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INFLUENCE OF FEEDBACK AND COMMENT LABELS  
ON INFORMATION SHARING IN A COMPUTER MEDIATED  
COLLABORATIVE ENVIRONMENT

THESIS

Gary D. Denney, Captain, USAF

AFIT/GIR/ENV/01M-05

DEPARTMENT OF THE AIR FORCE  
AIR UNIVERSITY  
AIR FORCE INSTITUTE OF TECHNOLOGY

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Wright-Patterson Air Force Base, Ohio

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AFIT/GIR/ENV/01M-05

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ENVIRONMENT

THESIS

Presented to the Faculty

Department of Systems and Engineering Management

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In Partial Fulfillment of the Requirements for the  
Degree of Master of Science in Information Resource Management

Gary D. Denney, M.B.A.

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March 2001

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ON INFORMATION SHARING IN A COMPUTER MEDIATED COLLABORATIVE  
ENVIRONMENT

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Gary D. Denney

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Abstract

A group support system (GSS) uses a combination of networked personal computers, software that collects, manipulates, and aggregates member's individual input, and human facilitation to improve the group decision-making process. Group support systems are being used in the Air Force today in a variety of capacities and in particular by the Warner-Robins Air Logistics Center (WR-ALC) to assess acquisition risks. GSS facilitators at WR-ALC are interested in achieving the optimal productivity out of their GSS system. Prior GSS research has found that certain structural and social dimensions of GSS designs might influence whether optimal process improvements take place. However, the dimensions that positively influence group performance have continued to be a matter of debate.

This debate has been fueled, at least in part, by research which has produced mixed results. This thesis looked at several structural and social contingencies to explore possible explanations for the mixed results found in GSS research. The study examined the effect of: anonymity, identification, self-regulation, and facilitator provided feedback on user information sharing behavior, quality of the group decision, unequal participation among group members, and user attitudes with the GSS meeting. The results of the study indicated that the anonymity theory was partially supported since users in an anonymous condition provided more intellectual comments than any other condition. In addition, the self-regulation theory was partially supported since users were found to have more satisfaction with the GSS meeting in this treatment.

# INFLUENCE OF FEEDBACK AND COMMENT LABELS ON INFORMATION SHARING IN A COMPUTER MEDIATED COLLABORATIVE ENVIRONMENT

## I. Introduction

A group support system (GSS) is a computer mediated collaborative environment that allows groups to generate, organize, evaluate, and communicate information (Anson, Bostrom, and Bayard, 1995:189). Proponents of this technology have claimed that GSS groups, when compared to face-to-face groups, achieve greater idea generation (Nagasundaram and Bostrom, 1995:89), higher decision quality (Zigurs and Kozar, 1994), and increased process gains such as satisfaction and learning (Mejias and Shepherd, 1997:141). Empirical results of GSS effectiveness, however have been mixed. Some studies found strongly positive results when using a GSS over traditional meetings, while others found mildly positive, mixed, neutral, or negative results (Lam, 1997:195). Contextual factors that differ from study to study may provide a potential explanation for these varied findings.

Recent studies have tried to address these mixed effects by looking at the social and structural dimensions of GSS designs. For example, research by Lea (1998) showed that attributes of the facilitator and the system design could influence the perceptions and social interactions of the individual group members. This study showed group performance and attitudes toward the group and the technology improved, when the members of the group thought the facilitator was fair and the structure prevented the facilitator from being biased toward one member of the group. A second study by

Herberlie and Tolbert (1999) evaluated the impact of facilitator alignment, co-location, and video intervention on the efficacy of a GSS when deployed in a distributed environment. Although many of their findings confirmed Lea's study, Herberlie and Tolbert found that the GSS facilitator might not need to be physically separated from the decision group to ensure perceptions of neutrality. Each of these previous efforts called for further investigation of other contextual factors that may influence GSS processes and outcomes. The goal of this line of research is to discover GSS meeting processes and designs that can consistently increase the quantity and quality of comments and ideas generated in a meeting, and further the likelihood of finding increased decision quality (George, Easton, Nunamaker, and Northcraft, 1990:400). Given the conflicting research on GSS effectiveness, and the promising results of recent research on contextual factors of GSS design, this topic is worthy of further investigation.

The study reported here is one of four theses that continued the systematic investigation of contextual factors concerning various aspects of GSS use. All four theses used the same experiment to collect data, but each study examined a different area in GSS research. One study evaluated the effect that varying levels of anonymity had on user participation in GSS and face-to-face groups. A second study investigated the interaction of individual characteristics and anonymity on participation in a GSS environment. A third study analyzed the relative contribution of individual ideation, individual expertise, and team expertise for GSS and face-to-face groups. The final study, reported in this paper, examined the effects of coincidental feedback through comment labeling, loss of anonymity through participant labeling, and feedback provided by the facilitator on the quantity and quality of ideas generated in a GSS environment.

In a meta-analysis of GSS research, only seven of the over 200 studies have been conducted on the impact of providing feedback during a GSS session (Fjermestad and Hiltz, 1999). Yet, feedback is a critical element in goal directed and self-regulatory behavior. When feedback is understood, accepted, and acted upon by the participant it can enhance performance, motivation (Young and Kline, 1996), and learning (Hollenbeck, Hedlund, Ilgen, Lapine, and Colquitt, 1998).

Assessment feedback, is defined as information provided to an individual concerning some aspect of their performance on a task (Young and Kline, 1996:44). This study investigates the effects of two distinct types of feedback on individual participation and group effectiveness. Assessment feedback can be provided to users after task completion showing how often they contributed and how well their team scored on the task. This feedback will allow the group members to participate more evenly so the quality of the group decision will increase on future tasks given to the group. Coincident feedback is the specific information received by participants while the task is being performed. One form of coincidental feedback provided in group support systems occurs through comment labeling. Labeled comments provide a running tally on the participation of group members. Individuals can use coincidental feedback to regulate their own efforts, as well as apply normative pressures to other group members.

This study also investigates the effects of loss of anonymity on individual participation and group effectiveness. Combining participant labels with comment labeling effectively removes any anonymity usually offered to GSS participants. Group members can use the labels to directly attribute participation to specific individuals in a manner very similar to a face to face meeting.



## 1.1 Background

The goal of a GSS is to improve the group decision-making process by removing communication barriers, providing techniques for structuring decision analysis, and systematically directing the pattern, timing, or content of the discussion (Lam, 1997:194). In general, a GSS is designed to minimize or overcome process losses of traditional face-to-face meetings while seeking to enhance process gains (Heminger and Tung, 1993:33). The structural and social dimensions of specific GSS designs might influence whether process improvements ever take place. This study will look at two dimensions in particular to determine if process improvements occur. The study looks at the structural dimension in terms of comment and participant labeling, and the social dimension in terms of assessment feedback provided by the facilitator.

### 1.1.1 Effects Through Comment and Participant Labeling

Keeping users anonymous in a GSS session has been touted as one of the keys to overcoming process losses. Process losses are events that occur during meetings that prevent the group from performing to their optimal level. By keeping the identity of GSS participants unknown, anonymity reduces the fear of social disapproval and evaluation, increases the number of ideas generated, and lowers inhibition and censorship (Pinsonneault and Heppel, 1998:89). Research has also shown that keeping the identity of members involved in the GSS unknown can bring negative results to the meeting (El-Shinnawy and Vinze, 1998:171). One of the effects of anonymity is decreased participation through social loafing. Research on group process loss suggests that accountability is one of the key factors in ensuring that team members contribute to the

best of their ability (Hollenbeck and others, 1998:273). Users may participate less because they feel that anonymity will protect them from pressures to perform by other group members.

Anonymity in a GSS session can be reduced by labeling comments and labeling participants. Through the use of comment labels, participants receive coincidental feedback on the performance and contributions of other group members. The label is a structural component of the GSS environment since the information is contained on the system. Reducing anonymity through comment labeling is likely to have a positive effect on group processes. Comment labeling provides a coincidental source of feedback to group members that may inhibit social loafing effects and provide valuable information about individual contributions to all group members. On the other hand, labeling group participants can potentially have a negative effect on the group process. Labeling participants causes the loss of anonymity that inhibits some users from participating in the meeting. This study will examine the labeling effect to determine if labeled users will contribute more ideas to reach an optimal solution to a group problem.

#### 1.1.2 Facilitator Effects Through Goal Setting and Assessment Feedback

A facilitator is commonly used in a GSS meeting to direct activities before, during, and after a meeting to help the group achieve its outcomes (Niederman and Beise, 1996:23). The facilitators' role has been identified as influential to the GSS meetings' success (Niederman and Beise, 1996:23). To enhance user participation, a group facilitator typically performs specific behaviors during a meeting such as managing conflict, encouraging broad participation, and extending idea generation (Anson and

others, 1995:190). This study will investigate an additional approach to enhance user participation through providing goals and assessment feedback to participants.

Feedback and goal setting have been found to be important management tools because they serve both informational and motivational functions that can enhance work behavior (Early, Northcraft, Lee, Lituchy, 1990:87). The tools of providing goal setting and feedback are usually combined since they interact to achieve greater results than when they are used separately. Goal setting is more effective and usually only effective when combined with feedback since it allows performance to be tracked in relation to the goal (Locke and Latham, 1990:241). Feedback allows individuals to compare their behavior and actions against predefined targets and determine whether or not to adjust their actions to achieve those targets. This study will explore whether facilitator provided goal setting and assessment feedback given in a GSS meeting will produce optimal meeting results.

## 1.2 Research Applicability to the United States Air Force

During the late 1980's, the United States Air Force entered a period where budgets were cut and personnel were reduced. At the same time, Air Force senior leadership emphasized the concept that Air Force personnel must work smarter and do more with less. During this period, Air Force Logistic Centers faced the threat of outsourcing many aircraft maintenance functions. Also with the potential of closing two of the five Air Force Logistic Centers, a period of increased competition for business within the Air Force Logistic Centers and from private industry began. This concept of

competition for workloads and emphasis on cost cutting was emphasized to logistic units to help streamline their operations.

Air Force logistics units were introduced to the concept of "Lean Logistics" which improves an operational unit's capabilities by applying modern business practices across all logistics functions and processes. At the Warner-Robins Air Logistics Center, the Commander, General Hallin, wanted workers to find ways to improve processes, save time and money to become the "Wal-Mart" of all Logistic centers (Hallin, 1994). Logistics centers realized that they needed to increase communication and collaboration efforts among affected parties, which include senior management, logistics and maintenance personnel, engineers, and government contractors. Group support systems were identified as a tool to enhance meetings and the decision-making process.

Group support systems are being used by the Acquisition Support Team and the Reengineering division at the Warner-Robins Air Logistic Center, Robins Air Force Base Georgia. The Acquisition Support Team uses a GSS to assess acquisition risks by performing risk reduction analysis, best course of action, and collaborative thinking and development. The GSS has given the government and contractors the ability to determine requirements and develop project specification documents. A GSS allows parallel communication between parties, which decreases the time to develop a project's requirements documents.

For example, the Acquisition Support Team used a GSS to solve a dispute over available technology for the next generation of flight line heaters. In the initial project planning, the government submitted a request that was technologically impossible for the contractor to deliver. A GSS allowed both groups to work together to determine the best

course of action. The GSS permitted users to speak freely, without fear of retribution, allowing a consensus to be reached and a decision made in a timely manner.

The GSS facilitators at Robins Air Force Base state it takes users a whole day before they become comfortable with the system and understand the GSS functions. An entire day of productivity could be saved if users could be trained more efficiently so they understood the purpose of the GSS, how to use it, and what was expected of their role. Not only would valuable time be saved, but also reducing a meeting by one day would save considerable expense. For example, the GSS facilitator estimated that up to 90 people participate in one of their sessions at a given time. The cost of avoidance in productivity could amount to tens of thousands of dollars per session. An additional factor of concern is the motivation of team members to use a technology, regardless of its proposed benefits, where the costs seem so high.

The GSS facilitator also indicated that during the first day of meetings, he spends most of his time answering questions and concentrating on the flow of the meeting. Like most new technology, there is a learning curve that participants must overcome in order to become proficient with the system. The development of a familiarization exercise could help people climb the steep learning curve in a relatively short time. If users could quickly understand the GSS, the facilitator could free up this time to focus on other facilitator duties. This extra time could be used to allow the facilitator to provide feedback to users and reach a more efficient and higher quality decision. This study hopes to add insight into the configurations and procedures for a GSS that could make meetings more effective.

### 1.3 Summary

A GSS is a combination of computer hardware, software, and human facilitation that provides an assortment of communication and decision support tools intended to increase the effectiveness and efficiency of decision-making groups (Lea, 1998). The benefits of providing coincidental feedback during a GSS session have not been examined and studying the optimal combination of facilitator provided feedback and user labeling has yet to be addressed in a GSS environment.

Unclear roles of GSS facilitators have raised awareness that facilitators may not be doing all they can to improve the meeting process. Facilitators at Warner-Robins Air Logistic Center are looking for ways to assist GSS users to quickly understand the GSS process and functions. Providing feedback and goals to users may accelerate the process and allow users to reach a better group decision.

While much is understood about the impact of feedback and goal setting on traditional face-to-face groups, little is known about the impact they have on GSS groups. This study will shed light on this area by investigating the influence of feedback and comment labels on information sharing in a GSS environment.

This research will investigate the interactive effects of coincidental feedback through comment labeling, loss of anonymity through participant labeling, and facilitator provided assessment feedback on group participation, decision quality, and equal group participation.

#### 1.4 Sequence of Presentation

Chapter II of this study provides a review of the relevant literature from the body of GSS research with emphasis on research pertaining to the independent variables (coincidental feedback and feedback) studied in this thesis. Chapter III details the methodology used to conduct the research for this study and the results of this study are presented in Chapter IV. Finally, Chapter V discusses the data with respect to the hypotheses that were investigated with this study. Findings are presented with the conclusions, limitations, and recommendations for future GSS research.

## II. Literature Review

### 2.1 Introduction

In the 1950's, researchers began to intently study small group decision-making and the contribution of individual team member's actions to group effectiveness. This research found that many process losses occurred in groups. Process losses such as social loafing, evaluation apprehension, attention blocking, information overload, and dominance did not allow groups to perform at their optimal level. Researchers then began to look for new ways to use technology to overcome these problems and began experimenting with group support systems to help minimize or eliminate some of the process losses. After much experimentation, group support systems made their first appearance in literature in 1982 where the benefits of a GSS over traditional face-to-face meetings were reported (Fjermestad and Hiltz, 1999). While most prior GSS research compared the outcomes of a GSS versus traditional face-to-face meetings, the more recent research is interested in specific manipulations of a GSS to make meetings more productive and efficient (Zigurs and Kozar, 1994).

### 2.2 GSS Overview

The GSS is a tool that organizations can use to reduce the previously mentioned process losses that are often associated with group meetings. The main objective of the GSS is to improve the group decision-making process by removing the communication barriers, structuring the group interaction, and providing analytical tools for the task by using technology to assist the meeting (Hiltz, Johnson, and Turoff, 1991:82).



The technology used in a GSS includes a networked personal computer for each group member; software that collects, manipulates, and aggregates the individual input contributed by each member; individual monitors and a projected image to display individual and aggregated information (Zigurs and Kozar, 1994). The projected image acts as a focus point for discussions. While technology plays an important role in a GSS session, a human facilitator is often present to ensure a GSS meeting will run more efficiently. A facilitator makes sure that all group members get involved in the early stages of the meeting and will also manage dominant members of the group to ensure equal participation from all members (Clawson and Bostrom, 1993). Most research conducted on the benefits of using a facilitator in a GSS meeting show that facilitated GSS groups have a markedly greater likelihood of producing favorable effects in comparison to nonfacilitated groups (Fjermestad and Hiltz, 1999; Anson and others, 1995:189). The potential for increased productivity have made group support systems an increasingly popular tool in many organizations.

### 2.3 GSS Benefits

One of the most common methods to solve or work on a problem is for individuals to work together in groups to arrive at an accepted solution. There is widespread consensus from industry experts that in the coming years, work will be performed in task-focused teams, rather than in traditional departments or individual members of the organization (Ancona and Nadler, 1989; Drucker, 1988). Group support systems are already being used today for many different business applications such as business process reengineering, requirement elicitation, process and data model

development, and creative idea generation (Nagasundram and Bostrom, 1995). Many organizations are beginning to experiment with GSSs to realize some of the benefits they provide, while other organizations are increasing their usage of the tool. Group support systems have been a success in organizations with some realizing an average labor savings of 50-70% and a reduction in project cycle time averaging 90% (Reinig, Briggs, Shepherd, Yen, and Nunamaker, 1996:171). The reports of the dramatic benefits of a GSS should be viewed as genuine and not exaggerated. It is unlikely that anyone would use a GSS if the system did not increase group performance since designing, building, operating, and maintaining a GSS is quite expensive (George and others, 1990:398).

A GSS meeting may be preferred over a traditional face-to-face meeting since it has been shown that GSS meetings tend to produce more comments from meeting participants (Zigurs and Kozar, 1994). The quantity of ideas that are generated correlates very highly with the average quality of ideas produced during a meeting (Nagasundaram and Bostrom, 1995:96; Shepherd, Briggs, Reinig, Yen, and Nunamaker, 1996:155). Allowing group members to exchange multiple ideas is important since information sharing is positively related to the quality of a group decision (Mennecke and Valachich, 1998:174). Group members often feed off other individual's ideas, or piggyback, which then leads to more comments and better solutions. When groups can access a larger pool of information about a problem, it will potentially enable them to make a better decision for the organization (Dennis, 1996). Therefore, groups have the potential to outperform individuals on a task due to the synergy that is generated from having individuals work together (George and others, 1990:395).

While generating numerous ideas is valuable, groups must be careful to give everyone a chance to participate in a meeting so that a dominant member does not steer the meeting toward just one point of view. If one person dominates the meeting, that person also begins to obtain power and subsequently controls the turntaking of who is permitted to speak in the meeting (Hiltz and others, 1991:85). In a traditional face to face meeting, only one person can speak at a time and some members may never get an opportunity to voice their ideas. A GSS helps minimize the effect of a dominant group member by reducing production blocking, which will provide all users an equal opportunity to participate in the meeting.

#### 2.2.1 Anonymity and Identification in a GSS Environment

One of the key aspects touted about a GSS to help reduce process losses is the anonymity it provides to users. A GSS provides different levels of anonymity depending on the options chosen by those involved in the meeting.

A GSS can be configured so that none of the comments entered during the session are labeled with an identifier. This would provide the most anonymity to the participants during the session. The GSS configuration could also be manipulated to allow a label with a generic identifier such as red, green, or blue to indicate the submitter of each comment. This would allow group members to associate comments to a participant (e.g. red, green, or blue), but still provide individuals with anonymity, since the person would not be linked to the color identifier. The GSS could take away anonymity by purposely labeling each member of the meeting with their comment identifier.

Anonymity has been found to be one of the most interesting and important aspects of a GSS, yet the least understood (Valachich, Dennis, Jessup, and Nunamaker, 1992:101). For example, prominent GSS researchers have stated that little is really known about the role anonymity plays in a GSS (George and others, 1990:411). Empirical research has argued for the need to investigate the effect anonymity provided in a GSS has on group processes and outcomes (Jessup and George, 1997). While the use of a GSS has been shown to be beneficial there are mixed results from GSS studies showing the optimum configuration for a GSS. In particular many studies have shown conflicting results due to anonymity. Anonymity has also been found to increase critical comments, and to have a negative or insignificant effect on generating comments, group performance, and equality of participation (Pinnonneault and Heppel, 1998:91). In a GSS meta-analysis looking at GSS performance by comparing anonymous vs identified groups, twenty out of thirty-three experiments showed the anonymous condition being significantly better than the labeled condition. However labeled conditions were significantly better than anonymous conditions ten times (Fjermestad and Hiltz, 1999). To get a clearer picture of what is really occurring during a GSS session, we need to take a closer look at the differing schools of thought on labeling persons in a GSS session.

This chapter will explore possible explanations for the mixed results in GSS research by looking at the GSS structural and social contingencies. The structural contingencies depend on the way the GSS configuration is set up for the users. The chapter will look at three competing areas of thought that are believed to contribute to the success of a GSS: anonymity, identification, and self-regulation provided through coincidental feedback. A discussion on the social contingencies will then be presented

that demonstrates how a facilitator could provide goals and feedback to the group during the GSS session. This chapter will also present the hypotheses investigated for the research contained in this study. By testing the hypotheses of each competing theory, this paper hopes to provide more information to the body of knowledge concerning the optimal configuration and administration of a GSS session.

