfaction: Ns Usability: Ns Note: Not all dependent variables are reported here	H-C groups tend to make more supportive and critical remarks and arguments, ask more questions about problems and solutions, and ask more overall questions than L-C, pooled and solo groups. The results support AST. The authors also suggest that to realize more gains from individual deliberation, groups members need to spend more time muddling independently through the problem - 30 min, 1 hour, 24 hours, or more.	Pooled (nominal) and high collaboration (H-C) interacting groups outperform individuals (solo) and L-C groups. The results suggest that to generate more and better ideas hurried spontaneous exchanges are better than infrequent exchanges.
88 Jessup & Tansik, 1991	**Anonymity Proximity** **Interaction** Total comments: Ns Dist > DR Original solutions: Ns Ns Clarifications: A > I Dist > DR A-Dist>Rest Critical comments: Ns A-DR, I-Dist > I-DR, A-Dist General Satisfaction: Ns DR > Dist Note: Not all dependent variables are reported here.	Anonymous and dispersed groups have a greater depth of analysis than the others. Anonymous-dispersed groups generated the most & shortest comments, identified-FtF generated the least & the longest comments. The results suggest that different system configurations promote different problem solving approaches. Dist: Distributed -GSS DR: GSS; I_Identified; A-Anonymity	Anonymous and dispersed groups generate more comments than identified and FtF groups. FtF groups were more satisfied; highest levels of perceived effectiveness were from anonymous groups.
89 Joyner & Tunstall, 1970	**Comm Mode Process** **Structure** Quality: Ns Policy > Brainstorm Preferences FtF > DSS Brainstorm > Policy Order: Brainstorm then Policy Simpler: Brainstorm; Complex: Policy	The subjects preferred less complex tasks (task that related to them) to complex tasks (future oriented). Tools that provide a method to reduce the problem into small subsets improve performance (Policy). The GSS lacked flexibility- the users wanted to move between phases and sub-phases.	Groups using a high structure Policy strategy performed better than groups using a lower structure (Brainstorm). There were no differences between computer and non-computer groups.

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90 Kahai, Avolio & Sosik, 1995	**Process Structure-Anonymity Group Composition** Participation: P-A > S-A, N-A Ns Satisfaction: P-A > S-A > N-A Ns P-A: Participant Anonymity; S-A Source Anonymity; N-A: No Anonymity; Participation measured by comment blocks; Satisfaction of written discussion	Unexpected results: In the presence of initial differences in opinions, S-A was less effective at increasing participation than in the absence of initial differences; both S-A and P-A increased satisfaction. Anonymity reduced participation in presence of initial differences of opinions.	Anonymity is a complex variable. P-A increases participation significantly more than S-A. Both P-A and S-A increase satisfaction in comparison to N-A.
91 Karan, Kerr, Murthy, & Vinze, 1996; Experiment 1	**Comm Mode** Choice shift: FtF > GSS Decision time: FtF > GSS Process satisfaction: Ns	The subjects in the FtF groups were more willing to shift their decision to that of the group than the GSS subjects. In this experiment the GSS groups took less time than the FtF groups.	The results indicate that GSS groups are less likely to shift from their individual decisions to those of the group than FtF groups.
91 Karan, Kerr, Murthy, & Vinze, 1996; Experiment 2	**Process Structure-Anonymity** Choice shift: Ns		
92 Kerr & Murthy, 1994	**Comm Mode** Learning effects: GSS > FtF, Individual Process satisfaction: FtF > GSS Decision satisfaction: FtF > GSS Perceived efficiency: FtF > GSS Perceived improvement: FtF > GSS	GSS groups show a greater extent of learning than FtF groups, but are significantly less satisfied with the process and the outcome. FtF groups perceived themselves to be more efficient and improve their skills than GSS groups.	
93 Kim, Hiltz & Turoff, 1998	**Process Structure-Leadership Process** Decision quality: Ns Leader > No-L Perc.decision quality: Par > Seq Ns Decision satisfaction: Ns Ns Process Satisfaction: Par > Seq Leader > No-L Par: Parallel; Seq: Sequential; No-L: Non Leader	Sequential groups without a leader reported the lowest levels of process satisfaction.	The results suggest that less restrictive coordination structures (parallel) and the presence of a group leader lead to better decisions and higher process satisfaction than restrictive (sequential) coordination.

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94 Kinney & Dennis, 1994	**Comm Mode** **Task** **Equivocality** Decision time: CMC > AV > FtF Ns Decision quality: Ns H-Eq > L-Eq Consensus change Ns H-Eq > L-Eq Satisfaction: Ns Ns Media richness: FtF > AV, CMC Ns Perceived social FtF > CMC Ns	Media richness increased as both multiplicity of cues and immediacy of feedback increased. Social presence increased only as multiplicity of cues increased. AV: Audio/video; H-Eq: High equivocality; L-Eq: Low equivocality	Varying cues and feedback had no effect on decision quality, consensus change or communication satisfaction. Richer media (FtF) led to faster decisions regardless of task equivocality.
95 Kinney & Watson, 1992	**Comm Mode** **Task** **Equivocality** Decision time: CMC > A, FtF L-Eq > H-Eq Consensus change: Ns H-Eq > L-Eq Satisfaction: Ns H-Eq > L-Eq A: Audio (telephone)	Decision time was found to be higher in CMC dyads than in audio or FtF dyads. Media richness theory would suggest that consensus change would be greatest in a richer media (FtF, and audio); this was not observed.	Decision time varies as a function of medium. Further, no support for hypothesized differences in decision time and consensus as a function of medium and task was found.
96 Lam, 1997	**Comm Mode** **Task** **Structure** Decision quality: GSS > FtF No measure Critical arguments: GSS > FtF Ns Number comments: GSS > FtF Ns Procedure comments: GSS > FtF Ns Decision proposals: Ns Ns Support arguments: Ns Ns Clarifications: Ns Ns	There are strong interaction effects. GSS groups working on DIS and CON tasks are more critical and produce more comments than FtF groups. ADD: Additive DIS: Disjunctive CON: Conjunctive	In general a GSS increases the decision quality of decision-making groups. GSS significantly improves decision quality When groups are working on DIS or CON tasks. The results also indicate that there is a positive relationship between GSS and task complexity.
97 Lewe, 1996	**Comm Mode** **Group Size** Perceived Meeting Time: GSS > FtF-P > FtF Not Task Understanding: FtF-P > FtF; GSS >FtF Reported Evaluation apprehension: GSS > FtF FtF-P: Manual with Structure	Lewe suggests that there are 8 categories of effect patterns, e.g. successive effects, to isolation effects. Acceleration of the meeting as perceived by the participants is the strongest effect of the interventions.	Results show that overall GSS with facilitation has stronger effects than the GSS or facilitator alone. Facilitated structure improves task understanding, reduces dominance and enables the team to stay focused.

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98 Lewis, 1987	**Comm Mode** Ease of use: Ns Acceptance: Ns Perceived quality: GSS > FtF-P Satisfaction: FtF-P > FtF Num alternatives: GSS > FtF Commitment: FtF-P > FtF Process creativity: GSS > FtF-P > FtF Dominance reduction: GSS > FtF-P, FtF Chance to be heard: GSS > FtF-P Feasibility: GSS > FtF-P, FtF	GSS groups spent a considerable amount of time getting familiar with the procedures. Groups using the "booklet" (FtF-P) found the process more difficult than the groups using the GSS GSS, FtF-P: Booklet, FtF: Control	Groups using a GSS had more feasible solutions and more alternatives than groups using a booklet (FtF-P) and control groups (FtF). The GSS groups perceived the process to be more favorable than the others.
99 Lim & Benbasat, 1997	**Comm Mode** **Design-Tools** Normalized error: Ns PRT > No-PRT PRT: Problem presentation tool	Neglect of base rates is one of the causes of representativeness bias. A higher awareness by using the tool reduces the bias. Larger groups are needed to ascertain if the GSS will have any effects. However, this is more likely a primary result of cognitive limitations.	Representativeness bias was reduced by using the problem representativeness tool (a Bayesian probability map). Increased use of the tool led to greater awareness about the base rate and lead to better judgments.
100 Lim, Raman, & Wei, 1990, 1994	**Comm Mode** **Leadership** Influence: Ns Leader > No-leader Dominance: FtF > GSS Leader > No-leader	Groups with elected leader the effects of influence imbalance remain high even with a GSS; groups with No-leader, the presence of the GSS reduces the influence imbalance significantly. GSS inhibited the emergence of new leaders in groups where there were no established leaders.	GSS was found to suppress the emergence of new leadership. Influence was more even in No-leader groups with GSS than No-GSS groups. GSS promotes more democratic group discussion in the absence of an elected leader.
101 Limayem, Lee-Partridge, Dickson, & DeSanctis, 1993	**Process Structure-Facilitation** Post-meeting consensus: GSS Auto-F, GSS-F > FtF Perceived quality: GSS Auto-F, GSS-F > FtF	There were no significant effects between human and automated facilitation on consensus or perceived decision quality.	Both human and automated facilitation led to improved group outcomes. User driven modes had lower levels of group outcomes.
102 Liou & Chen, 1994, 1993	**Design- Tools** Perceived Task effectiveness: Ns Process satisfaction: Ns System satisfaction : Ns Cohesiveness: NS	Positive correlations were noted between process satisfaction and cohesiveness; task effectiveness and satisfaction.	The results show that it is possible to integrate GSS and JAD to support requirements specifications. No differences were found between the EBS and idea organizer tool.

