9-1998

Impact of Facilitator Co-Location and Alignment on the Efficacy of Group Support Systems Employed in a Distributed Setting

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THESIS

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The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

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THESIS

Presented to the Faculty of the Graduate School of Logistics

and Acquisition Management of the Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Information Resource Management

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September 1998

Acknowledgements

It would have been impossible to accomplish this study without the guidance and support of several people. I first would like to express my gratitude to Captain Cassie B. Barlow, PhD, USAF of the Sustainment Logistics Branch, Air Force Research Laboratory, for suggesting the topic of this research effort, sponsoring data collection, and serving as an advisor for thesis effort throughout. Thanks too to my reader Dr. Alan Heminger for his efforts to ensure the historical accuracy of this work. I am similarly indebted to Dr. Kenneth Graetz, PhD, of the University of Dayton for his inputs to this work and for generously allowing me the use of the school's laboratory to accomplish data collection and composition of the original draft of this thesis.

Special thanks and a deep sense of indebtedness go to my advisor Major Paul Thurston who taught me that the process of building a thesis was at least as important as the final product itself. Thank you sir. Your guidance infinitely improved this work, brought rigor to my approach, and significantly enhanced the quality of the education and the experience I gained in my time at AFIT.

Finally to my wife, who provided my inspiration and sacrificed so much to allow me to pursue my goal of obtaining an in-residence graduate degree, I express my deepest gratitude. Absolutely none of this would have happened without you Jenny.

Jeffrey A. Lea

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Abstract

Group Support Systems (GSSs) are a combination of hardware, software, and human facilitation designed and employed to increase the effectiveness and efficiency of decision-making groups. Engineers at the Sustainment Logistics Branch of the Air Force Research Laboratory have recently proposed employing the technology in a distributed setting to conjoin geographically separated members of decision-making groups in order to facilitate the reengineering of logistics processes in an any place/any time environment.

To date GSSs have been studied and employed primarily in the same time/same place setting. Consequently, little is known or understood of the effects that use of these systems may have on the group dynamic when employed in the distributed setting.

This thesis examines how two elements of GSS configuration, the location and alignment of the meeting facilitator, may impact system users' perceptions of situational equity, their attitudes towards the efficacy of the technology, their information-sharing behavior, and the quality of decisions reached by user-groups. The results of the work evidence that isolation of the facilitator from meeting members is desirable, and that facilitator neutrality is essential to the efficacy of such systems deployed in the distributed setting.

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I. Introduction

It was only after World War II that manufacturers in the United States first employed computers to perform and regulate industrial work. In the half-century since, the technological revolution spawned by the digital computer has transformed our national economy from a manufacturing to a service-based system in which the production and exchange of information is the central activity (Perrolle, 1997).

Today, digital networking technology is transforming the social structure of the workplace in similarly significant fashion. File transfer protocol, e-mail, and the Internet have extended the reach of the individual beyond the boundaries of the local, and even the national arena, giving rise to telecommuting, the virtual office, and for the first time in our history, a truly global economy.

Given these developments, it is inevitable that the business world will employ and rely more heavily upon interactive and distributed group communication to conduct operations in the future. Already, in fact, one species of systems that will help facilitate this interaction, called Group Support Systems (GSSs), have begun migration from computer laboratories in college campus basements to boardrooms across the globe.

1.1 Background

Through the years, the systems referred to in this discussion as GSSs have been given a host of other names including Group Decision Support Systems, Electronic Meeting Systems, Computer-Supported Collaborative work, and Computer-Mediated Communication Systems (Jessup and Valacich,

1993:6). The term GSS is used here to refer collectively to a network of computer systems and tools used to support goal-directed group work (Jessup and Valacich, 1993:5).

GSSs are a computer-based "social technology," a combination of hardware, software, and human facilitation that provides users with computer, communication, and decision support tools to increase the effectiveness and efficiency of decision-making groups (Turoff, Hiltz, Baghat, and Rana, 1993:400).[1] In a GSS, hardware and software combine to form a network of computer stations and protocols over which meeting members interact during the meeting process. The meeting facilitator administers system hardware and software, and in doing so, removes complexity from the system interface, providing users the ability to immediately employ the technology in an effective manner.

The responsibilities of the facilitator extend beyond simple system operation, however. This individual is additionally responsible for helping group leaders identify meeting objectives and develop meeting agenda prior to GSS sessions. Once objectives and agenda have been have been set, the facilitator then chairs the group session, administering the pre-set agenda via the GSS. The facilitator additionally provides user groups continuity by setting and describing ground rules for meeting member interaction, enforcing group protocols and norms, maintaining groups' knowledge repositories, and acting as goal champion and sponsor for user groups (Nunamaker, Briggs, Mittleman, Vogel, and Balthazard, 1997:192-193).

To date, research concerning the utility of GSSs has focused primarily on the technology and facilitator's ability to increase the efficiency of face-to-face group meetings (Nunamaker and others, 1997:202; Anson, Bostrum, and Wynne, 1995:200-201). Subsequent to recent advances in networking technology, however, the focus of GSS research has taken a new turn. Today, many professionals in the information technology field are interested in a GSS's potential to provide a means for geographically distributed decision-makers to meet and work in a virtual environment. Given the dearth of studies which have investigated the social dynamics of employing GSS in this setting, and the fact that an ability to involve remote participants actively and successfully remains to be documented, facilitation of distributed meetings is ripe for attention from scientists and practitioners (Nunamaker and others, 1997:202).

[1] Turoff, Baghat, and Rana (1993) offer this description as definition of a Group Decision Support System.

1.2 Research Applicability to the United States Air Force

In the late 1980s, the Air Force embraced and implemented Lean Logistics, an initiative designed to streamline the processes and infrastructure that drive costs and investments in logistics programs (Office of the Secretary of Defense, 1996:23). The move, as part of a larger Department of Defense effort, represented concession to the fact that the logistics systems, processes, organic capabilities, and inventories that our military developed during and since the Second World War were outdated, did not reflect modern budgetary constraints, and did not support surgical strike capabilities requisite in modern warfare (Kaminsky, 1996:n. pag.).

The overarching goal of the Lean Logistics program is to transition the force from a just-in-case, to a demand driven, just-in-time asset management and repair system. It incorporates several initiatives to accomplish this goal, including flexible asset repair, pipeline visibility, door to door distribution, and repair and return. Additionally, it incorporates more control and involvement in logistics processes by customers, a smaller base-level inventory, and higher velocity in the movement of assets between servicing units and customers (Office of the Secretary of Defense, 1996:24).

In 1996, The Office of the Secretary of Defense published its *Policy Regarding Performance of Depot-Level Maintenance and Repair for the Department of Defense*. The report, which speaks directly to the Lean Logistics effort, outlines the framework and stands as guidance as to the manner in which Department of Defense (DoD) depot maintenance is managed (Office of the Secretary of Defense, 1996:2). Central to this policy are the mandates that the military encourage development of innovative maintenance concepts and improved management structures, that it establish effective management systems and processes to provide visibility of assets in the repair cycle, and that it deploy management information systems that contribute to more effective and less costly maintenance operations (Office of the Secretary of Defense, 1996:22-25).

In response to this call, engineers at the Sustainment Logistics Branch of the Air Force Research Laboratory (AFRL/HESS) have proposed employing a GSS in a distributed setting to allow maintenance depots, base logistics units, and command headquarters to accomplish process redesign in an any place and

any time environment. AFRL/HESS's proposed system combines two in-work programs to address the technology need. The first is called RAPTR, or Readiness Assessment and Planning Tool Research.

RAPTR is essentially a business process reengineering toolkit intended to aid organizations in identifying candidate processes for reengineering, determining optimum changes to these processes, predicting the impact of these changes, and implementing the changes in a controlled manner. The tool is intended to enable an organization preparing for change to assess cultural, technological, and strategic issues within the organization. It is also intended to allow users to build a smart repository of lessons learned to be utilized during the design of the to-be process to reduce risk, save time, and improve the quality of future reengineering efforts (Air Force Research Laboratory Sustainment Logistics Branch, 1998:2).

The second component of the proposed system, the GSS component, is called Depot Operations Modeling Environment, or DOME. In addition to offering the traditional capabilities of a GSS, DOME also supports process modeling. It can enable different levels of users to collaborate as appropriate, and enable users at similar levels to work simultaneously on different components of the same process model, all in an any place and any time environment (Air Force Research Laboratory Sustainment Logistics Branch, 1997:n. pag.).

Final user demonstration and transition of these systems is targeted for the first quarter of 1999. DOME and RAPTR will be initially employed by the Warner-Robins Air Logistics Center in Georgia and Mountain Home AFB in Idaho as part of these organizations' ongoing effort to improve F-15 Periodic Depot Maintenance. Though AFRL/HESS engineers are optimistic of system success, as with any new technology, system operation, configuration, and capabilities will likely be refined over time.

1.3 Problem Statement and Purpose of Research

Two issues of particular importance to the feasibility, operation, and deployment of the DOME and RAPTR system surround questions of meeting facilitator location and alignment. First, need the facilitator be a neutral party, or would it suffice to have an employee of a represented organization facilitate the distributed meeting? Next, should that facilitator be geographically distributed from the group as

meeting members themselves are, or could that individual moderate the meeting from some common facility, in the presence of a represented party? Key to appreciating the significance of these questions is an understanding of the fact that the meeting facilitator, having super-user control over the meeting process, is both a technology enabler and an aid to the user. Alternate states of location and alignment, then, have the potential to moderate a facilitator's use (and possibly abuse) of power. Consequently, group member perceptions of the relative fairness of the meeting process and meeting outcomes will be influenced by aspects of the GSS structure (facilitator location) and by aspects of the social interactions enabled and moderated by GSS (facilitator alignment).

Obviously, securing the services of a neutral party to act as a facilitator for distributed meetings raises concern for the costs and availability of this service, and of facilitator access to any sensitive information which might be discussed or presented in these sessions (Anson and others, 1995:205). Similarly, establishing a separate but equal facility for this individual to moderate distributed meetings impacts the feasibility of the system from the technical and financial standpoint. From an engineering and cost perspective, the preferred system design is that in which the meeting facilitator is drawn from the organization of some represented constituent and is co-located with that meeting member.

When co-located with one member of the decision-making group, the facilitator possesses opportunity to give special assistance or information to that member during meetings without alerting other group members (Bostrum and others, 1993:159). Similarly, when aligned with a group member, the facilitator additionally may have inclination to provide assistance to that member, often at the expense of the other members of the decision-making group (Watkins and Winters, 1997:n. pag). Engineers at AFRL/HESS worry that the potential for abuse which exists in this arrangement might negatively impact the group dynamic, giving rise to general distrust of the meeting process among distributed group members. AFRL/HESS's ultimate concern for this effect, if indeed it exists, is that it would negatively impact group members' perceptions of process and outcome fairness, their attitudes towards the efficacy of GSS-supported meetings, their willingness to share information, and consequently, group decision quality and the utility of the proposed system itself.

This study was undertaken to examine the main and interactive effects of facilitator co-location and alignment with a meeting member on the perceptions, attitudes, and subsequent behavior of all members of a decision-making group. The results of this effort provide critical information necessary to evaluate the need for facilitator neutrality and isolation when GSS is employed in a distributed setting.

1.4 Summary

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. To date, GSS has been employed and studied primarily in face-to-face environments where facilitator and meeting members interact over the system in laboratories or conference rooms specifically designed for the purpose.

However, advances in digital networking technology have extended GSS's potential utility beyond the same place and time setting. Engineers at the Air Force Research Laboratory's Sustainment Logistics Branch are interested in the technology's ability to provide a means for geographically distributed constituents to engage in the redesign of logistics processes in a virtual environment.

While this proposal is technologically feasible, very little is understood of the impact of system design and configuration on the virtual group dynamic. This study sheds light on this dynamic, by evaluating the impact of facilitator alignment and co-location on the efficacy of GSS when deployed in a distributed environment.

1.5 Sequence of Presentation

Chapter II of this work provides a survey of relevant literature from the body of GSS research, with particular emphasis placed on works regarding the dependent variables of interest in this study. Chapter III describes the methodology employed in the conduct of research for this thesis, the results of which are presented in Chapter IV. Finally, in Chapter V, these data are interpreted in terms of the hypotheses investigated in this work, and research findings are presented along with the conclusions and recommendations for future research garnered from this investigative effort.

II. Literature Review

2.1 Introduction

Since the dawn of the computer age, the digital computer has been viewed as an enabler of productivity gain. In the 1950s, 60s, and 70s, such gains were realized primarily by employing computers to automate repetitive information processing tasks, thereby reducing associated costs to the organization. In the 1980s, however, computers became smaller, more powerful, less expensive, and more plentiful. Advances in networking technology, meanwhile, allowed these now-ubiquitous desktop systems to be linked to others to form networks. This latter fact alone made the digital computer infinitely more useful for accomplishing everyday work.

It was in the early 1980s that sensitivity to the potentials of networking technology led a group of professionals at the University of Arizona to design Plexsys, now called GroupSystems, which is notable as being arguably the first successful GSS ever developed (Nunamaker and other, 1997:169). Constructed for the explicit purpose of conjoining geographically separated work teams, the system was shown at an early stage in its testing to have a sum negative effect on the group process. This result was of course quite the opposite of its designers' intentions in developing the system.

GroupSystem's architects ultimately determined that though the technology itself was easy to use, system users lacked a mental model on which to base personal interactions in the virtual environment (Nunamaker and others, 1997:169). As a result, the technology was removed from that virtual setting and situated in a conference room-type meeting facility that would remain its home for almost the next fifteen years.

Today the effects of virtual communication on the group process are better documented and better understood. As a result, the original GSS hardware and software model has evolved to include a human facilitator. This individual has been charged with the significant responsibility interfacing with the system and users to enable user groups to employ the technology to an advantage. Now, though it is generally acknowledged that a GSS supported conference *can* be successful in the absence of a group facilitator, such a happening is perceived as being an exception to the rule (Viller, 1991:149).

This chapter explores the evolution of GSS research from initial work performed to reveal the basic mechanisms of computer-supported communication to its current focus today -- the technology's ability to support decision-making groups. Emphasis will be placed on how the GSS model was expanded from earlier techno-centric definitions to include a meeting facilitator as an essential part of the technology. Finally, this chapter details the theoretical basis for the original research contained in this study and describe the research hypotheses investigated in this work.

2.2 Evolution of GSS Research

The roots of GSSs date back to the early 1970s when initial investigations into the dynamics of using simple computer-messaging systems to support group communication were done. Since that time, the focus of research conducted on these systems has shifted away from investigation of the capabilities of the technology itself to focus instead on the dynamics of facilitating GSS supported group meetings in a same place and time environment.

Early work done on computer supported communication demonstrated that the conversations of individuals who employed computers as a medium for information exchange differed greatly from those of face-to-face groups. In experiments where computer-enabled and face-to-face control groups were assigned decision making tasks, computer users were shown to exchange fewer messages and to take longer to solve problems than their face-to-face counterparts. Interestingly, however, members of computer-enabled groups were also shown to participate more equally in the decision-making process than were the members of the control groups (Dennis and Gallupe, 1993:61).

It has been determined that there are significant differences between personal interactions and the on-line interactions of virtual groups, the main distinction being that virtual communications lack many social cues present in face-to-face meetings. Researchers have shown that this attenuation of social prompts has the sum effect of interfering with group members' ability to discern and observe social structures within the group, a problem which GSSs exacerbate still further by lending members asynchronous communication capabilities (Kiesler and Sproull, 1992:102-103; Nunamaker and others, 1997:169).

Subsequent to these findings, in 1984 the Group Systems team developed the concept of the electronic meeting room in an effort to counter the enervating effects of the virtual environment on the group process (Nunamaker and others, 1997:169; Wagner, Wynne, and Mennecke, 1993:12). The first electronic meeting rooms arranged participants on three sides of a rectangle with a public screen to serve as common focal point for the group at the open end (Nunamaker and others, 1997:188-189). As was hoped, this arrangement alleviated the greatest problems associated with purely virtual interactions, allowing groups to realize process gains using GSS.

For at least the next decade, GSS research focused on developing technology and techniques to make teams more productive in this same time and place environment (Nunamaker and others, 1997:169; Jessup and Valacich, 1993:5). Work conducted in the field of computer supported meeting systems at the end of the 1980s focused on comparing the performance of GSS supported groups against traditional, non-supported face-to-face groups in a rigorous, controlled fashion (Dennis and Gallupe, 1993:64).

Conducted almost exclusively in laboratory settings, this research extended the field's knowledge base by using "stronger research designs and more sophisticated measures to investigate the use of GSSs" than did the original studies of the 1970s (Dennis and Gallupe, 1993:64). The collective results of this effort were mixed and somewhat inconclusive. Meta-analysis of 29 studies comparing GSS supported to work groups without GSS support has since revealed that the technology seems to improve decision quality with some slight cost to group confidence and satisfaction with the meeting process (Anson, Bostrum, and Wynne, 1995:190-191). At the time of these original studies, though, researchers could only discern with surety that GSS impacted the group process in both positive and negative fashion.

During this same period, other GSS advocates had deployed the technology for use in various business organizations. In contrast to the participants of laboratory studies, field users generally recorded positive reactions to GSS. Curious as to the cause, researchers compared settings and found differences between the two to be immediately apparent. Most field studies, it seems, involved large groups of managers and professionals who employed GSS in the performance of complex tasks which took several days to complete. Most importantly, these groups were normally aided by an active process facilitator. In contrast, the majority of laboratory experiments had studied small, unaided groups of students who

employed GSS only to perform very simple tasks over a very short time period (Dennis and Gallupe, 1993: 68).

By the early 1990s, sensitivity to the potential of facilitation to help groups employ GSSs to an advantage had galvanized professionals active in the field of GSS research. Work conducted since has largely shifted away from investigation of the capabilities of the technology itself, to focus instead on the dynamics of facilitating GSS supported meetings in the same place and time environment.

2.3 Summary of Research Findings

GSSs have been shown to aid groups by providing users with at least four types of communication support: alternative communication channels for idea generation and comment; synchronization of the communication process; process structuring for communications protocols and human roles; and improved data collection, organization, filtering, and feedback (Turoff, Hiltz, Bahgat, and Rana, 1993:400-401). The collective impact of these aids is that they allow each participant in the decision making process to act as an individual problem solver, with freedom to concentrate his or her attention on specific aspects of a problem independent of other group members.

In face-to-face meeting environments, groups typically rely upon a sequential problem solving strategy in which an agenda is adopted and the group systematically completes one step in the problem solving sequence before moving on to another. Using GSS, group members are able to work on different segments of problem solution at the same time (Turoff and others, 1993:403). GSS therefore frees groups as collective wholes to work in a more effective manner (Turoff and others, 1993:401).

This ability for meeting participants to work and communicate in parallel prohibits any one member of a group from dominating or controlling the group discussion, and is understood to be the cause of the increased productivity of GSS supported idea generating groups (Jessup and Valacich, 1993:69; Tyran and others, 1992:317, 328-9). Studies which have simulated the verbal idea-generation process using GSS, either by incorporating a delay into the technology or by imposing strict procedural constraints on the process, have shown that groups supported this way were less productive than traditional face-to-face brainstorming groups (Jessup and Valacich, 1993:69).

Use of the electronic channel further impacts the group dynamic by providing meeting participants with anonymity. Anonymity has the direct effect of reducing evaluation apprehension, the fear that comments or ideas may be received by others in a negative way, thereby freeing group members to participate in the process more actively and honestly (Tyran and others, 1992:317, 328-9). Not surprisingly, anonymous groups have proven to be more critical of ideas submitted to the group, which seems to have the consequent effect of causing these groups to generate higher quality ideas and decisions (Connolly, Jessup and Valacich, 1990; Dennis and Gallupe, 1993:69-70; Jessup, Connolly, and Galagher, 1990).

Research has also demonstrated that facilitation of GSS supported meetings, task complexity, and group size, influence GSS effects. In particular, moderation of these meetings by a neutral facilitator in combination with GSS has been shown to significantly enhance the quality, effectiveness, and productivity of group sessions (Anson, Bostrum, and Wynne, 1993:201).

2.4 Role of the Facilitator in GSS-Supported Meetings

Reflecting new found appreciation for the role and importance of the group facilitator in GSS supported meetings, in 1990 Dennis, Heminger, Nunamaker, and Vogel expanded the traditional nuts and bolts definition of GSS to a five component socio-technical model they referred to as Electronic Meeting Support (EMS). Composed of facility, hardware, software, procedures, and facilitator, EMS holds that group performance and behavior can be improved by imposing an efficient structure on the group through specific heuristics, processes, and technologies (Dennis, Heminger, Nunamaker, and Vogel, 1990:112).

The main responsibilities of the meeting facilitator in EMS are to implement a session plan and coordinate member activity according to that plan (Dennis and others, 1990:114). Given that decision makers themselves are not system administrators but system users, there also exists a very obvious need for trained operators to mitigate the impact of the system administration on the process and manipulate the technology to maximize its effectiveness. Facilitators provide this support.

The most significant advantage provided groups by the facilitator, however, is the benefit of having a "neutral leader" who can oversee the group process without advocating a particular goal (Dennis

and others, 1990:114). Ultimately, the influence of the group facilitator frees the group's natural leader to participate fully in the meeting process, to the great advantage of the group itself (Dennis and others, 1990:114).

In 1993, the research team of Clawson, Bostrum, and Anson offered an expanded, empirically grounded definition of the facilitator's role in GSS-supported meetings. The authors derived from an extensive set of personal interviews and respondent surveys a comprehensive description of meeting facilitator traits and responsibilities which is reproduced in Table 2.1, next page (Clawson and others, 1993:552). This research team agrees with Dennis and others (1990) that the facilitator should be considered an integral element of GSS technology. They write, "...it is not likely that a group social technology such as GSS, in and of itself, will be sufficient to turn meetings into fully satisfying and effective exchanges. Research and field experience indicates that the quality of a GSS meeting is predominantly dependent on the facilitator" (Clawson, Bostrum, and Anson, 1993:549). This idea is discussed in greater detail in section 2.4.1, below.

2.4.1 Influence of Facilitation on Group Processes and Group Performance

In 1995, Anson, Bostrum, and Wynne reported that common group behavior patterns are actually counterproductive to achieving effective task and interpersonal outcomes (190). Quoting past research, the authors write that intervention is necessary to provide groups structured communication protocols and procedures in order to counter typical dysfunctional behavior and "effectively harness the knowledge and skills brought to the group by its members" (Anson, Bostrum, and Wynne, 1995:190). By their recommendation, this intervention should take two forms: GSS, and a third-party facilitator, "someone from outside the group who is trained in skills for assisting the group interaction while remaining neutral as to the content of discussions" (Anson and others, 1995:189).

Table 2.1 Facilitator Dimensions (Clawson and others. 1993: 556)

1.	Promotes ownership and encourages group responsibility
2.	Demonstrates self-awareness and self-expression
3.	Appropriately selects and prepares technology
4.	Listens to, clarifies, and integrates information
5.	Develops and asks the right questions
6.	Keeps groups focused on outcomes
7.	Creates comfort with and promotes understanding of the technology and Technology outputs
8.	Creates and reinforces an open, positive, and participative environment
9.	Actively builds rapport and relationship
10.	Presents information to the group
11.	Demonstrates flexibility
12.	Plans and designs the meeting process
13.	Manages conflict and negative emotions constructively
14.	Understands technology and its capabilities
15.	Encourages/supports multiple perspectives
16.	Directs and manages the meetings

These findings were derived from a study in which the authors examined the effects of the facilitator and GSS on group cohesion, interaction, and performance. The study itself was conducted with a sample of forty-eight groups tasked with developing a production strategy for building and flying paper airplanes. Four different experimental treatments were employed: groups were provided with either no support, facilitator support, GSS support, or both facilitator and GSS support.

Of all the groups studied, those supported by both GSS and a facilitator were by far the most successful. Consequently the authors determined that these variables had an additive effect on group

cohesion and process outcomes. In their own words, "the two sources tended to enhance or supplement one another when provided in combination" (Anson and others, 1995:201).

The authors also determined that the main effect of this relationship could be attributed to facilitator influence: a post-experimental survey revealed no difference in perception of facilitator impact between GSS and non-GSS groups. Between GSS supported groups, however, the survey revealed that the presence of a facilitator had great effect on user satisfaction. Facilitated subjects reported that the facilitator significantly enhanced the group process by helping them understand and employ GSS provided tools to their advantage. In sum, the authors write, a facilitator has a significant supplemental effect on GSS effectiveness, "but not vice versa" (Anson and others, 1995:202).

As a footnote to these findings, Anson and others caution that the additive effect between facilitator and GSS is not a given. "Specific variables," they write, "including facilitator quality and attitudes, and participant attitudes towards and experience with GSS, may neutralize the interactive effect and even interfere with the individual efficacy of GSS and facilitator" (1995:203). "The point is," the authors continue, "that additivity between multiple sources will depend on how they are consciously designed and implemented to complement one another" (1995:203). Consequently, declare the authors, "there exists a critical need for further empirical research to investigate causality between specific characteristics of intervention and the resulting outcomes, particularly for groups using GSS over various time and space continuums" (1995:203- 204).