## 2.3 Structural Contingencies

### 2.3.1 GSS Anonymity

A GSS has been linked to greater task orientation, increased decision quality, and significantly increased idea generation when compared with a traditional face-to-face meeting (Zigurs and Kozar, 1994; Nagasundram and Bostrom, 1995:89). There are generally three accepted components that contribute to improved performance in a GSS meeting that cannot be provided in a traditional face-to-face meeting, these components are parallelism, group memory, and anonymity. (Nunamaker, Dennis, Valacich, Vogel, and George, 1991). This section of the paper will focus on the anonymity component found in a GSS.

Anonymity is defined as the identifiability of group member contributions (Jessup and Connolly, 1990). This includes the ability of group members to correctly identify the source of messages they receive and the destination of any messages they send to other group members (George and others, 1990:398). Working in a group might inhibit a person who anticipates embarrassment, a hostile environment, conformity pressures, or other punishments from contributing a unique idea (Collaros and Anderson, 1969). Often individuals may not participate in a face-to-face meeting because of personality

characteristics or out of fear of voicing their opinion in front of superiors. People do not want to appear weak, unintelligent, or upset the cohesiveness of the group and the anonymity provides an avenue for people to voice their differing opinions (Jessup and Connolly, 1990). Configuring a GSS so that any particular comment cannot be directly tied back to the submitter should help reduce any rejection fears. With anonymity assured all members of the group should feel more comfortable to voice their opinion without any fear of retribution or embarrassment from other members of the group.

An anonymous GSS setting removes the normative cues associated with position, status, or past individual behavior (El-Shinnawy and Vinze, 1998). Information and comments exchanged therefore may not be rejected solely on the basis of individual member characteristics such as social status or expertise (Dennis, Hilmer, and Taylor, 1998:65). Users often begin to feel free to express their ideas since the idea will be judged on its own merit, not on who has suggested the idea. Anonymity encourages merit-based evaluation of ideas that can lead to more honest and creative input since it decreases conformity pressure (Boiney, 1998). Therefore cognitive resources are spent evaluating the idea and not on any bias a person may have against the sender of information.

Anonymity has been studied in many experiments and its benefits have produced tangible results for the group. In a short summary, anonymity reduces the fear of social disapproval and of evaluation, lowers user inhibitions, and censorship. Overall anonymity has been shown to improve participation and communication, promote more objective and honest evaluation of contributed ideas, and enhance the productivity of groups and their decision-making process (Connolly, Jessup, and Valacich, 1990).

## Hypothesis 1 Effects Through Anonymity

Research has suggested that increasing a users anonymity will increase their participation levels since anonymity reduces a persons' fear of rejection. Anonymity should also increase the equality of participation and quality of decisions since it allows the maximum amount of cognitive resources to focus on the information. Participants should be willing to contribute to the group discussion and not hold back any ideas. The participants' main focus should be on solving the problem at hand, not on how their comments may be accepted or rejected by the group. Since users can voice their opinions freely, they should also be more satisfied with the entire meeting experience.

Hypothesis 1A: Anonymity will have an effect increasing user information sharing behavior.

Hypothesis 1B: Anonymity will increase the quality of decision for the group.

Hypothesis 1C: Anonymity will discourage unequal participation from group members.

Hypothesis 1D: Anonymity will encourage positive user attitudes with the GSS meeting.

### 2.3.2 GSS Identification

While there have been many studies discussing the benefits of anonymity there has also been studies that show the potential pitfalls anonymity can create. Psychological research on interpersonal processes shows that anonymous interaction does not always result in positive outcomes (Jessup and George, 1997). Anonymity should promote more objective and honest evaluation of ideas and improve the quality of decision-making and

group performance, yet it also induces the negative effects of flaming and social loafing (Pinsonneault and Heppel, 1998:91).

#### 2.3.2.1 Flaming

Flaming is where group members begin to demonstrate uninhibited interaction and begin to send critical comments to other members of the group. Flaming occurs when anonymous group members begin to lose their individuality which results in a reduction of normal inhibitions, enabling group members to engage in behavior they would not normally display in a labeled situation (Jessup and Connolly, 1990). Some GSS groups have been known to degrade into just plain silliness and do not focus on the task at hand (Jessup and George, 1997). Flaming can be reduced when people are identifiable in a meeting since normative behavior is more likely to occur when users are labeled (Marx, 1999:105).

#### 2.3.2.2 Social Loafing

The other negative effect of anonymity is social loafing. Social loafing is the tendency for people to exert less effort when they pool their efforts toward a common goal than when they are held individually accountable. A common explanation for social loafing is that there is an inability to identify individual efforts in a group environment (Gagne and Zuckerman, 1999:525). Social loafing increases with member anonymity which increases with group size. The chance of detecting and identifying social loafing by any particular member decreases as group size increases (Kerr and Bruun, 1981:228). When people are in a small group they realize they are more identifiable and do not want



to risk letting others know that they are not pulling their weight in a meeting. Literature on social loafing indicates that accountability is one of the essential factors in ensuring each member of the group contributes to the best of their ability (Miles and Greenberg, 1993; Williams, Harkins, and Latane, 1989).

Social loafing can occur in a variety of tasks including those that require physical effort such as running (Huddleston, Doody, and Ruder, 1985) or cognitive effort such as reacting to proposals (Brickner, Harkins, and Ostrom, 1986). Studies have shown situations where members who are identified exert greater physical or mental effort than those working anonymously (Jessup and Connolly, 1990). One study found that participants in a tug-o-war competition pulled less hard on the rope when they believed that other people were pulling with them (Ingham, Levinger, and Peckman, 1974). Another study involving a GSS found that participants worked harder when co-participants could evaluate the individual performance of group members in an idea-generating task (Shepherd and others, 1996:158). These are just a few examples that show how increased identification can be an important mediator in social loafing.

We often believe that working together should inspire group members to maximize the group's potential and work harder to achieve positive outcomes. However, many times the benefits that group interaction provides, is not enough to arrive at the optimal solution. Often the information possessed by individual members is not shared with other members of the group. Another downfall of working collectively is that it lessens the possibility of being evaluated, which encourages people to participate in social loafing (Charbonnier, Huguet, Brauer, and Montiel, 1998:331). When participants were led to believe that their outputs could be individually identified, social loafing was

eliminated (Williams and others, 1981). Making an individual's performance more identifiable reduces the sense of the person being lost in the crowd and causes people to work harder (Swain, 1996:338). Researchers found that anonymous subjects loafed in some GSS experiments and exerted less effort than participants who were identified with a label. Identified subjects also typed more comments than those in an anonymous situation (Jessup and George, 1997).

When people are labeled, they are identified to other members of the group which now makes them accountable to the group for their actions (Marx, 1999:105). By labeling users in a GSS meeting, the label creates higher levels of accountability for those involved in the meeting (Hollenbeck and others, 1998:280). As more verbal and non-verbal cues are removed from the group process there begins a loss of social presence (Short, Williams and Christie, 1976; Rice 1993). That is, people become more like objects and not like real human beings. The result of the deindividuation is often the anti-social behavior previously mentioned that could be detrimental to the effectiveness of the group.

#### Hypothesis 2 Effects Through Identification

Since anonymity and identification are opposite factors, Hypothesis 1 and 2 predict the opposite results. The discussion on identification suggests that increasing identification, thereby reducing the anonymity, increases participation by producing social pressures on each member to do their fair share. Anonymity encourages social loafing and decreased participation. Identification introduces social pressures to participate in the group. Increased participation increases the chance that good ideas will

be generated and higher quality decisions will be achieved. Social pressures also will encourage equal participation since people will want to contribute to the group and not be singled out as a non-contributor. Since an optimal solution should be found in an identified group, the group will be satisfied with the overall GSS experience.

Hypothesis 2A: Identification will have an effect increasing user information sharing behavior.

Hypothesis 2B: Identification will increase the quality of decision for the group.

Hypothesis 2C: Identification will discourage unequal participation from group members.

Hypothesis 2D: Identification will encourage positive user attitudes with the GSS meeting.

### 2.3.3 Coincidental Feedback

When users receive coincidental feedback they begin to become self-aware of their performance. The user begins to compare one's perceived performance against a set standard. When people realize that a discrepancy exists between their performance and a stated goal they are faced with three options according to the Carver and Scheier theory: adhere to the standard and exert greater effort, lower the standard and continue to exert effort or withdraw from the task (Kanfer, 1990:134).

Self-regulation basically involves altering ones own response against a stated goal (Muraven, Baumeister, and Tice, 1999). Bandura and Kanfer view self-regulation as consisting of three major components: self-observation, self-evaluation, and self-reaction

(Kanfer, 1990:131). Self-observation is the attention given to specific aspects of one's own behavior that can occur from external or internal prompts (Kanfer, 1990:132). These prompts provide information to the user about the consequences of their actions. So through self-monitoring a person can gain knowledge about how they are performing on a task. The next component is self-evaluation. Feedback affects self-evaluation in that it provides a reference point for the performance comparison. A person can compare their performance against the stated goal and the user can evaluate their performance. This is important since many times a user will feel positive about their performance when the feedback mechanism indicates that they are performing sub-par. This allows the user to make corrections to their performance. The final component is self-reaction and this is the internal response that occurs in response to self-evaluation (Kanfer, 1990:132). If the self-evaluation indicates that a person's performance is consistent with the stated goal then this yields satisfaction, while if performance is not meeting the goal then this yields dissatisfaction.

For example, swimmers are often used to demonstrate self-regulation since they must be able to delay immediate gratification and improve their toleration of unpleasant events in order to achieve their long-term goal of succeeding. During competition swimmers use self-regulation to pace themselves against their opposition. They are aware of the other swimmers' performance, yet they are also aware of their own abilities and strategies to succeed in the event. The coincidental feedback received by the swimmers allows them to take all of these inputs and determine the pace that is needed to achieve a successful outcome (Anshel and Porter, 1996).

Coincidental feedback will also provide group members with information on how often they are participating in a task. Decision-making is often more difficult with the dominance of one individual since it causes some members of the group to be reluctant to participate (Steiner, 1972). Equality of participation in a meeting has been shown to increase the performance of the group as well as increase the number of ideas that are generated in the meeting (Dennis, 1991; Nunamaker, Vogel, and Konsynski, 1989). Equal rates of participation may generate alternative solutions that may not have been generated otherwise. These solutions may be more attractive to the group than the solution suggested by the more dominant members of the group (George and others, 1990:396).

Comment labeling provides feedback, which is important to the speed and effectiveness of the communication process (Dennis and Kinney, 1998:260). If GSS members can associate comments to participants, they can integrate pieces of information received at different times. Labeling thus helps minimize the time of understanding so the amount of time to complete a task is shortened (Dennis and Kinney, 1998:260). In addition, the group can have specific idea exchange so they can defend and criticize specific ideas (Valacich and others, 1992:105).

Facilitators, which have already been identified as a key to GSS success, believe that providing coincidental feedback will be a benefit to the GSS and will lead to superior results (Kelly and Bostrom, 1998:36). Participants can use the coincidental feedback to develop an evaluation of a participants' competence that will influence their choice to align with his or her ideas. Also people may notice that they are dominating the meeting and may choose to contribute less so others may become more involved. Participants

may also realize that one member or members of the group are not contributing ideas to the solution of a problem, and then apply normative pressure. Labeling provides the feedback that could allow the group to encourage others to begin participating with the group.

#### 2.3.3.1 Credibility Effects

Labeling users in a GSS provides a powerful effect on individual credibility. Comment labeling allows participants to associate comments with a single source. The sum of single source's comments can then be used to facilitate an estimate of his or her credibility. If a GSS user types in a comment but the comment cannot be traced to a specific person, how do other group members know that the comment is feasible and technologically valid? Credibility has been found to be an important factor to the acceptance and processing of a message (Petty and Cacioppo, 1986). In theory, people who are anonymous could make up information and not be held responsible for their actions. People could not challenge the information of the contributor since it is more difficult to immediately challenge a comment that is provided in an anonymous GSS setting (Dennis, 1996). This is particularly important when the information being presented or discussed in the GSS is ambiguous or difficult to process (Petty and Cacioppo, 1986).

### Hypothesis 3: Effects through Coincidental Feedback

Coincidental feedback suggests that comment labeling provides additional information that helps people pace themselves and integrate ideas by both source and content. The comment labels are important, not the relative level of anonymity. The labels allow users to self-regulate their input, which allows them to know the appropriate number of comments to submit. Since participants have more information available to them, the group should generate an optimal solution. Coincidental feedback should help create more balanced participation among members since members are self-aware of their performance. Coincidental feedback should also increase satisfaction with the GSS meeting since it eases integration of information. So the most information is comment and person, but we do not know if person labels have a positive or negative effect, which is contradictory from Hypothesis 1 and 2.

Hypothesis 3A: Coincidental feedback will have an effect increasing user information sharing behavior.

Hypothesis 3B: Coincidental feedback will increase the quality of decision for the group.

Hypothesis 3C: Coincidental feedback will discourage unequal participation from group members.

Hypothesis 3D: Coincidental feedback will encourage positive user attitudes with the GSS meeting.

## 2.4 Social Contingencies

### 2.4.1 Facilitator Effects Through Goal Setting and Feedback

One of the most common motivational techniques to increase productivity is to provide workers with goals. Simply defined, a goal is what an individual is trying to accomplish, it is the object or aim of the action (Locke, Shaw, Saari, and Latham, 1981:126). Goals enhance performance by increasing effort, persistence, directing attention, and improving strategy formulation (Locke and others, 1981). Goals also become a motivator for people since it challenges them to improve their skill level and prove their competence to authority figures (Locke and Latham, 1990:241). Over 400 studies have been conducted on goal research and the results indicate that specific difficult goals lead to better performance than specific easy goals, vague goals, or no goals at all (Locke and Latham, 1990:240). These studies also indicate that goals have little effect on productivity unless they are associated with feedback (Locke and Latham, 1990:192).

Feedback is often given to show progress in relation to the specified goal (Locke and others, 1981:133). It can be used as a motivator, an information giver, an explainer, and an idea generator (Zigurs and Kozar, 1994). Feedback provides both informational value in terms of promoting learning and motivational value in terms of promoting effort (Ilgen, Major, Hollenbeck, and Raising, 1979; Taylor, Fisher, and Ilgen, 1984). Most feedback research has shown that performance can be improved by providing specific task-relevant feedback (Ammons, 1956; Ilgen and others, 1979; Kopelman, 1986) and it has positive effects on team decision-making accuracy (Hollenbeck and others, 1998:278). The performance increases are possible since feedback provides users the



type, extent, and direction of errors so problems can be corrected (Becker, 1978:428). While giving a goal or feedback separately has shown to produce positive results, most researchers believe that there is an interactive effect of the difficult goal and the feedback that can significantly affect performance (Becker, 1978, 428).

A specific, difficult goal combined with feedback has been shown to increase productivity among workers. (Locke and others, 1981:134; Becker, 1978:428). Subjects who were given a difficult or moderately difficult goal performed much better if they received feedback than those groups that did not receive feedback (Frost and Mahoney, 1976). Feedback and goal setting work hand in hand to achieve superior performance. If people are only given feedback then they have no goal or level to achieve. If people have a difficult goal but no information is given on how well they performed, then there is no comparison to the goal. People do not know whether they have met the goal, surpassed the goal, or has failed to reach the standard, so the feedback becomes irrelevant (Becker, 1978:429). Without feedback, people have no way of knowing if they should increase or decrease their level of effort. The goal and feedback provide a self-assessment that allows a person a basis for adjusting their level of effort (Earley and others, 1990:88). A goal plus feedback has been shown to produce more benefits than providing a goal and no feedback (Schunk and Swartz, 1993). It is the joint effect of goal setting and feedback that can create a successful outcome. Two research studies can be looked at to demonstrate that goal setting without feedback will produce a negative effect on performance.

For example in a study that looked at consumer electrical usage, the treatment group that received a goal and feedback did much better at conserving energy than the group

that received a goal and no feedback. This study helps demonstrate the importance of the presence of providing both a goal and feedback toward obtaining optimal performance (Becker, 1978:431).

Another study conducted at Emery Air Freight found that when workers received reports of their results (feedback) and a goal, they performed better than those who received no information of their work results (Locke and others, 1981:134). Interestingly those who received no goal and no feedback performed just as well as those who received the goal without feedback. This study emphasizes the importance of receiving both a goal and feedback if management wants to see dramatic increases in productivity.

One method of feedback that could be provided in a GSS is to compare a person's individual result with other group member's scores and against a known average. Studies have shown that when individuals are allowed to view these various information inputs that it heightens the competitive nature of the task and motivates workers to perform well (Williams and others, 1981:310). People are often curious as to how they perform against the average and how they stack up against other people in a group. If participation feedback is provided to users during the GSS session, users may feel more comfortable with their own participation levels.

If people can receive feedback about how they compare with other group members they begin to participate in a phenomenon called social comparison. Social comparison is where members of the group begin to match their performance to the rate of people working around them. For example, if the group is working at a high level of effort individual members tend to work at a high level of effort as well (Goethals and Darley, 1987). Studies have shown that social comparison is an effective tool to combat

social loafing in groups (Shepherd and others, 1996:169). It has been suggested that feedback can play an important role in group decision-making and this may be an important direction for GSS research to increase productivity and fight some of the negative effects found in a GSS (Sengupta and Te'eni, 1991:631).

#### Hypothesis 4: Effects Through Goal Setting and Feedback

Facilitator provided goals and feedback suggests that group members will generate more comments since they have access to information on how well they performed on the previous task. Since participants have more information available to them, the group should generate an optimal solution. Facilitator provided feedback should create more balanced participation among members since members are aware of their performance vs the rest of the group. Facilitator provided feedback should also increase satisfaction with the GSS meeting since users now possess the most information available to them in a GSS setting.

Hypothesis 4A: Facilitator provided goal setting and feedback will have an effect increasing user information sharing behavior.

Hypothesis 4B: Facilitator provided goal setting and feedback will increase the quality of decision for the group.

Hypothesis 4C: Facilitator provided goal setting and feedback will discourage unequal participation from group members.

Hypothesis 4D: Facilitator provided goal setting and feedback will encourage positive user attitudes with the GSS meeting.

## 2.5 Interactive Effects of Feedback and Anonymity/Identification

In the preceding paragraphs, the paper discussed the potential outcomes that may occur when participants are labeled/not labeled or if they receive/do not receive feedback. This section will list several hypotheses that may occur when these items interact.

### 2.5.1 Interaction of Anonymity and Goal Setting/Feedback

#### Hypothesis 5: Effects Through Anonymity and Goal Setting/Feedback Interaction

If Hypothesis 1 is true, and anonymity provides positive effects by reducing fear of rejection, then the presence of assessment feedback could produce negative results. When users believe that they are anonymous in a GSS meeting, they will be surprised to discover that in fact their comments and actions are not anonymous. They will realize that they are being observed and monitored by the facilitator. Users will discover this when they are presented with the facilitator feedback. Since participants now know that their identity will not remain anonymous, they will participate less in the next exercise since they have lost their freedom to say whatever they want. Their perception of anonymity is different from the actual anonymity being provided. Now they do not want to risk embarrassment from the facilitator. Since many users will feel that they have been lied to about their identity status many will not have a pleasant reaction to the GSS meeting.

Hypothesis 5A: Interaction of anonymity and facilitator provided goal setting and feedback will have an effect discouraging user information sharing behavior.

Hypothesis 5B: Interaction of anonymity and facilitator provided goal setting and feedback will encourage negative user attitudes with the GSS meeting.

### 2.5.2 Interaction of Identification and Goal Setting/Feedback

#### Hypothesis 6: Effects Through Identification and Goal Setting/Feedback Interaction

Hypothesis 2 however suggests that anonymity could have a negative rather than a positive effect due to flaming or social loafing. If this hypothesis proves true, then assessment feedback should provide a synergistic effect. When participants who have been identified in the GSS session receive feedback and goal setting from the facilitator, they should begin to increase their participation levels. Participants will be surprised to discover that the facilitator has actually been monitoring the events that transpire over the GSS. The feedback will let the participants know that someone is watching their performance and this should be extra motivation to participate. As a result, social loafing should be even less evident in the next exercise given to the users, and flaming if present should diminish.

Hypothesis 6A: Interaction of identification and facilitator provided goal setting and feedback will have an effect increasing user information sharing behavior.

Hypothesis 6B: Interaction of identification and facilitator provided goal setting and feedback will discourage unequal participation from group members.

### 2.5.3 Interaction of Coincidental Feedback and Goal Setting/Feedback

#### Hypothesis 7: Effects Through Coincidental Feedback and Goal Setting/Feedback

##### Interaction

When participants receive coincidental feedback combined with goals and feedback provided by the facilitator, the information provided to group members should be redundant concerning unequal participation. Group members should already be aware of the rates of participation and the extra information will just reinforce their beliefs. The groups that had not received coincidental feedback however will be helped by the additional information and should begin to regulate their participation levels.

Hypothesis 7A: Groups who do not receive assessment feedback will continue to show a difference based on the presence of coincidental feedback through comment labels.