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103 Losada, Sanchez, & Nobel, 1990	**Comm Mode** **Task-Support** Socio-Emotional (SE) GSS > FtF Feedback > No Task behaviors Ns Ns	No formal hypotheses were stated. If GSS is used without feedback there is a reduction in SE interactive sequences; if GSS is used with feedback there is a significant increase in SE interactive sequences; if feedback is given without GSS there is a significant reduction in SE interactive sequences.	Technology (GSS) and feedback had a significant effect on ES interactive sequences but not on task interactive sequences. Feedback on social dynamics may help improve group process in CSCW.
104 Loy, Pracht, & Courtney, 1987	**Comm Mode** **Process Structure-Decision Process** Decision quality: DSS > FtF Ns Problem understanding: DSS > FtF Ns	The DSS, a graphical tool, seemed to provide an easy way for decision makers to work with their mental models. The DSS groups also required less time to complete the task (an observation).	Groups using the DSS performed better than groups without; problem understanding was also greater in the DSS groups.
105 Mark, Haake, & Streitz, 1997	**Design** Relation btw ideas: H > N H: Hypermedia Depth of documents: H > N N: Non-Hyper- Intr/inte node links: Ns media Changes in ideas: Ns Quality of document: H > N Group strategy: H > N Memory information: N > H Decision time: Ns Group satisfaction: N > H	The results show that groups can work with hypermedia structures. Hypermedia groups typically have a division of labor and use a top-down strategy	Hypermedia produce documents with more deeply elaborated concepts than non-hypermedia groups. These documents also had more ideas, depth, and concepts. Hypermedia groups were more likely to create network rather than hierarchical structures.
106 Massey & Clapper, 1995	**Comm Mode** Number of elements (ideas): GSS > FtF Number. of non redundant: Ns Element sharing: Ns Unique elements: GSS > FtF (0.06) Subjective/Comfort Suggesting ideas: GSS > FtF Less worried about others: FtF > GSS Sensitive issues: GSS > FtF Strong feelings: GSS > FtF Negative feelings: GSS > FtF	A NGT was used to generate an initial set of individual ideas. GSS groups generate a larger set of ideas (unique + redundant) via the simultaneous input allowed by the technology. The subjects participated in both GSS and FtF sessions. Self reports indicated that GSS groups were significantly more comfortable with the GSS than in the FtF setting.	GSS groups generate more ideas than FtF groups. However, GSS groups did not generate more unique ideas than FtF groups. GSS groups did not share a significantly higher proportion of their initial element pool than did FtF groups. GSS groups generated more original elements that were not in the pre-group collective pool of elements than did FtF groups.

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107 McGuire, Kiesler, & Siegel, 1987	Group Discussion **Comm Mode** Time to Consensus: CMC > FtF Remarks (quantity): FtF > CMC Argumentation: FtF > CMC First Advocacy: CMC > FtF	CMC groups took more time and took sides early. In comparison to FtF groups, CMC groups were less likely to provide feedback, convey social context cues, & coordinate turn taking.	Results suggest that use of a computer to communicate might be less influenced by norms than in FtF.
108 McLeod & Elston, 1995	**Process Structure-Anonymity** Epithets: Identified > Anonymous Error: Anonymous > Identified Polling: Identified > Anonymous Persuasive Arguments: Identified > Anonymous Personalization: Identified > Anonymous Persuasive devices & Strategies from content coding (only percents are reported)	This was an exploratory content analysis without any formal hypotheses. Anonymity decreases over time; group members develop the ability to recognize distinct personae in the group- character anonymity. AST suported.	The results suggest that there are differences in the use of persuasive linguistic devices between anonymous and identified groups. Anonymous groups were more flexible, and used a wider variety of devices than identi-fied groups. Anonymity is a multi-dimensional construct that varies by type, level, and changes over time.
109 McLeod & Liker, 1992; Austin, Liker, & McLeod, 1993 Experiment 1	**Comm Mode** Participation Equ: Ns Task focus: FtF > GSS Decision quality: GSS > FtF (p=.06) Group perceptions: Ns Alpha set to 0.10 for all dependent measures.	In exp 2, manually supported groups had longer responses, were more completely formatted, showed a greater awareness of the problem, had a trend for higher task strategy, and higher satisfaction. The results suggest that as the tasks become more complex (Exp 2), the need for structure increases. From Austin, et. al. The results suggest that the group member have control the of the monitor are more influential than the others. This supports AST.	Low structure GSS had no effects on participation equality, or member satisfaction. The GSS marginally improved task performance on a simple evaluative task and hindered performance on a more complex task.
109 McLeod & Liker, 1992; Austin, Liker, & McLeod, 1993 Experiment 2	**Comm Mode** Participation Equ: Ns Task focus: FtF > GSS Decision quality: Ns Group perceptions: Ns		
110 Mejias, Shepherd, Vogel, & Lazaneo, 1997; Mejias, Lazeneo, Rico, Torres, & Vogel, 1996	**Process Structure Environment-Culture** Consensus FtF > GSS-A,I Ns Consensus Change GSS-A,I > FtF Ns Decision Satisfa Ns Mexico > US Perceived Parti Ns Mexico > US Equality A: Anonymous; I: Identified	There are many interaction effects. Anonymity may reduce the commitment of group members toward their input, and thus help explain why identified treatment groups across cultures were better able to reach consensus especially within a collect-ivistic Mexican culture, which may produce pressure to reach agreement if participants are identified.	As the level of identity increases (from GSS-A to GSS-I and to FTF) the level of ranking consensus increases. Culture will affect group outcomes and the adoption of IT and therefore must be considered in the design and exportation of any new IT.

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111 Meijas, Vogel, & Shepherd, 1997	**Comm Mode** **Context-Culture** Avg. Num ideas: US- GSS > FtF US > M X GSS > FtF Num. Unique ideas: US- Ns US > M X GSS > FtF Per. Partic. equality: Ns M > US M: Mexico; US United States	GSS groups generate more ideas than FtF groups. Mexican GSS groups generated more ideas than FtF Mexican groups. Mexican GSS groups generated more unique ideas and reported higher perceived participation equality than Mexican FtF groups.	Under identified conditions, US groups generated more ideas and more unique ideas than Mexican groups. US groups showed no differences in perceived participation equality whereas Mexican GSS groups reported higher levels than FtF groups. Overall, Mexican GSS groups reported higher participation equality than US groups.
112 Mennecke, 1997	**Process Structure- Group Size** **Decision Approach** Unshared information: Ns Ns Shared information: S > US Ns Decision quality: Ns Ns Process satisfaction: interaction no measures Decision Satisfaction: Ns no measures	The results suggest that groups with a moderate level of information-sharing are less satisfied with the process than groups with higher performance and they are also less satisfied than groups with a lower performance. Thus, a U-shaped relationship.	There were no significant differences for group size on information sharing, decision quality, or process and decision satisfaction.
113 Mennecke, Hoffer, & Valacich, 1995	**Group Composition Comm Mode** Information Sharing: Ad-Hoc > Est Ns Process satisfaction: Est > Ad-hoc FtF > GSS Solution Satisfaction: Est > Ad-hoc Ns Cohesion: Est > Ad-hoc GSS > FtF EST: Established	Six of the established groups were deadlocked (unable to reach agreement); none of the ad-hoc groups were. Ad-hoc groups required significantly more time to complete the task than established groups	Contrary to hypotheses, est. groups discussed significantly less informa-tion than ad-hoc groups; and GSS groups performed no better and were less sat-isfied with the process than no-tech groups. Speculation about the reasons for these findings include the poss-ibility that the group size needs to be 7 or more to benefit from GSS; and that est groups, being significantly more cohesive, will not be as vigilant.