At no time in GSSs' short history has this need for empirical research into the dynamics of distributed facilitation of groups been more pronounced than the present. Now that the technology has left the womb of the electronic meeting facility to find new application in distributed settings, formerly theoretical questions as to the efficacy of employing GSS in this environment have suddenly become practical concerns with real impact on system success.

2.4.2 Meeting Facilitation Framework

In an effort to better understand and explain the dynamics of group facilitation, Bostrum, Anson, and Clawson (1993) published a group facilitation model that they call, simply, Meeting Facilitation Framework (MFF). An adaption of that model is depicted in Figure 2.1, next page.

MFF depicts group meetings as being directly and indirectly influenced by three possible sources of group facilitation: GSS technology, group member leaders, and external facilitators. Each provides *structure* to direct the group effort which varies according to the source. Meeting structure includes goals for meeting outcomes, procedures and techniques for accomplishing these goals, rules to follow during an activity, phase, or entire meeting, and roles for group members to assume in the meeting process (devil's advocate, facilitator, or decision-maker, for example) (Bostrum and others, 1993:156, 160).

Normally, a facilitator works with the group leader, and in some cases meeting participants as well, to establish the frame or context in which to organize and direct the group effort (Bostrum and others, 1993). It is the facilitator, however, who ultimately determines meeting structure by assigning participants relevant roles and establishing the rules, procedures, and techniques to be employed in the meeting for the attainment of meeting goals (Bostrum and others, 1993:160).

The facilitator, or facilitation source, also influences the meeting process through performance of *support* activities or actions that reinforce or hinder the effects of meeting structure on the group process. As just intimated, meeting support may effect the group in more than one manner. It may have a promotive influence on behavior if it facilitates the accomplishment of meeting outcomes. It may have a disruptive influence on the group by inhibiting progressive movement, thus causing process losses. Finally, meeting support may have a counteractive influence on behavior if it neutralizes or negates disruptive interaction and restores progressive movement toward accomplishment of desired outcomes (Bostrum, Anson, and Clawson, 1993:161-162).

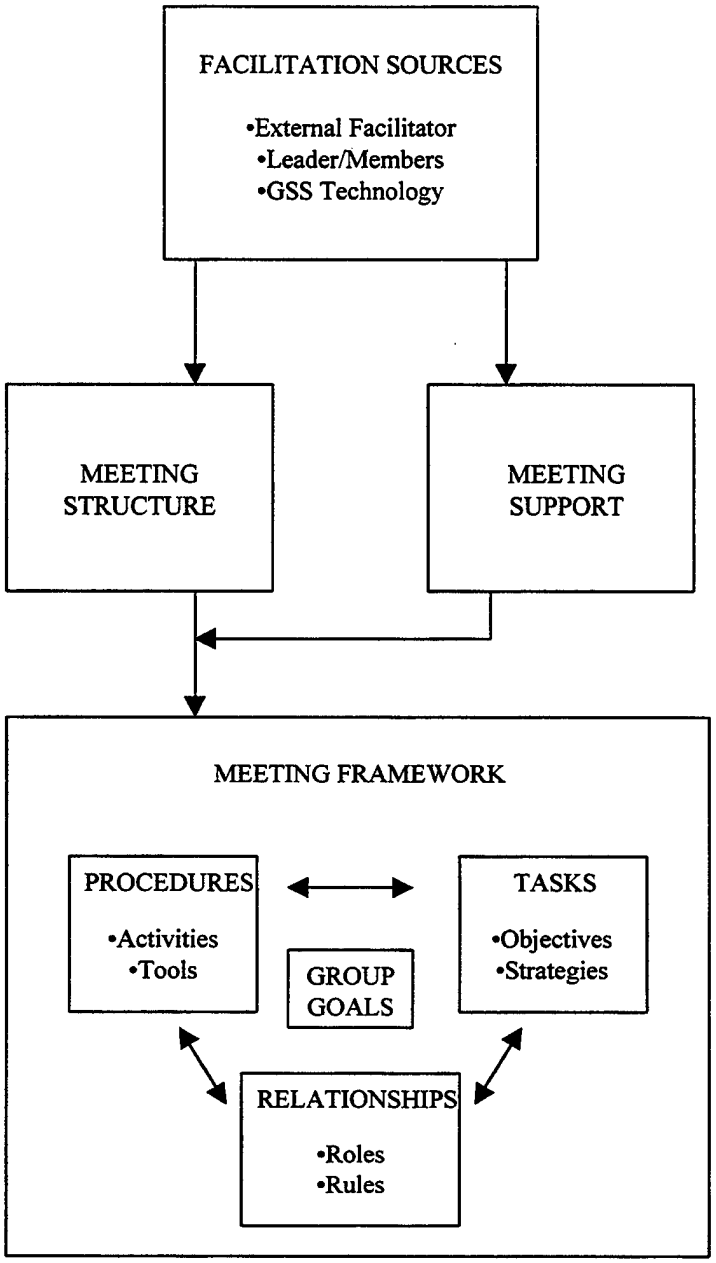


Figure 2.1 Meeting Facilitation Framework (Adapted From Bostrum and Others, 1993:146)

MFF finally explains that the interactive effect of meeting procedures, tasks, and relationships, as determined by the facilitator through his or her design and implementation of meeting structure and support, in concert, determine group members' involvement in and contribution to the group process. In cases where members perceive structure and or support to be somehow biased, involvement and contribution are expected to drop, with ultimate consequence on the quality of process outcomes (Bostrum and others, 1993:161-162).

Consequently, it may be hypothesized that *any* perception of irregularity in meeting structure and/or support by participants, correct or otherwise, will impact their perceptions of the fairness of their situation and their ultimate involvement and contribution to the group. It follows from consideration of the MFF model, then, that great care should be taken by the architects and facilitators of group meetings to design and employ forms of meeting structure and support which minimize user perceptions of process partiality.

2.5 Measuring Group Member Justice Perceptions in MFF

If facilitators can have a promotive and disruptive influence on users affective response to the meeting environment, and thus their contribution to the meeting process and process outcomes, it is important to understand when and under what conditions each is likely to occur. Greenberg's (1993) Taxonomy of Justice Classes is particularly useful in examining how elements and characteristics of facilitator influence impact individuals' perceptions of the "fairness" of the meeting context. That model is reproduced in Figure 2.2, next page.

For many years, the study of fairness in organizations was dominated by a distributive justice orientation, an approach that focused on outcomes, both the distribution of resources or rewards by allocators, and recipients' reactions to those allocation decisions (Greenberg, 1993:79). As this perspective gained dominance, researchers expanded the view to include consideration of the process by which outcomes are determined, represented in the model as procedural justice (Greenberg, 1993:79).

After a time, even this expanded model was determined to be too narrow due to its emphasis on structure (process and outcome). Missing was consideration of social factors which, researchers determined, also constitutes a source of perceived fairness (Greenberg, 1993:80).

	Category of Justice	
Focal Determinant	Procedural	Distributive
Structural	Systemic Justice	Configural Justice
Social	Informational Justice	Interpersonal Justice

Figure 2.2 Taxonomy of Justice Classes (Greenberg, 1993:83)

As a result, in 1993 Greenberg published the above Taxonomy of Justice Classes, in his own words, "to highlight the distinction between the structural and social determinants of justice by noting their place in each of the two established types of justice- distributive and procedural" (82). Juxtaposition of the two categories of justice against the two conditions by which each is assessed produced four classes of justice: systemic, configural, informational, and interpersonal. Each is represented in the model itself, above, and discussed in more detail, below.

Configural justice describes perceptions of fairness about outcomes that people learn through structural influences. In terms of the MFF, this would include the degree to which meeting members understand meeting structures themselves to be free from bias.

Systemic justice refers to perceptions of fairness about process that people learn through structural means. This type of fairness requires that meeting procedures allow for allocation decisions to be made such that they are consistent over people and time, and such that they represent the concerns of all interested parties (Greenberg, 1993:84). In terms of MFF, this type of perception may be influenced by a meeting facilitator's opportunity to more easily communicate with one or more group members – creating an unfair advantage for some of the group's members at the expense of others.

Informational justice involves providing knowledge about procedures to demonstrate regard for peoples' concerns (Greenberg, 1993:84). Such perceptions are process-oriented perceptions of fairness influenced by social means. Greenberg writes that providing people "adequate social accounts of the procedures used to determine desired outcomes" effectively accomplishes this end (Greenberg, 1993:85). In context of MFF, constituent perceptions of information justice are influenced by facilitator-performed support activities and the availability of feedback, which in turn are governed by the availability and accessibility of the facilitator him- or herself. If a facilitator appears aligned with one or more group members, for example, other group members may fear that they lack important information which puts them at a disadvantage.

Interpersonal justice, finally, refers to the perceptions of outcomes determined through social means. Greenberg explains that complaints of being "let down" by someone, or of selfish behavior, reflect a perception of failure to meet social obligations and thus a violation of interpersonal justice (Greenberg, 1993:86). This thought suggests that facilitators need not act in ways that are biased to create perceptions of interpersonal unfairness. Often, the simple appearance that a facilitator could give favor to one or more group members may be enough to cause frustration among others.

The above variables are significant to consideration of the MFF model in that they collectively categorize the types of perceptions that meeting participants may form concerning the fairness of meeting structure and support. Stated more explicitly in terms of the problem of DOME system configuration, Greenberg's taxonomy identifies four distinct perceptions of situational justice which may be influenced by facilitator co-location and alignment with a single meeting member with direct effect on the group process and process outcomes. The MFF model is related to Greenberg's justice classes in Figure 2.3, next page.

	Category of Justice	
Focal Determinant	Procedure	Outcomes
Structure	Fairness of System Design (Systemic Justice)	Equity of User Control over Process (Configural Justice)
Support	Facilitator Neutrality (Informational Justice)	User Perception of Group Synergy (Interpersonal Justice)

Figure 2.3 MFF Justice Perceptions

2.6 Relationship of Meeting Structure and Support to User Perceptions, Attitudes, Behavior, and Group Decision Quality

The relationship between facilitator structure (location) and support (alignment) with group member perceptions, attitudes, behavior, and decision quality is depicted in the nomological network (Figure 2.4, next page). The network describes that facilitator location and alignment influence the facilitator's ability and intent to communicate privately with a single meeting member over GSS in the distributed setting.

According to MFF, the abilities granted the facilitator by these variables in various combination largely determine the form that meeting structure and support take (Bostrum, Anson, and Clawson, 1993:156-157, 158). Greenberg tells us that users of a system individually form perceptions of the fairness of their situation based on cues present in their environment. This study assumes they do so relative to meeting support and structure.

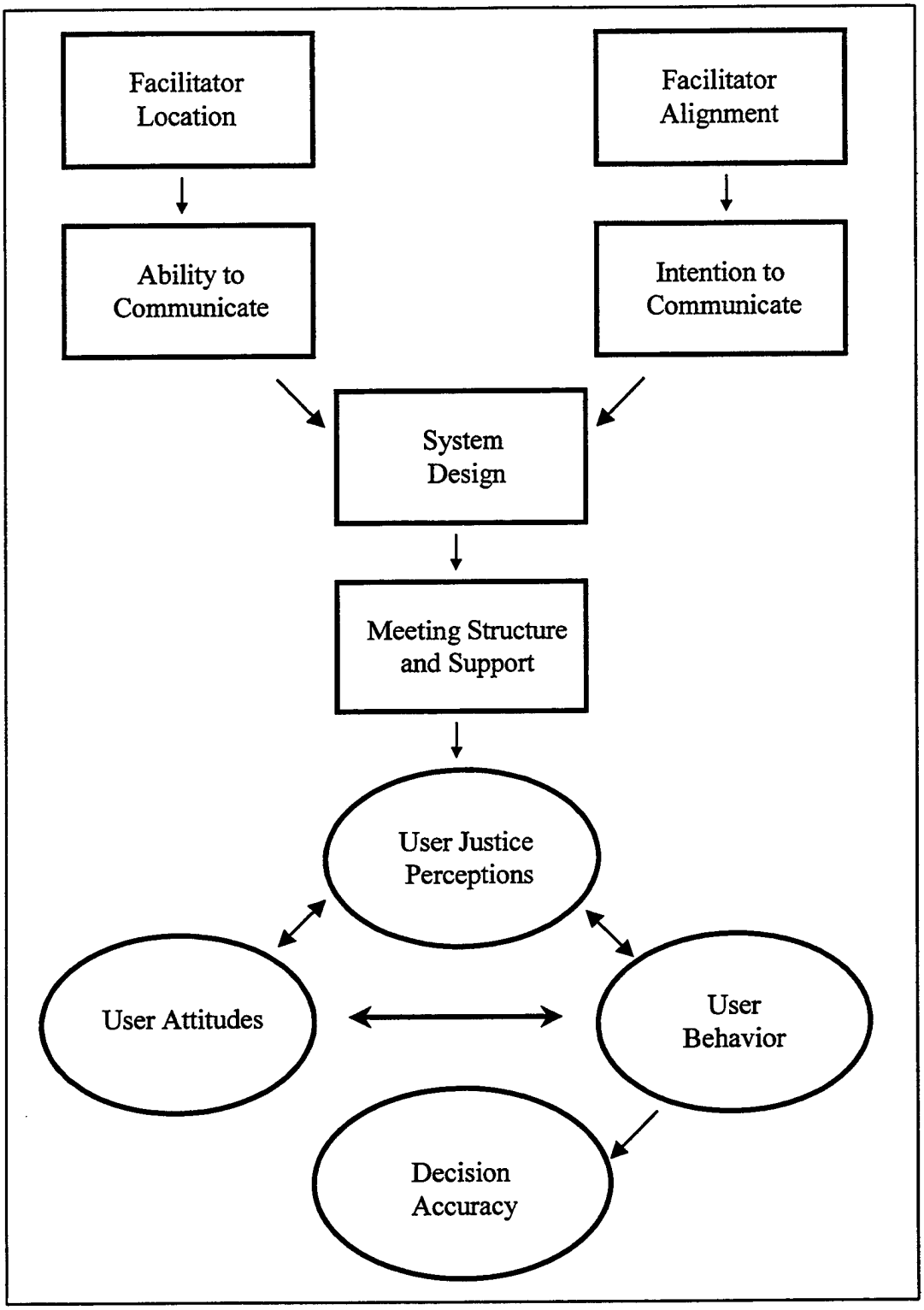


Figure 2. 4 Nomological Network

Next, we know from Bostrum and others' discussion of MFF that individual justice perceptions greatly effect users' attitudes towards their situation and individual behavior in the meeting setting. We know too, from that same discussion, that the relationship of perception, attitude, and behavior is dynamic and reflexive (Bostrum, Anson, and Clawson, 1993:158). Finally, the network describes that user behavior, as determined by user attitudes and perceptions, is considered to be the direct determinant of decision quality.

2.7 Research Hypotheses

This study assumes that system designs which contribute to the appearance of system and process partiality will have a negative effect on user justice perceptions, attitudes towards the efficacy of GSS, user behavior, and ultimately, group decision quality. The premise of the study itself is that the appearance of partiality can be influenced through the location and alignment of the facilitator. More specifically, this study suggests that co-location of the facilitator with a single group member will have a detrimental effect on the structural determinants of user justice perceptions. Similarly, the study asserts that alignment with a single group member will negatively impact the social determinants of user perceptions. Further, these effects should interact, such that users will perceive their situation as being most unfair when the meeting facilitator is both co-located and aligned with one meeting member. These perceptions of situational justice should, in turn, influence group member attitudes, behavior, and ultimately, group decision quality.

These hypotheses are stated more completely and explicitly in sections 2.6.1 – 2.6.3, below.

2.7.1 Hypothesis 1: Effects of Facilitator Co-location

Co-location of the facilitator with a single meeting member in a GSS configured in a distributed setting will negatively impact users' justice perceptions, their attitudes towards the efficacy of GSS, information sharing behavior, and group decision quality.

Hypothesis 1a: Co-location of the facilitator with a single meeting member in a GSS configured in a distributed setting will negatively impact user justice perceptions.

Hypothesis 1b: Co-location of the facilitator with a single meeting member in a GSS configured in a distributed setting will negatively impact user perceptions of the efficacy of GSS technology.

Hypothesis 1c: Co-location of the facilitator with a single meeting member in a GSS configured in a distributed setting will negatively impact user information-sharing behavior.

Hypothesis 1d: Co-location of the facilitator with a single meeting member in a GSS configured in a distributed setting will negatively impact group decision quality.

2.7.2 Hypothesis 2: Effects of Facilitator Alignment

Facilitator alignment with a single meeting member in a GSS configured in a distributed setting will negatively impact users' justice perceptions, their attitudes towards the efficacy of GSS, information sharing behavior, and group decision quality.

Hypothesis 2a: Facilitator alignment with a single meeting member in a GSS configured in a distributed setting will negatively impact user justice perceptions.

Hypothesis 2b: Facilitator alignment with a single meeting member in a GSS configured in a distributed setting will negatively impact user perceptions of the efficacy of GSS technology.

Hypothesis 2c: Facilitator alignment with a single meeting member in a GSS configured in a distributed setting will negatively impact user information-sharing behavior.

Hypothesis 2d: Facilitator alignment with a single meeting member in a GSS configured in a distributed setting will negatively impact group decision quality.

2.7.3 Hypothesis 3: Interactive Effects of Facilitator Co-Location and Alignment

Co-location and alignment of the facilitator with a single meeting member in a GSS configured in a distributed setting will have interactive, negative effect on users' justice perceptions, their attitudes towards the efficacy of GSS, information sharing behavior, and group decision quality.

Hypothesis 3a: Co-location and alignment of the facilitator with a single meeting member in a GSS configured in a distributed setting will have interactive, negative effect on user justice perceptions.

Hypothesis 3b: Co-location and alignment of the facilitator with a single meeting member in a GSS configured in a distributed setting will have interactive, negative effect on user perceptions of the efficacy of GSS technology.

Hypothesis 3c: Co-location and alignment of the facilitator with a single meeting member in a GSS configured in a distributed setting will have interactive, negative effect on user information-sharing behavior.

Hypothesis 3d: Co-location and alignment of the facilitator with a single meeting member in a GSS configured in a distributed setting will have interactive, negative effect on group decision quality.

2.8 *Summary*

Since the early 1970s, many group researchers have pointed out that typical group processes are counterproductive to achieving interpersonal and task outcomes. Consequently, interventions are required to structure group communication and decision-making processes in order to achieve higher quality meeting outcomes (Anson, Bostrum, and Wynne, 1993:190).

Given the specific and inconclusive nature of the body of GSS research, there exists a continuing need for investigation into the effects of GSS on the group dynamic, and an urgent need for conduct of work investigating the capabilities of GSS to enable virtual meetings of distributed meeting members (Nunamaker and others, 1997:202; Anson, Bostrum, and Wynne, 1995:203).

This latter need has recently made itself felt at the Sustainment Logistics Branch of the Air Force Research Laboratory where engineers are struggling with the question of how system configurations with alternative states of facilitator alignment and location might impact the efficacy of their proposed DOME system. A review of theoretical models describing the mechanisms of meeting facilitation and the formation of individual perceptions of situational fairness suggest that these various system configurations

might negatively impact the cohesiveness of user groups, their attitudes towards the efficacy of the system, their behavior, and ultimately, group decision quality.

The original research contained in this work sought to test the hypothesis that system designs in which the GSS facilitator is co-located and/or aligned with a single meeting member contribute to lower levels of perceived situational fairness among users, and thus have negative effects on the group process and process outcomes.

III. Methodology

3.1 Introduction

The first chapter of this work explained the nature and relevance of the research problem of concern to this study, specifically, the question of whether facilitator alignment and/or co-location with a meeting member impacts the efficacy of GSSs employed in a distributed setting. The second described the theoretical framework upon which this study was based, as well as the author's expectation that system designs which contribute to appearances of system and process partiality will have a negative effect on user justice perceptions, attitudes towards the efficacy of GSS, user behavior, and ultimately, group decision quality.

This chapter describes the research method employed to investigate this hypothesis, and how the theorized cause-and-effect relationship was operationalized, first as a series of related constructs, and each of these later as a set of as measured variables. It further describes the specific means by which data were collected to quantify each, and finally, the means by which these data were analyzed in an effort to make inference as to the actual nature of the relationship between the independent variables of concern and process outcomes.

3.2 Experimental Design

This study employed a wholly original experiment, called the Sport of Kings, to investigate the main and interactive effects of facilitator co-location and alignment with a meeting member on process outcome over a distributed GSS. The experiment itself employed a completely randomized 2 x 2 factorial design based on the four alternative system configurations described in Figure 3.1, next page.

In each situation, three experimental subjects interacted over a distributed GSS running GroupSystems software. These subjects were tasked by an experiment administrator (acting as the GSS facilitator and working from a script) to perform a hidden-profile, information sharing task which involved identifying the first, second, and third-place finishers, in order, from a field of nine horses running in a fictional race called the Cooper Stakes. This type of bet is called a *trifecta.*

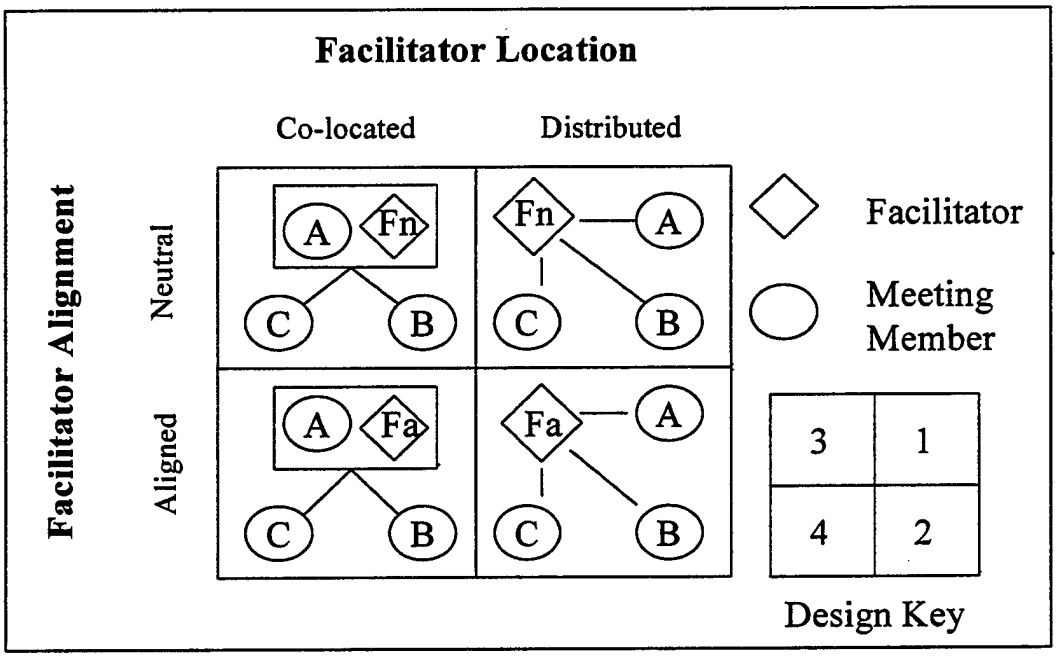


Figure 3.1 Alternative System Configurations

Chance and ability were not factors in the race. Instead, participants were provided information describing ten separate race conditions (including weather, track condition, and horses' post positions) along with information describing some of the nine horses' individual preferences relative to each race condition. This information was organized in a 108-bit matrix (9 horses * 10 conditional preferences + 9 post positions + 9 other race conditions = 108 information bits). Participants each received a partial matrix which served as a problem worksheet containing 36 unique, plus one shared bit of the 108 total bits of available information. Each worksheet was very carefully designed so that participants shared key race day information equally, and so that the bulk of preference information possessed by each did not correspond to any of the condition "keys" each possessed (see the master and participant worksheet matrices, attached in Appendix A).

If a horse's preference matched the corresponding condition on race day, participants were instructed to assign the horse a point in that condition category. If the horse's preference did not match up to the respective race condition, participants were instructed, conversely, to assign the horse a score of zero

for that category. Race winners were the horses who scored the highest number of points relative to the ten race-day conditions. The first, second, and third place finishers in the race scored eight, seven, and six out of ten possible points, respectively.

To give the experimental task salience, and experiment subjects a vested interest in task solution, participants were promised cash awards for correct bets. It was explained to them, however, that horse racing employs a betting scheme called *pari-mutuel* betting to determine odds on horses and payoffs for winning bets. According to this scheme, the higher amount bet on a *trifecta*, the lower the odds on a bet and the lower the payoff to bettors if the *trifecta* hits. Therefore, payoffs for correct bets were lower if all three group members managed to correctly identify the race winners than if just one or two group members managed to identify the winning *trifecta*. This arrangement challenged participants to either exchange information cooperatively to optimize group decision quality, or instead, to act selfishly and collect others' information or contribute false information to the group without contributing their own in order so as to maximize individual earnings.