### 2.9 Summary

This chapter discussed two different contingencies, social and structural, that may explain the mixed results that are often found in GSS research. Having users anonymous or identified during a GSS meeting are competing hypothesis that predict opposite effects on the outcome variables. The research design that will be used in this study is important since all competing hypotheses can be evaluated during one experiment where the anonymity level will be manipulated. Once all data is collected we will be able to compare the different experimental treatments and determine through statistical analysis which theory or theories are supported by the data.

### III. Methodology

#### 3.1 Introduction

As stated in Chapter One, this study evaluated the impact of feedback and coincidental feedback on the quantity of idea generation and the quality of decision-making in a GSS setting. Chapter Two looked at the previous research literature concerning the impact of feedback and coincidental feedback provided by labeling on group performance. This chapter describes how data were collected, computed, and statistically analyzed to test the hypothesized relationship between the independent variables of feedback and coincidental feedback.

#### 3.2 Experimental Design

For the purpose of this study, two widely used group decision-making tasks, the Moon Scenario (Appendix A) and the Desert Scenario (Appendix B), were used to investigate the main and interactive effects of anonymity, coincidental feedback, and assessment feedback on the perceptions, attitudes, and subsequent behavior (quantity of comments generated and quality of decision) of GSS decision making groups. These types of intellectual tasks are often used in group decision-making research (Bluedorn, Turban, and Love, 1999:280). In each manipulation, four subjects interacted as a team to solve the given scenario using a GSS. The group size of four is considered appropriate since the average number of people attending a decision-making meeting is usually less than five (Lam, 1997:199).

Individuals were randomly assigned to four-person team and each team was randomly assigned to one of the treatments. The factorial design crossed the presence of feedback and the type of labeling given to subjects. Subjects were randomly assigned to one of six cells manipulated feedback (feedback absent, feedback present) and labeling (GSS meeting with no labels, GSS meeting with only comments labeled, and GSS meeting with comments and users labeled via a placard).

### 3.3 Subjects

The 208 subjects required in this study were predominately United States Air Force Company Grade Officers (Lieutenants and Captains) who were either graduate students at the Air Force Institute of Technology, students at the Air Force Basic Communications Officer Training (BCOT) located at Keesler Air Force Base Mississippi. Roughly 25% were Air Force Reserve Officer Training Corps Cadets (college Freshmen through college Seniors). The age of subjects averaged 25 years old. Most subjects possessed at least a bachelor's degree and felt comfortable using a computer. The study used both male and female subjects since gender is not a factor in the experiment. See table below for more complete breakdown of demographics.



Table 1 Demographic Percentages of Participants

Education Level		Computer Use			
		Years of Use		Hours a Week	
High School	1%	Less than 1	0%	0-10	17%
Some College	25%	1-5	19%	11-20	33%
Bachelors	46%	6-10	43%	21-30	27%
Some Graduate	21%	More than 10	38%	More than 30	23%
Graduate	6%				
Gender		Age		Marital Status	
Male	79%	Low	17	Married	44%
Female	21%	High	53	Single	56%
		Mean	25.8		

### 3.4 Equipment and Facilities

During the experiment, the subjects were placed in different rooms, one called a task room and the other called the break room. In the break room, subjects completed questionnaires and the initial scenarios individually with paper and pencil. The break room was also used to provide subjects overall task instructions, goal and feedback information, and the final debrief. The task room was the location where the individuals worked as a group to solve the task using the GSS.

GSS sessions were conducted using a mobile GSS environment. The thesis team configured the GSS environment at each experiment location. Care was taken to ensure the room layout and equipment matched as closely as possible for each location. A total of six Pentium based computers and one server were configured with GroupSystems software running on a Windows 95 operating system. An In-focus machine allowed subjects to view the results of the experiment on an overhead screen.

### 3.5 Experiment Manipulations

Three experiment manipulations were used during the study: feedback, coincidental feedback provided through labeling, and lack of anonymity provided through person labeling. To manipulate feedback, subjects either received a goal and feedback information or only received a goal after completion of the first group scenario. To manipulate labeling and anonymity, subjects were randomly assigned to a particular treatment where comment labeling was absent, was present, or comment and user labeling was present. Experiment manipulation checks were included in the post-test survey given to all participants and are attached in Appendix C. In order to determine manipulation effectiveness, the means from groups who received the manipulation of feedback and labeling were compared to those groups that did not receive the manipulation. An Analysis of Variance (ANOVA) test was conducted to compare the difference between the means of the groups. The results of the three manipulation checks were successful and are described in the sections that follow.

#### 3.5.1 Feedback Manipulation

Feedback was successfully manipulated by providing subjects verbal and visual feedback after the first scenario was completed. Subjects either received feedback and a goal or just received the goal. The facilitator counted the number of comments input by each subject during the first scenario, created the feedback graphic attached in Appendix D, and individually showed each subject the results. The graphic given to the subjects depicted three types of information: the individual's total comments during the first

scenario, the total amount of comments contributed by other group members, and the average number of individual comments provided during pilot studies for the scenario. The facilitator explained each type of information to each subject individually and continued the process until all subjects had received the information. Experiment participants were unaware if their group was to receive feedback and a goal or just goal information.

Table 2 Reliability Analysis –Feedback Manipulation Checks

	M	SD	$\alpha$
Manipulation Check 1: Feedback	5.18	1.35	.74
My group received information on how well we shared information during the first task.	5.45	1.62	
Each member of my group knew how much they had contributed to the group during the first task.	5.35	1.62	
I knew how much information other members of my group shared during the first task.	4.93	1.74	

Summary results for the manipulation of feedback are provided in Figure 1. The manipulation of feedback results indicate that this manipulation was successful. Participants who were given feedback registered a marginal mean of 5.76 ( $s = 1.03$ ), compared to a marginal mean of 4.54 ( $s = 1.36$ ) for those who did not receive the manipulation. The summary statistics confirms that the difference in means is statistically reliable, ( $F(1, 208) = 52.16, p < 0.001, \eta^2 = 0.205$ ).

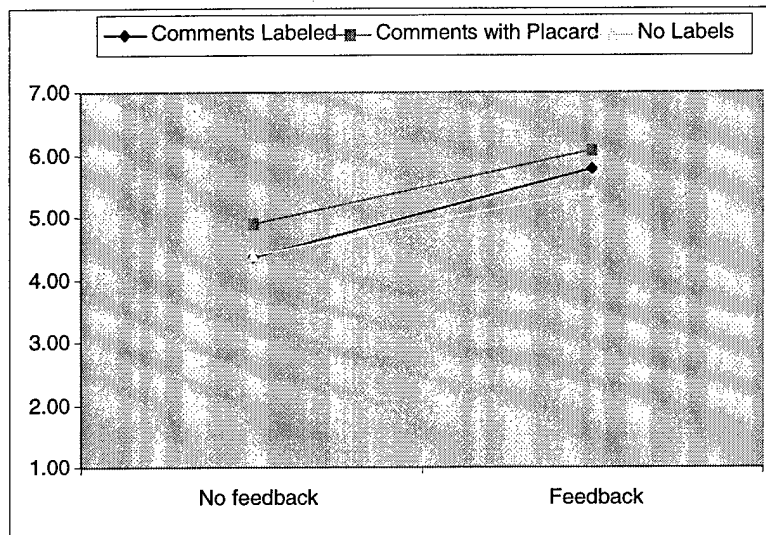


Figure 1 Plot of treatment means for manipulation of feedback.

### 3.5.2 Labeling and Anonymity Manipulation

The labeling and anonymity was successfully manipulated by assigning subjects to a condition where they knew the label of the comment provider, they did not know the label of the comment provider, or they knew the comment and user label of the individual. The subjects did not know the other possible treatments that they could be assigned to. Most of the subjects had not used a GSS before and did not know if comments would be labeled or unlabeled. One interesting item of note is that some participants in the no comment label treatment went ahead and identified themselves to other members of the group. After interviewing subjects after the session, it appeared subjects wanted to know the identity of other group members to verify who submitted individual comments. The scores for these subject groups were removed from the data and replaced with valid groups.

Table 3 Reliability Analysis – Labeling Manipulation Check

	M	SD	$\alpha$
Manipulation Check 2: Comment Labeling	4.64	1.50	.89
I could tell if someone was sharing more information than other members of the group.	4.64	1.65	
I could tell if someone participated less than other members of the group.	4.47	1.70	
Other group members could judge the extent that I participated in the group.	4.73	1.62	

Summary results for the manipulation of labeling are provided in Figure 2. The manipulation of comment labeling was also successful. Participants who were exposed to labeled comments registered a marginal mean of 5.09 ( $s = 1.15$ ). Those who had comments labeled combined with a placard registered a marginal mean of 5.28 ( $s = 1.25$ ). Those who had no comment labeling registered a marginal mean of 3.40 ( $s = 1.42$ ). A review of summary statistics confirms that the difference in means is statistically reliable, ( $F(2, 208) = 44.28, p < 0.001, \eta^2 = 0.305$ ).

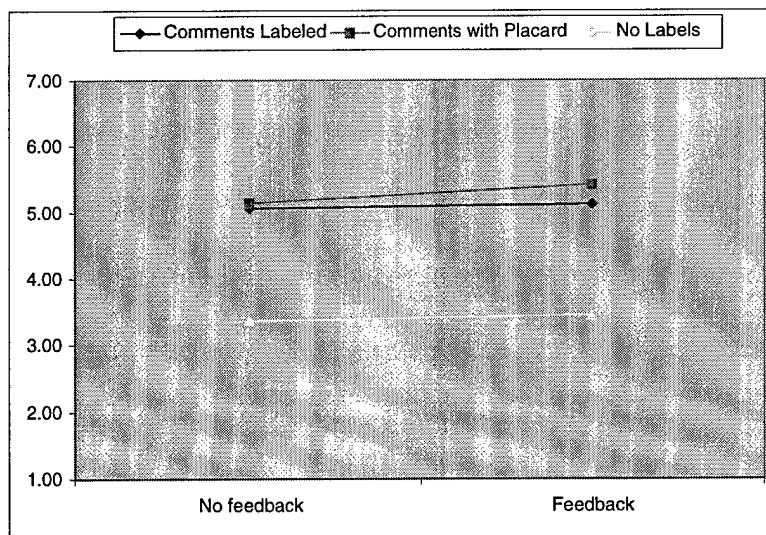


Figure 2 Plot of treatment means for manipulation of comment labeling.

Table 4 Reliability Analysis – Anonymity Manipulation Check

	M	SD	$\alpha$
Manipulation Check 3: Anonymity	4.91	1.50	.87
I could recognize the originator of most comments.	4.80	1.84	
Other group members could connect me to the comments I made.	4.93	1.62	
Other group members knew when I made a contribution to the group.	5.07	1.57	

Summary results for the manipulation of anonymity are provided in Figure 3. Review of the ANOVA for the final manipulation of anonymity shows that this manipulation was also successful. Participants who were identified through labeled comments registered a marginal mean of 5.02 ( $s = 1.34$ ). Those who had comments labeled along with a placard registered a marginal mean of 5.84 ( $s = 1.08$ ). Those who remained anonymous registered a marginal mean of 3.77 ( $s = 1.31$ ). A review of summary statistics confirms that the difference in means is statistically reliable, ( $F(2, 208) = 46.48, p < 0.001$ ), and tells us that the effect of the manipulation on this dependent variable was the strongest of the three with an  $\eta^2 = 0.315$ .

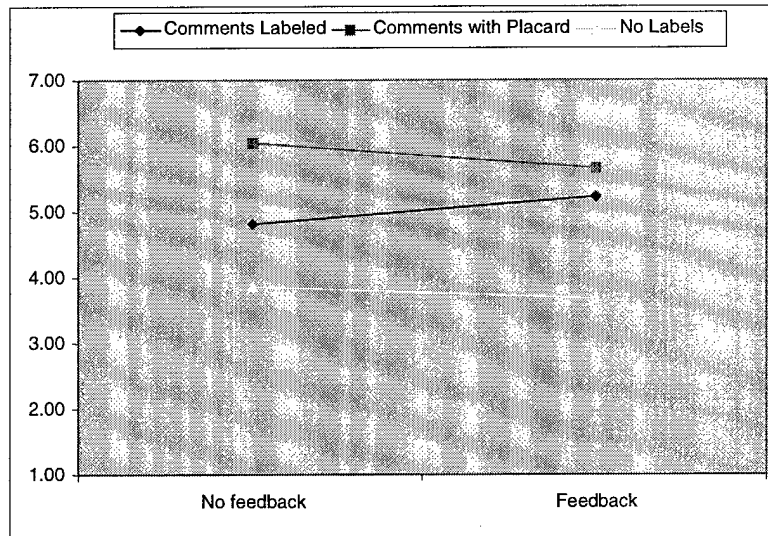


Figure 3 Plot of treatment means for manipulation of anonymity.

### 3.6 Task and Procedures

Once all four participants arrived, they were seated in the break room to begin the initial portion of the study. Working from a script (Appendix E), the facilitator introduced himself and his assistant who administered the experiment. The assistant handed a manila folder to each subject which contained a consent form, a personality questionnaire, and a paper copy of the moon scenario. The participants were asked to read and sign a consent form stating the subjects' rights during the study and that participation was voluntarily. When subjects signed the consent form (Appendix F), the assistant collected them and placed them in a clearly marked folder labeled "Consent Forms". The facilitator assured the subjects that any information provided during the experiment could not be traced back to them.

Subjects were then asked to complete the personality questionnaire which collected data for another thesis. Once this was completed, subjects placed the

questionnaire in the manila folder. The participants were then asked to read the moon scenario and using a pencil and paper individually rank the fifteen items in order of priority. Once subjects completed the task, they were to place the scenario paper into their manila folder. The facilitator then explained to the subjects group decision-making and problem solving skills. Emphasized during the presentation was the need for members to freely generate ideas or to brainstorm. It was explained that once ideas are exhausted, the group then must reach a consensus on the order of items in which all members can endorse.

After these activities, members were taken to the task room, which was where the GSS lab was configured. After arriving in the GSS area, subjects were given a short demonstration on how to use the GroupSystems tools of categorizer and vote. Categorizer is a tool within GroupSystems where participants can add comments to the GSS viewable to all group members. Vote allows participants to drag and drop items in a list, place them in a desired order, and submit their vote. Once all votes are submitted, GroupSystems tabulates the ranked items' mean, allowing the facilitator to then display the voting results.

Groups were given a short practice scenario where the team had to discuss possible ways to rank order a list of names which is provided in Appendix G. Groups were given five minutes to generate ideas and then the facilitator ended the discussion and allowed each member to individually vote on how the list should be ranked. The facilitator waited until all subjects had voted and then showed the final results to the team on an overhead screen via the in-focus machine. The facilitator described the voting results and emphasized the concept of consensus to the group. Team members were told



that in the actual scenario they would be given extra time to decide if they were satisfied with the voting results or they could be given the option to discuss for an additional five minutes and revote.

After the practice session, groups were given fifteen minutes to discuss the fifteen items from the moon scenario via the GSS. Groups were told to focus on discussing the merits of items, not on the rank order list since at the end of fifteen minutes they would be allowed to rank order the list, and submit their vote. The facilitator told the group that he would not answer any questions concerning the scenario, but would assist with any GSS specific questions. Subjects were told they would be notified when they had five and two minutes remaining in the discussion. Teams were then shown the list of items and the discussion time began.

At the end of the fifteen minutes the facilitator stopped the discussion and allowed each member to rank order the items based on the groups discussion. Once each member had ranked the items and submitted their vote, the results were compiled and shown to the group via the in-focus machine. The group then had to decide if they were satisfied with the results of the vote or they could be given an additional five minutes for discussion and then vote again. If members decided they were happy with the results they were given a five-minute break and told to meet in the break room. If the team wanted further discussion, they were given five more minutes for additional discussion and then revoted. The results were then shown to the group and they were given a five-minute break and told to regroup in the break room.

While the group was on break, the facilitator and his assistant counted the number of comments that had been input by each member. This was done by going to each

computer terminal and viewing the session log, which saves the comments input by each subject. If feedback was required for the group, the facilitator would input the information into a Microsoft Excel 97 spreadsheet and produced the feedback chart for the group. An example chart is depicted in Appendix D.

When the subjects returned from their break, they were given a five-item survey to measure their commitment to the group ranking of the moon scenario. Once the questionnaire was completed, it was placed into their manila folder.

After completing the questionnaire, the assistant began the goal discussion with the group. He showed the group two charts depicting group participation rates (Appendix H). One chart showed a group that participates equally and the other showed unequal participation rates. He then discussed that groups that participate more evenly will generally produce better results since one person does not dominate the entire meeting and everyone is able to voice their opinion. Also mentioned was that the more comments input during a meeting the greater the chance the optimum solution would be found in the comments. Subjects were then given the goal for the next task, which was participate equally while maximizing your number of comments on the desert scenario. If the group was part of the feedback manipulation they received the following additional information.

Each member in the assessment feedback condition was shown a chart found in Appendix D. The assistant approached each subject, then described and showed the individuals' total comments during the first scenario, the total amount of comments contributed by other group members, and the average number of individual comments

provided during pilot studies for the scenario. This concluded the feedback portion of the experiment.

After the discussion of goals and feedback, the assistant provided each subject with a paper copy of the desert scenario, which members completed individually. Once the scenario was completed the subjects placed the copy in their manila folder and the assistant reiterated the goal statement again to the group before they proceeded to the task room.

In the task room, the subjects were given fifteen minutes to discuss the fifteen items from the desert scenario. Groups were told to focus on discussing the merits of items and not on the rank order list since at the end of fifteen minutes they would be allowed to rank order the list and submit their vote. Teams were then shown the list of items in categorizer and the discussion time began. The same process of discussion and voting was repeated just as during the moon scenario.

Once the team had submitted their final vote, they were led back to the break room where they were given another five-item survey to measure their commitment to the group ranking of the desert scenario. Once the questionnaire was completed, it was placed into their manila folder.

Subjects were then given a 39-item questionnaire, attached in Appendix C, to collect data for the experiment constructs and manipulation checks. Once the questionnaire was completed, it was placed into the subject's manila folder.

The subjects were thanked for their time and asked if they had any questions concerning GSS or the experiment. Once all questions were answered, the subjects were

allowed to leave. The entire script for both parts of his experiment is found in Appendix E.

While the assistant was conducting the debrief, the facilitator compiled the comments submitted during the desert scenario. At each computer station he placed a disk in the machine to preserve a record of the comments generated during both sessions. To ensure an accurate history of data was kept, the groups voting results were saved on the facilitator workstation's harddrive, on diskettes, and printed for a hardcopy format. All material that was placed in the manila folders was labeled by session number and coded for analysis at a later time.

### 3.7 Hypothesis Outcome Measures

As discussed earlier, it is believed that the individual and combined effects of summary feedback from the initial task and the comment labeling created through comment/user labeling will effect individual user attitudes, participant's information sharing behavior, group decision quality, and unequal participation among members of the group. The definitions for all four constructs are depicted in Table 5

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**Table 5 Construct Definitions**

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**Construct 1. Participant's Attitudes**

**Definition:** Individual users' dispositions towards user satisfaction with dynamics of the participant group, user perception of ease of use, user belief in meeting utility, individual's ability to communicate, status effects of group, and participation in task related ideas.

**Construct 2. Participant's Information Sharing Behavior**

**Definition:** The average number of intellectual comments provided by each group in the desert scenario.

**Construct 3. Group Decision Quality**

**Definition:** Value of the group's desert scenario score.

**Construct 4. Unequal Participation**

**Definition:** The variation of the number of intellectual comments generated within each group in the desert scenario.

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The first construct employed six scales. The scales measured user satisfaction with dynamics of the participant group, user perception of ease of use, user belief in meeting utility, individual's ability to communicate, status effects of group, and participation in task related ideas.

The second construct was participation. This was quantitatively analyzed by looking at the number of intellectual comments input during the desert scenario. For the purposes of this study, intellectual comments were defined as comments specifically related to the intellectual problem-solving task, or the process by which the group

attempted to solve the task. Researchers coded intellectual participation according to individual thought processes within each entry. For instance, if a participant typed a paragraph of thoughts prior to striking the <Enter> key, each separate thought was coded as an intellectual comment, rather than the entire entry counted as a single input. Other comments that simply indicated agreement with other members' intellectual comments, affirmed previously submitted intellectual comments, or refuted previously submitted intellectual comments were coded as affirmation comments. The affirmation comments were not included in the count of comments input during a session. Individual number of intellectual comments for each participant in the desert scenario was totaled and divided by four to determine the average number of intellectual comments input by the group. The data was then used to determine if the manipulations had any effect on the participation rates during the experiment. In the treatments, one researcher coded all comments to maintain consistency. A second researcher coded a random sample of comments comprising 15% of the treatment groups. Results found that inter-rater reliability using Cronbach's alpha was assessed at .93.