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114 Miranda & Bostrom, 1994, 1993	**Comm Mode** **Environment-Exp** Issue based: FtF > GSS FtF > GSS Interpersonal: FtF > GSS FtF > GSS Integrative resolution: Ns Ns Distributed resolution: FtF > GSS FtF > GSS Avoidance: Ns Ns Productivity of conflict: Ns Ns	Interpersonal conflict is significantly lower in all sessions except during training in GSS groups. The structures changed across the four meetings.	GSS use appears to result in less interpersonal conflict, use of more constructive conflict and report more productive conflict.
115 Niederman & DeSanctis, 1995	**Process Structure-Decision Process** Information search: Ns Equivocality reduction: Ns Consensus: Ns Critical issues(CI): Ns Consensus/CI: SAA > GPA Perceived quality: Ns Process satisfaction: SAA > GPA Decision time: Ns Implementation: SAA > GPA	16 out of the 29 groups were coded for information search, equivocality reduction, consensus, and critical issues. The structured argument approach is also an example of a restrictiveness method. SAA: Structured argument; GPA: Group process approach.	The structured argumentation approach leads to greater combined examination of critical issues and consensus, higher satisfaction, and greater perceived implementation capabilities than the standard group process approach. No differences in perceived decision quality were observed.
116 Ocker & Fjermestad, 1998	**Comm Mode** Decision quality: Combined > FtF Creativity: Asynch > Combined > FtF	In terms of creativity, asynchronous groups out performed combined, which in turn out performed FtF groups. Combined groups produced higher quality decisions than FtF groups. There were no differences between asynchronous and combined groups	
117 Ocker, Fjermestad, Hiltz & Turoff, 1997; Ocker, Fjermestad, Hiltz, & Johnson, 1998	**Comm Mode** Creativity: Combined > Asynch-CMC, Synch-CMC, FtF Quality: Combined > Asynch-CMC, Synch-CMC, FtF Solution Sat.: Combined > Asynch-CMC, FtF Process Sat.: Ns	Synchronous-CMC groups were rated the lowest in terms of creativity and quality. However, synchronous-CC groups rated themselves as being more satisfied with their solution than either the asynchronous or FtF groups.	The creativity and quality of combined communication (FtF and Asynchronous-CMC) were significantly higher than the three other conditions. Combined groups also had higher solution satisfaction than the other conditions.
118 Ocker, Hiltz, Turoff, & Fjermestad, 1996, 1995	**Comm Mode Process Structure-Process** Quality: Ns Ns Creativity: CMC > FtF Ns	There were no interaction effects or effects for process. The task itself may not necessarily be an ill-structured task; it may be a well structured task; thus the groups were able to proceed to a solution.	The creative task of deciding upon the initial specifications for the design of a software system can benefit from asynchronous CMC. The CMC groups were judged to be considerably more creative in their designs. Quality was judged to be higher, but not significant.

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119 Olaniran, 1994	**Comm Mode** Idea quantity: CMC > FtF; CMC/FtF > CMC > FtF/CMC, FtF Decision quality: FtF/CMC > CMC, FtF, CMC/FtF Time to Consensus: CMC > FtF;	The author suggests that CMC use during idea generation reduces process losses. The use of CMC during the evaluation phase permits uninhibited criticism which leads to significantly greater decision quality in the FtF/CMC group.	Groups using CMC in the idea generation phase (CMC, CMC/FtF) generated more ideas than FtF (FtF/CMC, FtF)groups. The highest decision quality was found in FtF/CMC groups.
120 Olaniran, 1996	**Comm Mode** Ease of use: FtF > CMC Decision confidence: FtF > CMC Process Satisfaction: Ns Participation: FtF > CMC	The results suggest that decision confidence, ease of use and participation, in this order, together are determinants of member satisfaction. Ease of use is the dominant factor in CMC groups. FtF communication is easier to use than CMC.	Ease of use was lower in CMC groups than in FtF groups. Participation has less effect on satisfaction in FtF groups than in CMC groups.
121 Olson, Olson, & Meader, 1995	**Comm Mode** Design Quality: Ns Process Satisfaction: GSS+Video > GSS+Audio	This data was compared to Olson et al 1992. The video and audio groups spent significantly more time managing their meeting and clarifying their communication than GSS groups.	With extra technology (audio or video) and a shared work space, distributed groups can produce work that is indistinguishable in quality from GSS groups. Video appears to add more value than just audio.
122 Olson, Olson, Storrosten, & Carter, 1992	**Comm Mode** Quality: GSS > FtF Length: GSS > FtF Process Satisfaction: Ns Design Satisfaction: FtF > GSS	Supported groups spent less time than unsupported groups in discussion of issues, alternatives and criteria, but spent more time writing. Supported groups have more "extra" ideas.	Computer supported groups produced designs of higher quality than un-supported groups. Had a more selective examination of better ideas, focused on "core" issues.
123 Quaddus, Tung, Chin, Seow, & Tan, 1998	**Process Structure- Task Type** **Decision Approach** Issue conflict: Ns Type 4 > Type 2 Interpersonal conflict: Ns Ns Integrative Strategy: Ns Ns Distributive Strategy: Ns Ns Avoidance Strategy: DI > C Ns Decision quality: Ns Ns	Decision conferences generated more issue-based than interpersonal conflicts. Interaction: Issue conflict: Res Task DA > DI, C St Task DA > DA, C Distributive: Res Task DA,DI > C DI: Dialectical inquiry; DA: Devil's advocacy; C: Consensus; Res: Resource Task (Foundation) ST: Strategic Task	The results suggest that in terms of generating conflict there were no differences among the three conditions. For conflict management, DI and DA groups used less avoidance strategies than consensus groups. There were no differences in decision quality.

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124 Raman, Tan, Wei, 1993	**Task Type** **Preference** **Intellective** Consensus change: GSS > D-GSS Ns Decision Satisfaction: GSS > D-GSS Ns Decision Scheme Satisfaction: GSS > D-GSS Ns	It is suggested that the dispersed communications medium is too lean to aid groups in achieving consensus and can reduce satisfaction. All statistical analysis is by t-test. D-GSS: Distributed GSS	With a preference task, FtF groups achieve higher consensus change, decision and decision scheme satisfaction.
125 Rao, 1995, 1994	**Comm Mode** Listener feedback: Ns Listener comprehension: Ns Listener satisfaction: Ns Speaker satisfaction: Ns	The greater the feedback (audio, audio nonverbal, or written) the greater the listener comprehension.	CMC feedback may be comparable to verbal feedback in terms of comprehension of guiding the speaker. There are differences in satisfaction between the speaker and listener.
126 Reagan-Cirincione, 1992, 1994	**Process Structure-Decision Process** Accuracy of judgment: Interacting group > Statistical group > Best member	Because of lack of a true experimental design (control groups or alternative conditions) it is not possible to disentangle the relative contributions of group discussion, the external process facilitator, the social judgment analysis embodied in the Policy PC modeling program, the integrative cycles of estimates, feedback or discussion, or other aspects of the group process.	The author concludes that small, interacting groups were able to perform significantly better then the best member on decomposed judgment tasks when aided by an enhanced, iterative estimate-feedback-talk process. The results suggest that integrated facilitation, modeling and IT will improve group evaluation & assessment.
127 Reinig, Briggs, Shepherd, Yen, Nunamaker, 1995; 1996	**Context-Environment-Competition** Affective Reward: Ns **Context-Organizational-Goal** Affective Reward: Low-Baseline > High-Baseline; Control > High-Baseline	There were no interaction effects. The authors suggest that a sense of competition (experimentally induced) does not cause physiological arousal	The authors did not find affective reward increasing with either the sense of competition or goal difficulty.