In pilot testing, participants were promised a two dollars each if all participants correctly identified the winning *trifecta*, three dollars each to the winners for two correct bets, and six dollars for a single correct bet. Losing bets were to receive no award. Post-experimental interview revealed, however, that this arrangement too strongly encouraged opportunistic behavior-- participants often chose to act selfishly regardless of experimental treatment. Subsequently it was decided to revamp the scale to describe a payoff of seven dollars plus an undisclosed bonus to each group member if all members placed correct bets, and nine dollars for winning bets in any other combination in the experiment's final form. This arrangement proved to provide a more equal balance between participants' selfish and cooperative motivations.

Interestingly, post-experimental interview with pilot experiment participants also revealed that members of groups in which one participant acted selfishly could be quite affected by that individual's actions when results of the experiment were revealed to the group. In one case in particular, upon revelation of the session's outcome two members of a group became quite upset with the third who had acted to maximize individual return. Discussion of the ethics of that member's actions raged among the three for days afterward, in fact. With this episode in mind, it was decided that all subjects, regardless of

the pay scheme described and the results of the experiment itself, would be paid ten dollars upon completion of the experiment. A script was subsequently written for use in debriefing, and all future participants were debriefed individually and in private. Finally, results of the experiment were never again revealed to participants. The script used for participant debriefing is attached in Appendix B.

3.3 Experiment Manipulations

To manipulate facilitator location and alignment in the experiment, language was included in the experiment's introductory materials that called participants' attention to these relevant factors in the GSS's design and setup. The handouts for Treatments 1, 2, 3, and 4 are attached in Appendices C, D, E, and F, respectively.

Not surprisingly, facilitator location was quite easily, and quite successfully manipulated. Experiment participants were simply informed that the experiment's facilitator was either isolated from all experiment participants or was co-located in a common facility with a single meeting member. The particulars of this arrangement were further described by a corresponding graphic which represented the GSS's configuration.

Facilitator alignment with a meeting member, however, was not so easily arranged. Participants very easily understood and accepted the situation in which the session facilitator was reported to be a neutral experiment administrator. Suggesting a plausible reason why that individual would act to favor one participant over another, however, was not so easily accomplished. Ultimately, this end was achieved by informing participants that in face-to-face meetings, an experiment facilitator can align with a meeting participant and effectively influence a meeting's outcome. One of the primary purposes of this experiment, the language continued, was to find out if the GSS could mitigate the facilitator's ability to influence group actions and meeting outcomes. "Today," participants were told, "the facilitator will attempt to provide special help to [a single experiment participant] in order to maximize his or her performance." The specified individual was also encouraged to seek the aid of the facilitator during the experiment.

To enhance and ensure the effectiveness of these manipulations, treatment-specific exercises were created for inclusion in experiment handouts to reinforce the manipulations and verify participant's

understanding of the experiment's design, agenda, and use of the matrix worksheet. These exercises are included at the back of each treatment handout included in Appendices C – F.

Ultimately, manipulation checks included in a survey administered to all participants at the end of each experiment session demonstrated that experiment manipulations were successful. That survey is attached in Appendix G. The results of this data analysis effort are described in the next chapter, section 4.2.

3.4 Subjects

The seventy-two subjects employed in this study were drawn almost evenly from the undergraduate student body of the University of Dayton and the graduate student body of the Air Force Institute of Technology. Male and female participants were employed in equal number in the data collection effort.

3.5 Equipment and Facilities

All experiment sessions were run at the University of Dayton's GSS laboratory. This facility contained a network of seven clients running GroupSystems over Windows 95 and a server running Windows NT 4.0 distributed between four rooms in a wing of the school's psychology department.

At least one station in each room had access to a headset telephone line. This voice channel was used, in part, to direct group activities during experiment sessions. The voice channel was a conference line which, once established, could be opened or closed in any room individually as long as it was kept open in at least two other. Use of the headset system, however, required that the channel be kept open in at least two rooms at all times.

Though the inflexibility of this headset system was somewhat problematical from a procedural standpoint, it was also in another sense a boon to experiment manipulation. Because the voice channel was a broadcast system, in Treatments 1 and 2 where the facilitator is isolated from participants, experiment subjects had full assurance they were privy to all communications transferred via the network and that the facilitator had no private or special access to a single meeting member. On the downside, however, the

fact that the administrator did not have the ability to close and then reopen the channel required that participants be instructed to take off the headsets at times during the experiment and then later instructed via GSS to don them again. This requirement, though unwieldy, seemed to have no detrimental effect on experiment proceedings.

3.6 Task and Procedures

In order to preserve participants' identity over the voice channel, a randomized block design was used to schedule experiment sessions and experiment participants. In all, 24 sessions were conducted consisting of three male and three female groups each by treatment.

When originally scheduled for an experiment session, participants were randomly assigned a participant identifier (either A, B, or C) and given instructions to the University of Dayton's GSS laboratory. Upon arrival at the laboratory, subjects were greeted at the door by the experiment administrator/GSS facilitator and escorted to the appropriate workstation based on their assigned participant identifier. Pre-placed at each station were an introductory handout and two envelopes, one containing the respective matrix worksheet, the other a betting form (attached in Appendix H) and survey (Appendix G).

At their workstations, participants were asked to read and sign a consent form, tutored on use of the telephone headset, and told to await further instructions via the headset system. Once all participants were situated, the facilitator, working from the script attached at Appendix I, instructed participants via the headset system to read the introductory handout and complete the exercise section attached at the back. At this point the facilitator left the room when co-located with Participant A to avoid unnecessary distraction to the subject.

After allowing participants sufficient time to read through introductory materials and complete the exercise section, the facilitator visited participants individually at their workstations to confirm participants' answers on the treatment-specific exercise and to clear up any confusion indicated by incorrect answers as necessary.

Once this task was complete for all participants, the facilitator returned to his station, provided participants a summary of the information contained in the experiment handout, and opened the GSS Topic Commenter screen for all participants. The facilitator then conducted an interactive tutorial on system operation via the telephone headset.

When the tutorial session was complete, experiment participants were instructed to open the envelopes containing the matrix worksheet at their stations, take off their telephone headsets, and set free on the GSS to discuss the problem of identifying race winners as a group for forty minutes. Participant identifiers were automatically attached by the GSS to each comment submitted to the group. During this discussion period, the facilitator guided the group effort and provided updates on time remaining through text-based messages according to the experiment script.

When one minute of the allotted forty remained, the facilitator submitted a final message to the group informing them of this fact and asking them to don their telephone headsets when the Topic Commenter screen closed at the end of that time. After taking away participants' ability to add comments to the Topic Commenter screen and then confirming that all participants were indeed wearing their headsets, the facilitator re-opened the Topic Commenter screen and informed participants via the voice channel that they had ten minutes with which to individually review the comments submitted during the discussion session. The facilitator updated participants of time remaining at five, seven and nine minutes into the period, and closed the screen at the ten-minute mark. At this time, participants were instructed to open the envelopes containing the betting form and survey, to remove their headsets, and to complete these forms.

Once again, after allowing participants sufficient time to complete these tasks, the facilitator visited each subject individually, this time to debrief participants using the debriefing script attached at Appendix B. When this task was completed, the facilitator collected experiment materials along with a transcript of the group's conversation over the GSS, labeled them by treatment and group, and placed them in a manila envelope for later coding, transcription, and analysis.

3.7 Hypothesis Outcome Measures

To recap discussion from Chapter 2, this study was based upon the premise that manipulation of facilitator alignment and location in a distributed GSS largely determines meeting structure and support with consequent effect on user justice perceptions, user attitudes, user behavior and group decision quality. The first step taken in the operationalization of these constructs was to write a clear and complete definition for each. These definitions, described in Table 3.1, below, were then validated by the group of subject experts who served as advisor and readers for this thesis.

Table 3.1 Construct Definitions

Construct 1. User Justice Perceptions Definition: Users' impressions of facilitator neutrality (informational justice), the equity of user control over the group process (configural justice), group synergy (interpersonal justice), and the fairness of GSS design (systemic justice).
Construct 2. User Attitudes Definition: Users' dispositions towards the performance of the meeting facilitator, utility of the GSS, and dynamics of the participant group.
Construct 3. User Behavior Definition: Users' contribution of proprietary information to the group, measured and expressed as a percentage of the available whole.
Construct 4. Group Decision Quality Definition: Average value of individual decisions reached by participants in a group, measured relative to optimal decision set.

Zikmund (1984) writes that cognitive phenomena such as "attitudes, motivations, expectations, intentions, and preferences cannot be observed" (222). For this reason, user justice perceptions and user attitudes towards GSS efficacy were operationalized and measured through creation and administration of a post-experimental survey. The process by which that survey was designed and validated is described in further detail in section 3.8, below.

Construct 3, user behavior, was quantified as a measure of individual information transfer levels to the group. This was done by manually coding recorded transcripts of the text-based conversation which took place over the GSS to identify individual contribution levels as a percentage of the information provided to each participant on the matrix worksheet. To this end, no effort was made to perform content analysis on user messages: only direct reference to information was credited as a contribution to the group. Group information transfer levels were obtained by evaluating the aggregate of individual members' raw scores as a percentage of the 108- bit whole.

Group decision quality, finally, was similarly quantified through direct observation. The optimal decision set to the experimental task was assigned a numerical value by multiplying the first, second, and third-place horses' preference scores by 0.5, 0.333, and 0.167, respectively. This formula yielded a weighted value of 7.33 for the decision set ([8 points * 0.5] + [7 points * 0.333] + [6 points * 0.167] = 7.33). To assign each group's efforts an aggregate value, individual bets were first assessed using this formula, then summed and divided by three to obtain an average score for the group. This number was later compared to the value of the optimal decision set to assess the relative accuracy (quality) of each group's decision.

3.8 Survey Design and Validation

The first step taken in the development of items to measure user justice perceptions and attitudes towards GSS efficacy was to break each of these constructs into the set of discrete measured variables described in Table 3.2, next page. Next, a set of six items was drafted to measure each variable. Each item was designed to employ a seven-point Likert scale to measure user perceptions and attitudes.

Table 3.2 Definition of Measured Variables by Construct

Construct 1. User Justice Perceptions

Measured Variable 1a. User Perceptions of Facilitator Neutrality (Informational Justice)

Definition: Users' impressions of facilitator biases and the impact of these biases on facilitator conduct, behavior, and direction of the group process.

Measured Variable 1b. User Perceptions of Equity of Control over Group Process (Configural Justice)

Definition: Users' impressions of whether the power to influence the meeting process, outcome, or other group members was distributed equally among experiment participants.

Measured Variable 1c. User Perceptions of Group Synergy (Interpersonal Justice)

Definition: Users' impressions of whether group members shared information cooperatively.

Measured Variable 1d. User Perceptions of the Fairness of GSS Design (Systemic Justice)

Definition: Degree to which the user was contented with the interactions and behavior of subject group members.

Construct 2. User Attitudes

Measured Variable 2a. User Satisfaction with Facilitator

Definition: Degree to which the user is contented with the performance of the meeting facilitator.

Measured Variable 2b. User Belief in GSS Utility

Definition: Degree to which the user feels the GSS was a useful aid to the group and the group meeting process.

Measured Variable 2c. User Satisfaction with the Dynamics of the Participant Group.

Definition: Degree to which the user was contented with the interactions of group members.

These questions were assessed by subject experts to ensure their clarity and completeness. After passing this initial test, each was tested to establish its content validity. To this end, a group of five subjects was drawn from the Air Force Institute of Technology's (AFIT) student body and individually tasked with matching questions from the draft survey to the construct each thought the question was designed to measure. Subjects were also instructed to mark items which they thought were vague or unclear and suggest changes. Survey items were printed on separate note cards and sorted in random order. Construct definitions were printed individually on 8 x 10-inch sheets of paper.

When the matching process was completed, respondents' coding of items was checked against the survey key. In cases where four of five subjects agreed with the key, questions were assessed as having an acceptable 80 percent inter-rater reliability rating at the item level. Questions which did not meet this criteria were either discarded or re-written. In the latter situation, new items were written for the respective construct to return the number of questions measuring each construct to the original total of six.

After this initial test, the process was repeated with a new group of five raters. In this iteration, twelve new survey items were included which were intended to serve as checks of the power of manipulation of facilitator location and alignment in the experiment. In this test, all survey items except one produced inter-rater reliability ratings of 80 percent or better. Excepting the lone item, all were included in the draft survey employed in the experiment pilot.

Through reliability analysis of data collected from pilot testing, the draft survey was ultimately paired down from six questions per measured variable, to four each, making for a grand total of thirty-six randomized items included in the final document ([7 measured variables + 2 manipulation checks] * 4 questions each = 36 questions total). The first step taken in the ultimate analysis of collected survey data was to evaluate the inter-item reliability of survey items. To this end, collected survey data was first coded to a spreadsheet. Next, randomized survey items were sorted by the item key, and then evaluated using SPSS statistical software to derive a correlation matrix and reliability coefficient for each set of four questions by measured variable. Mean and standard deviation were also calculated for each item.

One question was deleted from the User Perceptions of the Fairness of GSS Design scale due to poor correlation with other items in the scale. All scales achieved an acceptable reliability of .80 or greater as indexed by Chronbach's alpha. The actual items retained, means, standard deviations, and scale reliabilities are described in Tables 3.3 – 3.5, below and next pages. Reported scale means have been standardized by dividing the grand mean by the number of items included in each measure.

Table 3.3 Reliability Analysis – Manipulation Checks

	M	SD	α
Manipulation Check 1: Facilitator Location	**4.56**	**0.00**	**0.95**
One of the experiment participants had better access to the facilitator than the other participants.	4.51	2.14	
One of the experiment participants had the ability to communicate with the facilitator without the knowledge of the other participants.	4.58	2.21	
One of the experiment participants had the ability to communicate with the experiment facilitator outside of the GSS.	4.58	2.42	
The facilitator had the ability to communicate with one experiment participant without the knowledge of the other participants.	4.60	2.21	
Manipulation Check 2: Facilitator Alignment	**3.57**	**0.07**	**0.83**
The facilitator had incentive to provide special aid to one experiment participant.	3.79	1.88	
The facilitator had motivation to influence the experiment's outcome in favor of one experiment participant.	3.40	1.65	
The facilitator had reason to provide special help to just one experiment participant.	3.83	1.77	
The facilitator was motivated to enhance the performance of one participant at the expense of the other participants.	3.28	1.76	

Table 3.4 Reliability Analysis - User Justice Perceptions

	M	SD	α
MV1a: User Perceptions of Facilitator Neutrality	**4.53**	**0.14**	**0.80**
The facilitator did not provide special aid to any participant during the experiment.	4.11	2.02	
The facilitator helped all participants equally during the experiment.	4.52	1.86	
I trusted that the facilitator was helping all participants fairly during the experiment.	5.04	1.61	
The facilitator acted impartially throughout the experiment.	4.44	1.63	
MV1b: User Perceptions of Equality of Power Distribution Among Experiment Participants	**4.83**	**0.04**	**0.86**
No experiment participant had more control over the meeting process than any other.	4.51	1.61	
All experiment participants shared equal power to control meeting outcomes.	4.91	1.72	
I had the same level of control over meeting outcomes as every other experiment participant.	4.88	1.69	
All experiment participants shared equal power to control the information exchange process.	5.02	1.53	
MV1c: User Perceptions of Group Synergy	**5.22**	**0.21**	**0.93**
All experiment participants willingly shared their information with the group.	5.08	1.47	
All experiment participants shared information cooperatively to benefit the group as a whole.	5.22	1.49	
All experiment participants actively shared information with the group.	5.43	1.48	
Every experiment participant shared information freely with the group.	5.16	1.68	
MV1d. User Perceptions of the Fairness of GSS Design	**5.07**	**0.40**	**0.91**
The GSS employed in the experiment was set up to benefit all participants equally.	5.26	1.60	
The setup of the GSS benefited all experiment participants equally.	5.09	1.67	
The setup of the GSS favored all participants equally.	4.86	1.82	

Table 3.5 Reliability Analysis - User Attitudes

	M	SD	α
MV2a: User Satisfaction with Facilitator	**5.56**	**0.07**	**0.90**
I am satisfied with the aid the facilitator provided ME during the experiment.	5.16	1.58	
I feel the facilitator performed his duties in a satisfactory manner.	5.75	1.17	
I am satisfied with the facilitator's direction of the group's activities during the experiment.	5.65	1.33	
In my opinion, the facilitator performed his duties effectively.	5.68	1.25	
MV2b: User Belief in GSS Utility	**5.19**	**0.12**	**0.85**
I feel the GSS employed in the experiment aided the information exchange process.	4.95	1.50	
I feel the GSS employed in the experiment was an aid to group efficiency.	4.83	1.53	
I feel the GSS employed in the experiment helped the group exchange information.	5.58	1.11	
I feel the GSS employed in the experiment helped focus the information exchange process.	5.38	1.26	
MV2c: User Satisfaction with Dynamics of the Participant Group	**5.41**	**0.03**	**0.91**
I would not mind working with this group again.	5.66	1.27	
I am pleased with the performance of our group.	5.27	1.47	
In my opinion, I and the other experiment participants worked effectively as a group.	5.27	1.30	
I found the other experiment participants easy to work with.	5.43	1.18	

3.9 Statistical Analysis

To distill meaning from collected data, two-way factorial analysis of variance (ANOVA) was performed to compare group means by treatment. As the name at least partially suggests, ANOVA requires comparison of the variance of sample data contained within each treatment group with the variance of other corresponding groups to evaluate the null hypothesis that the collective means of each group are equal.

This end was accomplished through performance of a series of F-tests to evaluate the main and interactive effects of facilitator alignment and location on group means. An F-statistic, the ratio of variation between treatment groups to the variation among all groups, was computed for each dependent

variable of interest to this study. This statistic was determined to be statistically reliable when the probability of Type I error (falsely rejecting the null hypothesis) was less than five percent (*alpha* (α) < 0.05). In each case that the F-statistic was found to be significant, the null hypothesis that treatment means were equal was rejected in favor of the alternative explanation that there existed a meaningful relationship between the independent and dependent variables of concern.

When such a relationship was determined to exist, an index known as *eta-squared* (eta^2) was employed to assess its strength. This measure, which can range between 0 and 1.00, quantifies the influence of facilitator alignment or location on the dependent variable of immediate interest. According to this index, the relationship between variables grows stronger as eta^2 approaches 1.00.

Though standards differ considerably between researchers on the substantive interpretation of points along the index itself, in measures of human perceptions, attitudes, and behavior, an eta^2 near 0.05 is generally considered a weak effect, 0.10 a moderate effect, and an eta^2 greater than 0.15 a strong effect. These standards, however, must be considered somewhat arbitrary and can be revised downward (Jaccard and Becker, 1997:275-276).

It must be appreciated that eta^2 describes the strength of the relationship between two variables of interest in a set of *sample* data. This fact is of concern to this discussion mostly because the index can be informative even in cases where the F-statistic is non-significant. Because statistical power increases with sample size, when sample sizes are small (as in the case of this study), the power of the tests employed will tend to be low and researchers will subsequently be relatively unlikely to reject a false null hypothesis. If the null hypothesis is not rejected and eta^2 is small, then the statistical decision to not reject the null hypothesis is reinforced. Situations in which the F-statistic is not significant and eta^2 is relatively large, however, serve as flags alerting the researcher of potentially low statistical power and occasion of Type II error.

For each of the measured variables and constructs of concern to this study, as appropriate, ANOVA was performed to generate interaction tables and summary statistics. These products were then examined to evaluate the significance of the relationship between treatment means.

3.10 Summary

This chapter describes the process by which an original 2 x 2 factorial experiment was designed validated, and administered to investigate the question of whether facilitator alignment and/or co-location with a meeting member impacts the efficacy of GSSs employed in a distributed setting. In addition to describing the methods in this investigation, the chapter explains how the theorized cause-and-effect relationship between manipulation of independent variables and process outcomes was operationalized, first as a series of related constructs, and each of these later as a set of as measured variables. It further describes the specific means by which data were garnered to quantify each, and finally, the means by which these data were analyzed in an effort to make inference as to the actual nature of the relationship between the independent variables of concern and process outcomes.

The results of this analysis effort are described in the following chapter. Interpretation of these results and recommendations for future research based on these findings are presented in Chapter V.

IV. Analysis of Data

4.1 Introduction

This chapter presents an assessment of the effectiveness of manipulations included in the experimental design and an analysis of collected data. The consequence of this information in terms of the research hypotheses of interest to this work is described in Chapter V.

4.2 Manipulation Checks

To assess the effectiveness of a manipulation, it is only necessary to compare the means of survey data collected from groups which experienced the manipulation against those which did not and then to test for a difference between the two. Though Student's t-test for comparison of treatment means could have been used for this purpose, for the sake of consistency and convenience, ANOVA, and, subsequently, the F-test, were employed to the same end.[2]

4.2.1 Facilitator Location

The summary results of ANOVA for manipulation of facilitator location are presented in Figure and Table 4.1, next page, respectively.

A review of summary statistics shows that the manipulation was a success, with recipients of the manipulation registering a marginal mean of 6.35 (s = 0.64) for perception of co-location of the facilitator with a single experiment participant against a marginal mean of 2.79 (s=1.40) for those who were not exposed to the manipulation. Review of summary statistics verifies that this difference in means is significant at an $\alpha = .001$ level, $F(1,68) = 192.14$, $p < .001$, and tells us that the effect of the manipulation on the dependent variable was very strong ($eta^2 = .74$).

[2] Student's t and the F-test essentially report the same result, the value of the F statistic equaling the squared value of the t.

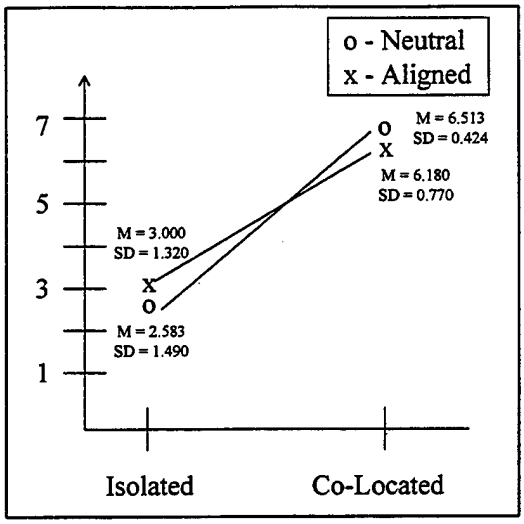


Figure 4.1 Interaction Table for Manipulation of Facilitator Location

Table 4.1 Summary Statistics for Manipulation of Facilitator Location

Source	Degrees Freedom	Mean Square	F	Significance	Eta^2
LOCATION	1	227.556	192.138	.000	.739

4.2.2 Facilitator Alignment

The summary results of ANOVA for manipulation of facilitator alignment are presented in Figure and Table 4.2, next page.

Review of ANOVA for manipulation of facilitator alignment shows that this manipulation was also successful: participants who were exposed to it registered a marginal mean of 4.19 (s = 1.29) for perception of alignment of the facilitator with a single meeting member, against a marginal mean of 2.95 (s = 1.31) for non-recipients of the manipulation. Review of summary statistics confirms that the difference in means is statistically reliable, $F(1,68) = 16.94$, $p < .001$, $eta^2 = .20$. Though strong in a general and objective sense, it is relevant to note that the strength of this manipulation is weaker than the facilitator location manipulation in the experiment.

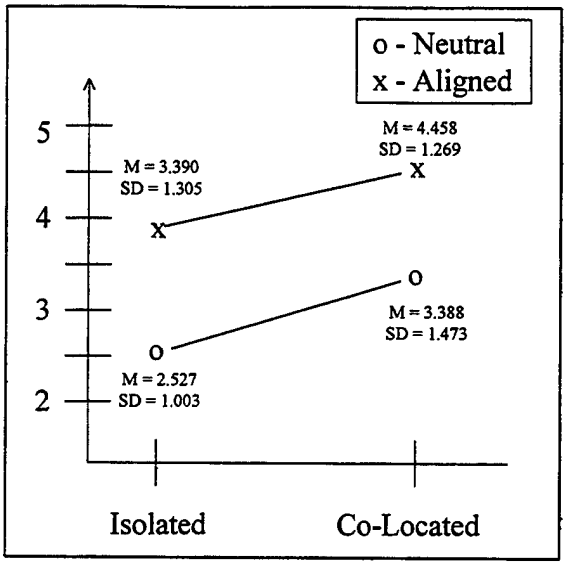


Figure 4.2 Interaction Table for Manipulation of Facilitator Alignment

Table 4.2 Summary Statistics for Manipulation of Facilitator Alignment

Source	Degrees Freedom	Mean Square	F	Significance	Eta^2
ALIGNMENT	1	27.503	16.941	.000	.20

4.3 Group Member Perceptions of Fairness

4.3.1 User Perceptions of Facilitator Neutrality

The summary results of ANOVA for User Perceptions of Facilitator Neutrality are presented in Figure and Table 4.3, next page.