The third construct group decision quality was quantitatively measured by comparing the group scores from the desert scenario. Scenario scores were calculated by taking the groups item rankings and comparing them to the suggested expert's ranking. The expert ranking for the moon scenario comes from a group of NASA experts (Hall, 1971:51). The desert scenario expert ranking comes from the former commander of the United States Air Force Desert Survival school. The absolute difference between item placements created a value for each item. These were summed for each item to create a

group decision score. If a team correctly placed all items in correct order, their team score would be zero.

The fourth construct unequal participation was quantitatively measured by comparing the variation between the number of intellectual comments generated in the desert scenario per group. The smaller the variation for each group equates to more equal participation levels.

### 3.8 Survey Design

The user attitudes construct used six measured variables described in Table 6 below. Each variable was measured with five items using a seven-point Likert scale. The final survey included thirty-nine randomized items [(6 measured variables \* 5 questions each) + (3 manipulation checks \* 3 questions each)].

All survey data was input into a Microsoft Excel 97 spreadsheet and then imported into the SPSS 10.0 statistical software package to determine Cronbach's alpha and to conduct the ANOVA analysis. The requested output from SPSS was a correlation matrix, reliability coefficient, mean, and standard deviation for each questionnaire item. Scale reliability was estimated by calculating the internal consistency of each multi-item scale as indexed by Cronbach's coefficient alpha ( $\alpha$ ). The mean for each measured variable was calculated by dividing the grand mean by the number of items included in each measure.

Table 6 Reliability Analysis - User Attitudes

	M	SD	$\alpha$
<b>User Satisfaction With Dynamics of the Participant Group</b>	5.95	.81	.86
I would not mind working with this group again.	6.17	0.93	
I am pleased with the performance of our group.	5.95	0.92	
In my opinion, we worked effectively as a group.	5.74	1.17	
I found the other group members easy to work with.	5.99	1.00	
I enjoyed participating in the group activity.	6.04	1.02	
<b>User Belief in Meeting Utility</b>	5.56	1.06	.87
The tools and processes helped us exchange information.	5.76	1.21	
The tools and processes helped us make good use of the information we shared.	5.62	1.28	
The tools and processes helped us to know about the things we agreed on.	5.67	1.27	
The tools and processes helped us to focus on the points where we disagreed.	5.25	1.47	
The tools and processes helped us to know the extent we achieved consensus.	5.77	1.30	
<b>Individual's Ability to Communicate</b>	5.89	.80	.72
I experienced few problems expressing my ideas to the other group members.	5.43	1.53	
I felt comfortable putting forward my own ideas.	6.39	0.88	
I had little trouble understanding the points made by other group members.	5.48	1.26	
I was able to comment on the ideas submitted by other group members during the session.	6.04	1.01	
I think the other group members received the information I shared.	6.02	1.08	

Table 6 continues



Table 6 (Continued)

User Perception of Ease of Use	6.06	.92	.89
Learning to use the tools and process provided was easy for me.	6.58	0.67	
I found it easy to use the tools and process to share information.	6.14	1.22	
I found it easy to use the tools and process to receive information.	6.07	1.18	
I found it easy to use the tools and process to make sense of shared information.	5.93	1.11	
I found it easy to use the tools and process to help my group complete the task.	5.90	1.26	
Status Effects of Group	2.22	1.11	.82
One or more of the group members tried to intimidate the others.	2.23	1.58	
One or more of the group members tried to force their opinions on the group.	2.77	1.71	
I felt inhibited from participating in the discussion because of the behavior of one or more of the other members.	1.70	0.98	
I felt pressure to conform to a particular viewpoint.	2.23	1.45	
One or more of the group members tried to dominate the discussion.	2.38	1.43	
Participation in Task Related Ideas	5.76	.83	.82
Everyone in the group was very involved in the group's discussion.	5.83	1.13	
I got a lot of good ideas about ranking from the other members of my group.	5.78	1.06	
Everyone in my group seemed to contribute all of the ideas they had about the task.	5.71	1.13	
No one seemed to be holding back information.	5.84	1.20	
My group shared a lot of information while we completed this task.	5.93	0.92	

### 3.9 Statistical Analysis

A multivariate ANOVA was performed on the data collected during the experiment which will compare the means of the populations. An ANOVA uses data to compare several treatments in order to determine if they achieve different results (Lapin, 1978:525). The ANOVA was used to determine if there were statistically reliable differences among the means due to the feedback, anonymity, or their interaction.

The threshold for the probability of a Type I error (falsely rejecting a null hypothesis) was set to less than five percent. When analyzing the data, an F statistic was used to test if we can reject the null hypothesis. If the F statistic was sufficiently large, so that the likelihood of its occurring by chance is less than .05, then we reject the null hypothesis. If the calculated F-statistic is greater than the critical value of F associated with an  $\alpha < 0.05$ , then the variation is attributed to the difference between the treatments, and the null hypothesis will be rejected in favor of the alternative hypothesis (Lapin, 1978:533).

The eta-squared statistic was used to determine the effect size. Eta-squared is the proportion of the total variability in the dependent variable accounted for by the variation in the independent variable. It is calculated as the ratio of the effect variance ( $SS_{\text{effect}}$ ) to the total variance ( $SS_{\text{total}}$ ). An eta-squared near 0.05 is generally considered a weak effect, 0.10 a moderate effect, and an eta<sup>2</sup> greater than 0.15 a strong effect. These standards, were used when analyzing the results from the experiment (Jaccard and Becker, 1997:275-276).

### 3.10 Summary

The purpose of this chapter was to describe the 2x3 factorial experiment which explored the impact of coincidental feedback and feedback and goal setting on the efficacy of GSS. Chapter Three described the equipment and facilities used, the subjects used in the study, and the task and procedures of the experiment. Also discussed were the questions used for the survey. The chapter then explained and defined the constructs of user attitudes, participation, group decision quality, and unequal participation. Finally, the chapter presents the statistical methods that were used to analyze and discover the relationship between the previously mentioned independent variables and process outcomes.

Chapter Four will present the results of the statistical analysis in narrative and graphical form.

## IV. Analysis of Data

### 4.1 Introduction

This chapter provides a statistical analysis and graphical display of the data collected during the experiment. Chapter Five presents a more detailed description of the findings based on the previously mentioned hypothesis.

### 4.2 Information Sharing

The following section presents the data concerning information sharing behavior. The data will be used to answer hypotheses 1A, 2A, 3A, 4A, 5A, and 6A. The summary results of ANOVA information sharing behavior are presented in Figure 4 and Table 7.

Table 7 Means and Standard Deviations for Information Sharing Behavior

	Comments Labeled		No Labels		Comments with Placard	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Feedback	21.83	9.24	21.78	8.22	16.50	2.95
No Feedback	23.94	9.25	24.97	6.24	17.53	2.96

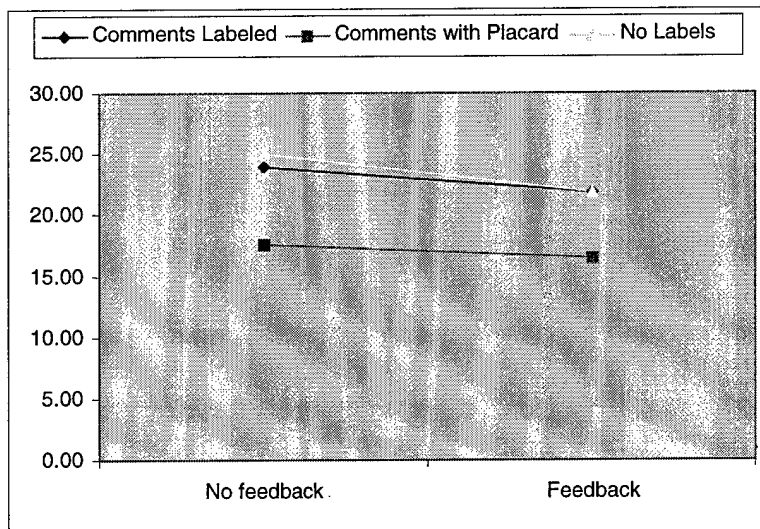


Figure 4 Plot of treatment means for information sharing behavior.

Providing different anonymity levels appears to have had an effect on participation ( $F(2, 52) = 4.204, p = 0.021, \eta^2 = 0.155$ ). Groups that had no labels recorded a mean of 23.38 ( $s=7.24$ ) intellectual comments per session, groups that had comment labels recorded a mean of 22.88 ( $s=9.25$ ), and groups that received coincidental feedback had a mean of 16.99 ( $s=2.91$ ) intellectual comments per session. ANOVA results show that providing feedback had no effect on group participation ( $F(1, 52) = 1.138, p = 0.292, \eta^2 = 0.024$ ). There is also evidence against the presence of an interaction between the feedback and labeling ( $F(2, 52) = .094, p = 0.910, \eta^2 = 0.004$ ).

#### 4.3 Quality of Group Decision

The following section presents the data concerning quality of decision for the group. The data will be used to answer hypotheses 1B, 2B, 3B, 4B. The summary results of ANOVA group decision quality are presented in Figure 5 and Table 8.

Table 8 Means and Standard Deviations for Group Decision Quality

	Comments Labeled		No Labels		Comments with Placard	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Feedback	58.20	9.82	59.75	22.66	60.89	10.64
No Feedback	50.67	13.82	59.50	10.24	56.25	13.83

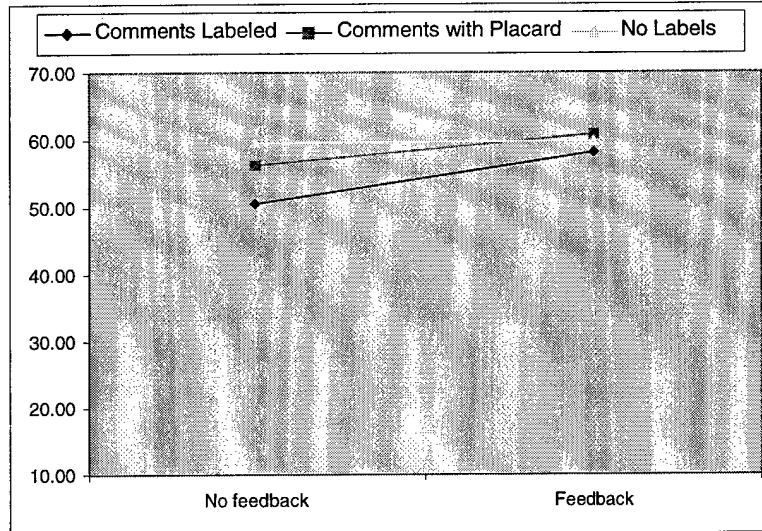


Figure 5 Plot of treatment means for group decision quality.

A review of ANOVA results shows that providing different anonymity levels had no effect on the group decision quality ( $F(2, 52) = .690, p = 0.507, \eta^2 = 0.029$ ). Similarly, feedback had no effect on the group decision quality ( $F(1, 52) = 1.135, p = 0.292, \eta^2 = 0.024$ ).

#### 4.4 Unequal Participation

The following section presents the data concerning unequal participation. The data will be used to answer hypotheses 1C, 2C, 3C, 4C, 6B, and 7A. The summary results of ANOVA unequal participation are presented in Figure 6 and Table 9.

Table 9 Means and Standard Deviations for Unequal Participation

	Comments Labeled		No Labels		Comments with Placard	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Feedback	.15	.005	.23	.126	.20	.005
No Feedback	.18	.005	.20	.107	.22	.100

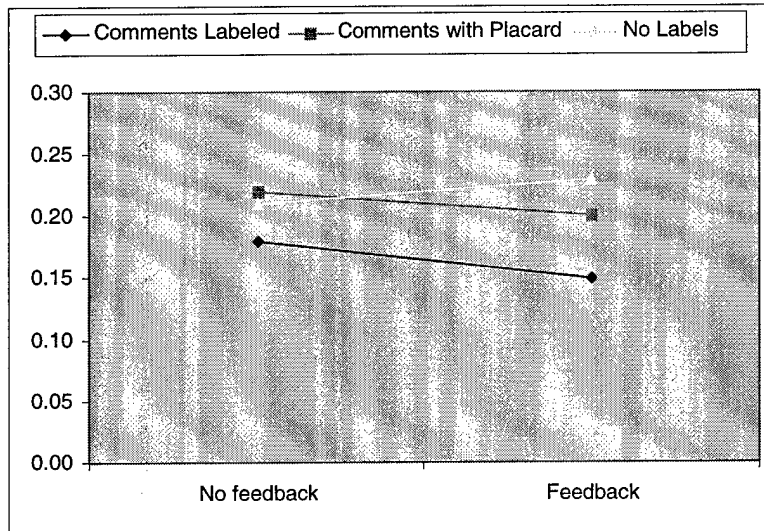


Figure 6 Plot of treatment means for unequal participation.

A review of the ANOVA results shows that the different anonymity levels had no effect on the unequal participation rates ( $F(2, 52) = 2.043, p = 0.141, \eta^2 = 0.082$ ). Results also indicate that providing feedback had no effect on unequal participation rates among the group ( $F(1, 52) = .121, p = 0.729, \eta^2 = 0.003$ ). There is also no evidence to support an interaction effect between feedback and anonymity levels ( $F(2, 52) = .651, p = 0.526, \eta^2 = 0.028$ ).

#### 4.5 Group Member Attitudes toward the Group and GSS

The following sections present the data concerning user attitudes with the GSS meeting. The data will be used to answer hypotheses 1D, 2D, 3D, 4D, and 5B.

#### 4.5.1 User Satisfaction With Dynamics of the Participant Group

The summary results of ANOVA user satisfaction with dynamics of the participant group, are presented in Figure 7 and Table 10.

Table 10 Means and Standards Deviations for User Satisfaction With Dynamics of the Participant Group

	Comments Labeled		No Labels		Comments with Placard	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Feedback	5.75	1.00	6.01	.73	6.17	.61
No Feedback	5.86	.89	5.85	.80	6.11	.69

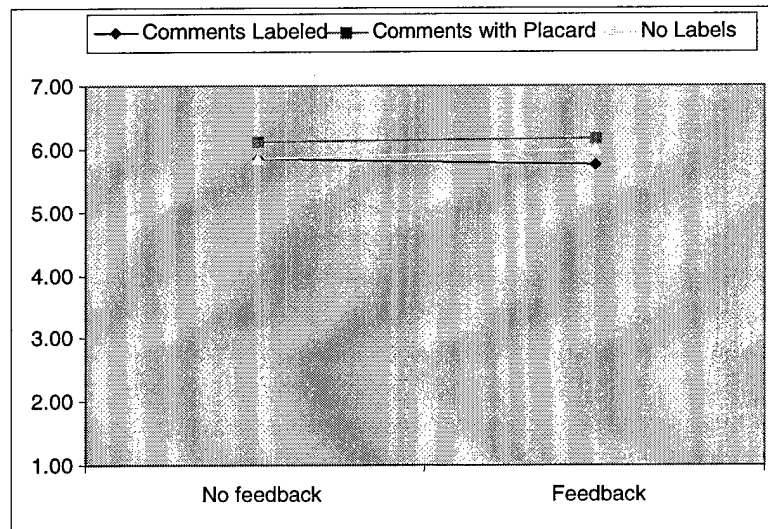


Figure 7 Plot of treatment means for user satisfaction with dynamics of the participant group.

Providing different levels of anonymity had a slight effect on user satisfaction with dynamics ( $F(2, 208) = 3.149, p = 0.045, \eta^2 = 0.030$ ). Individuals that had comments labeled with a placard recorded a mean of 6.14 ( $s=.65$ ) per session, groups that had comments labeled had a mean of 5.80 ( $s=.95$ ) and groups with no labels had a mean of 5.93 ( $s=.76$ ) per session. However, it should be noted the effect was not very



strong since the  $\eta^2$  value was low. A review of the ANOVA results shows that providing feedback had no effect on user satisfaction with dynamics of the participant group ( $F(1, 208) = .078, p = 0.780, \eta^2 = 0.000$ ). The data also indicate there was no effect from the interaction of feedback and anonymity level ( $F(2, 208) = .512, p = 0.600, \eta^2 = 0.005$ ).

#### 4.5.2 User Belief in Meeting Utility

The summary results of ANOVA user belief in meeting utility are presented in Figure 8 and Table 11.

Table 11 Means and Standards Deviations for User Belief in Meeting Utility

	Comments Labeled		No Labels		Comments with Placard	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Feedback	5.37	.99	5.73	.75	5.53	1.20
No Feedback	5.51	1.14	5.75	1.10	5.57	1.12

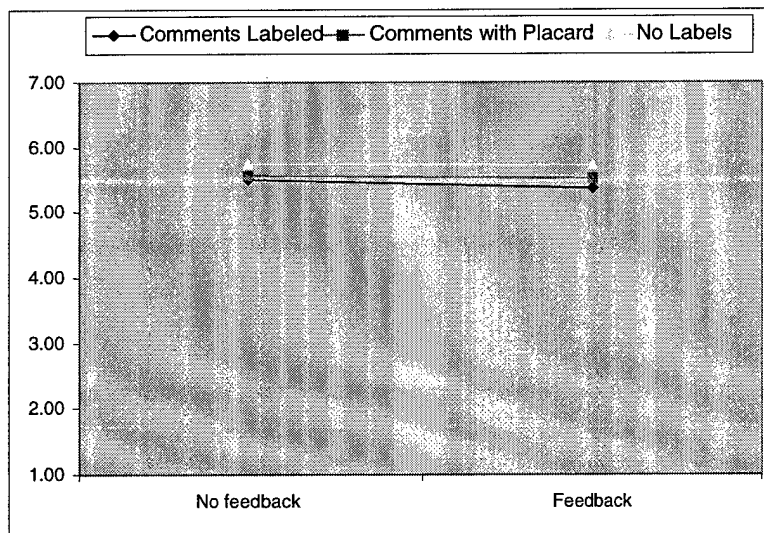


Figure 8 Plot of treatment means for user belief in meeting utility.

A review of the ANOVA results shows that different levels of anonymity had no effect on user belief in meeting utility ( $F(2, 208) = 1.445, p = 0.238, \eta^2 = 0.014$ ). Similarly, the use of feedback had no effect on user belief in meeting utility as compared with groups in which feedback was not received ( $F(1, 208) = .204, p = 0.652, \eta^2 = 0.001$ ). These main effects do not show an interaction effect as evidenced by the ANOVA results ( $F(2, 208) = .067, p = 0.936, \eta^2 = 0.001$ ).

#### 4.5.3 Individual's Ability to Communicate

The summary results of ANOVA individual's ability to communicate are presented in Figure 9 and Table 12.

Table 12 Means and Standard Deviations for Individual's Ability to Communicate

	Comments Labeled		No Labels		Comments with Placard	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Feedback	5.77	.81	5.78	.76	5.88	.86
No Feedback	5.83	.91	6.04	.71	6.08	.73

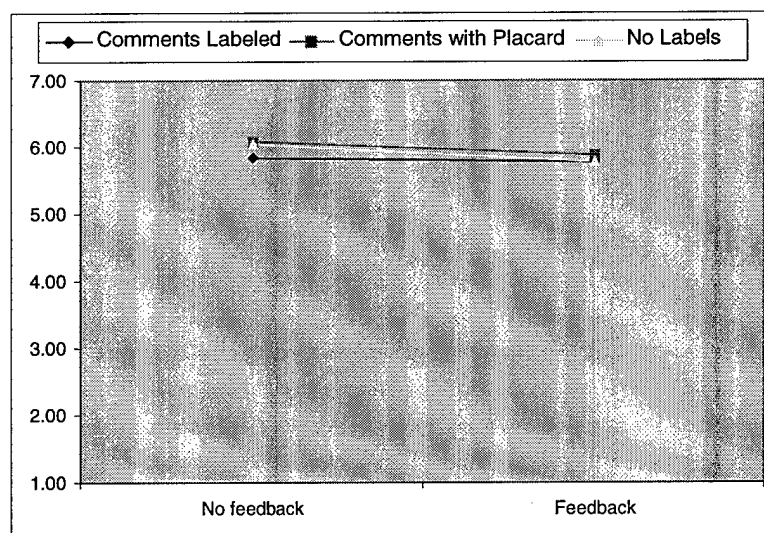


Figure 9 Plot of treatment means for individual's ability to communicate.

Providing different levels of anonymity had no effect on an individual's ability to communicate ( $F(2, 208) = .920, p = 0.400, \eta^2 = 0.009$ ). ANOVA results demonstrate that providing feedback had no effect on an individual's ability to communicate ( $F(1, 208) = 2.379, p = 0.125, \eta^2 = 0.012$ ). Data also indicate there was no effect from the interaction of feedback and the given anonymity level ( $F(2, 208) = .310, p = 0.734, \eta^2 = 0.003$ ).

#### 4.5.4 User Perception of Ease of Use

The summary results of ANOVA user perception of ease of use are presented in Figure 10 and Table 13.