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128 Rhee, Pirkul, Jacob, & Barhki, 1995	**Comm Mode** **Environment** Judgment accuracy: FtF > CMC Results Negotiation time: CMC > FtF not Joint profit: NS Reported Confrontive/Criticism remarks: CMC > FtF Only Avoidance remarks: FtF > CMC Comm Integrative: Ns Mode Conflict management: FtF > CMC Satisfaction (member): FtF > CMC	FtF groups showed more concern for other members well-being (profit) than CMC groups. CMC groups were less concerned with equality than individual profit. CMC groups handled conflict more assertively; FtF was more cooperative. Negotiation time for both CMC and FtF decreased as a function of time, which indicates learning of task and technology. AST.	CMC negotiations were viewed as a win-lose situation, exchanged more confrontive remarks, and took longer to reach agreement than FtF groups.
129 Roy, Gauvin, & Limayem, 1996	**Design** Total ideas: Ns Unique ideas: Ns Ratio (Unique/Total): Ns Loafing: Ns	Social matching refers to adjusting one's level of effort to that of the group, while social loafing refers to a reduction in effort when working in groups rather than individually.	There is a significant positive effect of the public screen on the number of unique ideas. Constant feedback does appear to trigger social matching. For optimal results participants should be provided feedback at the end of their task, it provides a comparison standard.
130 Sambamurthy, DeSanctis, & Poole, 1991; Sambamurthy & Poole, 1992; Sambamurthy, Poole, & Kelly, 1993	**Group Perceptions Process Structure-Level** Consensus: L2 > L1 Change in understanding: Ns Confidence in Decision: L2 > L1 Quality: L2 > L1 Satisfaction: L2 > L1 Comfort, Challenge, Respect: Ns **GDSS Impacts on Decision Making** Organization Ns Insight L2 > L1 Depth of evaluation L1 > L2 Ideational connection L2 > L1 Idea evaluation L2 > L1 Task focus Ns	GSS level 2 is a richer communications medium than GSS level 1. Groups with positive attitudes towards the GSS achieved more favorable group outcomes than groups with negative attitudes. Correlations (alpha at 0.1) were found between: organization, consensus & confidence; insight, consensus, & confidence; perceived quality & satisfaction; idea evaluation, consensus, & satisfaction; ideational connection, consensus, confidence, perceived quality, & satisfaction.	Level 2 GSS better for reducing equivocality & increasing consensus. Level 2 had higher levels of Quality & effectiveness; Level 2 had less conflict than Level 1 groups. Results agree with AST. The results indicate that, compared to L 1, L 2 enabled groups to attain significantly higher levels of insight and ideational connection and to avoid nonproductive uses of formal evaluation.

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131 Savicki, Kelley & Lingenfelter, 1996	**Group Composition-Gender** Number of pronouns used: F > M Participation Number messages: Mixed > M Word count: Ns Process Satisfaction: F > M Conflict Argumentativeness: Ns Flaming: M > F, Mixed Tension reducing: Ns Opinion shift: F, Mixed > M	Uses the individual or the message as the unit of analysis for statistical purposes, rather than the group. F: Females; M: Males; Mixed: split male/female	Gender seems to play out its effects in small task groups using CMC, but its effects are modified by group and CMC factors. The complexity of the interaction between gender composition, gender or participation, and other variables has yet to be explored fully.
132 Savicki, Kelley, & Lingenfelter, 1996	**Group composition-Gender** / **Task Type** Participation-words: F > M, Mix / Ns Participation-comments: Ns / Ns Process satisfaction: F > Mix, M / Ns Group development: F > Mix, M / Ns F: Female-only; M: Male-only; Mix: Mixed	Chi-square analysis indicates that female-only groups had the largest percentages of messages containing opinions, followed by male-only, then Mixed groups with the least. Male-only groups had the largest percentage of messages containing tension, then mixed, and last female-only.	Female-only groups, regardless or task, sent more words, were more satisfied with the group process, and reported higher levels of group development than the male-only or mixed groups.
133 Savicki, Kelly, & Oesterreich, 1998	**Group composition-Gender** / **Task Support-Instructions** Participation-words: Ns / Ns Participation-comments: Ns / GD > S Process satisfaction: F, Mix > M / Ns Group development: Ns / Ns F: Female-only; M: Male-only; Mix: Mixed GD: Group Development instructions; S: Standard	Interaction effect: Female only groups reported significantly higher group development than either male only or mixed when given groups development instructions. Message and word counts were not significantly related to group development, but when combined with choice of language measures they are significant.	In terms of socio-emotional behaviors, the results suggest that groups given group development instructions can over come the lack of a rich medium for communication.

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134 Sengupta & Te'eni, 1993	**Task Support-Cognitive Environment-Exp** Individual Cognitive Control: CF > NCF CF > NCF Strategy Convergence: Ns Time effect Time per Iteration: CF > NCF No measure Group Strategy Convergence: CF > NCF No measures Collective Control: CF > NCF No measures Decision Time: CF < NCF No measures CF: Cognitive Feedback; NCF: No CF	This study shows three important design considerations: 1. Individual then group decision making; 2. Feedback at both the individual and group level; 3. Repeated exposure to the decision environment. The study demonstrates Adaptive Structuration in that there is significant improvement. Attitudes and decision quality should have been measured.	Users receiving cognitive feedback have higher levels of cognitive control than those groups which do not. Learning effects are reported in CF groups; convergence improves for CF and NCF groups over blocks of trials.
135 Sharda, Barr, & McDonnell, 1988	**Comm Mode Environment-Exp** Effectiveness: DSS > FtF DSS > FtF Decision Time: DSS > FtF in first 3 periods; Ns in last 5 periods. # of alters: Ns Ns Confidence: Ns Ns	The DSS group significantly out performed the non-DSS in the last four periods. More time was required than non-DSS groups in the first 3 periods, suggesting a learning curve and AST.	DSS groups produced significantly better decisions with less variability than non-DSS groups; the efficiency loss is only a short-term effect
126 Sheperd, Briggs, Reinig, & Yen, 1995; 1996; Experiment 1	**Task Support Cognitive Feedback** Number of unique Solutions: Social comparison > No social Comparison	Subjects in the first experiment produced 50% more ideas working with one particular facilitator. Facilitator style can effect performance.	Social comparison appears to be useful and inoffensive method for reducing the effects of social loafing, and thereby improving the productivity of anonymous brainstorming groups.
126 Sheperd, Briggs, Reinig, & Yen, 1995; 1996; Experiment 2	**Task Support Cognitive Feedback** Number of unique Solutions: High-Salience (Feedback High) > Low-Salience (Feedback Low) > No Comparison (No-Feedback)		

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137 Sia, Tan, & Wei, 1996	**Design** **Task** **Type** Consensus Change Ns I > P Influence Equality IDS > CPS I > P Interaction effect: with the preference task, consensus change was higher in CPS than IDS groups. I: intellective; P: Preference IDS: Individual Screens CPS: Common Public Screens	The use of a common public screen may help to focus group attention on key issues and encourage group consensus. The use of individual screens to display information may permit members to pursue their own trains of thought and alleviate domination from others. When performing the preference task, dominant group members might have effectively employed the CPS to exercise their influence and move the group towards consensus.	Groups working on preference tasks must be careful with the use of IDS, because influence equality can be attained only at the expense of lower consensus. Therefore, unless true group consensus is not critical, a CPS should be used rather than several IDS.
138 Sia, Tan, & Wei, 1996	**Process structure** **Proximity** **Anonymity** **Decision** **Process** Choice shift D > P Ns Ns Preference change D > P Ns D > P several interaction effects; D: Distributed; P: Proximate	Anonymity and process information exposure has little effect on group polarization. A limited degree of polarization can be stimulated by the proximate setting if anonymity and arguments are used by the group.	Distributed groups had higher choice shift than proximate groups. The absence of visual cues and social presence in distributed groups helps to stimulate group polarization.
139 Sia, Tan, & Wei, 1997	**Design** **Task** **Type** Efficiency of influence: Icon > Text Ns Equality of influence: Icon > Text interaction Dominance: Text > Icon Ns	The results suggest that the icon-based interface reduces the cognitive load on the group and speeds up the learning process, thus permitting them to be more proficient than text-based groups	GSS groups using an icon-based interface achieve greater efficiency of influence, greater equality of influence, and less dominance than groups using a text-based interface.
140 Siegel, Dubrovsky, Kiesler,& McGuire, 1986; Experiment 1, 2, 3	**Comm Mode** Participation Equality: CMC > FtF Uninhibited: CMC > FtF Choice shift: CMC > FtF Decision Time: CMC > FtF Total Comments: FtF > CMC Number proposals: CMC > FTF	All CMC groups took more time, made fewer remarks, and communicated more proposals than did FtF groups. The sequential groups had more comments on organizing the discussion. Computer Mail may reduce Deindividuation.	CMC groups make fewer comments, and take longer to reach decisions than do FtF groups. CMC groups participate more equally in the discussions and exhibit more uninhibited behavior. CMC groups show greater choice shifts than FtF groups.