A review of ANOVA results shows that the alignment of the facilitator had a negative effect on user perceptions of facilitator neutrality (m = 3.80, s = 1.16) as compared with groups in which the facilitator was not aligned (m = 5.26, s = 1.27), $F(1,68) = 27.79$, $p < .001$, $eta^2 = .29$. Co-location of the facilitator with a single meeting member also appears to have a negative effect on user perceptions of facilitator neutrality (m = 4.27, s = 1.55) as compared with groups in which the facilitator was not co-located with a group member (m = 4.80, s = 1.23). This effect, however, was not statistically reliable: $F(1,68) = 3.51$, $p > .065$, $eta^2 = .05$. Consideration of these summary statistics suggests, however, that if

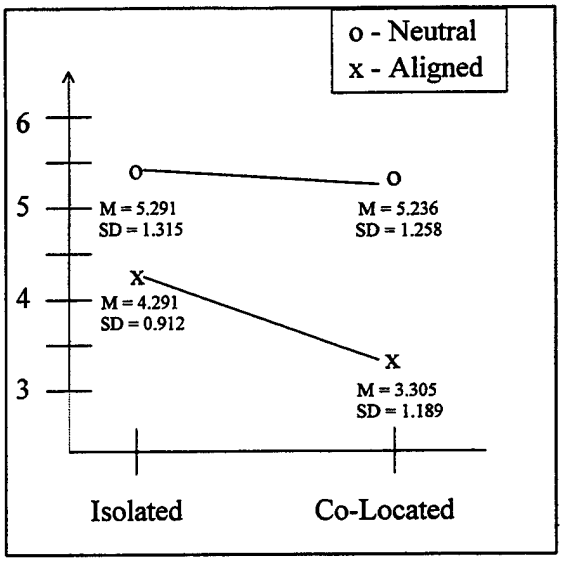


Figure 4.3 Interaction Table for User Perceptions of Facilitator Neutrality

Table 4.3 Summary Statistics for User Perceptions of Facilitator Neutrality

Source	Degrees Freedom	Mean Square	F	Significance	Eta^2
ALIGNMENT	1	38.647	27.790	.000	.290
LOCATION	1	4.883	3.511	.065	.049
INTERACTION	1	3.897	2.802	.099	.040

sample size and thus the power of our statistical tools were increased, we might uncover statistically reliable evidence of existence of an effect by facilitator location.

These main effects were not qualified by a statistically reliable interaction effect, $F(1,69) = 2.80$, $p < .099$, $eta^2 = .04$. Groups in which the facilitator was co-located and aligned with a single group member, then, did not perceive the facilitator to be less neutral than other treatment groups

4.3.2 User Perceptions of Equality of Power Distribution Among Experiment Participants

The summary results of ANOVA for User Perceptions of Equality of Power Distribution Among Experiment Participants are presented in Figure and Table 4.4, next page.

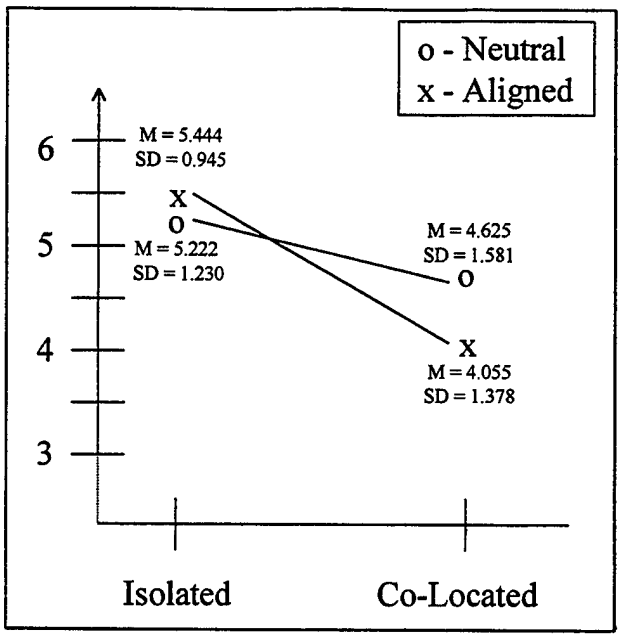


Figure 4.4 Interaction Table for User Perceptions of Equality of Power Distribution Among Experiment Participants

Table 4.4 Summary Statistics for User Perceptions of Equality of Power Distribution Among Experiment Participants

Source	Degrees Freedom	Mean Square	F	Significance	Eta^2
ALIGNMENT	1	.543	.319	.574	.005
LOCATION	1	17.751	10.425	.002	.133
INTERACTION	1	2.820	1.656	.202	.024

The influence of facilitator alignment and location on user perceptions of equality of power distribution among experiment participants is shown in Table 4.3. A review of ANOVA results shows that the alignment of the facilitator with a single meeting member had no effect on user perceptions of equality of power distribution among experiment participants (m = 4.75, s = 1.36) as compared with groups in which the facilitator was not aligned (m = 4.92, s = 1.43), $F(1,68) = 0.32$, $p > .57$, $eta^2 = .01$. Co-location of the facilitator with a single member, however, did have a negative effect on measured levels of this variable. Groups with a co-located facilitator recorded less equal perceptions of power distribution between group members than those groups in which the facilitator was isolated from all members

(m = 4.34, s = 1.49 vs. m = 5.33, s = 1.08, respectively). This effect was statistically reliable at an $\alpha = .05$ level: $F(1,68) = 10.42$, $p = .002$, $eta^2 = .13$.

These main effects were not qualified by a statistically reliable interaction effect: $F(1,69) = 1.65$, $p > .202$, $eta^2 = .02$. Groups in which the facilitator was co-located and aligned with a single group member, then, did not perceive the distribution of power between experiment participants to be more unequal than the members of other treatment groups.

4.3.3 User Perceptions of Group Synergy

The summary results of ANOVA for User Perceptions of Group Synergy are presented in Figure and Table 4.5, next page.

A review of the ANOVA results shows that the alignment of the facilitator had a negative effect on user perceptions of group synergy ($m = 4.69$, $s = 1.45$) as compared with groups in which the facilitator was not aligned ($m = 5.76$, $s = 1.10$), $F(1,68) = 12.78$, $p = .001$, $eta^2 = .16$. Co-location of the facilitator also appears to have had slight negative effect on user perceptions of group synergy ($m = 4.94$, $s = 1.46$) as compared with groups in which the facilitator was not co-located with a group member ($m = 5.50$, $s = 1.26$). This effect, however, was not statistically reliable: $F(1,68) = 3.49$, $p = .066$, $eta^2 = .05$. Close consideration of these summary statistics suggests though, that if sample size and thus the power of our statistical tools were increased, there might also exist reliable evidence of existence of an effect.

These main effects are not qualified by an interaction effect of any statistical significance: $F(1,69) = 0.02$, $p = .872$, $eta^2 = .00$. Thus, groups in which the facilitator was co-located and aligned with a single group member, then did not perceive lower levels of group synergy than other treatment groups.

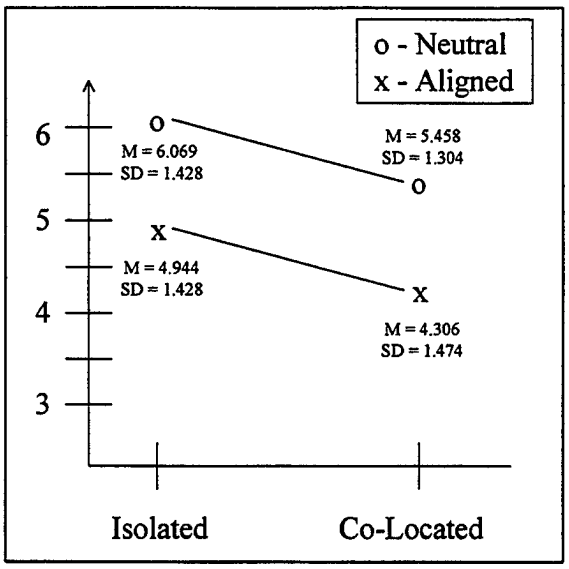


Figure 4.5 Interaction Table for User Perceptions of Group Synergy

Table 4.5 Summary Statistics for User Perceptions of Group Synergy

Source	Degrees Freedom	Mean Square	F	Significance	Eta^2
ALIGNMENT	1	20.885	12.784	.001	.158
LOCATION	1	5.695	3.491	.066	.049
INTERACTION	1	.004	.026	.872	.000

4.3.4 User Perceptions of Fairness of GSS Design

The summary results of ANOVA for User Perceptions of Fairness of GSS Design are presented in Figure and Table 4.6, next page.

A review of ANOVA results reveals that alignment of the facilitator with a single meeting member had a negative effect on user perceptions of fairness in GSS design (m = 3.51, s = 1.27) as compared with groups in which the facilitator was not aligned (m = 4.10, s = 1.02), $F(1, 68) = 5.52$, $p = 0.22$, $eta^2 = .08$. The co-location of the facilitator also had a negative effect on user perceptions of the fairness of the GSS design (m = 3.33, s = 1.28) as compared with groups in which the facilitator was not co-located with a group member (m = 4.28, s = 0.85). This effect was statistically reliable: $F(1, 68) = 14.77$, $p < .001$, $eta^2 = .18$.

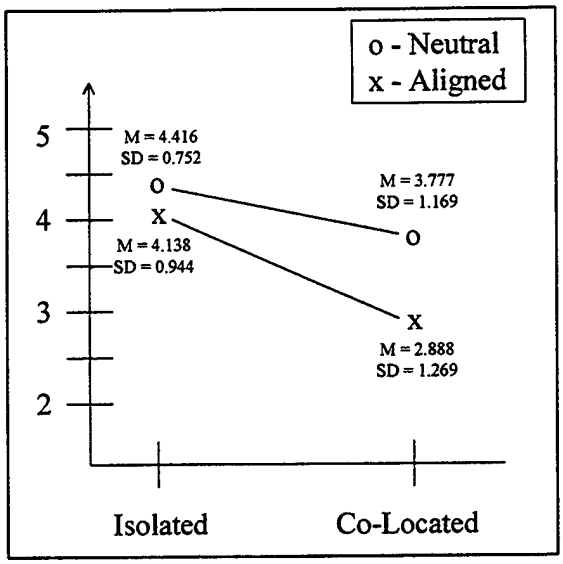


Figure 4.6 Interaction Table for User Perceptions of Fairness of GSS Design

Table 4.6 Summary Statistics for User Perceptions of Fairness of GSS Design

Source	Degrees Freedom	Mean Square	F	Significance	Eta^2
ALIGNMENT	1	6.125	5.523	.022	.075
LOCATION	1	16.056	14.777	.000	.176
INTERACTION	1	1.681	1.515	.223	.022

These main effects, however, evidence no interaction effect: $F(1,69) = 1.51$, $p = .223$, $eta^2 = .02$. Groups in which the facilitator was co-located and aligned with a single group member thus did not perceive the design of the GSS to be less equitable than the other treatment groups.

4.4 Group Member Attitudes Toward the Facilitator, Group, and GSS

4.4.1 User Satisfaction with Facilitator

The summary results of ANOVA for User Satisfaction with Facilitator are presented in Figure and Table 4.7, next page.

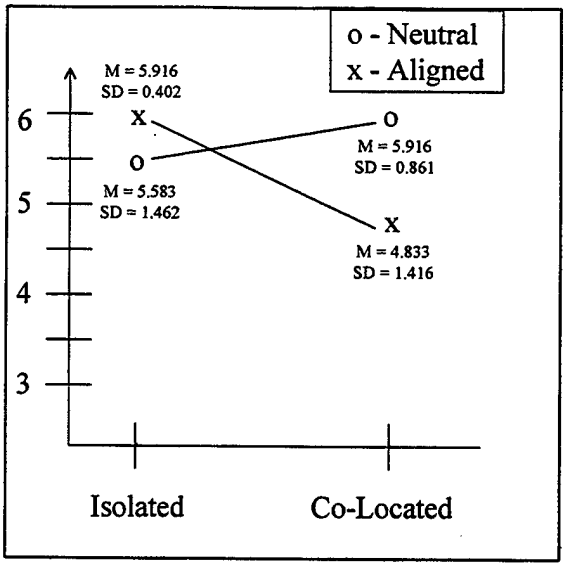


Figure 4.7 Interaction Table for User Satisfaction with Facilitator

Table 4.7 Summary Statistics for User Satisfaction with Facilitator

Source	Degrees Freedom	Mean Square	F	Significance	Eta^2
ALIGNMENT	1	2.531	2.004	.161	.029
LOCATION	1	2.531	2.004	.161	.029
INTERACTION	1	9.031	7.151	.009	.095

Review of the ANOVA results shows that alignment of the facilitator had no effect on user satisfaction with the facilitator (m = 5.37, s = 1.16) as compared with groups in which the facilitator was not aligned (m = 5.75, s = 1.19), $F(1,68) = 2.00$, p = .161, eta^2 = .03. Similarly, the co-location of the facilitator appeared to have no effect on user satisfaction with that individual (m = 5.37, s = 1.28) as compared with groups in which the facilitator was not co-located with a group member (m = 5.75, s = 1.07), $F(1,68) = 2.00$, p = .161, eta^2 = .03.

These main effects, however, are qualified by a statistically reliable interaction effect, $F(1,69) = 7.15$, p = .009, eta^2 = *.10.* Groups in which the facilitator was co-located and aligned with a single group member, then, were less satisfied with the performance of the facilitator than other treatment groups.

4.4.2 *User Belief in GSS Utility*

The summary results of ANOVA for User Belief in GSS Utility are presented in Figure and Table 4.8, below.

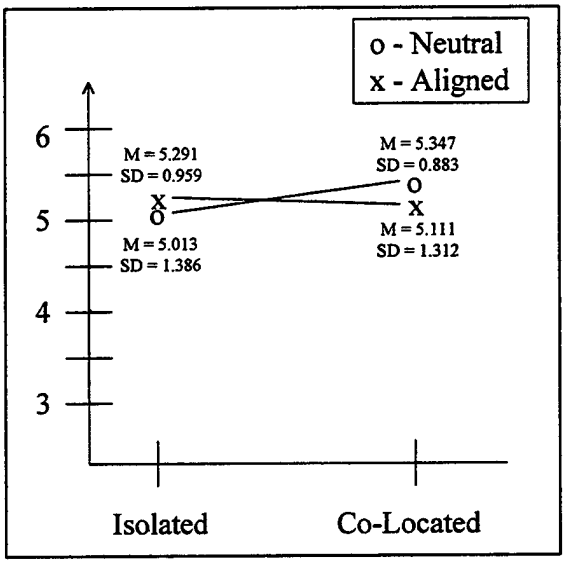


Figure 4.8 Interaction Table for User Belief in GSS Utility

Table 4.8 Summary Statistics for User Belief in GSS Utility

Source	Degrees Freedom	Mean Square	F	Significance	Eta^2
ALIGNMENT	1	.0007	.006	.939	.000
LOCATION	1	.105	.079	.780	.001
INTERACTION	1	1.188	.889	.349	.013

A review of ANOVA results shows that the alignment of the facilitator had no effect on user belief in GSS utility (m = 5.20, s = 1.16) as compared with groups in which the facilitator was not aligned (m = 5.18, s = 1.16), $F(1,68) = 0.01$, p = .939, eta^2 = .00. Similarly, co-location of the facilitator with a single meeting member had no effect on user belief in GSS utility (m = 5.22, s = 1.11) as compared with groups in which the facilitator was not co-located with a group member (m = 5.16, s = 1.18). Review of the summary statistics described in Table 4.8 confirms this assertion ($F(1,68) = 0.08$, p = .780, eta^2 = .00.

These main effects are not qualified an interaction effect: $F(1,69) = 0.89$, $p = .349$, $eta^2 = .01$. Groups in which the facilitator was co-located and aligned with a single group member then, did not believe the GSS was any less utile than other treatment groups.

4.4.3 User Satisfaction with Dynamics of Participant Group

The summary results of ANOVA for User Satisfaction with Dynamics of Participants Group are presented in Figure and Table 4.9, below.

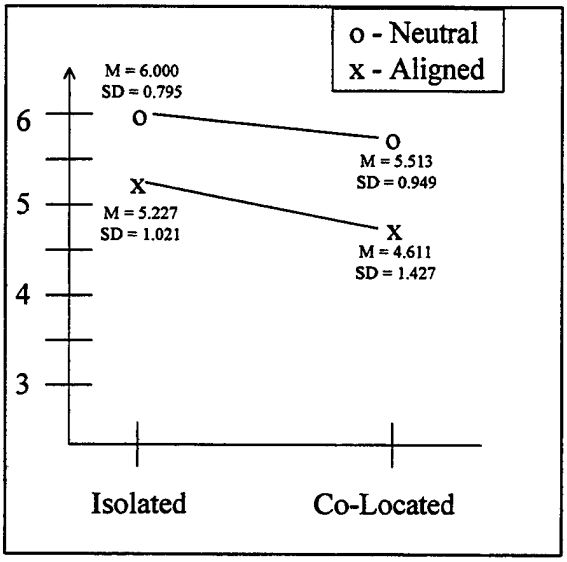


Figure 4.9 Interaction Table for User Satisfaction with Dynamics of Participant Group

Table 4.9 Summary Statistics for User Satisfaction with Dynamics of Participant Group

Source	Degrees Freedom	Mean Square	F	Significance	Eta^2
ALIGNMENT	1	8.508	7.375	.008	.098
LOCATION	1	8.855	7.676	.007	.101
INTERACTION	1	.834	.723	.398	.011

ANOVA results show that the alignment of the facilitator had a negative effect on user satisfaction with participant group dynamics ($m = 5.07$, $s = 1.30$) as compared with groups in which the facilitator was not aligned ($m = 5.75$, $s = 0.89$), $F(1,68) = 7.37$, $p = .008$, $eta^2 = .10$. The co-location of the facilitator also had a negative effect on this perception ($m = 5.06$, $s = 1.28$) as compared with groups in which the

facilitator was not co-located with a group member (m = 5.76, s = 0.03). This effect was statistically reliable $F(1,68) = 7.67, p = .007, eta^2 = .10$.

ANOVA revealed, however, no interaction between these main effects: $F(1,69) = 0.72$, $p = .398$, $eta^2 = .01$. Thus do we conclude that groups in which the facilitator was co-located and aligned with a single group member were not less satisfied with the dynamics of their participant group than were the other treatment groups.

4.5 User Behavior (Information Transfer Between Users Expressed as a Percentage)

The summary results of ANOVA for Construct 3, User Behavior, are presented in Figure and Table 4.10, next page.

ANOVA revealed that alignment of the facilitator had a negative effect on information transfer between users (m = 0.82, s = 0.21) as compared with groups in which the facilitator was not aligned (m = 0.96, s = 0.009), $F(1,68)$ = 13.7o, $p < .001$, $eta^2 = .17$. The co-location of the facilitator, however, appears to have had no effect on user behavior (m = 0.90, s = 0.17) as compared with groups in which the facilitator was not co-located with a group member (m = 0.88, s = 0. 17). Review of the summary statistics contained in Table 4.10 confirms this statement: $F(1,68) = 0.15$, $p > .701$, $eta^2 = .00$. Further, Table 4.10 presents evidence against the presence of an interaction effect between these main effects: ($F(1,69) = 0.07$, $p = .788$, $eta^2 = .00$). Groups in which the facilitator was co-located and aligned with a single group member did not transfer less information between members than the other treatment groups.

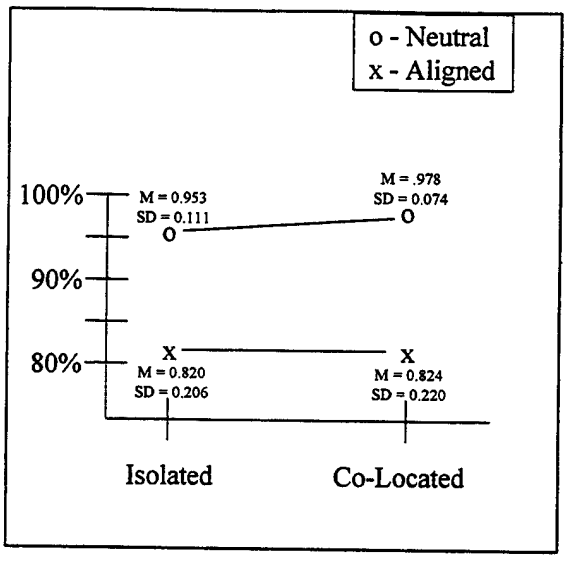


Figure 4.10 Interaction Table for User Behavior (Expressed as a Percentage)

Table 4.10 Summary Statistics for User Behavior (Expressed as a Percentage)

Source	Degrees Freedom	Mean Square	F	Significance	Eta^2
ALIGNMENT	1	512.00	13.700	.000	.168
LOCATION	1	5.556	.149	.701	.002
INTERACTION	1	2.722	.073	.788	.001

4.6 Decision Quality

The summary results of ANOVA for Construct 4, Decision Quality, are presented in Figure and Table 4.11, next page.

A review of the ANOVA results shows that the alignment of the facilitator did have a negative effect on user perceptions of facilitator neutrality (m = 7.05, s = 0.41) as compared with groups in which the facilitator was not aligned (m = 7.25, s = 0.23), $F(1,68) = 5.84$, $p = .018$, $eta^2 = .08$. Co-location of the facilitator with a single meeting member, however, did not have an effect on decision quality levels (m = 7.13, s = 0.32) as compared with groups in which the facilitator was not co-located with a group member (m = 7.17, s = .38). Review of Table 4.11 confirms this assertion: $F(1,68) = 0.32$, $p = .575$, $eta^2 = .01$.

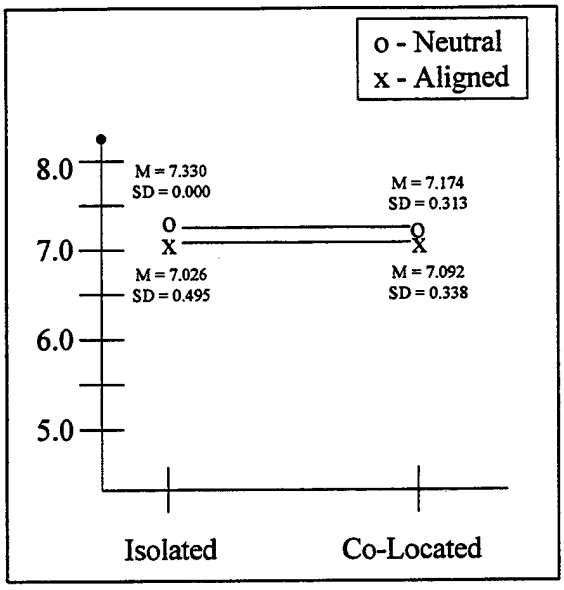


Figure 4.11 Interaction Table for Decision Quality

Table 4.11 Summary Statistics for Decision Quality

Source	Degrees Freedom	Mean Square	F	Significance	Eta^2
ALIGNMENT	1	.669	5.838	.018	.079
LOCATION	1	.0036	.318	.575	.005
INTERACTION	1	.220	1.920	.170	.027

Finally, these main effects are not qualified by an interaction effect ($F(1,69) = 1.92$, $p = .170$, $eta^2 = .02$). Thus do we conclude that groups in which the facilitator was co-located and aligned with a single group member did not produce decision of lower quality than members of the other treatment groups.

4.7 Summary

This chapter presents an assessment of the success of manipulations included in the experimental design and the results of analysis performed on data collected through survey administration and direct observation of experiment participants. The results of this analysis effort, excluding the discussion of

manipulation success, are presented in Table 4.12. In the following chapter, Chapter V, these results are discussed more specifically in terms of the research hypotheses of interest to this investigative effort.

Table 4.12 Summary of Effect Size and Statistical Significance

	Strength of Effect (eta^2)		
	Location	Alignment	Interaction
User Justice Perceptions			
Facilitator Neutrality	.05	.29 **	.04
Equality of Power Distribution	.13 **	.05	.02
Group Synergy	.05	.16 **	.00
Fairness of GSS Design	.18 **	.08 *	.02
User Attitudes			
Satisfaction with Facilitator	.03	.03	.10 **
Belief in GSS Utility	.00	.00	.01
Satisfaction with Group Dynamic	.10 **	.10 **	.01
User Behavior (Information Transfer)	.00	.17 **	.00
Decision Quality	.00	.08 *	.03

* $\wp < .05$, ** $\wp < .01$

V. Conclusions and Recommendations

5.1 Introduction

The stated purpose of this research was to evaluate the need for facilitator neutrality and isolation from meeting members in GSSs configured in distributed settings. The study posited that system configurations in which the facilitator is co-located and/or aligned with a meeting member contribute to appearances of system and process partiality, to the detriment of the group process and process outcomes. To investigate this hypothesis, the author of this work sought to isolate and quantify the main and interactive effects of facilitator location and alignment on user justice perceptions, user attitudes towards the efficacy of GSS, user information-sharing behavior, and group decision quality.