Table 13 Means and Standard Deviations for User Perception of Ease of Use

	Comments Labeled		No Labels		Comments with Placard	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Feedback	5.96	.97	6.09	.93	6.11	.92
No Feedback	6.09	.93	5.99	1.06	6.16	.76

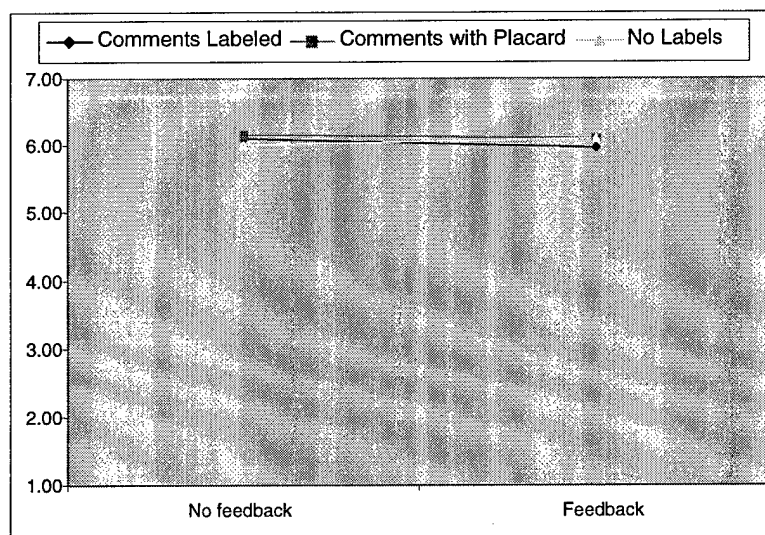


Figure 10 Plot of treatment means for user perception of ease of use.

A review of the ANOVA results indicates that providing different levels of anonymity had no effect ( $F(2, 208) = .257, p = 0.774, \eta^2 = 0.003$ ). Also, providing feedback had no effect on user perception of ease of use ( $F(1, 208) = .054, p = 0.817, \eta^2 = 0.000$ ). There is also no evidence to support an interaction effect between feedback and anonymity found in the ANOVA results ( $F(2, 208) = .289, p = 0.749, \eta^2 = 0.003$ ).

#### 4.5.5 Status Effect of Group

The summary results of ANOVA status effect of group are presented in Figure 11 and Table 14.

Table 14 Means and Standard Deviations for Status Effect of Group

	Comments Labeled		No Labels		Comments with Placard	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Feedback	2.35	1.17	2.09	.71	2.07	1.00
No Feedback	2.18	1.16	2.40	1.45	2.19	1.07

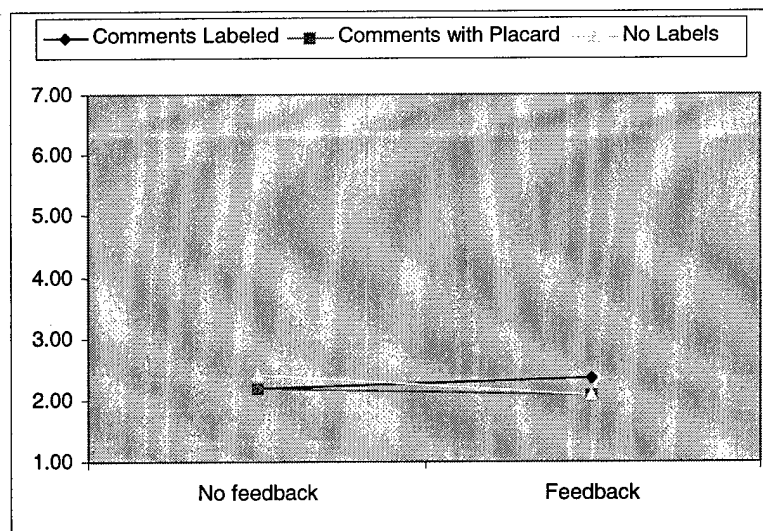


Figure 11 Plot of treatment means for status effect of group.

Providing different levels of anonymity had no effect on the status effect of the group ( $F(2, 208) = .284, p = 0.753, \eta^2 = 0.003$ ). The ANOVA results also demonstrate that providing feedback had no effect on the status effect of the group ( $F(1, 208) = .328, p = 0.568, \eta^2 = 0.002$ ). Data indicate there was no effects from the interaction of feedback and anonymity level ( $F(2, 208) = .818, p = 0.443, \eta^2 = 0.008$ ).

#### 4.5.6 Participation in Task Related Ideas

The summary results of ANOVA participation in task related ideas are presented in Figure 12 and Table 15.

Table 15 Means and Standard Deviations for Participation in Task Related Ideas

	Comments Labeled		No Labels		Comments with Placard	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Feedback	5.48	.85	5.75	.82	5.83	.79
No Feedback	5.82	.83	5.87	.79	5.90	.87

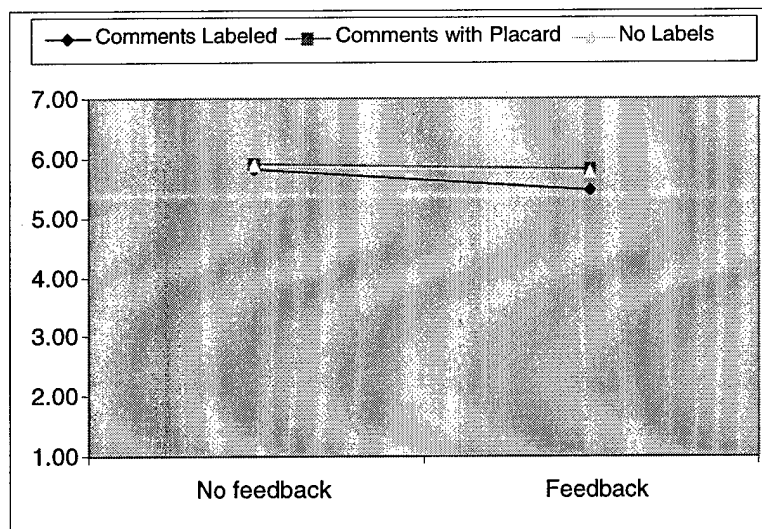


Figure 12 Plot of treatment means for participation in task related ideas.

Providing different levels of anonymity had no effect on an individual's participation in task related ideas ( $F(2, 208) = 1.321, p = 0.269, \eta^2 = 0.013$ ). The ANOVA results demonstrate that providing feedback had no effect on an individual's participation in task related ideas ( $F(1, 208) = 2.421, p = 0.121, \eta^2 = 0.012$ ). Data also indicate there was no effect from the interaction of feedback and anonymity level ( $F(2, 208) = .571, p = 0.566, \eta^2 = 0.006$ ).

#### 4.6 Summary

This chapter presented the ANOVA results of data collected during the experiment through survey administration and subject participation. Chapter Five discusses the results of the experiment by looking at each of the research hypothesis. In addition Chapter Five summarizes the research findings and include limitations and recommendations for future research.

## V. Conclusions and Recommendations

### 5.1 Introduction

The purpose of this study was to look at several competing GSS factors that could help explain the mixed results found in GSS research and help facilitators determine the optimal configuration for GSS meetings. The study looked at different theories discussed in Chapter Two to determine how they affect participation, decision quality, unequal participation, and member attitudes toward the GSS. To investigate the different hypothesis, an experiment was created that would allow the competing factors to be examined in one experiment. The main and interactive effects could then be studied to determine which theory or theories support the optimal GSS configuration. The results of the experiment are described in this final chapter by examining each hypothesis that was stated in Chapter Two. Finally, this chapter will present the overall conclusions of this research along with any study limitations and recommendations for future research.

### 5.2 Hypothesis 1: Effects Through Anonymity vs Hypothesis 2: Effects Through Identification

Hypothesis 1 and 2 will be explained in the same section since each predicted opposite results would occur. Therefore, if the results are statistically reliable, the results must favor one or the other. Hypothesis 1 proposed that providing users anonymity in a GSS meeting would increase information sharing behavior, increase the quality of the group decision, discourage unequal participation, and encourage positive user attitudes toward the GSS meeting. Hypothesis 2 stated that identifying users in a GSS meeting would increase information sharing behavior, increase the quality of the group decision,

discourage unequal participation, and encourage positive user attitudes toward the GSS meeting. For ease of understanding, Hypothesis 1 and 2 are broken into four separate sub-hypotheses.

#### 5.2.1 Hypothesis 1A and 2A:

Hypothesis 1A suggested that anonymity will have an effect increasing user information sharing behavior. Hypothesis 2A suggested that identification will have an effect increasing information sharing behavior. Examination of the ANOVA results from Chapter Four presents strong evidence to support the anonymity factor. As 1A hypothesized, the anonymity condition produced more intellectual comments than when members were identified. Members who remained anonymous must feel that anonymity allows them to freely generate more ideas than when they can be completely identified.

#### 5.2.2 Hypothesis 1B and 2B:

Hypothesis 1B suggests that anonymity will increase the quality of decision for the group. Hypothesis 2B posited that identification will increase the quality of decision for the group. Analysis of data collected however presented no support for either statement.

#### 5.2.3 Hypothesis 1C and 2C:

Hypothesis 1C posited that anonymity will discourage unequal participation from group members. Hypothesis 2C suggests that identification will discourage unequal participation from group members. Evidence provided by ANOVA, however, showed no support for either hypothesis.



#### 5.2.4 Hypothesis 1D and 2D:

Hypothesis 1D presented the idea that anonymity will encourage positive user attitudes with the GSS meeting. Hypothesis 2D presented the idea that identification will encourage positive user attitudes with the GSS meeting. Recalling from Chapter Two, user attitudes are measured from six discrete variables which are user satisfaction with dynamics of the participant group, user perception of ease of use, user belief in meeting utility, individual's ability to communicate, status effects of group, and participation in task related ideas. Of the six variables, only user satisfaction with dynamics of the participant group indicated any statistical difference. The difference was between the anonymous condition and the coincidental feedback condition. The data indicate that anonymity did not encourage optimal user satisfaction with dynamics of the participant group. Group members may feel that not knowing who contributed certain information may lead to dissatisfaction with the meeting.

#### 5.3 Hypothesis 3: Effects Through Coincidental Feedback

Hypothesis 3 proposed that providing users coincidental feedback during a GSS meeting would increase information sharing behavior, increase the quality of the group decision, discourage unequal participation, and encourage positive user attitudes toward the GSS meeting. Hypothesis 3 is broken into four separate sub-hypotheses discussed below.

### 5.3.1 Hypothesis 3A:

Hypothesis 3A posited that coincidental feedback will have an effect increasing user information sharing behavior. However, a review of ANOVA results show no support for this statement. In fact results indicate that coincidental feedback discourage user information sharing behavior. Participants generated the least number of comments under this condition.

### 5.3.2 Hypothesis 3B:

Hypothesis 3B suggests that coincidental feedback will increase the quality of decision for the group. Analysis of data collected from the experiment presented no support for this hypothesis.

### 5.3.3 Hypothesis 3C:

Hypothesis 3C presented the idea that coincidental feedback will discourage unequal participation from group members. Data analysis however shows no support for this statement.

### 5.3.4 Hypothesis 3D:

This hypothesis suggests that coincidental feedback will encourage positive user attitudes with the GSS meeting. Similar to Hypothesis 1D, this hypothesis used the same six discrete variables to measure user attitudes. Review of ANOVA results show that the only statistically reliable effect was user satisfaction with dynamics of the participant group. Members in the comments labeled with a placard treatment scored the highest among all experimental treatments. These group members may have enjoyed the group

activity more since they were aware of who contributed comments, which supports the coincidental feedback theory.

#### 5.4 Hypothesis 4: Effects Through Goal Setting and Feedback

Hypothesis 4 proposed that a facilitator providing goals and feedback to users in a GSS meeting would increase information sharing behavior, increase the quality of the group decision, discourage unequal participation, and encourage positive user attitudes toward the GSS meeting. This idea is broken down into four separate sub-hypotheses described below.

##### 5.4.1 Hypothesis 4A:

Hypothesis 4A presented the idea that facilitator provided goal setting and feedback will have an effect increasing user information sharing behavior. Evidence provided by ANOVA, however, showed no support for this statement.

##### 5.4.2 Hypothesis 4B:

Hypothesis 4B suggests that facilitator provided goal setting and feedback will increase the quality of decision for the group. This hypothesis is not supported from ANOVA evidence.

#### 5.4.3 Hypothesis 4C:

Hypothesis 4C posited that facilitator provided goal setting and feedback will discourage unequal participation from group members. Review of ANOVA results indicate no support for this statement.

#### 5.4.4 Hypothesis 4D:

This hypothesis suggests that facilitator provided goal setting and feedback will encourage positive user attitudes with the GSS meeting. Similar to Hypothesis 1D, this hypothesis used the same six discrete variables to measure user attitudes. ANOVA results indicate that no support for this statement.

### 5.5 Hypothesis 5: Effects Through Anonymity and Goal Setting Feedback Interaction

Hypothesis 5 stated that providing users anonymity in a GSS meeting along with goal setting and feedback would have an interactive effect that would discourage information sharing behavior and encourage negative user attitudes toward the GSS meeting. This hypothesis is broken into two separate sub-hypotheses.

#### 5.5.1 Hypothesis 5A:

Hypothesis 5A suggests that anonymity and facilitator provided goal setting and feedback will have an interactive effect discouraging user information sharing behavior. Analysis of data collected does not show support for this statement.

### 5.5.2 Hypothesis 5B:

Hypothesis 5B posited that anonymity and facilitator provided goal setting and feedback will have an interactive effect encouraging negative user attitudes with the GSS meeting. Review of ANOVA results indicate that an interactive effect was not evident.

### 5.6 Hypothesis 6: Effects Through Identification and Goal Setting/Feedback Interaction

Hypothesis 6 stated that identifying users in a GSS meeting and providing goal setting and feedback would have an interactive effect that would increase information sharing behavior and discourage unequal participation. For ease of understanding, Hypothesis 6 is broken into two separate sub-hypotheses discussed below.

#### 5.6.1 Hypothesis 6A:

Hypothesis 6A posited that identification and facilitator provided goal setting and feedback will have an interactive effect increasing user information sharing behavior. Analysis of data collected during the experiment, however, presented no support for this hypothesis.

#### 5.6.2 Hypothesis 6B:

Hypothesis 6B posited that anonymity and facilitator provided goal setting and feedback will have an interactive effect discouraging unequal participation from group members. Review of ANOVA results show no support for this statement.

## 5.7 Hypothesis 7: Effects Through Coincidental Feedback and Goal Setting/Feedback Interaction

Hypothesis 7 proposed that groups who do not receive assessment feedback will continue to show a difference based on the presence of coincidental feedback through comment labels. This hypothesis is discussed below.

### 5.7.1 Hypothesis 7A:

Review of ANOVA results for Hypothesis 7A show that the interactive effect was not evident.

## 5.8 Conclusions and Recommendations

This study began by looking at different structural and social contingencies that would help find the optimal configuration and administration of a GSS session. After analyzing the collected survey and observational data, only the theories of anonymity and coincidental feedback are partially supported. The experiment helped support the anonymity theory's belief that under anonymous conditions users would generate more intellectual comments. This similar finding supporting the benefits of anonymity has been found in other GSS studies and can be added to the GSS body of knowledge. Only one variable to measure user attitudes was found to support the coincidental feedback theory. This variable was the satisfaction with dynamics of the participant group. This found that users were more satisfied with the group when they received coincidental feedback when compared with being anonymous. This finding can also be added to the GSS body of knowledge. Besides these two findings, no evidence was available to

support the other hypothesis listed in this study. While the study found some results to help optimally configure a GSS session, much work must still be done to discover the optimal configuration of group support systems.

The Air Force is currently using group support systems to solve various problems throughout the Air Force. Prior research has shown the importance of getting users to submit as many ideas as possibly to arrive at an optimal solution. This study has demonstrated that anonymous conditions in a GSS meeting provided more intellectual comments than GSS meetings where members can be identified. Administrators of the group support systems DOME and RAPTR should use these findings and continue to leave group members anonymous. Looking at the data, all GSS conditions scored high on satisfaction with the system, ease of use, ability to communicate, and meeting utility. These results indicate that users are willing and able to use the tool to solve problems. The Air Force should continue to use group support systems since they have the potential to outperform traditional meetings.

### 5.9 Limitations and Recommendations for Future Research

A limitation to this study was the amount of time and exposure the subjects were given on the GSS. Even though the experiment lasted approximately two hours, the features of the GSS had to be scaled down to allow the groups to complete the tasks in a reasonable amount of time. Ideally, groups would be introduced to more features of the GSS, but this would warrant a longer experiment.

A second limitation to the study was group size. While this experiment used a group size of four, which is common among GSS experiments, a larger group may be

necessary to study the effects of anonymity and identification. For example, in a small group of four people, users may still be able to identify each other even in an anonymous condition. If the group was much larger, users would have a harder time identifying other members. Some real world group support systems have dozens of participants in a GSS meeting and larger group sizes would provide more external validity.

A third limitation was external validity of the experiment. While the tasks given to the participants to solve in the study are commonly used problem solving tasks, they still do not reflect real world problems that would be solved in a GSS session. A more realistic and beneficial experiment would be to observe real world GSS meetings and determine if findings in the laboratory can be carried over to the workplace. This is a potential area for future research since most of the research conduct on group support systems has been performed in the laboratory, few studies have been conducted outside the laboratory and no studies have been performed in an Air Force work environment. In particular the Air Force could look into performing similar "GSS introduction" tasks used in this experiment to allow users to become familiar with the system before they begin solving a real-world problem. Taking a short amount of time to perform a sample GSS session may save time in the long run since users may become more familiar with the system and more comfortable performing tasks on the GSS.

Another area for future research is that groups in this experiment were either given a goal and no facilitator provided feedback or a goal with facilitator provided feedback, either way all conditions received a goal. Another study that would create a condition where groups were not given a goal might be beneficial to look into. For instance, a goal may be providing enough information to the users to motivate them to



perform differently. This type of study would help determine whether or not goals provide valuable information to the GSS users.

## Appendix A: Moon Scenario

You are a member of a space crew originally scheduled to rendezvous with a mother ship on the lighted surface of the moon. Due to mechanical difficulties, however, your ship was forced to land at a spot some 200 miles from the rendezvous point. During re-entry and landing, much of the equipment aboard was damaged and, since survival depends on reaching the mother ship, the most critical items available must be chosen for the 200-mile trip.

The 15 items left intact and undamaged after landing are listed below. Your task is to rank them in terms of their necessity to your crew in reaching the rendezvous point. Place the number 1 by the most crucial item, the number 2 by the second most crucial, and so on through number 15, the least important.

- \_\_\_ Box of matches
- \_\_\_ First-aid kit containing injection needles
- \_\_\_ Five gallons water
- \_\_\_ Food concentrate
- \_\_\_ Life raft
- \_\_\_ Magnetic compass
- \_\_\_ One case dehydrated milk
- \_\_\_ Parachute silk
- \_\_\_ Portable heating unit
- \_\_\_ Signal flares
- \_\_\_ Solar-powered FM receiver transmitter
- \_\_\_ Stellar map (of the moon's constellation)
- \_\_\_ Two .45-caliber pistols
- \_\_\_ Two 100-pound tanks of oxygen
- \_\_\_ 50 ft. of nylon rope

## Appendix B: Desert Scenario

It is approximately 10:00 AM in mid August and you have just crash-landed in the Sonora Desert in southwestern United States. The twin engine plane, containing the bodies of the pilot and the co-pilot, has completely burned. Only the airframe remains. None of the rest of you have been injured. The pilot was unable to notify anyone of your position before the crash. However, he had indicated before impact that you were 70 miles south - southwest from a mining camp which is the nearest known habitation and that you were approximately 65 miles off the course that was filed in your Flight Plan.

Before the plane caught fire your Patrol was able to salvage the 15 items listed on the attached sheet. Your task is to rank these items according to their importance to your survival. Place the number 1 by the most crucial item, the number 2 by the second most crucial, and so on through number 15, the least important.