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141 Silver, Cohen, & Crutchfield, 1994:; Experiment 2	**Group Composition-Skill** Number of Ideas: SU > SD Uncommonness: Ns No. Statements giving ideas: SU > SD Positive Evaluation: Ns Data/Facts: SD > SU SD Status differentiated- Heterogeneous distribution of scores; SU: Status undifferentiated- Homogeneous distribution of scores on Desert survival exercise.	No manipulation check is reported; not discussed is how many participants suspected deception. In any case, this study of effects of equal status members vs. Unequal status members on interaction lacks external validity; the groups did not have a prior status structure and the manipulation is questionable.	Groups in the SD condition in both experiments initiated significantly fewer total ideas than SU groups, even when differences in total time spent talking were controlled. Higher status members spent significantly more time talking in FtF (Exp. 1) groups and sent significantly more words in the CMC condition. Thus, status can be an important characteristic for the number and originality of ideas exchanged.
142 Smith, Hayne, & Connole, 1992	**Comm Mode** Decision time: GSS > FtF Decision quality: Ns	This was a time pressure study which used dollar incentives to encourage rapid decision making.	GSS groups take longer to make decisions even with incentives for rapid decision making.
143 Smith, & Hayne, 1997	**Comm Mode** **Environment Time Pressure** Decision quality: Ns GSS > FtF Decision time: No measures GSS > FtF Leader emergence: GSS > FtF No measures	Under time pressure both GSS and FtF groups showed a significant decrease in decision quality. Under time pressure GSS groups used a non-anonymous, leader-directed decision process which was characterized by unequal participation.	GSS groups used more time to make decisions and made higher quality decisions than FtF groups. Under time pressure, GSS groups utilized a more leader-directed process than FtF groups.
144 Smith & Vanecek, 1990, 1989	**Comm Mode** Information exchange FtF > CMC Comprehensiveness: FtF > CMC Goal progress: FtF > CMC Participation Perceived: Ns Deviation from correct answer: Ns	FtF developed a social structure. FtF developed more opportunities for consensus and new ideas. CMC groups were frustrated by lagging feedback.	CMC may not be an effective communications medium for GSS.
145 Smith & Vanecek, 1988	**Comm Mode** Information exchange: FtF > CMC Comprehensiveness: FtF > CMC Progress toward goal: FtF > CMC Participation Perceived: FtF > CMC Deviation from correct ans: CMC > FtF	The results suggest that non-simultaneous CMC has a detrimental effect on the thoroughness of information exchange, sharing and comprehensiveness. Lack of immediate feedback in the CMC groups may have accounted for the lower performance.	FtF groups outperformed CMC groups in a structured decision task.

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146 Spears, Lea, & Lee, 1990; Lea & Spears, 1991	**Process Structure** **Process Structure-Anonymity** Attitude: Ns Ns	There was a significant interaction effect which suggests that the capacity for social influence via CMC will vary widely depending on the user's perceived relation to others. There were no decision outcomes; the groups only were to discuss the topic.	De-individuating discussants who were immersed in the group produced greater polarization in the direction of a pre-established group norm than de-individuating discussants treated as individuals. It seems paradoxical that isolating participants may increase their sense of allegiance to a group.
147 Smolensky, Carmody, & Halcomb, 1990	**Group Composition** **Task Type** Uninhibited Comments: Est > Ad-hoc Type 2 > Type 4	There were significant interactions: Established groups working on Type 2 tasks had significantly more uninhibited comments than with the type 4 task. The authors suggest that there is an inverse relationship between uninhibited comments and number of decisions.	Established groups and groups working on a Type 2 Task had significantly more uninhibited comments than ad-hoc groups or groups working on the choice-dilemma (type 4) task.
148 Sosik, Avolio, & Kahai, 1998	**Process Structure Anonymity** Perceived stimulation: Ns Perceived consideration: A > I Perceived inspirational Leadership: A > I Perceived goal setting: A > I (all have positive effect on creativity) A: Anonymous; I: Identified	The results suggest that goal setting and inspirational leadership are positively related to group creativity. Also, intellectual stimulation and individualized consideration were negatively related to group creativity.	The effects of goal setting, individualized considerations, and inspirational leadership were significantly stronger under anonymous versus identified conditions.
149 Steeb & Johnston, 1981	Decision Analytic Measures **Comm Mode** Problem attributes considered GSS > FtF Actions and events considered GSS > FtF Decision Quality Measures Decision content GSS > FtF Decision breadth GSS > FtF Decision feasibility Ns Decision detail GSS > FtF Decision time GSS > FtF Satisfaction with Process GSS > FtF Satisfaction with Decision GSS > FtF	The manual groups (non-aided) spent 91% of their time generating actions and events and exchanging information, and less than 9% of the time on quantitative judgmental activities. Manual groups tended to split into factions and defend their choices. GSS groups spent as much time in value analysis as in generating actions and events. GSS groups spent the largest amount of time making quantitative evaluations. These results suggest adaptive structuration.	GSS groups considered more attributes, considered more comprehensive information, were more complete and appropriate in the alternative sets than unaided groups. Aided groups were more confident in their choice and comfortable with the process than the unaided groups.

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150 Straus, 1996	Dependent Variable **Comm Mode** **Group Composition-Knowledge** Performance(quality): Ns / Ns Participation: CMC > FtF / ? Information Sharing: Ns / Ns Process Satisfaction: FtF > CMC / Ns Task Satisfaction: CMC > FtF / Ns Time: CMC > FtF / ?	The correlation between extroversion and participation was significant in CMC groups but not in FtF groups. This suggests that the equalization effect is caused by the ability to participate simultaneously, not because CMC suppresses member inhibitions. Individuals with more information dominated in both media. The more clues that were shared the better the performance. AST effects.	Participation is not equal across members of CMC groups; it is merely less unequal in CMC than FtF. Patterns of interaction and performance in CMC groups do not depart substantially from FtF groups, although CMC may introduce new process losses. Difficulties in coordination and consensus building in CMC may limit the use of this medium for complex intellective tasks.
151 Straus & McGrath, 1994	**Task Type** Gen Int Jud Effectiveness: Ns Ns F>C Productivity: F>C F>C F>C Avg Quality: Ns Ns Ns Communication: Ns F>C F>C Media Satisfaction: Ns F>C F>C Positive Reactions: Ns Ns F>C Negative Reactions: Ns Ns C>F F: FtF; C: CMC, Ns: Not significant All the results are interaction. Gen= Generate; Int= intellective; Jug= judgement	Differences in perceived effectiveness of media increase as task requires more coordination. CMC is viewed as less suitable for coordination tasks, particularly for those that require consensus on issues related to values. Many CMC groups ran out of time before completing the intellective task. The results suggest that with sufficient time to finish the tasks, CMC groups may not have differed from FTF groups in content and quality.	The results suggest that CMC groups are less productive than FtF groups. However, there are few significant differences in effectiveness and quality. CMC groups require more time to complete the tasks than FtF. Several interaction effects are reported suggesting CMC is less suited for cognitive coordination tasks.
152 Straus, 1997	**Comm Mode** Task communication: FtF > CMC Non-task communication: FtF > CMC Task focus: CMC > FtF Supportive communication: CMC > FtF Disagreements: CMC > FtF Personal attacks: Ns Equality of participation: CMC > FtF Cohesiveness: FtF > CMC Satisfaction: FtF > CMC Productivity: FtF > CMC	CMC groups had a more constant amount of task focus over time whereas task focus decreased gradually in FtF groups. For tasks requiring consensus (intellective & judgment tasks) task communication was positively associated with productivity. There were numerous interactions between Comm mode and task type. Results were not reported by Task type.	CMC groups had less communication, higher task focus, more disagreement and supportive comments, and more equal participation, lower cohesiveness and lower productivity than FtF groups.