In this final chapter, the results of the investigative effort are described according to the research hypotheses set forth in Chapter II and in a general set of conclusions and recommendations drawn from consideration of this set of hypotheses. These conclusions are ultimately qualified by a discussion of the limitations of the research effort. Finally, recommendations for further research are presented based on the conclusions and limitations of the study.

5.2 Hypothesis 1: Effects of Facilitator Co-Location

Hypothesis 1 proposed that co-location of the facilitator with a single meeting member in a GSS configured in a distributed setting would negatively impact users' justice perceptions, their attitudes towards the efficacy of GSS, user information sharing behavior, and group decision quality. For the purpose of evaluation, this complex idea was broken into a set of four sub-hypotheses that are described and discussed further, next page.

5.2.1 Hypothesis 1a

Hypothesis 1a posited that co-location of the facilitator with a single meeting member in a GSS configured in a distributed setting would negatively impact user justice perceptions. Review of data analysis presented in Chapter IV presents strong support for this proposition.

Recalling that the user justice perception construct was broken down into four discrete measured variables (user perceptions of facilitator neutrality, equality of power distribution among experiment participants, group synergy, and fairness of GSS design), we see that ANOVA results were statistically significant with strong effects for two of these four: equality of power distribution among experiment participants, and fairness of GSS design.

That these variables represent the structurally moderated perceptions from Greenberg's (1993) justice taxonomy and were influenced by the location of the facilitator (a structural influence in MFF) adds credence to the hypothesis that co-location of the facilitator with a single meeting member has a negative impact on user justice perceptions. The other measured variables in this set, user perceptions of facilitator neutrality and user perceptions of group synergy, were not statistically significant. These results indicate that the structural influence of facilitator location has little effect on the socially-moderated perceptions of justice.

5.2.2 Hypothesis 1b

Hypothesis 1b suggested that co-location of the facilitator with a single meeting member in a GSS configured in a distributed setting would negatively impact user attitudes towards the efficacy of GSS technology. Examination of the ANOVA results from Chapter IV presents some evidence to support this statement.

Like the user justice perceptions construct, user attitudes towards the efficacy of GSS was broken down into a set of discrete measured variables. Co-location of the facilitator with a single meeting member was demonstrated to have no effect on user satisfaction with the meeting facilitator and user belief in GSS utility. User satisfaction with the dynamics of the participant group, however, did evidence a moderate to strong effect according to location of the facilitator. To explain this

inconsistency, it is conjectured that the set did not measure the user attitudes construct *in toto* as was intended, but rather, that the individual components of this set measure more discrete and differing attitudinal constructs. Further support for and discussion of this statement is presented in section 5.5, *Limitations and Suggestions for Further Research.*

5.2.3 Hypothesis 1c

Hypothesis 1c presented the idea that co-location of the facilitator with a single meeting member in a GSS configured in a distributed setting would negatively impact user information-sharing behavior. Analysis of data collected through direct observation of participant groups, however, presented no support for this statement.

5.2.4 Hypothesis 1d

Hypothesis 1d posited that that co-location of the facilitator with a single meeting member in a GSS configured in a distributed setting would negatively impact group decision quality. The results of ANOVA performed on data collected through direct observation of experiment participants, though, presented no evidence to support this hypothesis.

5.3 Hypothesis 2: Effects of Facilitator Alignment

Research Hypothesis 2 stated that facilitator alignment with a single meeting member in a GSS configured in a distributed setting would negatively impact users' justice perceptions, their attitudes towards the efficacy of GSS, user information sharing behavior, and group decision quality. As in the case of Hypothesis 1, this complex idea is broken down into a set of four sub-hypotheses. Each is described and discussed, next page.

5.3.1 Hypothesis 2a

Hypothesis 2a suggested that alignment of the facilitator with a single meeting member in a GSS configured in a distributed setting would negatively impact user justice perceptions. Results of

ANOVA testing show statistically significant effect for three of the four variables used to operationalize the user justice perceptions construct.

Specifically, user perceptions of facilitator neutrality and user perceptions of group synergy showed especially strong effects from facilitator alignment with a single meeting member. That these two variables represent the socially moderated perceptions of fairness from Greenberg's (1993) justice taxonomy and were influenced by the alignment of the facilitator (a social influence in the MFF) provides strong support for the hypothesis that alignment of the facilitator with a single meeting member has negative influence on justice perceptions.

In addition to these strong effects, user perceptions of the fairness of GSS design, a structurally-moderated perception of fairness according to Greenberg's (1993) taxonomy, was also shown to have been moderately effected by facilitator alignment. This fact suggests that there may be some spill over effects of the social influence of alignment on this structurally induced fairness perception.

Finally, user perceptions of equality of power distribution among experiment participants, was decidedly not related to facilitator alignment.

5.3.2 Hypothesis 2b

Hypothesis 2b suggested that facilitator alignment with a single meeting member in a GSS configured in a distributed setting would negatively impact user perceptions of the efficacy of GSS technology. Similar to the earlier example of Hypothesis 1b, alignment of the facilitator with a single meeting member was demonstrated to have no effect on the first two of the three measured variables that compose the set, user satisfaction with the meeting facilitator and user belief in GSS utility.

Again, however, user satisfaction with the dynamics of the participant group does show evidence of a moderate to strong effect from alignment of the facilitator. That this example so closely correlates to findings for Hypothesis 1b further supports the idea of complexity in operationalization of the user attitudes construct.

5.3.3 Hypothesis 2c

This hypothesis maintained that facilitator alignment with a single meeting member in a GSS configured in a distributed setting would negatively impact user information-sharing behavior. ANOVA analysis of collected data presents strong support for this statement, demonstrating that groups with neutral facilitators transferred roughly thirteen percent more information than counterpart groups with an aligned facilitator.

5.3.4 Hypothesis 2d

Hypothesis 2d asserted that facilitator alignment with a single meeting member in a GSS configured in a distributed setting would negatively impact group decision quality. Again ANOVA analysis of collected data strongly supports this statement.

5.4 Hypothesis 3: Interactive Effects of Facilitator Co-Location and Alignment

Research Hypothesis 3 posited that co-location and alignment of the facilitator with a single meeting member in a GSS configured in a distributed setting would have an interactive, negative impact on users' justice perceptions, their attitudes towards the efficacy of GSS, user information sharing behavior, and group decision quality. As in both cases before, this idea is broken down into a set of four sub-hypotheses, described and discussed below.

5.4.1 Hypothesis 3a

This hypothesis suggested that co-location and alignment of the facilitator with a single meeting member in a GSS configured in a distributed setting would have an interactive, negative effect on user justice perceptions. Review of ANOVA results for the four measured variables used to operationalize the user justice perceptions construct show no support for this statement however.

5.4.2 Hypothesis 3b

This postulate stated that co-location and alignment of the facilitator with a single meeting member in a GSS configured in a distributed setting would have an interactive, negative effect on user perceptions of the efficacy of GSS technology. Similar to the example of Hypotheses 1b and 2b, two of the three measured variables used to operationalize the user attitudes construct were statistically insignificant.

The mean level of users' satisfaction with the meeting facilitator was shown to differ from the other treatment groups when the meeting facilitator was both aligned and co-located with a single experiment participant. The moderate effect size of this relationship provides some support to the hypothesis that co-location and alignment of the facilitator interact to negatively impact user attitudes.

Once more, the consequence of this finding with regard to operationalization of the user attitudes construct is discussed in greater detail in section 5.5 of this work.

5.4.3 Hypothesis 3c

Hypothesis 3c suggested that co-location and alignment of the facilitator with a single meeting member in a GSS configured in a distributed setting would have an interactive, negative effect on user information-sharing behavior. Evidence provided by ANOVA, however, showed no support for this statement.

5.4.4 Hypothesis 3d

Hypothesis 3d posited that co-location and alignment of the facilitator with a single meeting member in a GSS configured in a distributed setting would have an interactive, negative effect on group decision quality. Review of ANOVA results for this example, does not support the hypothesis.

5.5 Conclusions and Recommendations

Through analysis of collected survey and observational data, this study concludes then that co-location of the facilitator with a single meeting member in a GSS configured in a distributed setting has moderate to strong impact on the structural determinants of user justice perceptions and user satisfaction with the dynamics of the participant group. No evidence was found, however, of an effect caused by co-location of the facilitator with a meeting member on user belief in the efficacy of the technology, user satisfaction with the performance and conduct of the meeting facilitator, information transfer between users, or group decision quality.

Alignment of the facilitator with a single meeting member may not detract from users' perceptions of the utility of GSS. This condition does, however, impact group members' perceptions of situational justice (the social determinants of said perceptions in particular), their satisfaction with the dynamics of the participant group, their willingness to share information with the user group, and ultimately the quality of the group's decisions. These findings are profound given the relatively weak manipulation of the alignment variable, and the fact that the facilitator acted neutrally in every condition regardless of location or alignment. These results tell us that group members' perceptions of social and structural influences matter to the group process, and that they ultimately effect both user behavior and group performance.

Finally, tandem co-location and alignment of the facilitator with a meeting member was shown to have no interactive effect on user justice perceptions, their attitudes towards the efficacy of the technology (excepting user satisfaction with the facilitator), their willingness to share information with the group, or group decision quality. This fact suggests that these variables are independent and do not interact with each other.

In sum, the findings of this work indicate that isolation of the facilitator from meeting members is a desirable quality in GSS configuration, and that obtaining a neutral facilitator to moderate GSS-supported meetings has significant effect on the efficacy of GSSs when employed in a distributed environment. Since the value of the DOME and RAPTR systems lies not only in their ability to connect distributed users, but also their potential capability to encourage increased communication and collaboration among user units, it is recommended to AFRL/HESS system engineers and future architects of similar systems that, as a

minimum, arrangements be made to obtain neutral agents to facilitate distributed meetings supported by these systems or in some manner influence the perceptions of meeting members to indicate facilitator neutrality. This study also suggests that the value of the proposed technologies would be further increased through construction of special facilities which would allow DOME and RAPTR system facilitators to moderate group meetings in isolation from group members.

It must be understood that this set of recommendations is not a prescription to add gold plating to already expensive technologies. Instead they identify means for the Air Force to help ensure the success of future Lean Logistics process reengineering efforts and to realize return on monies spent in the development and on the future costs of DOME and RAPTR operation.

5.6 Limitations and Recommendations for Future Research

Of immediate concern to the conclusions and recommendations drawn in this study is the fact that the set of sample data employed in the analysis effort was relatively small (n = 72). Consequently, the power of the statistical tools employed was reduced, which increased the likelihood that Type II error was committed and that in some instance a false null hypothesis was not rejected. This concern was partially attended to in this study by paying close concern to the magnitude of the influence of independent on dependent variables (as indexed by eta^2) and the statistical significance of that effect. One of the main considerations of future follow-on or continuation studies, however, should be to augment or otherwise employ a larger data set for analysis purposes to re-examine the conclusions drawn here.

Another perceived limitation of this study was that the measured variables employed to operationalize the "users' attitudes toward GSS" construct (satisfaction with the facilitator, belief in GSS utility, and satisfaction with the dynamics of the participant's group) seem to measure discrete and differing aspects of the intended target. In consideration of the larger context of this work, though, this fact can and should actually be considered a strength as well as a weakness. On one hand, breaking the construct into a set of measured variables increased both the reliability and validity of the specific attitudinal measures, and highlighted the fact that "user attitudes toward GSS" is a complex construct. On the other hand, the means by which the construct was operationalized is a weakness in that the construct was *only* broken up into a set

of three measured variables. In future studies of this sort, the construct's definition should be expanded to include a more comprehensive set of measured variables. Examples that immediately come to mind include satisfaction with other aspects of the GSS (that is, group task and physical GSS environment), as well as intentions to actively participate and honestly communicate with other members of the group. Satisfactory accomplishment of this task in and of itself, in fact, would constitute a significant contribution to the body of GSS knowledge.

A third concern for the reliability of study results centers around the artificiality of the experiment's manipulation of facilitator alignment. In essence, the language of this manipulation directly states that the facilitator is not a neutral experiment administrator, but rather an agent of the experimenter who has been instructed to provide special help to one meeting member in order to maximize that individual's performance. That this manipulation was so blatant might cause some to argue that it might artificially deflate measures collected from treatment groups exposed to it. Future studies of this sort might well be advised to devise a more elegant means of modulating the alignment variable.

That being said, it is worth noting that though the effect of the manipulation as reflected in observed eta^2 values is quite strong relative to the observed effects of manipulation of facilitator location, manipulation checks which measured participants' perception of each manipulation showed quite the opposite. This fact suggests that even though experiment participants were not consciously impressed by the manipulation, facilitator alignment with a single meeting member nonetheless had significant effect on users' perceptions of situational justice, their satisfaction with the group dynamic, their information sharing behavior, and group decision quality.

Of similar interest to future researchers should be the fact that in all situations and all experiment treatments, the facilitator actually did act impartially-- despite the language of the manipulation. The ultimate import of this fact is that we cannot discern from this work what the impact of actual alignment of the facilitator with a single meeting member might be on the group process and process outcomes, only hypothesize that it would have an even more significant and debilitating effect on the group process, particularly in repeated sessions over time.

As a final observation, it interesting to note that as predicted, manipulation of facilitator location and alignment had specific and correlational effect on the structural and social determinants of user justice perceptions, respectively. This observation adds to our confidence in the predictive power of the theory underlying Greenberg's Taxonomy of Justice Classes, the reliability and validity of the measures developed in this work to isolate and quantify discrete perceptions of situational justice, and thus, the findings and conclusions drawn as a result of their employ.

Appendix A: Sport of Kings Master and Participant Worksheet Matrices

Master Information Sheet
Race Information

Race Conditions		Info to:
Month	May	B
Post Time	1:00	B
Weather	Clear	C
Temperature	80s	C
Humidity	Medium	A
Track Condition	Dry	A
Length of Race	1 ¼ Mile	A
Crowd Size (S,M,L)	Large	B
Region (N,S,E,W)	East	C

Post Positions		Info to:	Pref. to:
Lane 1	Classy Lassie	A	C
Lane 2	Rebecca's Dream	B	A
Lane 3	Miss Zavalla	C	B
Lane 4	Cypress Queen	A	B
Lane 5	Dandy Courtin	B	A
Lane 6	Honey Sue	C	B
Lane 7	Ruthless Ruthie	A	C
Lane 8	Magic Rose	C	A
Lane 9	Fancy Free	B	C

Master Information Sheet

	Ruthless Ruthie	Honey Sue	Rebecca's Dream	Fancy Free	Classy Lassie	Cypress Queen	Dandy Courtin	Miss Zavalla	Magic Rose
Post Position Preference	Lane 7	*Lane 5*	Lane 2	Lane 9	*Lane 6*	Lane 4	*Lane 8*	Lane 3	*Lane 1*
Crowd Size Preference	*Small*	*Medium*	Large	Large	*Medium*	Large	*Small*	Large	*Medium*
Humidity Preference	*Low*	*High*	*Low*	*High*	*High*	Medium	Medium	Medium	Medium
Month Preference	May	*April*	May	*June*	*April*	*July*	*July*	May	May
Race Length Preference	1 ¼ Mile	1 ¼ Mile	*1 1/8 Mile*	*11/8 Mile*	11/4 Mile	11/4 Mile	*1 Mile*	*1 Mile*	1 1/4 Mile
Region Preference	*North*	*West*	East	*West*	*South*	East	East	East	East
Temp Preference	*70s*	80s	80s	*70s*	80s	80s	*60s*	*70s*	*70s*
Time Preference	*12:00*	1:00	*2:00*	1:00	1:00	1:00	*10:00*	*9:00*	1:00
Track Condition Preference	*Soft*	Dry	Dry	*Soft*	*Soft*	*Muddy*	Dry	*Soft*	Dry
Weather Preference	*Rain*	*Cloudy*	Clear	Clear	Clear	Clear	Clear	*Rain*	*Cloudy*
Total Points	3 / 10	4 / 10	7 / 10	4 / 10	4 / 10	8 / 10	4 / 10	5 / 10	6 / 10

Participant A

WORKSHEET

Race Conditions		Ruthless Ruthie	Honey Sue	Rebecca's Dream	Fancy Free	Classy Lassie	Cypress Queen	Dandy Courtin	Miss Zavalla	Magic Rose
	Post Position	LANE 7				LANE 1	LANE 4			
	Post Position Preference →			LANE 2				LANE 8		LANE
Crowd Size	Crowd Size →	SMALL			LARGE		LARGE		LARGE	
Humidity **Medium**	Humidity →				HIGH Pts: 0					
Month	Month →		APRIL			APRIL	JULY		MAY	
Race Length **1 1/4 Mile**	Race Length →					1 1/4 MILE Pts: 1				
Region	Region →		WEST	EAST	WEST			EAST		EAST
Temp	Temp →	70s	80s				80s	60s		
Time	Time →			2:00	1:00			10:00		1:00
Track Condition **Dry**	Track Condition →									
Weather	Weather →	RAIN		CLEAR		CLEAR			RAIN	CLOUD
	Total Pts	Pts:	Pts:	Pts:	Pts:	Pts:	Pts:	Pts:	Pts:	Pts:

Participant B

Race Conditions	WORKSHEET	Ruthless Ruthie	Honey Sue	Rebecca's Dream	Fancy Free	Classy Lassie	Cypress Queen	Dandy Courtin	Miss Zavalla	Magic Rose
	Post Position			LANE 2	LANE 9			LANE 5		
	Post Position Preference →		LANE 5				LANE 4 Pts:		LANE 3	
Crowd Size LARGE	Crowd Size →				LARGE Pts: 1					
Humidity	Humidity →		HIGH	LOW			MEDIUM	MEDIUM		
Month MAY	Month →									
Race Length	Race Length →	1 1/4 MILE	1 1/4 MILE						1 MILE	1 1/4 MIL
Region	Region →	NORTH				SOUTH	EAST		EAST	
Temp	Temp →			80s	70s	80s			70s	70s
Time 1:00	Time →					1:00 Pts: 1				
Track Condition	Track Condition →	SOFT		DRY	SOFT			DRY		DRY
Weather	Weather →		CLOUDY		CLEAR		CLEAR	CLEAR		
	Total Pts	Pts:	Pts:	Pts:	Pts:	Pts:	Pts:	Pts:	Pts:	Pts:

Participant C

Race Conditions	WORKSHEET	Ruthless Ruthie	Honey Sue	Rebecca's Dream	Fancy Free	Classy Lassie	Cypress Queen	Dandy Courtin	Miss Zavalla	Magic Rose
	Post Position		LANE 6						LANE 3	LANE
Crowd Size	Post Position Preference →	LANE 7			LANE 9	LANE 6				
Humidity	Crowd Size →		MEDIUM	LARGE		MEDIUM		SMALL		MEDIUM
Month	Humidity →	LOW			HIGH	HIGH			MEDIUM	MEDIUM
Race Length	Month →	MAY		MAY	JUNE			JULY		MAY
Region **EAST**	Race Length →			1 1/8 MILE	1 1/8 MILE		1 1/4 MILE	1 MILE		
Temp **80s**	Region →									
Time	Temp →				70s Pts: 0					
Track Condition	Time →	12:00	1:00				1:00		9:00	
Weather **CLEAR**	Track Condition →		DRY			SOFT	MUDDY		SOFT	
	Weather →									
	Total Pts	Pts:	Pts:	Pts:	Pts:	Pts:	Pts:	Pts:	Pts:	Pts:

Appendix B: Sport of Kings Debriefing Script

Debrief Script

[Perform debriefing of each participant individually, at experiment stations.]

The Sport of Kings experiment is designed to measure the effect of GSS technology on the information sharing behavior and personal interactions of groups. Today data was collected on levels of individual information transfer, the consequent accuracy of participants' bets, and participants' opinion and satisfaction with GSS, the facilitator's performance, and the experience in general.

The experiment is built around the hypothesis that facilitator neutrality and isolation from experiment participants is necessary to the effective functioning of GSS when used to connect geographically-distributed users. Data is being collected for four different treatments: one where the facilitator is neutral and isolated from participants, one where the facilitator is neutral but co-located with one of the participants, one where the facilitator is aligned with one of the participants, but isolated from him or her, and finally, one in which the facilitator is both aligned with a participant and co-located with that participant.

The experimental task challenges individuals either to share information cooperatively with the group, or to compete with the group to maximize individual earnings. The strategy you and the other experiment participants each employed today is not unique to or reflective of your personality or abilities, but a consequence of the artificiality of the experimental design. For this reason, results of the betting process are not being revealed to experiment participants. Instead, all participants are being paid ten dollars cash, which is more than the nine dollars a single individual would earn by competing with group to maximize individual return.

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?

[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.

At this time I simply need you to complete this "Certificate of Payment" so that I may pay you your ten dollars and then you're free to go."

[Collect experimental materials, release form, betting form, and survey. Have participant complete Certificate of Payment. Collect form. Pay individual ten dollars cash.]

[Place all experiment materials in a manila envelope. Complete and include Data Collection Cover Sheet and seal envelope.]

Appendix C: Sport of Kings Experimental Treatment 1 Handout

Sport of Kings Experiment

Introduction

This experiment is being conducted to collect data on users' assessment of a computer meeting system called a Group Support System, or GSS for short. GSS is a combination of networked computers and a human facilitator which allows groups of decision makers to work together in a virtual environment. Today you'll use GSS to work through the problem of identifying the three top finishers from a field of nine horses running in a fictional race called the Cooper Stakes. At the end of the experiment, each of you will bet individually on the horses you think will finish first, second, and third in the race, in exact order. This type of bet is called a *trifecta.*

Your bet will not be revealed to the other experiment participants.

Task Description

Chance and ability are not factors in the Cooper Stakes. Instead, race results have been predetermined and are known only to the facilitator. The horse whose racing preferences best match the conditions on race day will win the race. At each GSS workstation is a participant-specific racing form/worksheet that contains information about race conditions and preferences of the horses running in the race. During this experiment you'll have the opportunity to exchange information with the other experiment participants in order to build a better profile of each of the horses and make a more informed decision when it comes time to place your bet on the *trifecta.*

Your racing form contains some information shared by other experiment participants, and some known only to you. Your worksheet makes no distinction between the two. Trial-and-error will be your only means of determining if a piece of information is held by some other participant or is known to you alone.

The experiment has one other slight catch. Horse racing employs a betting scheme called *pari-mutuel* betting to determine odds on horses and payoffs for winning bets. According to this scheme, the higher the amount bet on a *trifecta,* the lower the odds on a bet and the lower the payoff to bettors if the *trifecta* hits.

The developer of the GSS is very interested in seeing the system perform well. For this reason he has entrusted the facilitator with an undisclosed sum to pay off winning bets. If the entire group manages to identify the winning *trifecta,* each participant will be paid $7.00 for his or her efforts, plus a bonus to be disclosed at the end of the experiment. In any other combination, however, individuals will be paid $9.00 for a correct bet. Participants who fail to identify the winning trifecta will receive no money for their efforts. This information is summarized in the table below.

	Total Earnings	
Number Of Correct Bets	Total earnings for Correct Bet	Total Earnings for Incorrect Bet
3	(3) $7.00 + BONUS	(0) N/A
2	(2) $9.00	(1) $0.00
1	(1) $9.00	(2) $0.00
0	(0) N/A	(3) $0.00

Experimental Design

There are three participants in this experiment. Your name (Participant A, B, or C) will be prominently posted on the computer station you are assigned.

The meeting facilitator is not an experimental subject, but experiment administrator. As such, this individual controls the GDSS system, the distribution of instructions and information to experiment participants, participant activities, and the distribution of cash payments at the end of the session.

The setup of the GSS system is described in Figure 1. All meeting participants, including the facilitator, are located in separate facilities, isolated from each other as described below.

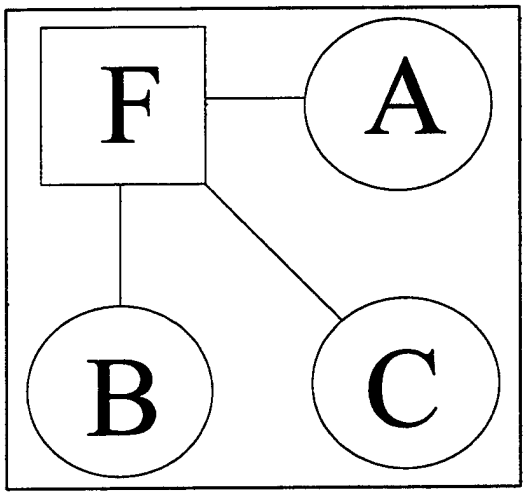


Figure 1. Physical Design of GDSS

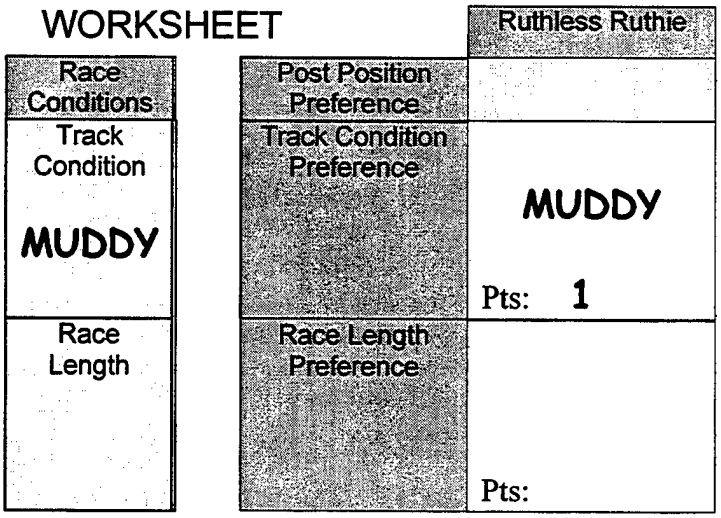
All interaction and communication between participants A, B, and C and the facilitator will take form of broadcast messages transmitted over your telephone headset or the GSS. Neither the facilitator nor any experiment participant has the ability to communicate individually with another participant using these systems.