- \_\_\_ A pair of sunglasses per person
- \_\_\_ Book entitled "Edible Animals of the Desert"
- \_\_\_ Bottle of salt tablets (1000 tablets)
- \_\_\_ Compress kit and gauze
- \_\_\_ Cosmetic Mirror
- \_\_\_ Flashlight
- \_\_\_ Magnetic compass
- \_\_\_ One liter of water per person
- \_\_\_ One top coat per person
- \_\_\_ Parachute (red and white)
- \_\_\_ Penknife
- \_\_\_ Plastic Raincoat (large size)
- \_\_\_ Sectional Air Map of the Area
- \_\_\_ 2 liters of 100% proof vodka
- \_\_\_ .45 caliber pistol

Appendix C: Post-Test Questionnaire

Answer the questions using the following scale

- 1 Strongly Disagree
- 2 Disagree
- 3 Disagree Somewhat
- 4 Neither Agree Nor Disagree
- 5 Agree Somewhat
- 6 Agree
- 7 Strongly Agree

- \_\_\_\_\_ I would not mind working with this group again.
- \_\_\_\_\_ I am pleased with the performance of our group.
- \_\_\_\_\_ In my opinion, we worked effectively as a group.
- \_\_\_\_\_ I found the other group members easy to work with.
- \_\_\_\_\_ I enjoyed participating in the group activity.
- \_\_\_\_\_ Learning to use the tools and process provided was easy for me.
- \_\_\_\_\_ I found it easy to use the tools and process to share information.
- \_\_\_\_\_ I found it easy to use the tools and process to receive information.
- \_\_\_\_\_ I found it easy to use the tools and process to make sense of shared information.
- \_\_\_\_\_ I found it easy to use the tools and process to help my group complete the task.
- \_\_\_\_\_ The tools and processes helped us exchange information.
- \_\_\_\_\_ The tools and processes helped us make good use of the information we shared.
- \_\_\_\_\_ The tools and processes helped us to know about the things we agreed on.
- \_\_\_\_\_ The tools and processes helped us to focus on the points where we disagreed.
- \_\_\_\_\_ The tools and processes helped us to know the extent we achieved consensus.

Answer the questions using the following scale

- 1 Strongly Disagree
- 2 Disagree
- 3 Disagree Somewhat
- 4 Neither Agree Nor Disagree
- 5 Agree Somewhat
- 6 Agree
- 7 Strongly Agree

\_\_\_\_\_ I experienced few problems expressing my ideas to the other group members.

\_\_\_\_\_ I felt comfortable putting forward my own ideas.

\_\_\_\_\_ I had little trouble understanding the points made by other group members.

\_\_\_\_\_ I was able to comment on the ideas submitted by other group members during the session.

\_\_\_\_\_ I think the other group members received the information I shared.

\_\_\_\_\_ One or more of the group members tried to intimidate the others.

\_\_\_\_\_ One or more of the group members tried to force their opinions on the group.

\_\_\_\_\_ I felt inhibited from participating in the discussion because of the behavior of one or more of the other members.

\_\_\_\_\_ I felt pressure to conform to a particular viewpoint.

\_\_\_\_\_ One or more of the group members tried to dominate the discussion.

\_\_\_\_\_ Everyone in the group was very involved in the group's discussion.

\_\_\_\_\_ I got a lot of good ideas about ranking from the other members of my group.

\_\_\_\_\_ Everyone in my group seemed to contribute all of the ideas they had about the task.

\_\_\_\_\_ No one seemed to be holding back information.

Answer the questions using the following scale

- 1 Strongly Disagree
- 2 Disagree
- 3 Disagree Somewhat
- 4 Neither Agree Nor Disagree
- 5 Agree Somewhat
- 6 Agree
- 7 Strongly Agree

\_\_\_\_\_ My group shared a lot of information while we completed this task.

\_\_\_\_\_ My group received information on how well we shared information during the first task.

\_\_\_\_\_ Each member of my group knew how much they had contributed to the group during the first task.

\_\_\_\_\_ I knew how much information other members of my group shared during the first task.

\_\_\_\_\_ I could recognize the originator of most comments.

\_\_\_\_\_ Other group members could connect me to the comments I made.

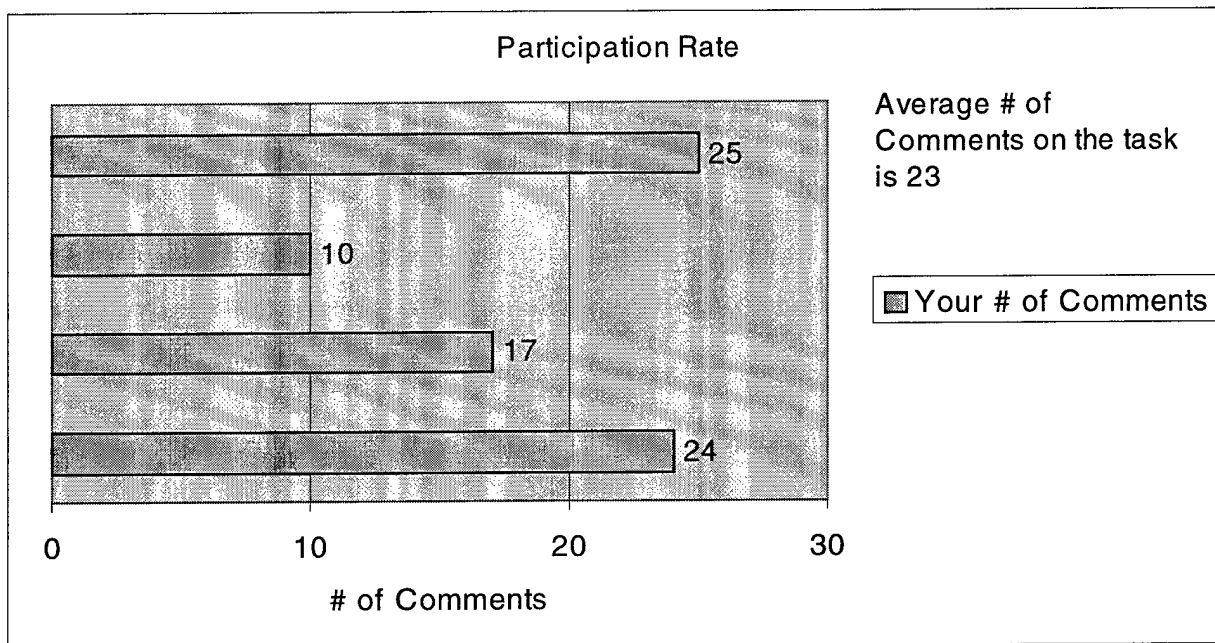
\_\_\_\_\_ Other group members knew when I made a contribution to the group.

\_\_\_\_\_ I could tell if someone was sharing more information than other members of the group.

\_\_\_\_\_ I could tell if someone participated less than other members of the group.

\_\_\_\_\_ Other group members could judge the extent that I participated in the group.

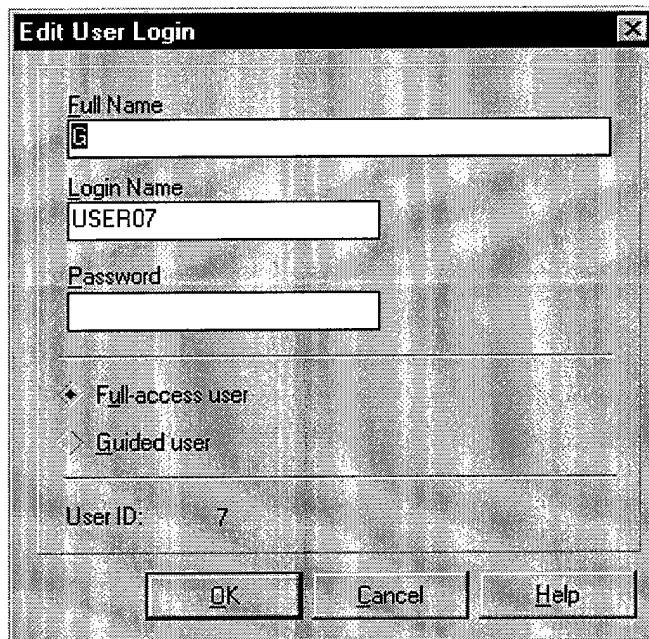
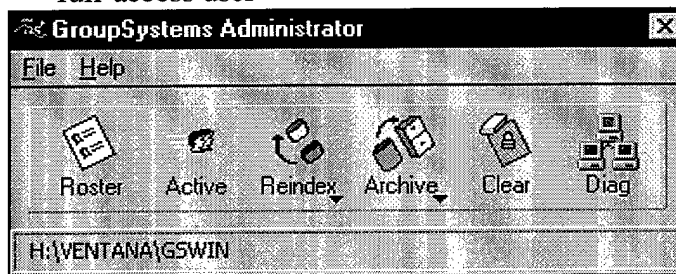
Appendix D: Feedback Chart Example



## Appendix E: Experiment Script

### GSS: Pre-Experiment Steps

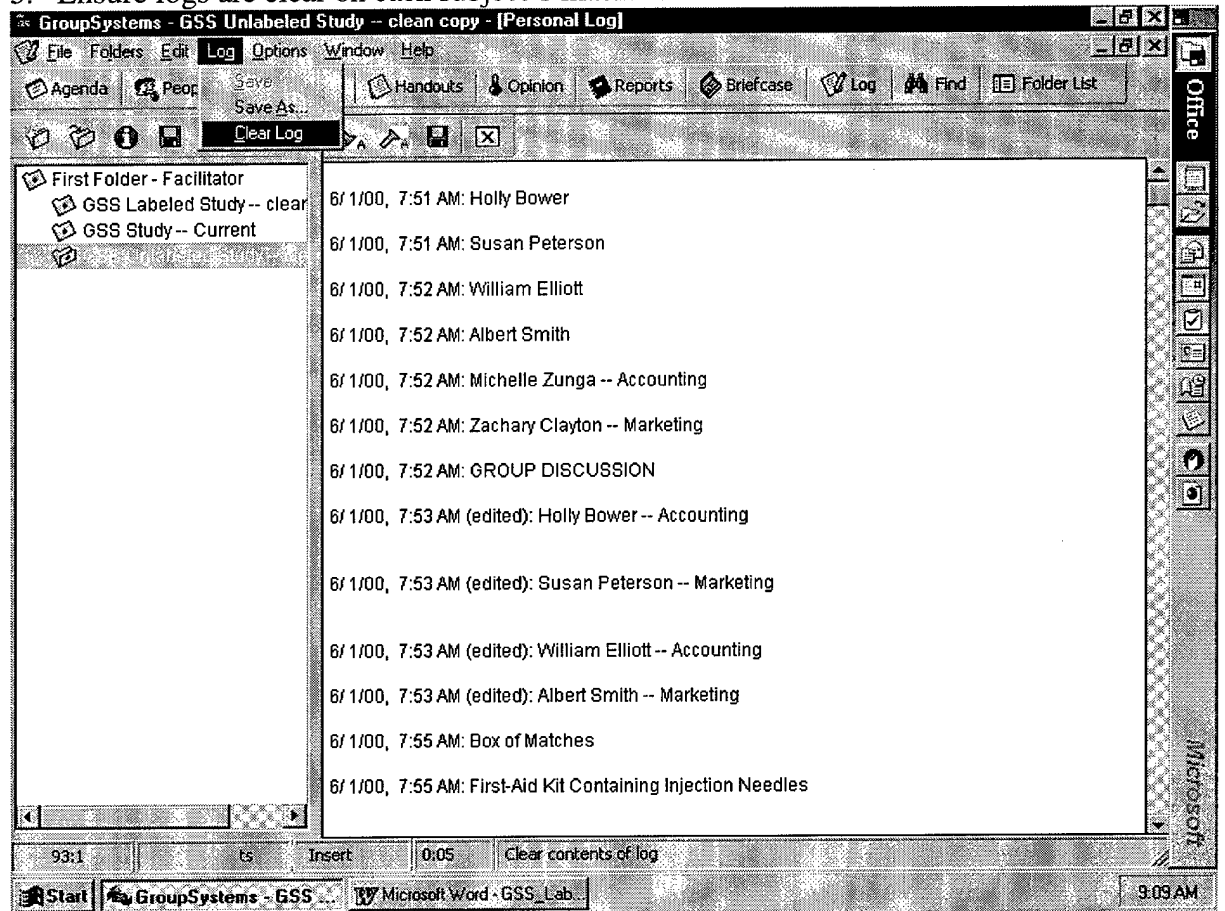
1. Ensure following items are available:
  - Big folder labeled consent forms
  - 4 Manila folders
    - Attached via paper clip are
      - Consent form
      - Demographic/Personality Questionnaire
      - 1 copy of Moon Scenario
2. Check out Projector and printer with paper
3. In Group System Admin, click on Clear, then open roster, edit user terminal, set to full-access user



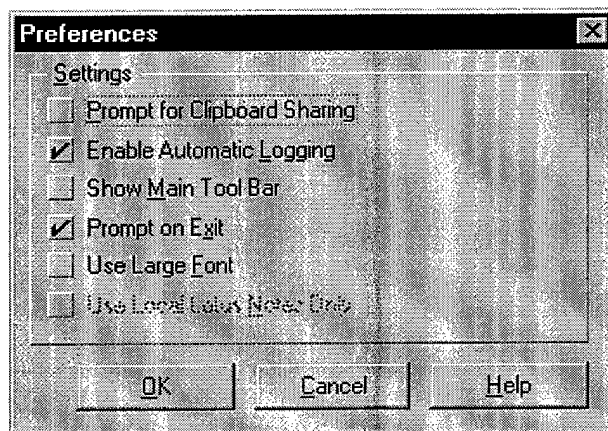
4. Start Group Systems WGE at Facilitator station and all user stations



5. Ensure logs are clear on each subject's machine.

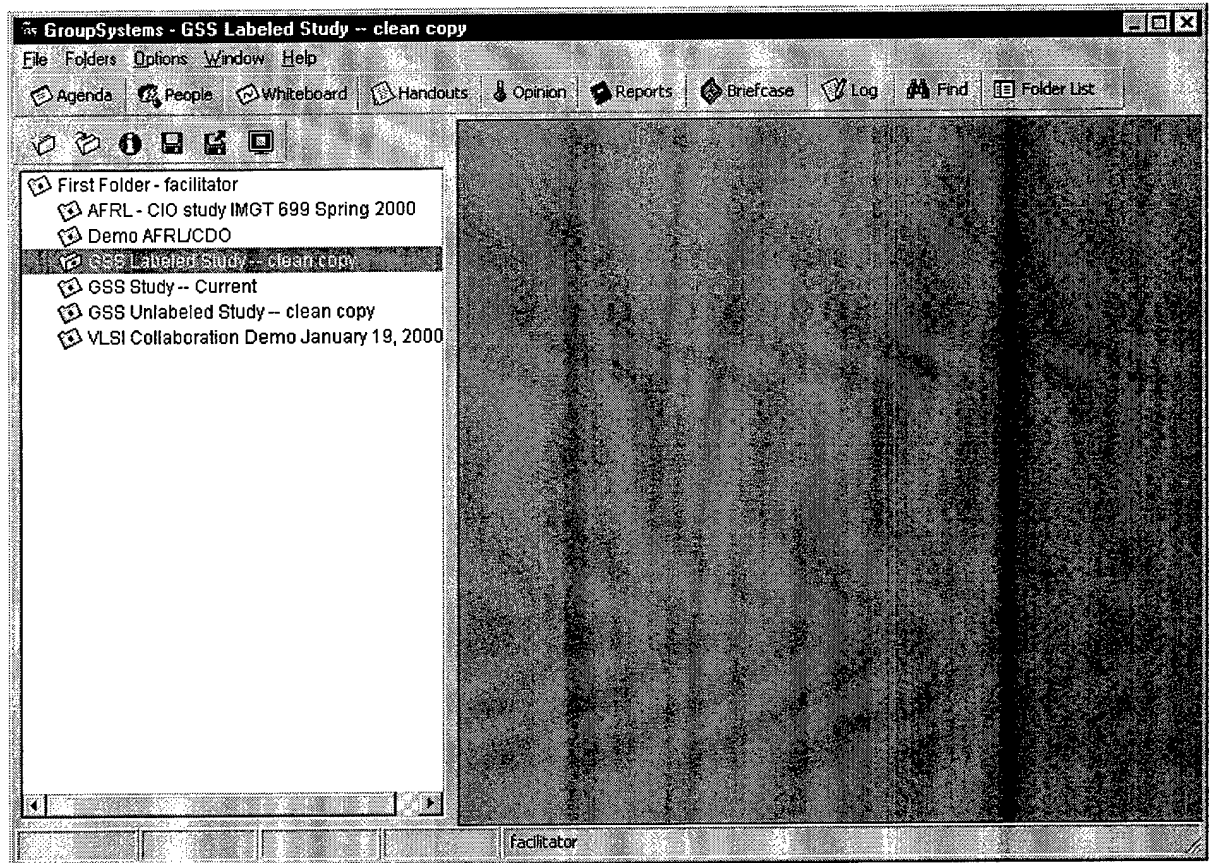


6. At each user station Under Options – Preferences check the following boxes

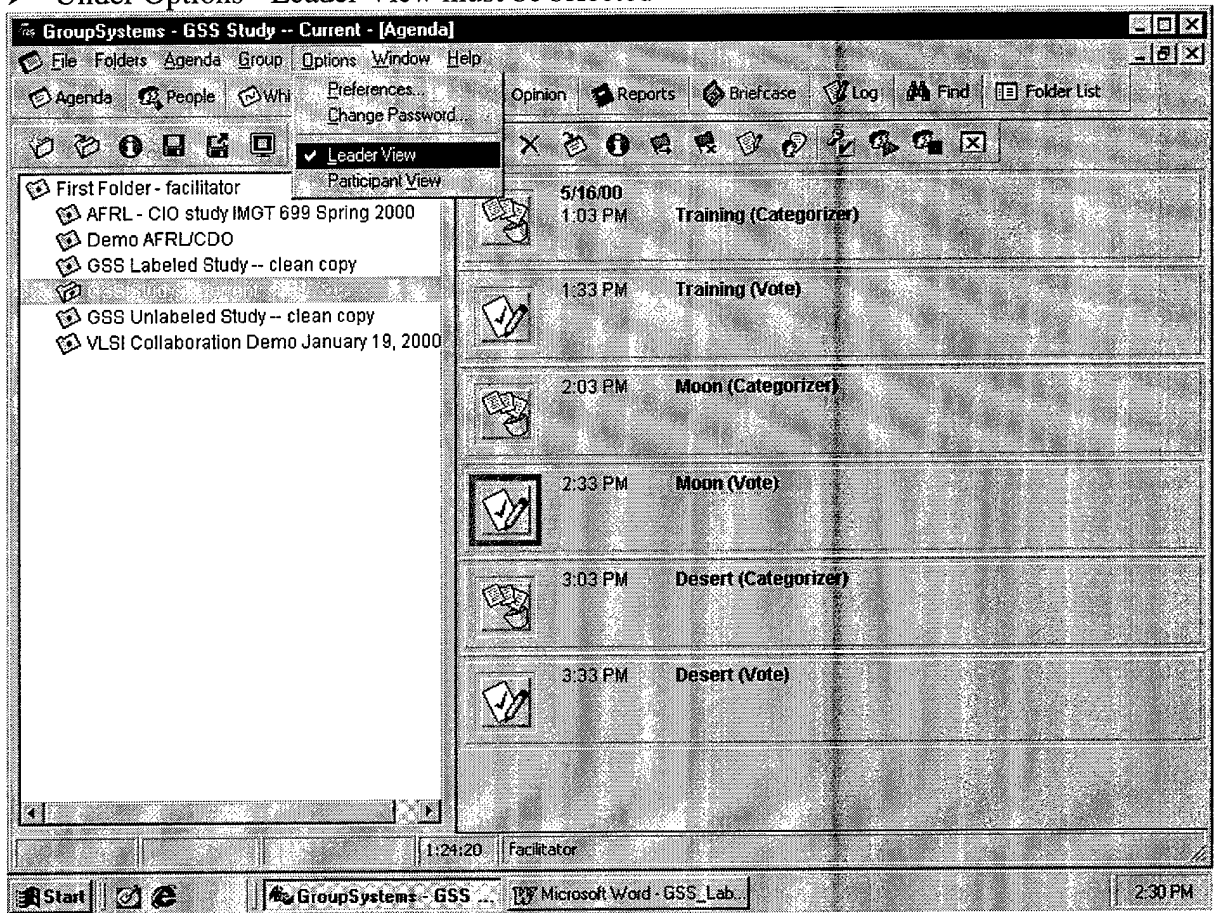


7. Ensure each participant station has a 3.5" floppy inserted in the drive

8. Copy all activities for session from:  
For a labeled session: GSS Labeled Study – clean copy  
For an unlabeled session: GSS Unlabeled Study – clean copy
9. Paste to GSS Study – Current



10. Configure each GSS station for EACH ACTIVITY on facilitator station
  - Under Options - Leader View must be selected



➤ Under Group – Group Settings the following boxes must be checked

**Group Settings** [X]

Participant Privileges

Apply To: **All users (default) \*** [Reset]

<input type="checkbox"/> Add Ideas	<input checked="" type="checkbox"/> View Comments
<input type="checkbox"/> Modify Ideas	<input checked="" type="checkbox"/> Add Comments
<input type="checkbox"/> Add Categories	<input type="checkbox"/> Modify Comments
<input type="checkbox"/> Modify Categories	<input type="checkbox"/> View Participation Meter
<input type="checkbox"/> Move Ideas to Category	<input type="checkbox"/> Multiple Comment Windows
<input type="checkbox"/> Copy Ideas to Category	<input type="checkbox"/> Use Private List
	<input type="checkbox"/> Annotate Comments