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153 Tan, Raman, Wei, 1994; Tan, Wei, & Raman, 1991; Tan, Wei, & Raman, 1991	**Comm Mode Task Interact.** Pre-meeting consensus: Ns I > P Ns Post-meeting consensus: Ns I > P Yes Consensus change: Ns P > I Ns Influence equality: Ns I > P Ns Decision satisfaction: Ns Ns Ns Decision scheme satis: Ns Ns Ns I: Intellective; P: Preference	The preference task result in lower post-meeting consensus but a higher overall change than intellective task. The groups adapt differently depending on the task type- AST.	The results show that task type significantly effects consensus change and influence equality. The authors recommend: additional research on other task types, the need to establish common group decision outcome measures, and focus on task complexity, difficulty, uncertainty, and equivocality.
154 Tan, Teo, & Wei, 1995	**Design** Pre-meeting consensus: Ns Post-meeting consensus: MU > SU Perceived decision quality: Ns Perceived process quality: Ns	Groups that use a consensus monitor several times achieve higher post-meeting consensus than groups that use a consensus monitor only once. MU: Multiple use of consensus monitor. SU: Single use of consensus monitor.	The use of a consensus heuristic increases post-meeting consensus, but has no effect on decision quality and process satisfaction.
155 Tan, Wei, Watson, 1993	**Comm Mode Task Interact.** Status Inf: FtF > GSS, D-GSS P > I No Sustained Inf: FtF > GSS, D-GSS P > I No Residual Disagreements: FtF < GSS, D-GSS I > P No Inf: Information	A sequential communication strategy was used for all support levels: group members took turns to contribute their ideas during each round. Ideas were only posted to a common display. The facilitator controlled the presentation order.	A GSS dampens status influence and sustained influence, though at the expense of creating greater residual disagreement, especially for a preference task. No differences were reported between GSS and D-GSS groups.
156 Tan, Wei, Watson, Clapper, & McLean, (in press)	**Comm Mode Task Type (between)** US Influence M.: FtF > Dr, Dist. P > I Consensus rounds: Dr, Dist > FtF I > P Challenges: Dr, Dist > FtF I > P Singapore Majority Influence: Ns	Individualistic cultures (US) are more likely and collectivistic cultures are less likely to challenge majority influence regardless of communication medium. The impact of CMC on majority influence is independent of task type. Interaction: Intellective: Ns; Preference Ns	CMC can be used to reduce majority influence and thereby increase input and creativity. Video conferencing may be used to supplement CMC in individualistic cultures.

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157 Tan, Wei, Watson, & Walczuch, 1998	**Comm Mode** **Task** **Culture** Status influence: FtF > CMC P > I Ns Sustained influence: FtF > CMC P > I S > US Perceived influence: FtF > CMC P > I Ns	Interaction effect: Perceived influence- Singaporean groups in a FtF setting and a preference task had higher perceived influence than all other treatments.	The results suggest that sustained influence was higher in Singapore groups than US groups; Status influence & sustained influence were higher in preference task groups than intellective task groups.
158 Toth, 1994	**Task Support-Cognitive** **Feedback** Time: Ns Total Messages: Ns Choice-Shift: Ns Attitude: Ns Group Discussion Consensus: Ns Social Pressure: Graph> Text > Graph+Avg Persuasive Arguments: Graph+Avg > Text > Graph	The results suggest that the Graph + Avg implies an informational decision proposal or group consensus before the group begins any discussion- AST.	The authors suggest that the inclusion of two-dimensional graphics can either augment or inhibit normative and informational forms of social influence during the group decision making process,
159 Tung & Heminger, 1993	**Process Structure-Decision Process** Decision Quality: Ns Quality of assumptions: Ns Importance of assumptions: Ns Validity of assumptions: DI > C Perception Measures: Process satisfaction: Ns Decision satisfaction: Ns Depth of evaluation: Ns Group attraction: Ns Meeting quality: Ns	The results suggest that DI groups make assumptions of higher validity than consensus groups. It is also suggested that the GSS is beneficial to all groups and is strong enough to mask any differences. DI: Dialectical Inquiry C: Consensus DA: Devil' s Advocacy	The results indicate that there are no significant differences between DA, DI, and consensus groups in terms of performance or perception.
160 Tryan, George, & Nunamaker, 1992	**Comm Mode** Identified defects: Ns Potential productivity: Ns Process loss: B 2 times higher than M or GSS Process gain: B higher than M or GSS B: Baseline; Manual (FtF)	Without ANOVA or other statistical results, it is not possible to know exactly what the results are. The authors do suggest that the FtF and GSS groups get preoccupied with the visual display and become highly structured. The result is a greater emphasis on evaluation and not on identification of defects. AST	Mean process loss in baseline groups was over twice as much as that of the other two treatments. However, the task supports (transparencies or group outlier) appear to have a restrictive effect on the review groups in terms of process gains; baseline groups had higher process gains.

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161 Valacich, Dennis, & Connolly, 1994; Experiment 2	**Group Size** **Comm Mode** Number of ideas: L > M > S GSS > Nominal Idea quality: L > M > S GSS > Nominal Satisfaction: L > M > S Ns Small: 4 subject/group Medium: 8 subjects/group Large: 12 Subjects/group	In general larger groups out perform smaller groups in number and quality of ideas. However, these numbers have not been normalized for group size.	A moderate size group (8 to 10 members) using GSS produces more unique ideas than equivalent numbers of individuals working alone and pooling their output, and without quality or satisfaction penalties. The evidence suggests that this is due to the GSS elimination of production blocking. The optimal group size for idea generation may be determined by the situation.
161 Valacich, Dennis, & Connolly, 1994; Experiment 3	**Group Size** **Comm Mode/Inter** Number of ideas: L > M; L-GSS > L-Nominal Satisfaction: Ns GSS > Nominal Medium: 6 Subjects/group Large: 12 Subjects/group		
161 Valacich, Dennis, & Connolly, 1994; Experiment 4	**Method-Technology** **Task Order** Number of ideas: Ns Ns Interaction effect: Standard GSS > Blocked-GSS		
162 Valacich, Dennis, & Nunamaker, 1992	**Group Size** **Process Structure** **Anonymity** Unique Ideas : L > S Ns Ideas Quality: L > S Ns Satisfaction: Ns I > A Critical comments: L > S A > I Willingness Participate again Ns Ns Rated Effectiveness: Ns I > A	An interaction effect: identified small groups least critical; large anonymous groups most critical L: Larger (9); S: Smaller (3) A: Anonymous; I: Identified	Larger groups had more ideas and higher quality than smaller groups. The results suggest that there may be various type and levels of anonymity: content and process.

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163 Valacich, George, Nunamaker, & Vogel, 1994	**Process Structure-Proximity** **Group Size** Number of Unique Ideas: D-GSS > GSS L > S Idea of quality: D-GSS > GSS L > S High quality ideas: D-GSS > GSS L > S	Proximate groups may have filtered many task related cues by focusing on the public screens, thus entering less original ideas. Group size had no apparent effect. There were no size*proximity interactions. The authors suggest that the (Same-GSS) subjects were in large room and thus it was not easy to identify who was working. This suggests AST.	Distributed groups generated more unique ideas of higher overall quality than proximate groups. This suggests that idea generating tasks require less coordinating activities and thus remain focused.
164 Valacich, Mennecke, Wachter, Wheeler, 1994	**Comm Mode by Task Eq** **Task Eq / High-Eq / Low-Eq** Social presence: H > L / F >V,T>C; / F >T>C>V Media richness: H > L / F >T>V>C; / Ns Composure: H > L / Ns / F>C>T>V Equality: H > L / Ns / F>C,T>V Trust: H > L / Ns / F>T>C>V Similarity: H > L / Ns / F>T>C>V Solution satisfac: H > L / Ns / C>V>F>T Process satisfac: H > L / Ns / V>C,T>F Task focus: H > L / Ns / F>T>C>V Final consensus: Ns / Ns / Na Decision quality: Ns / Na / Ns Decision time: L > H / V>F,T>C / T>F,V>C	The dyads found all media to have higher social presence and richness when performing the High-Eq task. This is consistent with past research. Dyads performing the High_Eq task were more satisfied and had more task focus than dyads performing the Low-Eq task. Low_Eq task dyads used more time than High-Eq dyads. H: High equivocality task; L: Low equivocality task; F: FtF; V: videophone; T: telephone; C: CMC; Na: not available	
165 Valacich, Wheeler, Mennecke, & Wachter, 1995; Valacich, Mennecke, Wachter, & Wheeler, 1993	**Group Size Composition** / **Group Knowledge** Number of Solutions: L > S / Ns Unique Solutions: L > S / Het-L > Homo-L High quality feasible: L > S / Het-L > Homo-L Het: Heterogeneous Homo: Homogeneous L: Larger; S: Smaller	There was an interaction effect for larger and distributed information groups. Suggests the need for critical mass. Smaller groups made need more time. Small heterogeneous groups engaged in more information sharing than larger groups in either treatment. Thus, it appears that poor performance of small heterogeneous groups was not due to a lack of information sharing- the groups failed to accumulate a critical mass of information on the problem space to spur synergy and piggybacking. AST.	Larger groups outperform smaller groups for an idea generation task when using CMC. Group performance is also affected by logical group size. Homogenous groups experience less performance gains for increased group size than did heterogeneous groups. Larger heterogeneous groups (8 or 10) had superior performance while smaller heterogeneous groups (5 o 6) did poorly.