All comments submitted via the GSS will be marked with the contributor's name (Facilitator, Participant A, B, or C).

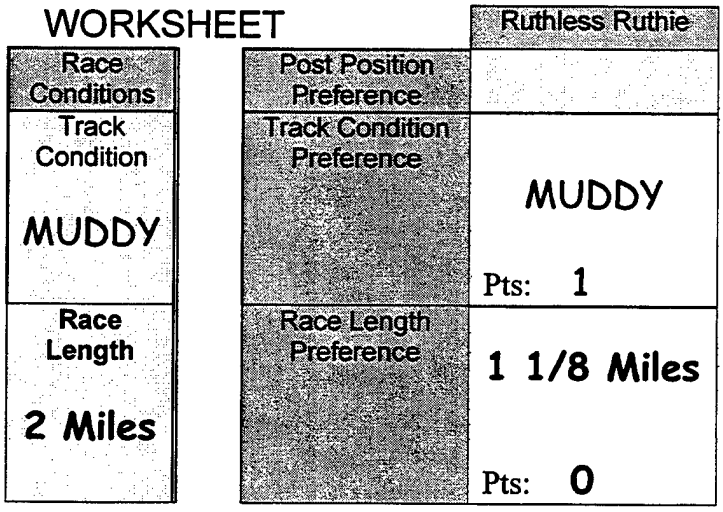
Continue to next page.

Choosing the Winners

Using the worksheet provided, you will match horses' preferences to the actual conditions of the race. If a horse's preference in a given category matches up to the respective condition on race day, you will award the horse a point for that category. For example, if Ruthless Ruthie likes racing on a muddy track and you determine that the track is muddy on the day of the race, you will award Ruthless Ruthie a point in the "Track Condition" category. See the example, below:

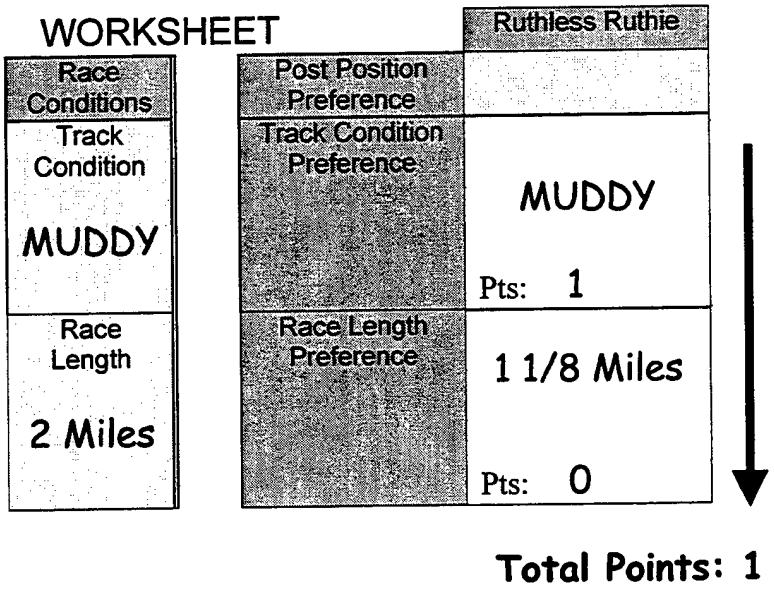


If a horse's preference does not match up to the respective race condition, you will award the horse a score of zero for the respective category. For example, if you discover that Ruthless Ruthie likes running races which are 1 1/8 miles in length and you determine the Cooper Stakes is a 2 mile race, you will award her a score of zero in the "Race Length" category. See the example below:



Continue to next page.

The race winner will be the horse whose preferences best match the 10 race conditions, that is, the horse with the highest score of 10 possible points. The second-place horse will have the second highest total of 10 possible points; the third-place finisher will have the third-highest total of 10 possible points. In our example (see below), Ruthless Ruthie has scored one out of two possible points.



Agenda

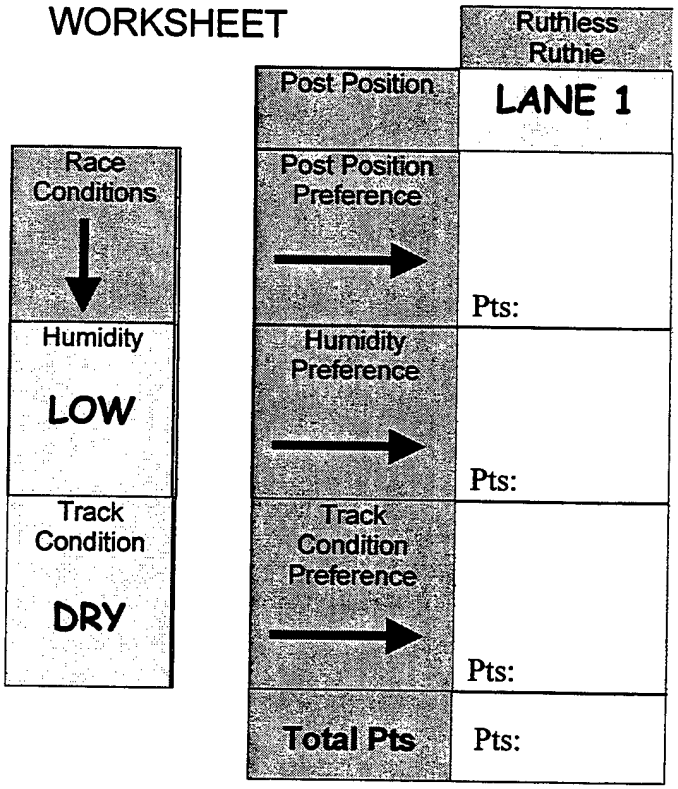
1. Participants read introductory materials.
2. Participants complete comprehension exercise at their workstations.
3. The facilitator describes task and demonstrates system operation to participants.
4. The facilitator enables GSS, allowing participants 40 minutes to discuss the experimental task as a group. The facilitator will monitor time and inform participants when 35, 30, 25, 20, 15, 10, 5, 3, and 1 minute remain.
5. The facilitator allows participants 10 minutes to review comments submitted to the group.
6. Participants individually place bets on the race by completing the betting form provided. There is no time limit for this part of the experiment.
7. Participants complete a survey asking them about their interaction with other group members using GSS, their opinion of the usefulness of the system, and their satisfaction with the job done by the meeting facilitator. There is no time limit for this part of the experiment.
8. Facilitator collects experiment materials from participants and briefs each individually on the results and purpose of the experiment.

Exercise
Sport of Kings

Instructions: Working through the following exercise will sharpen the skills and understanding you will need to successfully perform Sport of Kings experimental tasks. Please answer all of the questions below. Feel free to ask the facilitator for help and/or clarification at any time. There is no time limit for this task..

1. Read the following paragraph and transcribe the information it contains to the worksheet. Use the worksheet to answer the question below. Circle the best answer.

Ruthless Ruthie - Runs best on a dry track. Prefers high humidity. Prefers running from Lane 1.



Q1 (Circle Best Answer): How many points should you award Ruthless Ruthie based on the information above?

A. 0 B. 1 C. 2 D. 3

Please Complete Questions 2 - 5, Next Page.

2. Use the chart below to answer Question 2.

	Total Earnings	
Number Of Correct Bets	Total earnings for Correct Bet	Total Earnings for Incorrect Bet
3	(3) $7.00 + BONUS	(0) N/A
2	(2) $9.00	(1) $0.00
1	(1) $9.00	(2) $0.00
0	(0) N/A	(3) $0.00

Q2 (Circle True or False): If Participant A is the only participant to correctly identify the winning *trifecta* for the Cooper Stakes, he or she will be paid $9.00 at the end of the experiment and Participants B and C will receive no money for participating in the experiment.

TRUE FALSE

3. (Circle True or False): My bet will never be revealed to the other participants by the facilitator.

TRUE FALSE

4. (Circle True or False): Neither the facilitator nor any experiment participant has the ability to communicate with another participant without the group's knowledge using the GSS or headset telephone systems.

TRUE FALSE

5. (Circle True or False): The meeting facilitator is not an experimental subject, but an unbiased experiment administrator.

TRUE FALSE

Appendix D: Sport of Kings Experimental Treatment 2 Handout

Sport of Kings Experiment

Introduction

This experiment is being conducted to collect data on users' assessment of a computer meeting system called a Group Support System, or GSS for short. GSS is a combination of networked computers and a human facilitator which allows groups of decision makers to work together in a virtual environment. Today you'll use GSS to work through the problem of identifying the three top finishers from a field of nine horses running in a fictional race called the Cooper Stakes. At the end of the experiment, each of you will bet individually on the horses you think will finish first, second, and third in the race, in exact order. This type of bet is called a *trifecta.*

Your bet will not be revealed to the other experiment participants.

Task Description

Chance and ability are not factors in the Cooper Stakes. Instead, race results have been predetermined and are known only to the facilitator. The horse whose racing preferences best match the conditions on race day will win the race. At each GSS workstation is a participant-specific racing form/worksheet that contains information about race conditions and preferences of the horses running in the race. During this experiment you'll have the opportunity to exchange information with the other experiment participants in order to build a better profile of each of the horses and make a more informed decision when it comes time to place your bet on the *trifecta.*

Your racing form contains some information shared by other experiment participants, and some known only to you. Your worksheet makes no distinction between the two. Trial-and-error will be your only means of determining if a piece of information is held by some other participant or is known to you alone.

The experiment has one other slight catch. Horse racing employs a betting scheme called *pari-mutuel* betting to determine odds on horses and payoffs for winning bets. According to this scheme, the higher the amount bet on a *trifecta,* the lower the odds on a bet and the lower the payoff to bettors if the *trifecta* hits.

The developer of the GSS is very interested in seeing the system perform well. For this reason he has entrusted the facilitator with an undisclosed sum to pay off winning bets. If the entire group manages to identify the winning *trifecta,* each participant will be paid $7.00 for his or her efforts, plus a bonus to be disclosed at the end of the experiment. In any other combination, however, individuals will be paid $9.00 for a correct bet. Participants who fail to identify the winning trifecta will receive no money for their efforts. This information is summarized in the table below.

	Total Earnings	
Number Of Correct Bets	Total earnings for Correct Bet	Total Earnings for Incorrect Bet
3	(3) $7.00 + BONUS	(0) N/A
2	(2) $9.00	(1) $0.00
1	(1) $9.00	(2) $0.00
0	(0) N/A	(3) $0.00

Experimental Design

There are three participants in this experiment. Your name (Participant A, B, or C) will be prominently posted on your computer station.

The meeting facilitator is not an experimental subject, but experiment administrator. As such, this individual controls the GDSS system, the distribution of instructions and information to experiment participants, participant activities, and the distribution of cash payments at the end of the session.

In face-to-face meetings, the facilitator can align with a meeting participant and effectively influence a meeting's outcome. One of the primary purposes of this experiment is to find out if the GSS can mitigate the facilitator's ability to influence group actions and meeting outcomes. **Today, the facilitator will attempt to provide special help to Participant A in order to maximize his or her performance.** Participant A is encouraged to seek the aid of the facilitator.

The setup of the GSS system is described below, in Figure 1. All meeting participants, including the facilitator, are located in separate, isolated facilities, as described below.

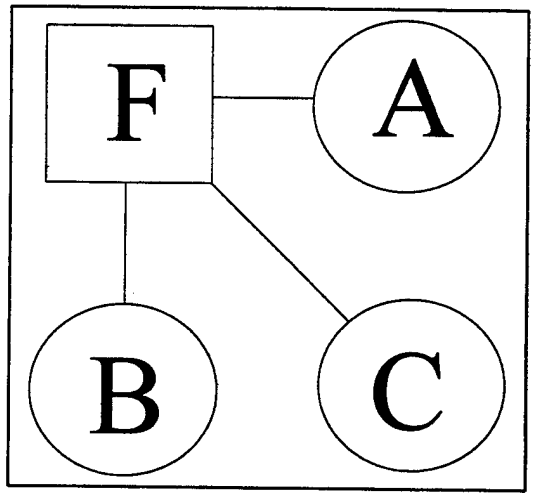


Figure 1. Physical Design of GDSS

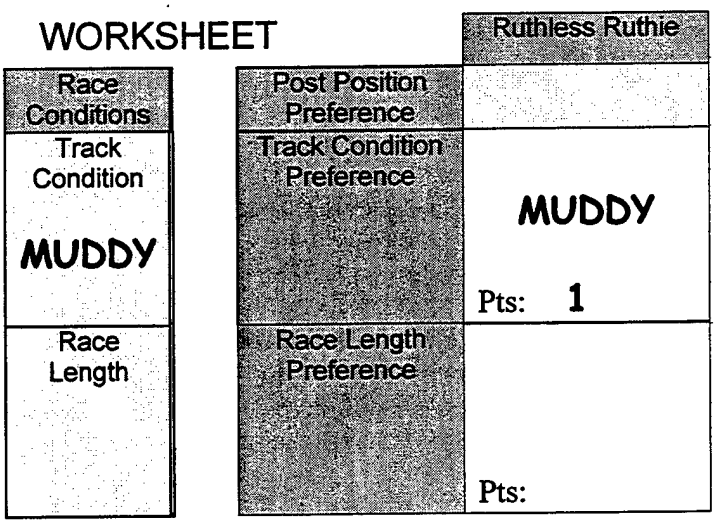
All interaction and communication between participants A, B and C and facilitator will take form of broadcast messages transmitted over your telephone headset or the GSS. Neither the facilitator nor any experiment participant has the ability to communicate individually with another participant using these systems.

All comments submitted via the GSS will be marked with the contributor's name (Facilitator, Participant A, B, or C).

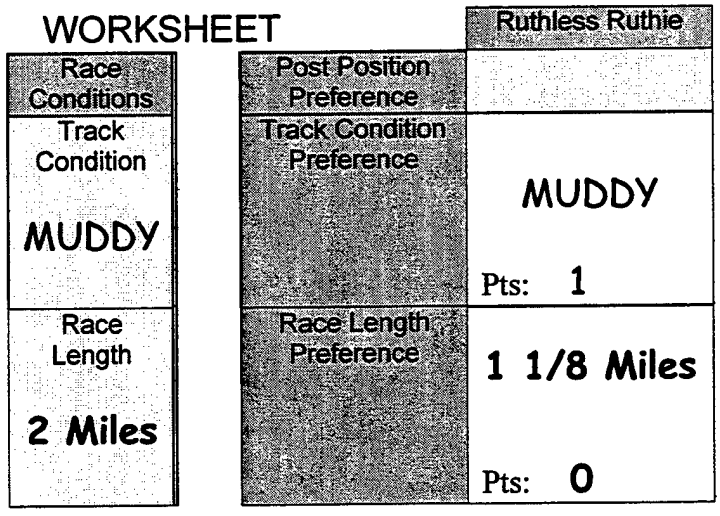
Continue to next page.

Choosing the Winners

Using the worksheet provided, you will match horses' preferences to the actual conditions of the race. If a horse's preference in a given category matches up to the respective condition on race day, you will award the horse a point for that category. For example, if Ruthless Ruthie likes racing on a muddy track and you determine that the track is muddy on the day of the race, you will award Ruthless Ruthie a point in the "Track Condition" category. See the example, below:



If a horse's preference does not match up to the respective race condition, you will award the horse a score of zero for the respective category. For example, if you discover that Ruthless Ruthie likes running races which are 1 1/8 miles in length and you determine the Cooper Stakes is a 2 mile race, you will award her a score of zero in the "Race Length" category. See the example below:



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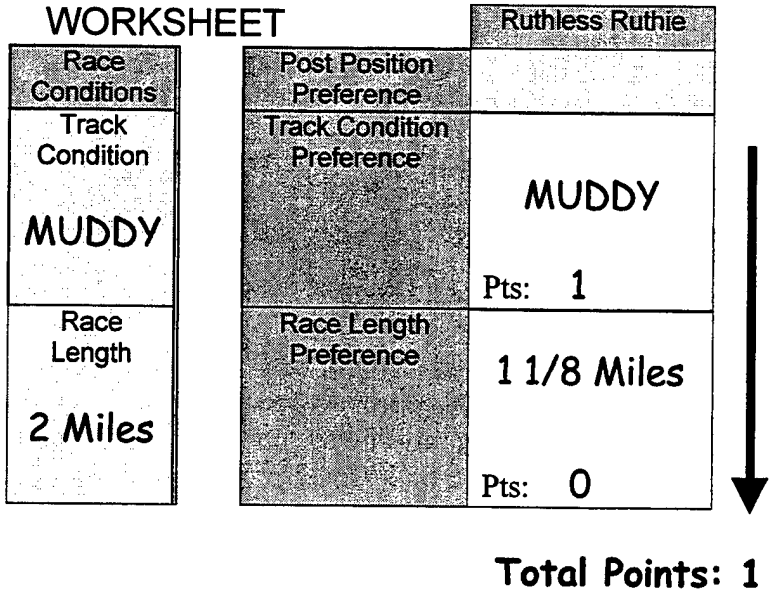
The race winner will be the horse whose preferences best match the 10 race conditions, that is, the horse with the highest score of 10 possible points. The second-place horse will have the second highest total of 10 possible points; the third-place finisher will have the third-highest total of 10 possible points. In our example (see below), Ruthless Ruthie has scored one out of two possible points.



Agenda

9. Participants read introductory materials.

10. Participants complete comprehension exercise at their workstations.

11. The facilitator describes task and demonstrates system operation to participants.

12. The facilitator enables GSS, allowing participants 40 minutes to discuss the experimental task as a group. The facilitator will monitor time and inform participants when 35,30, 25, 20, 15, 10, 5, 3, and 1 minute remain.

13. The facilitator allows participants 10 minutes to review comments submitted to the group.

14. Participants individually place bets on the race by completing the betting form provided. There is no time limit for this part of the experiment.

15. Participants complete a survey asking them about their interaction with other group members using GSS, their opinion of the usefulness of the system, and their satisfaction with the job done by the meeting facilitator. There is no time limit for this part of the experiment.

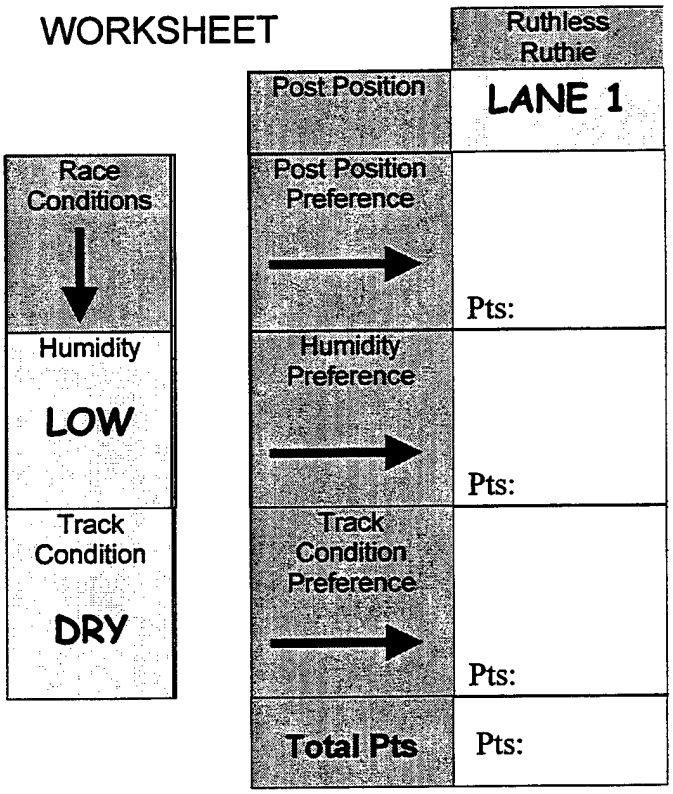
16. Facilitator collects experiment materials from participants and briefs each individually on the results and purpose of the experiment.

Exercise
Sport of Kings

Instructions: Working through the following exercise will sharpen the skills and understanding you will need to successfully perform Sport of Kings experimental tasks. Please answer all of the questions below. Feel free to ask the facilitator for help and/or clarification at any time. There is no time limit for this task.

6. Read the following paragraph and transcribe the information it contains to the worksheet. Use the worksheet to answer the question below. Circle the best answer.

Ruthless Ruthie - Runs best on a dry track. Prefers high humidity. Prefers running from Lane 1.



Q1 (Circle Best Answer): How many points should you award Ruthless Ruthie based on the information above?

A. 0 B. 1 C. 2 D. 3

Please Complete Questions 2 - 5, Next Page.

7. Use the chart below to answer Question 2.

	Total Earnings	
Number Of Correct Bets	Total earnings for Correct Bet	Total Earnings for Incorrect Bet
3	(3) $7.00 + Bonus	(0) N/A
2	(2) $9.00	(1) $0.00
1	(1) $ 9.00	(2) $0.00
0	(0) N/A	(3) $0.00

Q2 (Circle True or False): If Participant A is the only participant to correctly identify the winning *trifecta* for the Cooper Stakes, he or she will be paid $ 9.00 at the end of the experiment and Participants B and C will receive no money for participating in the experiment.

TRUE FALSE

8. (Circle True or False): My bet will never be revealed to the other participants by the facilitator.

TRUE FALSE

9. (Circle True or False): Neither the facilitator nor any experiment participant has the ability to communicate individually with another participant using these GSS or headset telephone systems.

TRUE FALSE

10. (Circle True or False): The facilitator will attempt to provide special help to Participant A in order to maximize his or her performance.

TRUE FALSE

Appendix E: Sport of Kings Experimental Treatment 3 Handout

Sport of Kings Experiment

Introduction

This experiment is being conducted to collect data on users' assessment of a computer meeting system called a Group Support System, or GSS for short. GSS is a combination of networked computers and a human facilitator which allows groups of decision makers to work together in a virtual environment. Today you'll use GSS to work through the problem of identifying the three top finishers from a field of nine horses running in a fictional race called the Cooper Stakes. At the end of the experiment, each of you will bet individually on the horses you think will finish first, second, and third in the race, in exact order. This type of bet is called a *trifecta.*

Your bet will not be revealed to the other experiment participants.

Task Description

Chance and ability are not factors in the Cooper Stakes. Instead, race results have been predetermined and are known only to the facilitator. The horse whose racing preferences best match the conditions on race day will win the race. At each GSS workstation is a participant-specific racing form/worksheet that contains information about race conditions and preferences of the horses running in the race. During this experiment you'll have the opportunity to exchange information with the other experiment participants in order to build a better profile of each of the horses and make a more informed decision when it comes time to place your bet on the *trifecta.*

Your racing form contains some information shared by other experiment participants, and some known only to you. Your worksheet makes no distinction between the two. Trial-and-error will be your only means of determining if a piece of information is held by some other participant or is known to you alone.

The experiment has one other slight catch. Horse racing employs a betting scheme called *pari-mutuel* betting to determine odds on horses and payoffs for winning bets. According to this scheme, the higher the amount bet on a *trifecta,* the lower the odds on a bet and the lower the payoff to bettors if the *trifecta* hits.

The developer of the GSS is very interested in seeing the system perform well. For this reason he has entrusted the facilitator with an undisclosed sum to pay off winning bets. If the entire group manages to identify the winning *trifecta,* each participant will be paid $7.00 for his or her efforts, plus a bonus to be disclosed at the end of the experiment. In any other combination, however, individuals will be paid $9.00 for a correct bet. Participants who fail to identify the winning trifecta will receive no money for their efforts. This information is summarized in the table below.

	Total Earnings	
Number Of Correct Bets	Total earnings for Correct Bet	Total Earnings for Incorrect Bet
3	(3) $7.00 + BONUS	(0) N/A
2	(2) $9.00	(1) $0.00
1	(1) $9.00	(2) $0.00
0	(0) N/A	(3) $0.00

Experimental Design

There are three participants in this experiment. Your name (Participant A, B, or C) will be prominently posted on your computer station.

The meeting facilitator, is not an experimental subject, but an unbiased experiment administrator. As such, this individual controls the GDSS system, the distribution of instructions and information to experiment participants, participant activities, and the distribution of cash payments at the end of the session.