Leader

General Configuration

<input type="checkbox"/> Comment Numbers	<input type="checkbox"/> Version History
<input checked="" type="checkbox"/> Date and Time Stamps	<input checked="" type="checkbox"/> One Line per Idea
<input checked="" type="checkbox"/> Author Tag	<input checked="" type="checkbox"/> One Line per Category

[Save as Default] [OK] [Cancel] [Help]

**Group Settings** [X]

Participant Privileges

Apply To: **All users (default) \*** [Reset]

<input type="checkbox"/> Add Ballot Items	<input type="checkbox"/> Multiple Comment Windows
<input type="checkbox"/> Modify Ballot Items	<input type="checkbox"/> View Participation Meter
<input checked="" type="checkbox"/> View Comments	<input checked="" type="checkbox"/> Allow Bypass
<input type="checkbox"/> Add Comments	<input checked="" type="checkbox"/> Cast and Exit
<input type="checkbox"/> Modify Comments	<input type="checkbox"/> View Results
<input type="checkbox"/> Annotate Comments	<input type="checkbox"/> View Voter Comparison
	<input checked="" type="checkbox"/> Modify Votes

Leader

General Configuration

<input type="checkbox"/> Comment Numbers	<input type="checkbox"/> Randomized Ballot Items
<input checked="" type="checkbox"/> Date and Time Stamps	<input type="checkbox"/> Version History
<input checked="" type="checkbox"/> Author Tag	

[Save as Default] [OK] [Cancel] [Help]

11. Researchers Label Subjects Monitors with placard (if applicable)
  - Ensure four placards (blue, green, red and yellow) are available

## Prep Room: Introduction

1. When subjects arrive, introduce yourself. Have subjects wait in the prep room. Tell subjects "The task will begin when all participants have arrived."
2. Once all participants have arrived, have all subjects sit down in the prep room.
3. Facilitator says: "Welcome to the study. I'm XX and this is XX. We are AFIT students conducting an experiment for our Masters degree. We will be asking you some questions about yourself. Our study looks at how different types of groups interact to solve a problem. During the course of this experiment you will be asked to complete three questionnaires, receive some group interaction training, and conduct tasks individually and as a group. About half way through this two hour experiment you will be given a short break."
4. Facilitator says: "My assistant will now hand out a manila folder with some attached information. Please don't look at the attached information until asked."
5. Assistant provides participants with manila folder.
6. Facilitator says: "To begin, please remove the consent-form from the manila folder. This form indicates your rights as a participant in the study. Please read the consent form and print and sign your name at the bottom of the page. Your participation is voluntary. If at any time you want to stop please let the facilitator know."
7. Subjects read and sign (if applicable) Consent Form
8. Assistant collects consent forms
9. Facilitator says, "This is the only place your name will be recorded during this experiment."
10. Assistant puts consent forms in big folder labeled consent forms.
11. Facilitator says: "We would now like you to fill out the individual characteristics questionnaire attached to the manila folder. All responses to this questionnaire are completely confidential and will not be associated with you as an individual. Use the rating scale provided to indicate how accurately each statement describes you. Think about yourself as you generally are now and not as you wish to be in the future. Please read each statement carefully. Does anyone have any questions?"
12. Subjects complete questionnaire.
13. Facilitator says: "Please place the questionnaire in the manila folder."

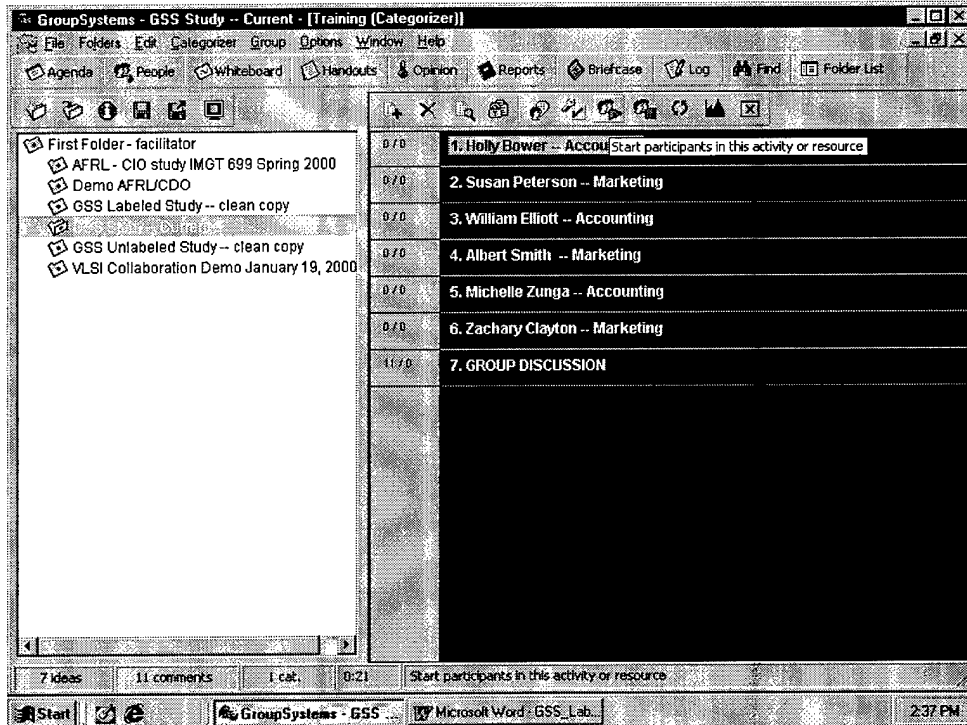
14. Facilitator says: "Now lets complete a problem solving task individually. Please read the scenario and complete the exercise. It will take you approximately 5 minutes to complete the exercise. If you finish early, please remain quiet until everyone completes the exercise. Please remove the scenario from your manila folder."
15. Facilitator says: "Please begin."
16. Subjects individually complete Moon Scenario
17. Facilitator says: "Please place the Moon Scenario in the manila folder."
18. Facilitator says: "Before we move to another room let's discuss group decision making and problem solving in general. The first step is for the group to discuss the problem and all pertinent issues related to the problem. One method often used to do this is "brainstorming" during which ideas are freely generated and not judged on quality or feasibility. Once the brainstorming session is complete, the group then attempts to reach consensus on a solution. This does not necessarily mean all individuals completely agree with the groups' decision, but the decision is one that all can endorse. There are different methods groups use to reach consensus, one of which is voting. If the results of the group vote indicate agreement, then consensus is reached. If the group does not have agreement, further discussion may be required to reach consensus. Remember the purpose of this study is to look at how different types of groups interact to solve a problem. Does anyone have any questions before we move to the next phase of the study."
19. Facilitator says: "Please pick up your manila folder and follow me."
20. Assistant moves subjects to Task Room (GSS Room)

## GSS Room: Training

1. Assistant says: "Please take a seat at one of the computers."
2. Subjects sit at one of the GSS stations
3. Training Script
  - Facilitator flips UP projector
  - As you introduce options in GSS point to them on the screen.
  - Facilitator says: "A group support system is made up of software, computers and a facilitator. Each of your computers has Group System software (point to screen) loaded on it. This software and hardware is often used in the Air Force to increase the effectiveness of decision-making groups."
  - Facilitator says: "We will only be introducing you to a small set of the capabilities of a GSS because of our limited time. As you use this software, please only use the capabilities we introduce to you so we can minimize the impact on your time and ours. For the purposes of this study we will be using two GSS tools: Categorizer and Vote."
  - PAUSE
  - Facilitator says: "Before we begin the actual group problem-solving scenario, we will first guide you through a brief training session. You will be introduced and allowed to practice with GSS Categorizer and Vote tools. Let's begin."

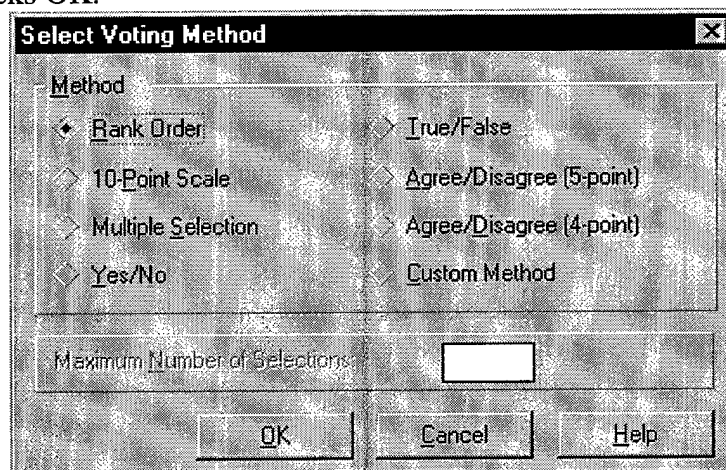


➤ Facilitator starts participants in Training (Categorizer)

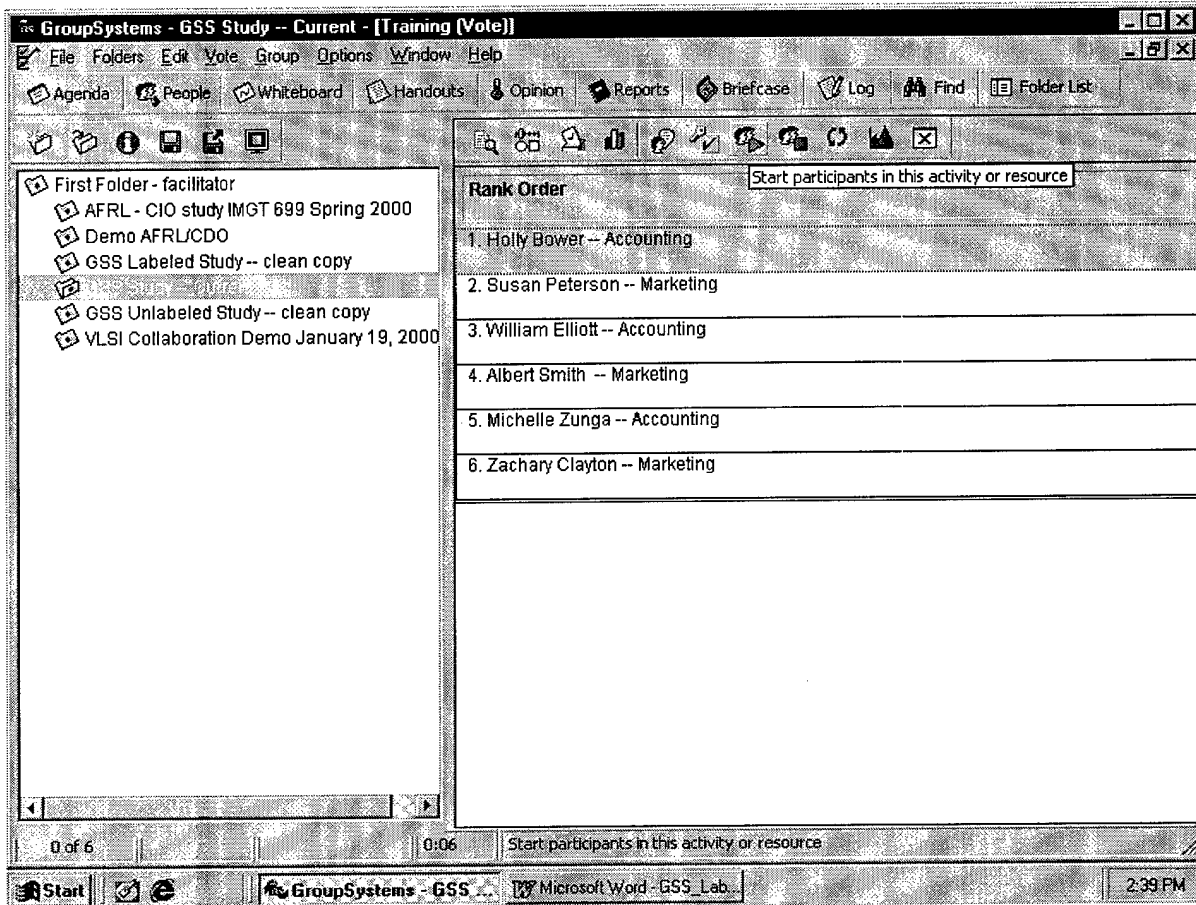


- Facilitator says: “At this point, you should have been invited to join an activity. Please click on Yes.” (Note to Researcher: In some cases this field will be blank.)
- Facilitator says: “You may receive another log-in prompt. Please click on OK.”
- Facilitator says: “You should now see a list of six names and a category called “Group Discussion”. Double Click on Group Discussion.”
- Facilitator says: “A new window should appear on your screen. This is a discussion area where you will provide comments for the group problem-solving task. At this point your cursor should be in the large field at the bottom of the window. This is the box where you enter your comments. Please type in one method you would use to rank order the list of names.”
- PAUSE
- Facilitator says: “Click on the Submit key at the bottom of the window on the left. The comment you entered should appear in the notepad above the large field. Everyone in the GSS session will be able to see all comments submitted. Does anyone not see other’s comments?”

- For a Labeled Session the facilitator says: “If you look at the end of each comment you will see that the GSS software labels the person who entered the comment. You should see our choice of labels (blue, green, red or yellow) at the end of each comment.”
- Facilitator says: “As your group brainstorms and you enter your individual comments, all of you will be able to see the inputs of the entire group. Reading others’ thoughts and ideas allows you to “piggyback” off each other which should improve your group brainstorming process.”
- Facilitator says: “Now that we’ve shown you how to enter comments, we will now have you perform a practice session before we move into the problem-solving task. Your group’s task is to discuss possible ways your group could rank order the names. Any and all comments are valuable, including ideas on how to rank the names, and your thoughts/opinions of each other’s ideas. You will have a couple of minutes to discuss the task as a group. At the end of the session we will measure group consensus on how you ranked the list by introducing you to the GSS Vote tool.”
- Facilitator says: “Please begin discussing the task.”
- Assistant notifies facilitator when time reaches 5 minutes.
- Facilitator says: “Please stop discussing the task at this time.”
- Facilitator says: “You’ve had plenty of time to discuss possible ways to rank order the list of names. Now it’s time to actually rank the names. Hopefully, during the discussion period, your group decided how to rank the list. We will now introduce you to the GSS Vote tool where each of you will individually rank the list of names. Please close the Group Discussion window.”
- Facilitator closes training categorizer and selects voting method for ballot and clicks OK.

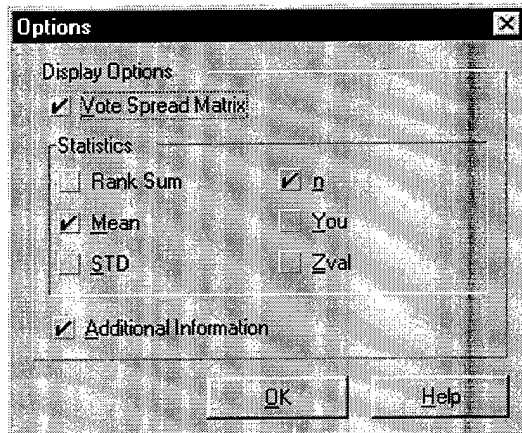


➤ Facilitator: Start participants in Training (Vote).

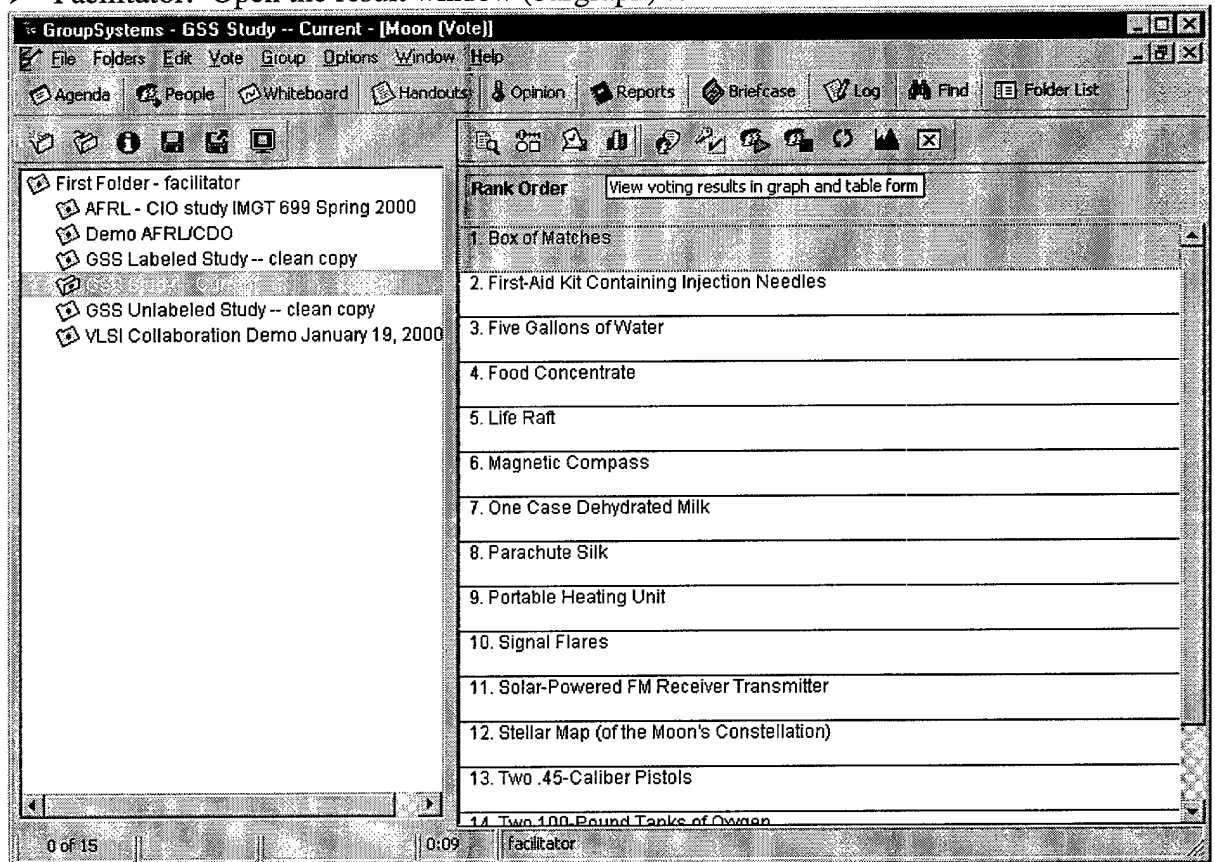


- Facilitator says: “You have been invited to join the Voting activity. Please click yes. Now you should see the original list of names. You change the sequence of the list by clicking and dragging an item to the position in the list you wish to move it. Please begin voting by re-ordering the list now.”
- PAUSE
- Facilitator says: “Once you are satisfied with your list order, cast your ballot by clicking on the “cast ballot” icon, which is the 2<sup>nd</sup> from the left. You will receive a dialogue box asking you to confirm your ballot. Please click yes and wait for further instructions.

➤ Ensure voting graph tool is set as follows:



➤ Facilitator: Open the result window (bargraph) to monitor individual votes.



- When n=number of participants, the group is done. Display the results with the projector and explain the level of group consensus.

	Ballot Item	1	2	3	4	5	6	Mean	n
1	Holly Bower -- Accounting	0	0	0	0	0	0	-	0
2	Susan Peterson -- Marketing	0	0	0	0	0	0	-	0
3	William Elliott -- Accounting	0	0	0	0	0	0	-	0
4	Albert Smith -- Marketing	0	0	0	0	0	0	-	0
5	Michelle Zunga -- Accounting	0	0	0	0	0	0	-	0
6	Zachary Clayton -- Marketing	0	0	0	0	0	0	-	0

Selected row: Holly Bower -- Accounting

Total number of voters (N): 0  
 Group consensus (1.00 = most consensus): 0.00  
 Your agreement with the group results: -1.00

- Facilitator says: “During the actual problem-solving tasks following this training, your group will be given 5 minutes after the initial vote to allow your group to determine if everyone is satisfied with the final solution, or if further discussion is needed.”