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166 Valacich, Paranka, George, Nunamaker, 1993	**Proximity Comm Mode Interaction** Idea quality: Ns. GSS > FtF No Idea quantity: Ns. GSS > FtF No Satis. Accuracy: Ns. Ns. No Satis. Precision: Ns. GSS > FtF No	Both GSS and distributed groups remained more task focused than verbal and FtF groups, which entered more social and non-task related comments. AST, supported.	Groups using GSS for this low-ambiguity task generated more unique and high-quality ideas (over a fixed period of time) than verbal groups. It is suggested that the differences are due to a medium's concurrence. Verbal communication is a serial medium and supports only one concurrent episode at a time, GSS is a parallel medium and has a greater concurrence.
167 Valacich & Schwenk, 1995	**Process Structure-Decision Process** Solution quality: DA > DI, E Num. Alternatives: DA > DI, E; Num Rounds Ns Process satisfaction- Ns Solution satisfaction- Ns **Communication Mode** Solution quality: Ns Solution Satisfaction Ns Num. alternatives: CMC > FtF Number of rounds: CMC > FtF Process Satisfaction- CMC > FtF Communications Medium: CMC, Verbal (FtF) Decision Method: DA, DI, Expert	Group process analysis revealed that expert groups made more supportive arguments than did DA & DI. No difference between DA & DI. There were no other significant differences. Verbal groups made more total comments, more supportive comments, more solution and problem clarifications, & asked more questions about the solutions and problem than did CMC groups. CMC groups made more critical comments, required a larger number of decision cycles.	DA had higher decision quality than did DI and E groups. No significant differences on solution quality were found between verbal and CMC groups. There were no significant differences on solution or process satisfaction for the decision method.

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168 Valacich & Schwenk, 1995	**Group Composition** Solution quality: Ns Num. Alternatives: CMC, Artificial > Intact Group Process: Supportive remarks- FtF > CMC Solution & problem clarifications- FtF > CMC Questions asked- FTF > CMC Time discussing solutions- CMC > FtF Critical arguments- CMC > FtF **Environment-Evaluative Tone:** Solution quality- Objective DA > Carping DA Num. Alternatives- Objective DA > Carping DA Group Process- Ns	The results suggest that groups exposed to a carping DA make critical comments whereas groups exposed to an objective DA tend to be more supportive and elaborate on alternatives. CMC groups exposed to carping mimic the process while objective CMC groups tend to build on prior solutions with very little evaluation Group Composition: Artificial, Intact, CMC Decision Aid: Objective, Carping	The results suggest that CMC groups develop more solution alternatives than groups communicating verbally and groups exposed to objective DA generate higher quality decision than do carping DA groups.
169 VanSchaik & Sol, 1990	**Process Structure Comm Mode Environment-Exp** Quality: S > No-S Ns Periods 1-5 No-DSS did better, after period 5 DSS did better. S: Structure; No-S: No-Structure	There are 3 major things happening: 1. There is feedback on performance; 2. Time- improvement is shown in all groups; 3. Adaptation. Users have a positive opinion about the DSS.	Decision quality improves significantly when decision makers are guided via problem Structuration.
170 Venkatesh & Wynne, 1991	**Process Structure-Comprehensiveness** Time: Ns Number Ideas: GSS > GSS-CH, GSS-GH Problem Formulation: GSS-CH > GSS Problem Solution: Ns Total Performance: GSS-CH > GSS Perceived Communication Quality: GSS-GH > GSS-CH Perceived Gain Understanding: GSS-GH > GSS-CH CH: Combined Heuristic; GH: General Heuristic	GSS-CH treatments did best in the problem formulation measure, and baseline groups the worst, as hypothesized. However, the non-significant solution performance results suggest that groups in the two experimental treatments lost momentum in the transition between the formulation and solution phases. The results suggest AST in terms of restrictiveness.	System restrictiveness is a the way a DSS limits its users decision-making processes to a subset of all processes. The results suggest that the relationship between restrictiveness and task related perceptions is curvi-linear. GSS-CH, most restrictive, and GSS the least.

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171 Walther, 1995, 1992; Walther & Burgoon, 1992	**Comm Mode Task Interact.** Immediacy/Affection: CMC > FtF Yes No Similarity/Depth: CMC > FtF No No Composure/Relaxation: CMC > FtF No Yes Formality: Ns No Yes Dominance/Inequality: CMC > FtF No No Receptivity/Trust: Ns No No Task-Social Orientation: FtF > CMC No Yes Message accumulation: Ns No No	CMC groups as a function of time: more immediacy, more similarity, more composed, less formal, less task oriented, and more social oriented. The author suggests that there was less "stress" observed in the CMC groups. The FtF groups had to attend 3 planned meetings, which contained audio-video equipment and an administrator. Adaptation to more pro-social behavior occurs as a function of time. The results suggest AST.	CMC groups adopt a more pro-social behavior over time than do FtF groups. The results suggest that CMC groups became less formal and less task oriented over time. CMC groups self disclosed and probed more than FtF groups. CMC groups develop and evolve in relationally positive directions. The effects of time in general appear to be stronger than the medium.
172 Warkentin, Sayeed, & Hightower, 1997	**Comm Mode** Cohesiveness: FtF > CMC Process Perceptions: FtF > CMC Outcome Satisfaction: FtF > CMC Group member support: FtF > CMC Unique information Ex. Ns	Collaboration technologies may hinder the development of a strong sense of cohesion and satisfaction with the group's interaction process.	The results suggest that FtF groups out perform and have higher levels of satisfaction than CMC groups.
173 Watson, DeSanctis, & Poole, 1988; Poole, Holmes, Watson, & DeSanctis, 1993; Poole & DeSanctis, 1992; Poole, Holmes, & DeSanctis, 1991	**Comm Mode** Consensus: PreMeeting- Ns; PostMeeting- Ns Influence: Ns; Attitude (process): M > G > B Decision Making Interactions Decision-making phases: M > B, G Procedural insights: G > M > B Task-communication fit: B, G > M Number of ideas: M > B, G Depth of analysis: M > B,G, Equality of participation: Ns Start up friction: G > B, M Task-focus: Ns Leadership emergence: M, G > B Amount of communication: M, G > B M; Manual (FtF with support)), B: Baseline (FtF with no support), G: GSS	Computer groups had less substantial discussion than Manual or Baseline groups. Computer groups said that the problem solving process was less understandable. Computer groups had less communication than did FtF, manual or baseline groups. Computer groups were more procedure oriented than issue oriented. The interface and lack of time on the system may be the problems. GSS groups experience more start-up and mechanical friction than B or M groups, suggesting that they spent a large amount of time trying to understand the system and how it could be used to carry out the task. Thus they had a limited amount of time to work on the task. Mode switch was difficult for GSS groups. AST.	GSS results in loss of social context cues. Manual group had a more positive attitude. Structure improves consensus. GSS increased the organization of the decision process over M and B groups and generated more discussion related to procedural insight. However, GSS groups did not have any increases in depth of analysis or critical analysis. GSS groups had less ideas than M. The authors suggest that a Level 2 GSS, which provides more sophisticated structural support, may promote more effective decision making than this level 1 system.