The setup of the GSS system is described below, in Figure 1. You can see from the picture that Participants B and C are located in separate, isolated facilities and that Participant A is co-located with the facilitator.

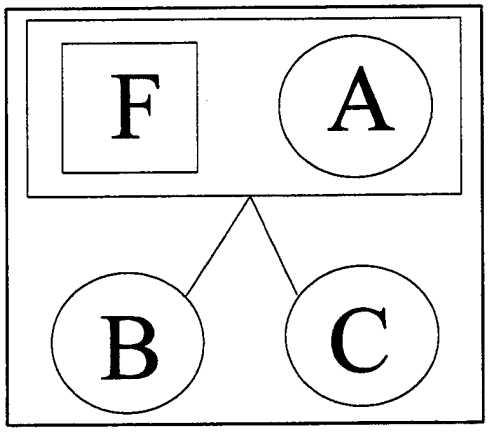


Figure 1. Physical Design of GDSS

All interaction and communication between participants B and C and facilitator will take form of broadcast messages transmitted over your telephone headset or the GDSS. Neither the facilitator nor any experiment participant has the ability to communicate individually with another individual using these systems.

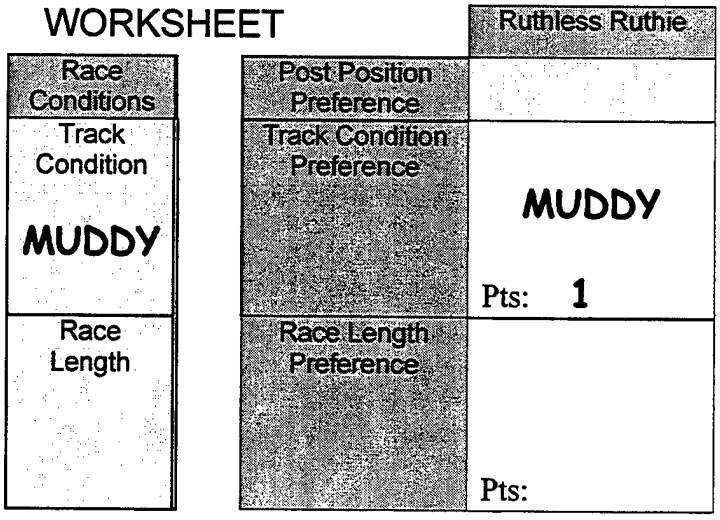
All comments submitted via the GSS will be marked with the contributor's name (Facilitator, Participant A, B, or C).

Participant A and the facilitator because they are sharing a room, will of course be able to communicate outside of the system without the knowledge of Participants B and C.

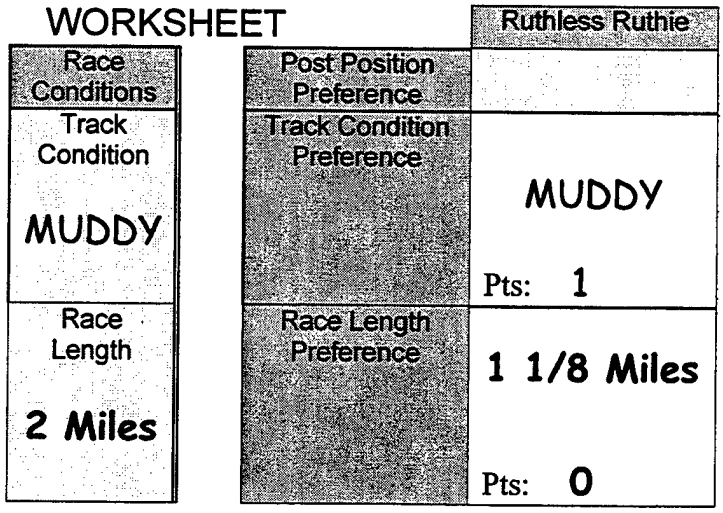
Continue to next page.

Choosing the Winners

Using the worksheet provided, you will match horses' preferences to the actual conditions of the race. If a horse's preference in a given category matches up to the respective condition on race day, you will award the horse a point for that category. For example, if Ruthless Ruthie likes racing on a muddy track and you determine that the track is muddy on the day of the race, you will award Ruthless Ruthie a point in the "Track Condition" category. See the example, below:

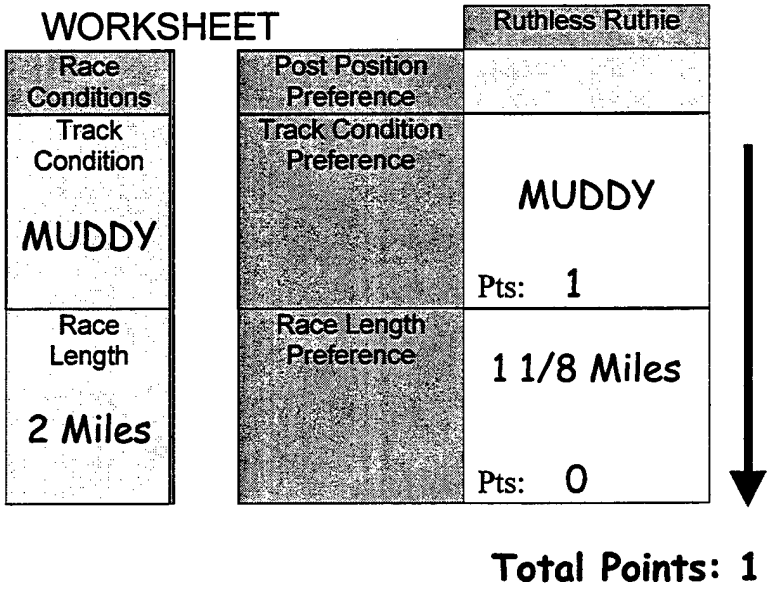


If a horse's preference does not match up to the respective race condition, you will award the horse a score of zero for the respective category. For example, if you discover that Ruthless Ruthie likes running races which are 1 1/8 miles in length and you determine the Cooper Stakes is a 2 mile race, you will award her a score of zero in the "Race Length" category. See the example below:



Continue to next page.

The race winner will be the horse whose preferences best match the 10 race conditions, that is, the horse with the highest score of 10 possible points. The second-place horse will have the second highest total of 10 possible points; the third-place finisher will have the third-highest total of 10 possible points. In our example (see below), Ruthless Ruthie has scored one out of two possible points.



Agenda

17. Participants read introductory materials.

18. Participants complete comprehension exercise at their workstations.

19. The facilitator describes task and demonstrates system operation to participants.

20. The facilitator enables GDSS, allowing participants 40 minutes to discuss the experimental task as a group. The facilitator will monitor time and inform participants when 35, 30, 25, 20, 15, 10, 5, 3, and 1 minute remain.

21. The facilitator allows participants 10 minutes to review comments submitted to the group.

22. Participants individually place bets on the race by completing the betting form provided. There is no time limit for this part of the experiment.

23. Participants complete a survey asking them about their interaction with other group members using GDSS, their opinion of the usefulness of the system, and their satisfaction with the job done by the meeting facilitator. There is no time limit for this part of the experiment.

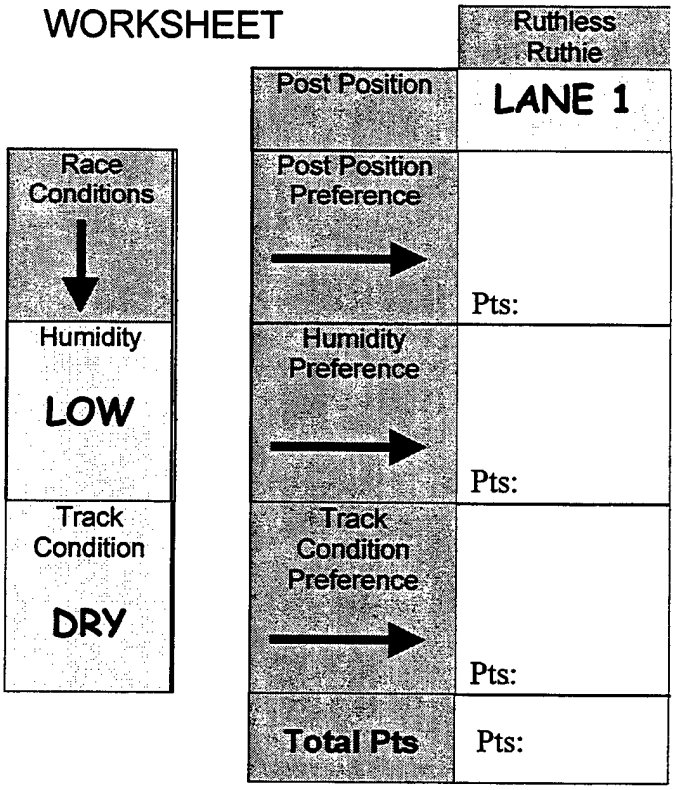
24. Facilitator collects experiment materials from participants and briefs each individually on the results and purpose of the experiment.

Exercise
Sport of Kings

Instructions: Working through the following exercise will sharpen the skills and understanding you will need to successfully perform Sport of Kings experimental tasks. Please answer all of the questions below. Feel free to ask the facilitator for help and/or clarification at any time. There is no time limit for this task..

11. Read the following paragraph and transcribe the information it contains to the worksheet. Use the worksheet to answer the question below. Circle the best answer.

Ruthless Ruthie - Runs best on a dry track. Prefers high humidity. Prefers running from Lane 1.



Q1 (Circle Best Answer): How many points should you award Ruthless Ruthie based on the information above?

A. 0 B. 1 C. 2 D. 3

Please Complete Questions 2 - 5, Next Page.

12. Use the chart below to answer Question 2.

	Total Earnings	
Number Of Correct Bets	Total earnings for Correct Bet	Total Earnings for Incorrect Bet
3	(3) $7.00 + BONUS	(0) N/A
2	(2) $9.00	(1) $0.00
1	(1) $ 9.00	(2) $0.00
0	(0) N/A	(3) $0.00

Q2 (Circle True or False): If Participant A is the only participant to correctly identify the winning *trifecta* for the Cooper Stakes, he or she will be paid $ 9.00 at the end of the experiment and Participants B and C will receive no money for participating in the experiment.

TRUE FALSE

13. (Circle True or False): My bet will never be revealed to the other participants by the Facilitator.

TRUE FALSE

14. (Circle True or False): The facilitator will be able to speak privately with Participant A during the experiment without Participant B and C's knowledge.

TRUE FALSE

15. (Circle True or False): The meeting facilitator is not an experimental subject, but an unbiased experiment administrator.

TRUE FALSE

Appendix F: Sport of Kings Experimental Treatment 4 Handout

Sport of Kings Experiment

Introduction

This experiment is being conducted to collect data on users' assessment of a computer meeting system called a Group Support System, or GSS for short. GSS is a combination of networked computers and a human facilitator which allows groups of decision makers to work together in a virtual environment. Today you'll use GSS to work through the problem of identifying the three top finishers from a field of nine horses running in a fictional race called the Cooper Stakes. At the end of the experiment, each of you will bet individually on the horses you think will finish first, second, and third in the race, in exact order. This type of bet is called a *trifecta.*

Your bet will not be revealed to the other experiment participants.

Task Description

Chance and ability are not factors in the Cooper Stakes. Instead, race results have been predetermined and are known only to the facilitator. The horse whose racing preferences best match the conditions on race day will win the race. At each GSS workstation is a participant-specific racing form/worksheet that contains information about race conditions and preferences of the horses running in the race. During this experiment you'll have the opportunity to exchange information with the other experiment participants in order to build a better profile of each of the horses and make a more informed decision when it comes time to place your bet on the *trifecta.*

Your racing form contains some information shared by other experiment participants, and some known only to you. Your worksheet makes no distinction between the two. Trial-and-error will be your only means of determining if a piece of information is held by some other participant or is known to you alone.

The experiment has one other slight catch. Horse racing employs a betting scheme called *pari-mutuel* betting to determine odds on horses and payoffs for winning bets. According to this scheme, the higher the amount bet on a *trifecta,* the lower the odds on a bet and the lower the payoff to bettors if the *trifecta* hits.

The developer of the GSS is very interested in seeing the system perform well. For this reason he has entrusted the facilitator with an undisclosed sum to pay off winning bets. If the entire group manages to identify the winning *trifecta,* each participant will be paid $7.00 for his or her efforts, plus a bonus to be disclosed at the end of the experiment. In any other combination, however, individuals will be paid $9.00 for a correct bet. Participants who fail to identify the winning trifecta will receive no money for their efforts. This information is summarized in the table below.

	Total Earnings	
Number Of Correct Bets	Total earnings for Correct Bet	Total Earnings for Incorrect Bet
3	(3) $7.00 + BONUS	(0) N/A
2	(2) $9.00	(1) $0.00
1	(1) $9.00	(2) $0.00
0	(0) N/A	(3) $0.00

Experimental Design

There are three participants in this experiment. Your name (Participant A, B, or C) will be prominently posted on your computer station.

The meeting facilitator is not an experimental subject, but experiment administrator. As such, this individual controls the GSS system, the distribution of instructions and information to experiment participants, participant activities, and the distribution of cash payments at the end of the session.

In face-to-face meetings, the facilitator can align with a meeting participant and effectively influence a meeting's outcome. One of the primary purposes of this experiment is to find out if the GSS can mitigate the facilitator's ability to influence group actions and meeting outcomes. **Today, the facilitator will attempt to provide special help to Participant A in order to maximize his or her performance.** Participant A is encouraged to seek the aid of the facilitator.

The setup of the GSS system is described below, in Figure 1. You can see from the picture that Participants B and C are located in separate, isolated facilities and that Participant A is co-located with the facilitator.

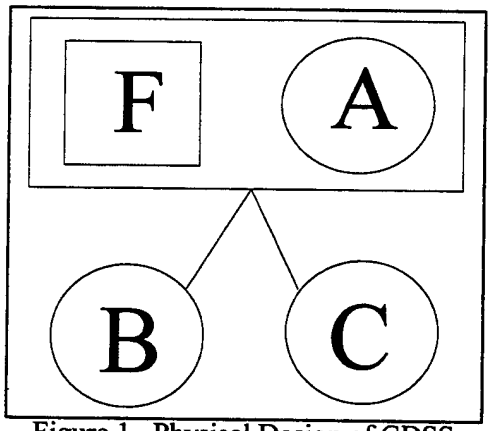


Figure 1. Physical Design of GDSS

All interaction and communication between participants B and C and facilitator will take form of broadcast messages transmitted over your telephone headset or the GSS. Neither the facilitator nor any experiment participant has the ability to communicate individually with another individual using these systems.

All comments submitted via the GSS will be marked with the contributor's name (Facilitator, Participant A, B, or C).

Participant A and the facilitator, because they are sharing a room, will of course be able to communicate outside of the system without the knowledge of Participants B and C.

Continue to next page.

Choosing the Winners

Using the worksheet provided, you will match horses' preferences to the actual conditions of the race. If a horse's preference in a given category matches up to the respective condition on race day, you will award the horse a point for that category. For example, if Ruthless Ruthie likes racing on a muddy track and you determine that the track is muddy on the day of the race, you will award Ruthless Ruthie a point in the "Track Condition" category. See the example, below:

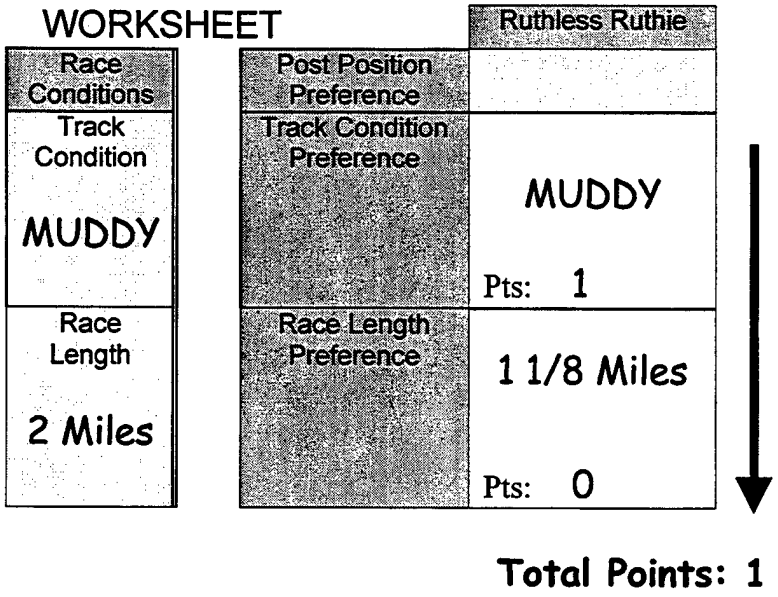
WORKSHEET		Ruthless Ruthie
Race Conditions	Post Position Preference	
Track Condition **MUDDY**	Track Condition Preference	**MUDDY** Pts: **1**
Race Length	Race Length Preference	Pts:

If a horse's preference does not match up to the respective race condition, you will award the horse a score of zero for the respective category. For example, if you discover that Ruthless Ruthie likes running races which are 1 1/8 miles in length and you determine the Cooper Stakes is a 2 mile race, you will award her a score of zero in the "Race Length" category. See the example below:

WORKSHEET		Ruthless Ruthie
Race Conditions	Post Position Preference	
Track Condition **MUDDY**	Track Condition Preference	**MUDDY** Pts: **1**
Race Length **2 Miles**	Race Length Preference	**1 1/8 Miles** Pts: **0**

Continue to next page.

The race winner will be the horse whose preferences best match the 10 race conditions, that is, the horse with the highest score of 10 possible points. The second-place horse will have the second highest total of 10 possible points; the third-place finisher will have the third-highest total of 10 possible points. In our example (see below), Ruthless Ruthie has scored one out of two possible points.



Agenda

25. Participants read introductory materials.

26. Participants complete comprehension exercise at their workstations.

27. The facilitator describes task and demonstrates system operation to participants.

28. The facilitator enables GDSS, allowing participants 40 minutes to discuss the experimental task as a group. The facilitator will monitor time and inform participants when 35, 30, 25, 20, 15, 10, 5, 3, and 1 minute remain.

29. The facilitator allows participants 10 minutes to review comments submitted to the group.

30. Participants individually place bets on the race by completing the betting form provided. There is no time limit for this part of the experiment.

31. Participants complete a survey asking them about their interaction with other group members using GDSS, their opinion of the usefulness of the system, and their satisfaction with the job done by the meeting facilitator. There is no time limit for this part of the experiment.

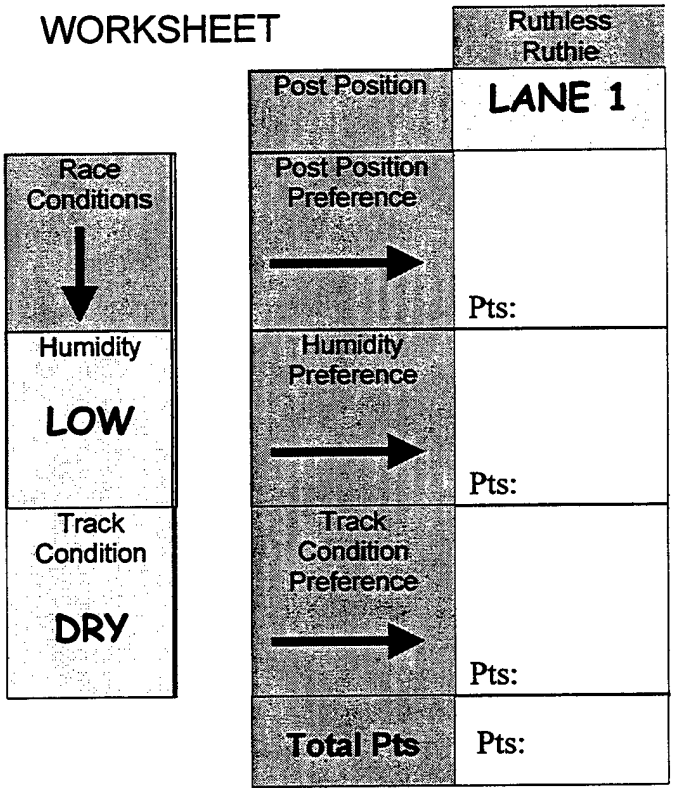
32. Facilitator collects experiment materials from participants and briefs each individually on the results and purpose of the experiment.

Exercise
Sport of Kings

Instructions: Working through the following exercise will sharpen the skills and understanding you will need to successfully perform Sport of Kings experimental tasks. Please answer all of the questions below. Feel free to ask the facilitator for help and/or clarification at any time. There is no time limit for this task..

16. Read the following paragraph and transcribe the information it contains to the worksheet. Use the worksheet to answer the question below. Circle the best answer.

Ruthless Ruthie - Runs best on a dry track. Prefers high humidity. Prefers running from Lane 1.



Q1 (Circle Best Answer): How many points should you award Ruthless Ruthie based on the information above?

A. 0 B. 1 C. 2 D. 3

Please Complete Questions 2 - 5, Next Page.

17. Use the chart below to answer Question 2.

	Total Earnings	
Number Of Correct Bets	Total earnings for Correct Bet	Total Earnings for Incorrect Bet
3	(3) $7.00 + BONUS	(0) N/A
2	(2) $9.00	(1) $0.00
1	(1) $ 9.00	(2) $0.00
0	(0) N/A	(3) $0.00

Q2 (Circle True or False): If Participant A is the only participant to correctly identify the winning *trifecta* for the Cooper Stakes, he or she will be paid $9.00 at the end of the experiment and Participants B and C will receive no money for participating in the experiment.

TRUE FALSE

18. (Circle True or False): My bet will never be revealed to the other participants by the Facilitator.

TRUE FALSE

19. (Circle True or False): The facilitator will be able to speak privately with Participant A during the experiment without Participant B and C's knowledge.

TRUE FALSE

20. (Circle True or False): The facilitator will attempt to provide special help to Participant A in order to maximize his or her performance.

TRUE FALSE

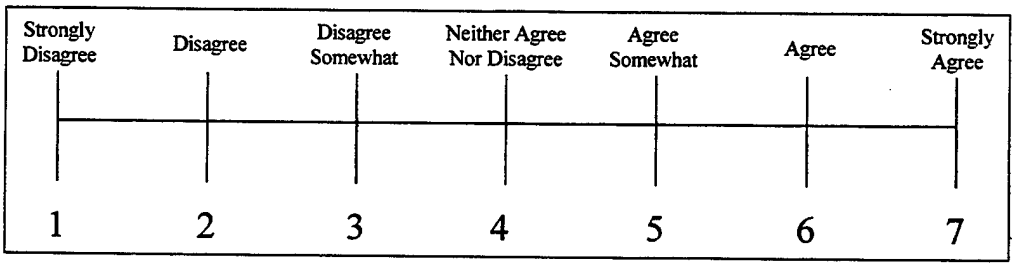
Appendix G: Sport of Kings Survey

Participant Identifier (A, B, or C) _____

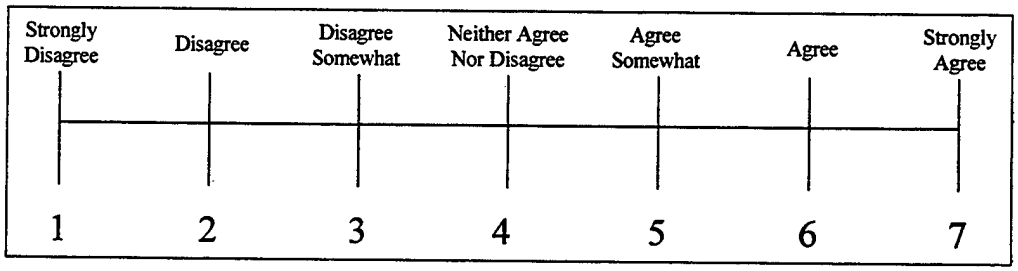
Survey

Please respond to the following statements using the scale provided with each statement. Circle only the number that best describes you reaction.

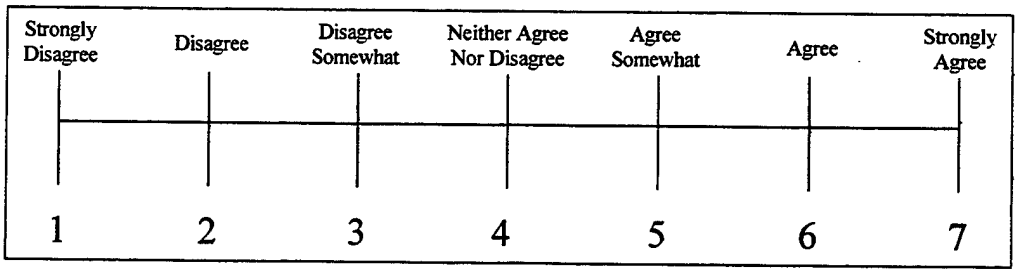
1. All experiment participants shared equal power to control meeting outcomes.