4. Training exercise complete.
5. Facilitator says: “I will now be closing the training session and beginning the first exercise. Please do not enter any information until instructed.”
6. Facilitator stops participants in Training (Categorizer).
7. Facilitator stops participants in Training (Vote).
8. Facilitator flips DOWN projector

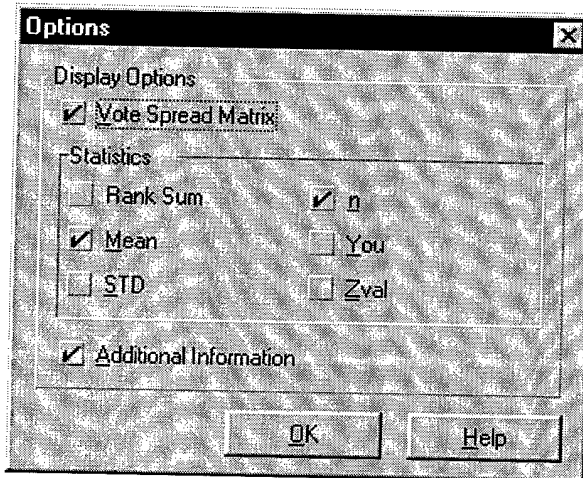
# GSS Room: Experiment One

## 1. Moon Scenario Script

- Facilitator says: "You will have 15 minutes to discuss the scenario as a group. The scenario you will be discussing is the same one you did previously as individuals. At the end of the 15 minutes you will each rank order the list individually. The ranking results will be consolidated as a group to indicate how well the group reached consensus. At this time the group will have another 5 minutes to determine if you have reached consensus. If the group did not reach consensus you should try to resolve any differences. The group will then individually rank the items again."
  
- Facilitator says: "During the 15-minute discussion period, focus on discussing each item's merits, not on where each item should be ranked. You will be able to rank order the list at the end of the 15 minutes. It is important to focus on discussion not on how to rank order since this could shut down conversation. It is normal to experience a lull during conversation, but this is part of group dynamics."
  
- Facilitator says: "Researchers will not answer questions dealing with the scenario during this session, but will assist with GSS questions. We will let you know when there are 5 and 2 minutes left in the session."
  
- Facilitators start participants in Moon Scenario -- Categorizer.
  
- Facilitator says: "At this point, you should have been invited to join an activity. Please click on Yes." (Note to Researcher: In some cases this field will be blank.)
  
- Facilitator says: "Now you should be prompted to enter an author tag. Please click on OK."
  
- Facilitator says: "You have a list of 15 items and a category called "Group Discussion". Double Click on Group Discussion."
  
- Facilitator says: "Are there any questions?"
  
- Facilitator says: "You may begin group discussion on the Moon Scenario."

Time (min/sec)	Facilitator Entry
10:00	FACILITATOR INPUT: YOU HAVE 5 MINUTES LEFT TO DISCUSS THE SCENARIO IF NEEDED.
13:00	FACILITATOR INPUT: YOU HAVE 2 MINUTES LEFT TO DISCUSS THE SCENARIO IF NEEDED.

- Subjects finish initial discussion.
- Facilitator says: "Please close your Group Discussion Window."
- Facilitator says: "We will now open a voting tool for your use."
- Facilitator starts Moon (Vote).
  
- Facilitator says: "You have been invited to join the Voting activity. Please click yes. Now you should see the original list of items. Please begin voting by re-ordering the list now just as you did in the training session."
  
- PAUSE (1 minute)
  
- Facilitator says: "Once you are satisfied with your list order, cast your ballot by clicking on the "cast ballot" icon, which is the 2<sup>nd</sup> from the left. You will receive a dialogue box asking you to confirm your ballot. Please click yes and wait for further instructions."
  
- Ensure voting graph tool is set as follows:



- Facilitator: Open the result window to monitor individual votes. When n=number of participants, the group is done. Display the results with the projector and explain the level of group consensus.



**Vote Spread - Moon (Vote)**

	Ballot Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Mean	n
1	Two 100-Pound Tanks of Oxygen	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	3
2	Five Gallons of Water	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	2.00	3
3	Stellar Map (of the Moon's Craters)	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3.00	3
4	Food Concentrate	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	4.33	3
5	Solar-Powered FM Receiver	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	4.67	3
6	Parachute Silk	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	6.00	3
7	50 ft. of Nylon Rope	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	7.00	3
8	Life Raft	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	8.00	3
9	First-Aid Kit Containing Injectable	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	9.67	3
10	Two .45-Caliber Pistols	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	10.33	3
11	One Case Dehydrated Milk	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	11.00	3
12	Portable Heating Unit	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	11.33	3
13	Signal Flares	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	12.67	3
14	Magnetic Compass	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	14.33	3
15	Box of Matches	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	14.67	3

**Selected row:** Two 100-Pound Tanks of Oxygen

**Total number of voters (N):** 3  
**Group consensus (1.00 = most consensus):** 0.98  
**Your agreement with the group results:** -1.00

Options    Sort    Graph    Print    Shift    Close    Help

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- Facilitator says: “You have the next five minutes to discuss the results further using the GSS. If you are satisfied with the results let the facilitator know. If not you will be given the chance to vote again at the end of the five minutes.”
- If group is satisfied with original outcome then go to STEP 2 else do the following:
  - Facilitator says: “Go ahead and vote again.”
  - Facilitator: Open the result window to monitor individual votes. Assistant lets Facilitator know when the group is done. Display the results with the projector and explain the level of group consensus.
  - Facilitator says: “These are your final results. “

2. Facilitator stops Moon (Vote).
3. Facilitator flips DOWN projector
4. Facilitator says: “Feel free to take a quick 5-minute break in the prep room. Please don’t discuss what color you are.”



5. Assistant counts number of comments per subject and creates appropriate feedback and goal charts.
6. Facilitator stops Subjects in Moon Scenario -- Categorizer

## Prep Room: Feedback

1. Subjects come back from break
2. Assistant says: "We would now like to give you a short questionnaire concerning your groups ranking on the task you just completed."
3. Assistant provides subjects with 5 item commitment to ranking Questionnaire
4. Goal and No Feedback or Goal Feedback Script
5. Assistant says: "During the group exercise just completed, your group worked together to solve a problem. Studies have shown that when individual members of the group participate fairly equally, the meeting will produce better results. For example, as you can see in the graph (show graph of equal proportion) the participation rates were almost equal among the group participants. The next graph shows participation rates where participants did not participate equally. What problem can result from the unequal levels of participation?"
6. (Wait for group to respond... Look for an answer such as subject 4 did not participate as much and he may have had the best answer while subject 2 dominated the meeting with his ideas. If group does not submit the answer looked for, provide an explanation.
7. Assistant says: "Studies have also shown that the more comments input during a meeting, the greater the chances to reach a high quality decision. In other words, the more ideas that are generated the better the chance the optimum solution will be found in those comments."
8. Assistant says: GOAL STATEMENT: "In the next task, try to participate equally while maximizing your number of comments."
9. IF GIVING FEEDBACK READ THE NEXT SECTION, IF NOT STOP AND  
PROCEED TO NEXT TASK
10. Assistant says: "I will now show each of you a graph showing your participation level in the previous task."
11. Assistant provides an explanation of the feedback.
12. Assistant says: "Next to the bar graph of each individual show their score. Once all subjects have looked at the paper give them the paper to start the desert scenario."

13. Assistant says: "You will now be given 5 minutes to complete the desert scenario. Please follow the directions on the page."
14. Subjects individually complete Desert Scenario
15. Assistant says: "We will now move to the Task room to continue the task. Remember the goal to participate equally while maximizing your number of comments. Please take your desert scenario and questionnaire with you and place it in your manila folder."
16. Researchers move subjects to Task Room (GSS Room)

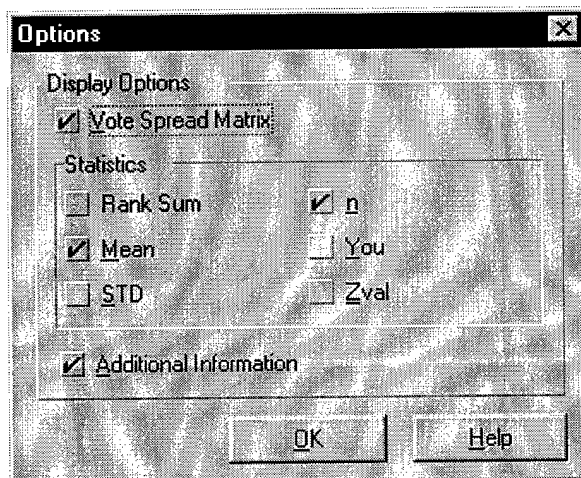
# GSS Room: Experiment Two

## 1. Desert Scenario Script

- Facilitator says: "You will have 15 minutes to discuss the scenario as a group. The scenario you will be discussing is the same one you did previously as individuals. At the end of the 15 minutes you will each rank order the list individually. The ranking results will be consolidated as a group to indicate how well the group reached consensus. At this time the group will have another 5 minutes to determine if you have reached consensus. If the group did not reach consensus you should try to resolve any differences. The group will then individually rank the items again."
  
- Facilitator says: "During the 15-minute discussion period, focus on discussing each item's merits, not on where each item should be ranked. You will be able to rank order the list at the end of the 15 minutes. It is important to focus on discussion not on how to rank order since this could shut down conversation. It is normal to experience a lull during conversation, but this is part of group dynamics."
  
- Facilitator says: "Researchers will not answer questions dealing with the scenario during this session, but will assist with GSS questions. We will let you know when there are 5 and 2 minutes left in the session."
  
- Facilitators start participants in Desert (Categorizer).
  
- Facilitator says: "At this point, you should have been invited to join an activity. Please click on Yes." (Note to Researcher: In some cases this field will be blank.)
  
- Facilitator says: "Now you should be prompted to enter an author tag. Please click on OK."
  
- Facilitator says: "You have a list of 15 items and a category called "Group Discussion". Double Click on Group Discussion."
  
- Facilitator says: "Are there any questions?"
  
- Facilitator says: "You may begin group discussion on the Desert Scenario."

Time (min/sec)	Facilitator Entry
10:00	FACILITATOR INPUT: YOU HAVE 5 MINUTES LEFT TO DISCUSS THE SCENARIO IF NEEDED.
13:00	FACILITATOR INPUT: YOU HAVE 2 MINUTES LEFT TO DISCUSS THE SCENARIO IF NEEDED.

- Subjects finish initial discussion.
- Facilitator says: "Please close your Group Discussion Window."
- Facilitator says: "We will now open a voting tool for your use."
- Facilitator starts Desert (Vote).
  
- Facilitator says: "You have been invited to join the Voting activity. Please click yes. Now you should see the original list of items. Please begin voting by re-ordering the list now."
  
- PAUSE (1 minute)
  
- Facilitator says: "Once you are satisfied with your list order, cast your ballot by clicking on the "cast ballot" icon, which is the 2<sup>nd</sup> from the left. You will receive a dialogue box asking you to confirm your ballot. Please click yes and wait for further instructions."
  
- Ensure voting graph tool is set as follows:



- Facilitator: Open the result window to monitor individual votes. When n=number of participants, the group is done. Display the results with the projector and explain the level of group consensus.
- Facilitator flips UP projector

**Vote Spread - Desert (Vote)**

	Ballot Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Mean	n
1	One Liter of Water per Person	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.00	3
2	Bottle of Salt Tablets (1000 T	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	2.00	3
3	Parachute (Red and White)	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	3.33	3
4	Cosmetic Mirror	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	3.67	3
5	Plastic Raincoat (Large Size)	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	5.00	3
6	.45-Caliber Pistol	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	6.33	3
7	Compress Kit and Gauze	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	6.67	3
8	2 Liters of 100% Proof Vodka	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	8.33	3
9	One Top Coat per Person	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	8.67	3
10	Penknife	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	10.33	3
11	Flashlight	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	10.67	3
12	Book Entitled "Edible Animals	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	12.00	3
13	A Pair of Sunglasses per Per	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	13.00	3
14	Magnetic Compass	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	14.00	3
15	Sectional Air Map of the Area	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	15.00	3

**Selected row:** One Liter of Water per Person

**Total number of voters (N):** 3  
**Group consensus (1.00 = most consensus):** 0.99  
**Your agreement with the group results:** -1.00

Options   Sort   Graph   Print   Shift   Close   Help

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- Facilitator says: “You have the next five minutes to discuss the results further using the GSS. If you are satisfied with the results let the facilitator know. If not you will be given the chance to vote again at the end of the five minutes.”
- If group is satisfied with original outcome then go to STEP 2 else do the following:
  - Facilitator says: “Go ahead and vote again.”
  - Facilitator: Open the result window to monitor individual votes. Assistant lets Facilitator know when the group is done. Display the results with the projector and explain the level of group consensus.
  - Facilitator says: “These are your final results. “
- 2. Researcher stops Desert (Vote).
- 3. Facilitator flips DOWN projector
- 4. Facilitator says: “Lets go back to the prep room to finish up.”

## Prep Room: Wrap-Up

1. Assistant provides subjects with Post-Session Questionnaire
2. Subjects complete Post-Session Questionnaire
3. Assistant debriefs subjects

“The experiment you just participated in was designed to measure the effect of feedback and goal setting on group performance, compare different levels of anonymity in a meeting on group performance, study ideation over time, and evaluate the influence of personality types on groups.”

“The experiment collected data on the quantity of comments provided, the quality of group decision, the timing of ideas generated, and participation rates from various personality groups.”

“I would like to thank you for your participation in this experiment. Do you have any other questions about the experiment you participated in today or on Group Support Systems?”

[Pause for questions.]

“Please, if you know others who are likely to participate in this experiment, please keep the details of the experiment to yourself in order to avoid biasing our final results and jeopardizing the continuation of this study.”

4. Researchers collect all handouts, data, disks, etc. and ensures all are labeled

Appendix F: Consent Form

Study Overview

Welcome to the experiment. The following is a general description of the study and a reminder of your rights as a potential subject. As in any study, your participation is completely voluntary. If now, or at any point during the study, you decide that you do not want to continue participating, please let the experimenter know and you will be dismissed without penalty. Also, please remember that your name will not be associated with any of the information that you provide during the study. All of the information you provide is absolutely anonymous and confidential.

In this study, you will be working as part of a group to complete two group tasks. You will also be asked to complete two questionnaires during the study. You will first be given a questionnaire to complete, then you will complete the first task as a group, after a short break you will be given the second task to complete as a group, and finally, you will be given a second questionnaire to complete. The experimenter will give you more specific instructions later in the study. If you have any questions or concerns at this time, please inform the experimenter.

For further information

The Air Force Institute of Technology faculty members responsible for conducting this research are Maj. Michael Morris and Maj. Paul Thurston. They would be happy to address any of your questions or concerns regarding this study. Maj. Morris can be reached at 255-3636 ext 4578 and Maj. Thurston can be reached at 255-6565 ext 4315.

If you would like to participate in this study, please sign in the space provided. Your signature indicates that you are aware of each of the following: 1) the general procedure to be used in this study, 2) your right to discontinue participation at any time, and 3) you and your name will not be associated with any of the information you provide.

Printed Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

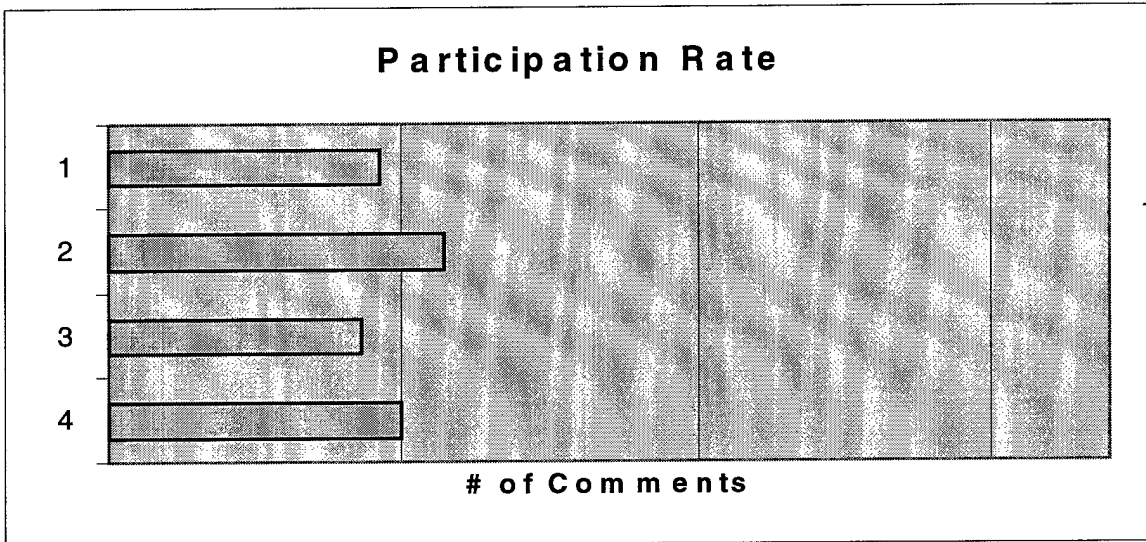


Appendix G: List of Names

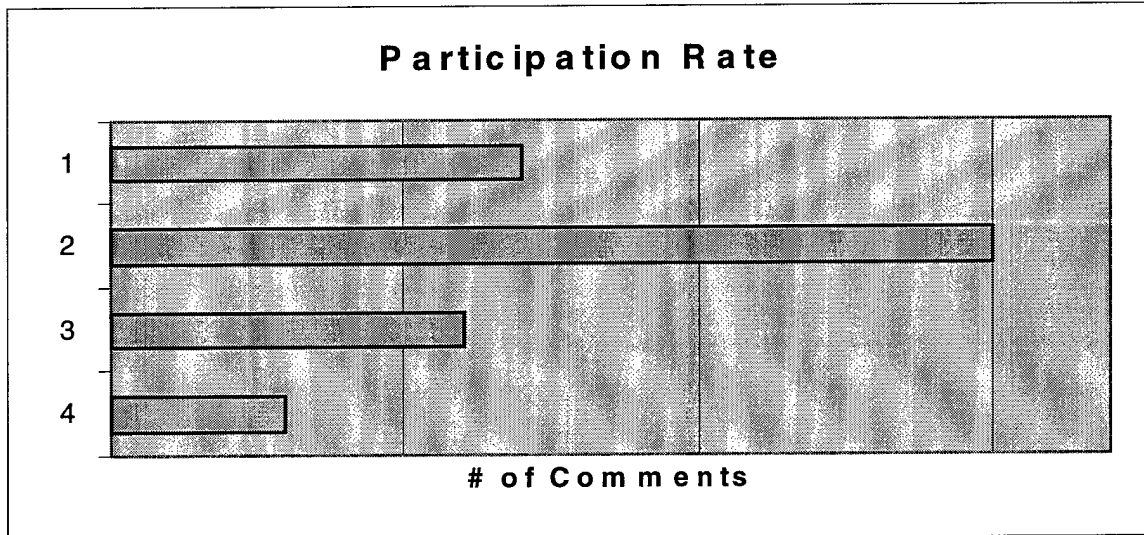
- \_\_\_\_\_ Holly Bower - Accounting
- \_\_\_\_\_ Zachary Clayton - Marketing
- \_\_\_\_\_ William Elliot - Accounting
- \_\_\_\_\_ Albert Smith - Marketing
- \_\_\_\_\_ Susan Peterson - Marketing
- \_\_\_\_\_ Michelle Zunga - Accounting

Appendix H: Participation Rate Charts

Equal Participation



Unequal Participation



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## Vita

Captain Gary D. Denney was born in Dayton, Ohio and graduated from Wayne High School in Huber Heights, Ohio in 1988. He entered undergraduate studies at Wright State University in Dayton, Ohio where he graduated with a Bachelor of Science degree in Management Information Systems in August 1992. He received his commission through Detachment 643 AFROTC at Wright State University.

His first assignment was at Robins AFB where he was a Deputy Accounting and Finance Officer. After changing career field to communications-information, he was assigned to Falcon AFB, Colorado in 1994, where he served as a software tester for the global positioning system. In July of 1997 he was assigned to Patrick AFB, Florida where he tested new modifications for Air Force space launch facilities. In August 1999 he entered the Graduate School of Engineering and Management, Air Force Institute of Technology. Upon graduation, he will be assigned to HQ ACC at Langley AFB, Virginia.

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<b>14. ABSTRACT</b>  A group support system (GSS) uses a combination of networked personal computers, software, and human facilitation to improve the group decision-making process. Group support systems are being used in the Air Force today in a variety of capacities and in particular by the Warner-Robins Air Logistics Center (WR-ALC) to assess acquisition risks. Prior GSS research has found that certain structural and social dimensions of GSS designs might influence whether optimal process improvements take place. However, the dimensions that positively influence group performance have continued to be a matter of debate.  This thesis looked at several structural and social contingencies to explore possible explanations for the mixed results found in GSS research. The study examined the effect of: anonymity, identification, self-regulation, and facilitator provided feedback on user information sharing behavior, quality of the group decision, unequal participation among group members, and user attitudes with the GSS meeting. The results of the study indicated that the anonymity theory was partially supported since users in an anonymous condition provided more intellectual comments than any other condition. In addition, the self-regulation theory was partially supported since users were found to have more satisfaction with the GSS meeting in this treatment.								
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