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174 Watson, Ho, & Raman, 1994	**Comm Mode Context-Culture** Consensus: Pre-Meeting: Ns SI > US Post-Meeting: FtF-P > GSS, FtF SI > US Consensus Change: FtF-P > GSS, FtF US > SI Equality: Ns SI > US FtF-P: FtF with support, FtF: Baseline- no support	For GSS groups the public screen became the focus of attention; the group members were addressing their comments to the screen rather than to the group. Groups with high pre-meeting consensus seemed content to let one person dominate the final solution. Manual groups had significantly higher consensus than GSS groups.	The authors suggest that SI groups had greater agreement before meeting. All groups in both cultures had the same levels of post-meeting consensus. However, the changes were greater in the US groups. Influence was more equal in the SI groups (controlling for pre-meeting consensus).
175 Weisband, 1992	**Comm Mode Process Structure Member-Char** Choice Shift: Ns E > Not-E Ns First Advocacy: Ns E > Not-E Ns **Comm Mode Only Measures** Time to proposal by advocate: CMC > FtF Time to consensus: CMC > FtF Total Remarks: Ns Arguments: Ns Implicit Preferences: CMC > FtF Explicit Proposals: CMC > FtF Social Pressure: Ns Task Irrelevant: CMC > FtF Uninhibited Remarks: CMC > FtF Participation Equality: CMC > FtF	First Advocacy (FA) effects: In groups that held early discussions, the first advocacy effect was observed; the groups also moved away from their initial preferences. This suggests a first advocate must listen to some group discussion before responding. Many third advocacy effects and interactions were reported. Despite the restrictiveness of CMC, the general process of group decision making (FtF and CMC) appears to be the same. Group members communicating electronically found ways to compensate for the low media richness in CMC. AST E: Early Discussion Not-E Not Early Discussion	The results suggest that early group discussion (FtF or CMC) positively affect the FA's behavior. Without early discussion the FA's proposal is off-base. The FA listens to group discussion and anticipates the group consensus. CMC groups need more time to exchange information in order to reduce the effects of technology. CMC groups had more implicit preferences, explicit proposals, more aggressive language, more task-irrelevant remarks, and less task-related arguments than FtF groups.
176 Weisband, 1994; Weisband, Schneider, & Connolly, 1995 Experiment 1	**Comm Mode Group-Comp Interact** Total Remarks: FtF > CMC H > L No Individual %: Ns H > L No Choice shift: Ns Ns No Peer rated influence: FtF > CMC H > L Yes Self rated influence: Ns H > L No	MBA students were significantly older than the undergraduates. No correlations were performed with age and the other dependent variables. Choice shift effects were not significant suggesting that status did not effect one's opinion. When status labels were hidden and high-status members were in the minority, status differences in participation and in influence were reduced. H: High Status	L: Low Status The results suggest that high status (MBA students) members dominate the group discussions in both FtF and CMC modalities over low status (undergraduates) members. Status labels and impressions have a larger impact on participation and influence than does the communication medium.

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176 Weisband, 1994; Weisband, Schneider, & Connolly, 1995 Experiment 2	**Group Composition Status Interact** Total Remarks: GM > UM H > L No Individual %: UM > GM Ns No Choice shift: Ns Ns No Peer rated influence: Ns Ns No Self rated influence: Ns Ns No GM: Graduate Majority; UM: Undergrad Majority		
176 Weisband, 1994 Weisband, Schneider, & Connolly, 1995; Weisband, 1994; Experiment 3	**Comm Mode Status Interact** Total Remarks: FtF > CMC H > L Yes Individual %: Ns H > L Yes Choice shift: Ns H < L No Peer rated influence: Ns H > L No Self rated influence: Ns Ns No		
177 Wheeler, Mennecke, & Scudder, 1993	**Process Structure-Restrictiveness Group Composition** PPO (HPH/LPO) **Decision quality** Problem score Ns Ns Constraint score Ns Ns **Group Perceptions** Participation R > NR HPO > LPO Process Satis R > NR R-LPO > RN-LPO Solution Satis R > NR	Many NR groups abandoned the process intervention and started to propose solutions before understanding the problem. The solutions were generally of very high quality. The results following from AST, suggest GSS designs favor HPO and are inadequate to support LPO. Also, training groups to use a structured process intervention may not be sufficient to promote actual appropriation.	Decision performance was generally higher (non-significant) for groups using NR-GSS. Participation, and both process and decision satisfaction were higher in R groups than NR groups. Task complexity may interact with the GSS structure and alter the embedded guidance.

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178 Wheeler & Valacich, 1996	**Process Method-Structure- Training** **Process Structure-Facilitation Level** Faithful appropriation: F > U 2 > 1 HT > LT Decision quality: F > U No measures Other interaction effects: Faithful appropriation: Active mediators > pass mediators F X Level 2 GSS > U X Level 1 GSS LT: Low Training; HT: High Training	The heuristic instructed groups to achieve 5 specific problem solving steps in a specific sequence. This experiment demonstrates that 3 appropriation mediators (facilitators, GSS configuration, & training) can increase the faithful use of structured decision techniques. Theory extends AST to Aprocess restricted adaptive Structuration theory (PRSAT).	Appropriation mediators effectively increase faithful use and reduce unfaithful use in relation to a heuristic activities and sequences. Facilitation had the largest effect of the 3 mediators and it had significant interactions with the other two. Greater faithful heuristic use did yield higher decision quality.
179 Wilson & Jessup, 1995	**Group Composition Process Structure Anonymity Interaction** Total number comments: Ns A > I No Number unique ideas: Ns A > I No Number of rarity ideas: Ns A > I No Critical comments: Ns Ns No Satisfaction: ES > US Ns No A: Anonymous; I: Identified; ES: Equal Status; US: Unequal Status	The authors reported that the manipulations worked; 76% of the anonymous groups stated it was not possible to trace the comments and 97% of the groups reported that they were equal status conditions. 55% of the unequal status groups confirmed their status. Perhaps the manipulation for status was not strong enough.	The results of this field experiment confirm the quantitative finding from laboratory experiments and the qualitative finding from field studies, that GSS anonymity is useful.
180 Winniford, 1991	**Comm Mode Group Size** Decision Quality: Ns Larger > Smaller Voting Behavior: GSS > FtF Larger > Smaller GSS-Large > GSS-Small GSS-Large > Manual-Large Decision Time: Ns Ns Process Satisfaction: Ns Ns	The greater the number of votes, the less the satisfaction. Thus large GSS groups were less satisfied. Small groups come to consensus fast. In large groups votes were taken seconds apart with no time for discussion (AST). GSS groups had a higher level of anonymity than did the manual groups.	The results suggest that larger GSS groups will require more voting in order to reach consensus. Satisfaction is inversely related to the number of votes called for.

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An Assessment of Group Support Systems Experimental Research: Results

AUTHORS	DEPENDENT MEASURES - OUTCOMES	COMMENTS - GROUP PROCESS ADAPTATION	CONCLUSIONS
181 Wood & Nosek, 1994	**Comm Mode Task-Complexity Interaction** Outcome Quality: GSS > FtF MC > LC Yes Ideation: GSS > FtF Ns No Participation Equality: GSS > FtF Ns Yes Time: GSS > FtF Ns No Satisfaction: Ns Ns No MC: More Complex; LC: Less Complex	Task complexity is posited as the major component of process complexity, which also increases with increasing group size. However, complexity is confounded with experience/order of task (all groups experienced LC before MC), and group size was manipulated. The authors hint at AST via their generalized model.	The results suggest that as task complexity increases, GSS groups achieve significantly higher outcome quality when compared to manual groups.
182 Yellen, Winniford, Sanford, 1995	**Member Char Comm Mode** System Satisfaction: E > I Ns Perceived Solution Quality: Ns Ns Number Original Solutions: Ns GSS > FtF Total Number Comments: E > I FtF > GSS E: Extroverts; I: Introverts	All analysis was at the individual level. There were no group analyses. The number of subjects per group were not clearly reported (max of 8). No AST measures.	I & E are less inhibited in a GSS environment; the I felt more comfortable in contributing. All subjects generated more comments in FtF and more solutions in GSS. The I/E plays a significant role in participation.
183 Zigurs, Poole, & DeSanctis, 1988	**Comm Mode** Amount of influence: Ns Distribution of influence: GSS > FtF Pattern of influence: GSS > FtF	The GSS groups spent a significant amount of time in verbal communication; This suggests that the interface was too complex for the amount of time spent in training. GSS spent more time communicating on procedures than did manual. (System opacity)	Was GSS training sufficient? System usage was low. GSS used more non- verbal communication. GSS had more problems getting organized. GSS less goal oriented than manual. No difference in decision quality. Adaptability to technology and group are key.
184 Zigurs, Wilson, Sloane, Reitsma, & Lewis, 1994	**Process Structure-Restrictiveness** **Group Performance** Solution quality: Ns **Group Perception** Perceived quality: Joint> Shared, No-Model> Shared, Group behavior: Ns Participation: Ns Solution Satis: Joint> Shared, No-model> Shared, Decision Satis: No-model > Shared, Leadership: Ns Socio-Emotional: Ns	The joint groups (which included a chauffeur) had the highest solution quality. The subjects had difficulties in understanding the tasks. No-model groups finished after they first agreed upon solutions, joint and shared groups work through several iterations.	The results suggest that the simulation system helped groups improve their performance through improving their understanding of task constraints. The availability of the system encouraged groups to continue working on the task. Chauffeured groups have higher levels of performance and satisfaction than groups working the system themselves. Suggests AST.