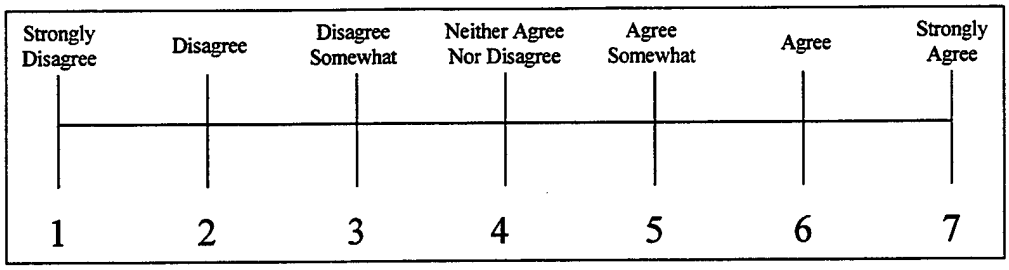
2. The setup of the GDSS benefited all experiment participants equally.



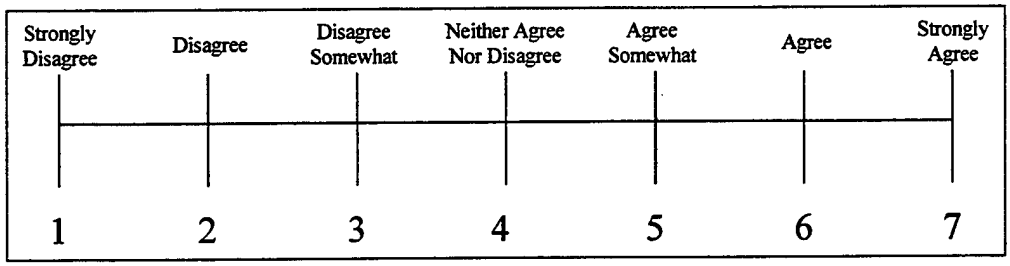
3. The GDSS employed in the experiment was set up to benefit all participants equally.



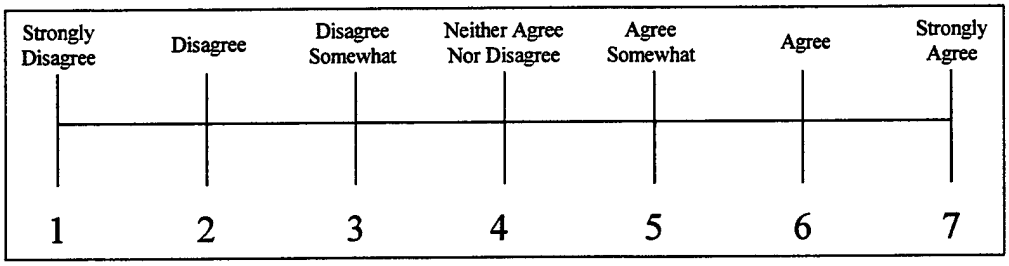
4. I feel the GDSS employed in the experiment helped focus the information exchange process.



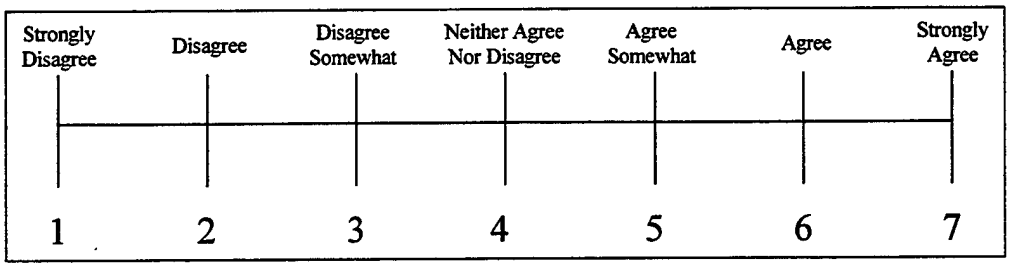
5. The facilitator did not provide special aid to any participant during the experiment.



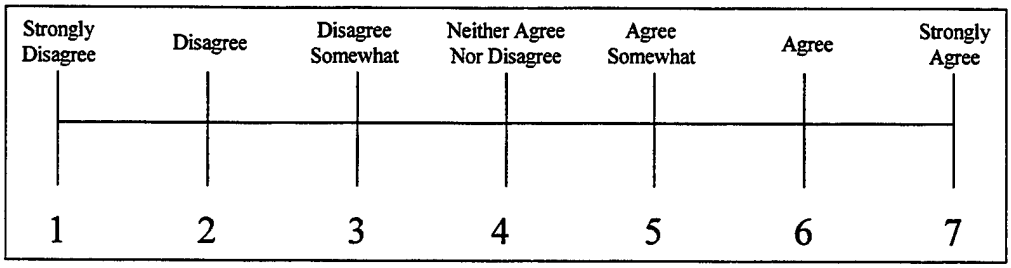
6. The facilitator had incentive to provide special aid to one experiment participant.



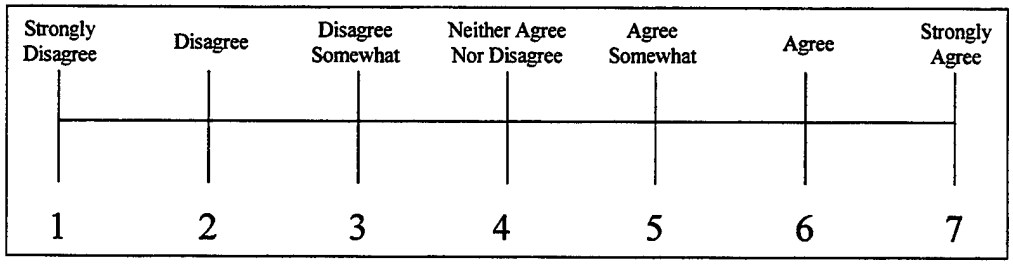
7. One of the experiment participants had the ability to communicate with the experiment facilitator outside of the GDSS.



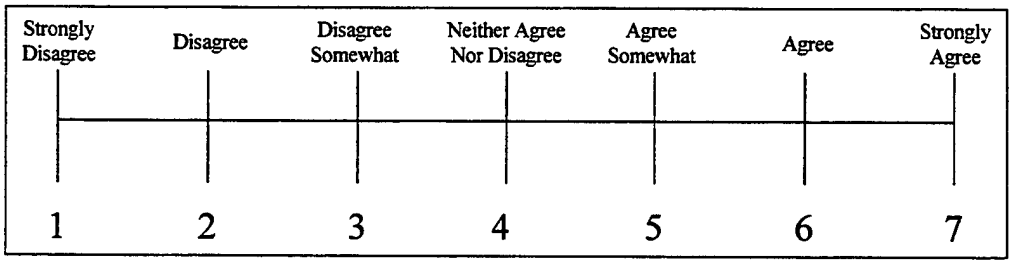
8. The facilitator helped all participants equally during the experiment.



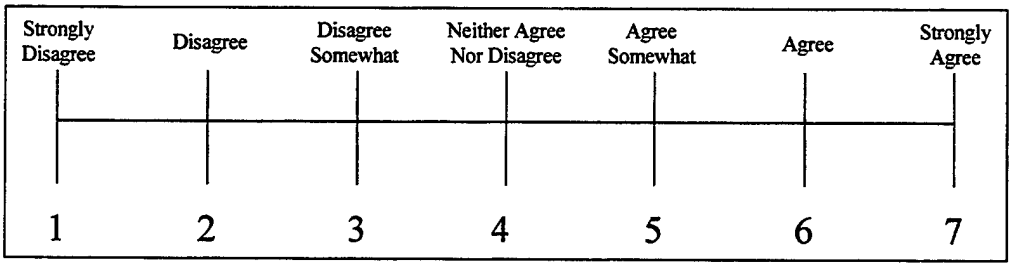
9. I am pleased with the performance of our group.



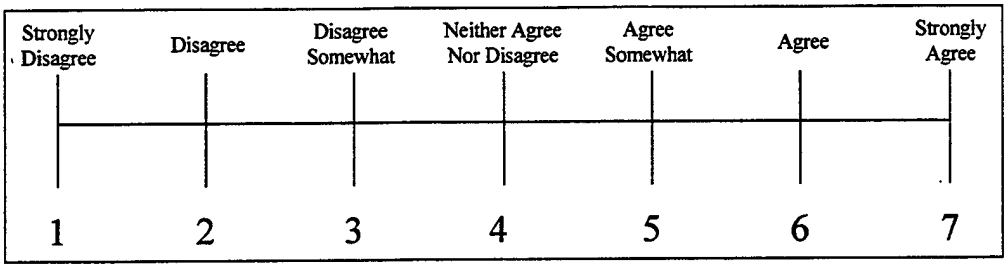
10. I am satisfied with the aid the facilitator provided ME during the experiment.



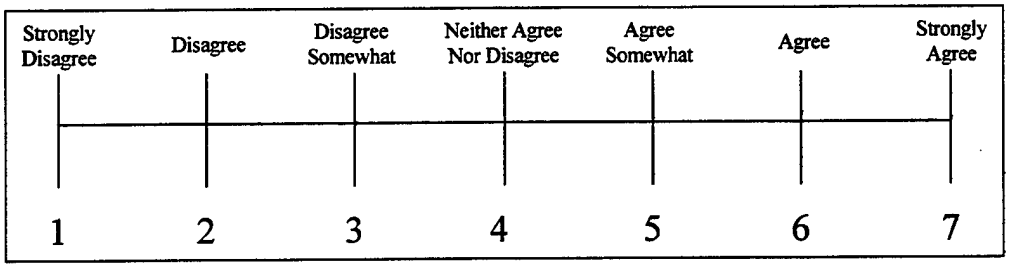
11. In my opinion, the facilitator performed his duties effectively.



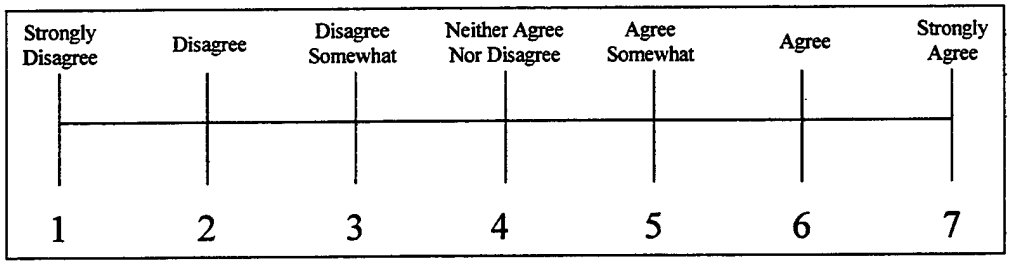
12. One of the experiment participants had better access to the facilitator than the other participants.



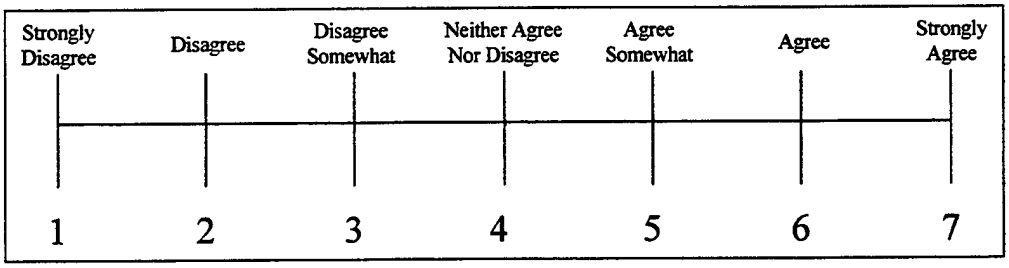
13. I feel the facilitator performed his duties in a satisfactory manner.



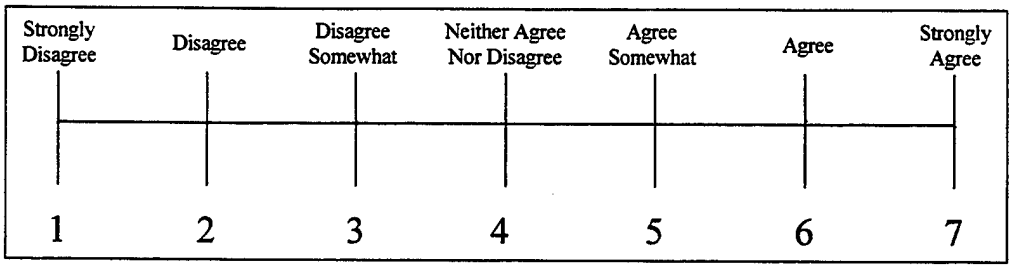
14. The facilitator was motivated to enhance the performance of one participant at the expense of the other participants.



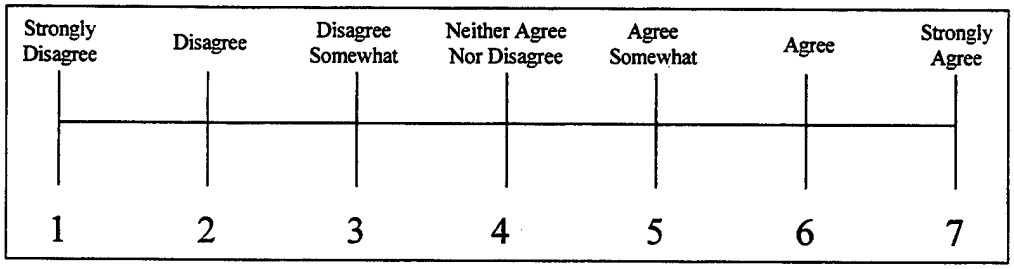
15. The setup of the GDSS favored all participants equally.



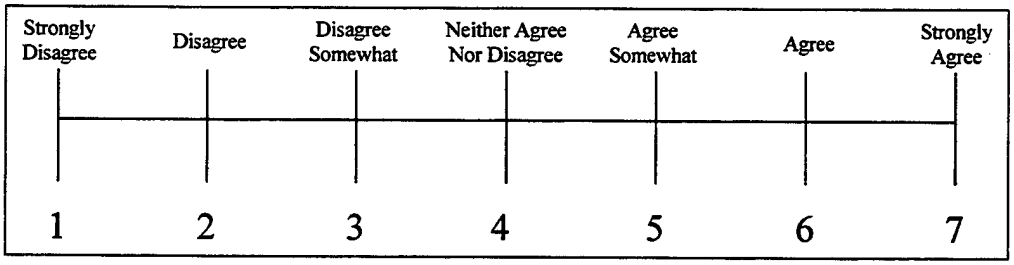
16. I would not mind working with this group again.



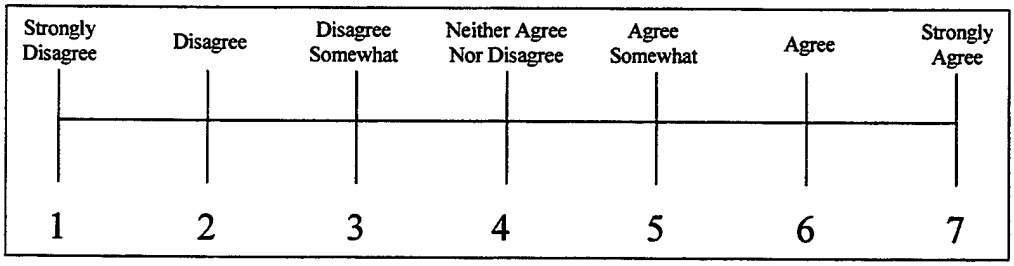
17. The setup of the GDSS ensured no meeting member could unduly influence the meeting process.



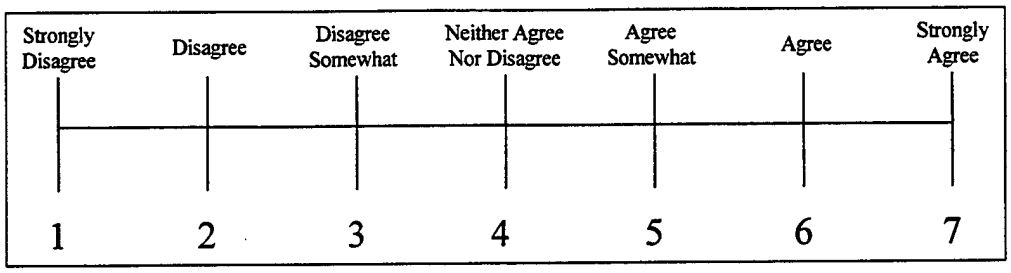
18. In my opinion, I and the other experiment participants worked effectively as a group.



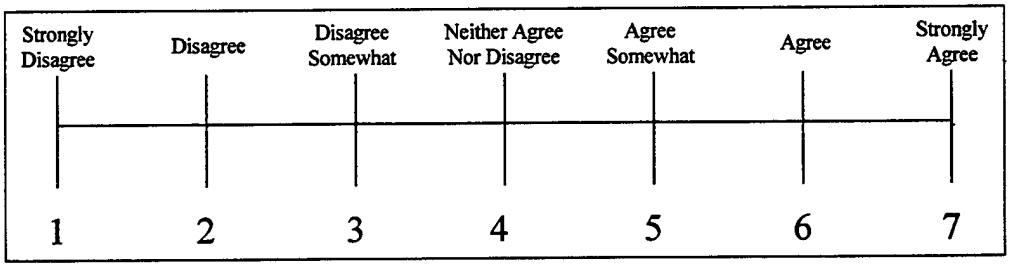
19. All experiment participants willingly shared their information with the group.



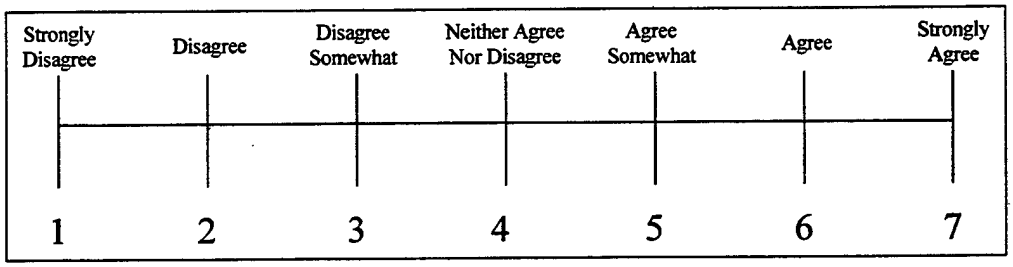
20. The facilitator had reason to provide special help to just one experiment participant.



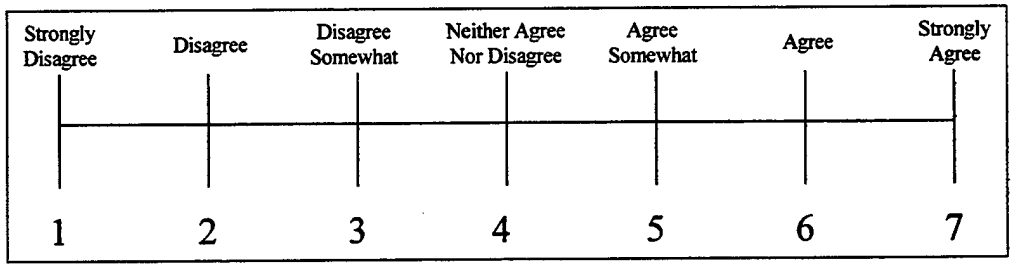
21. The facilitator acted impartially throughout the experiment.



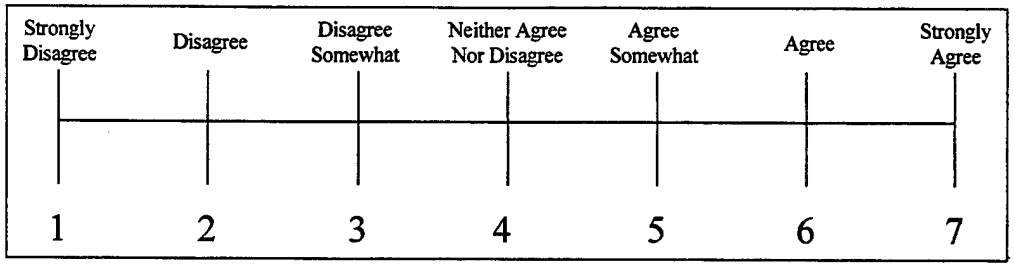
22. All experiment participants shared information cooperatively to benefit the group as a whole.



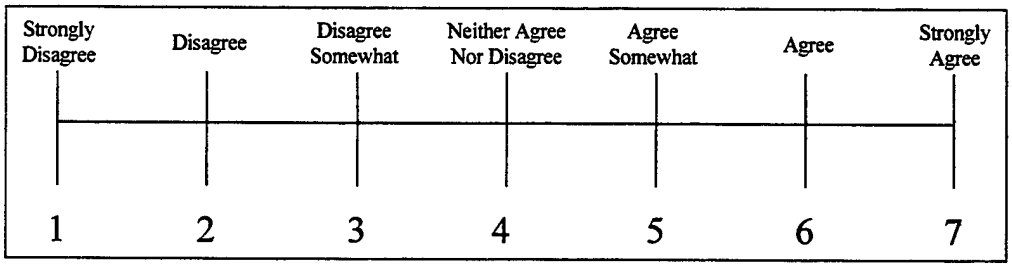
23. I had the same level of control over meeting outcomes as every other experiment participant.



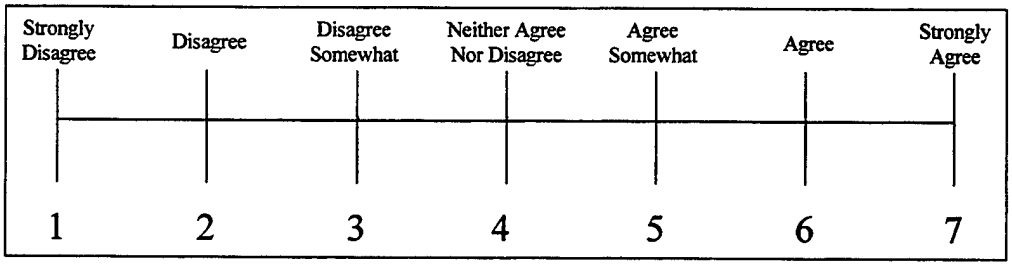
24. I feel the GDSS employed in the experiment helped the group exchange information.



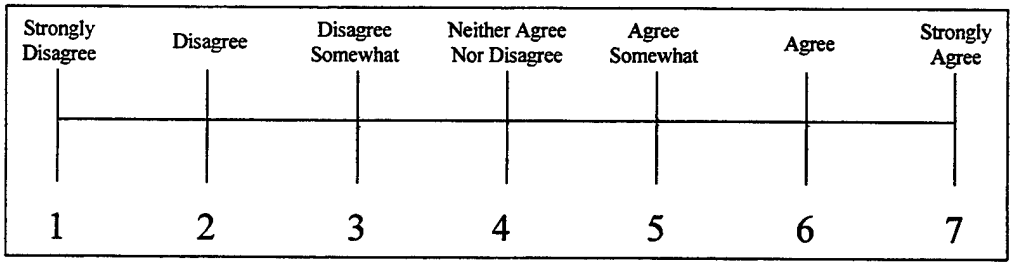
25. I found the other experiment participants easy to work with.



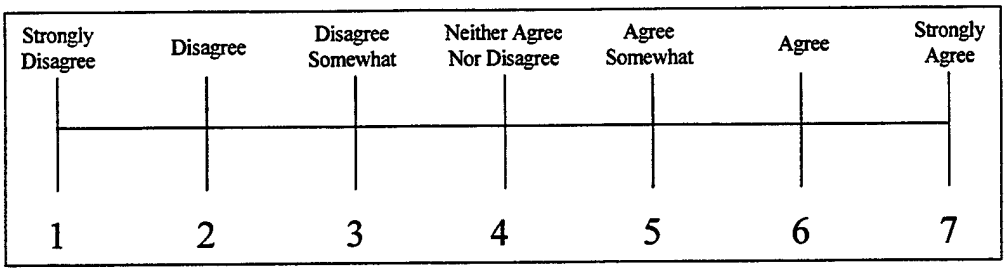
26. All experiment participants shared equal power to control the information exchange process.



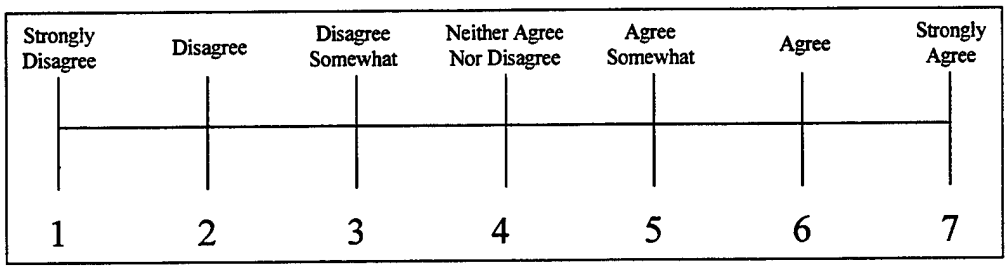
27. No experiment participant had more control over the meeting process than any other.



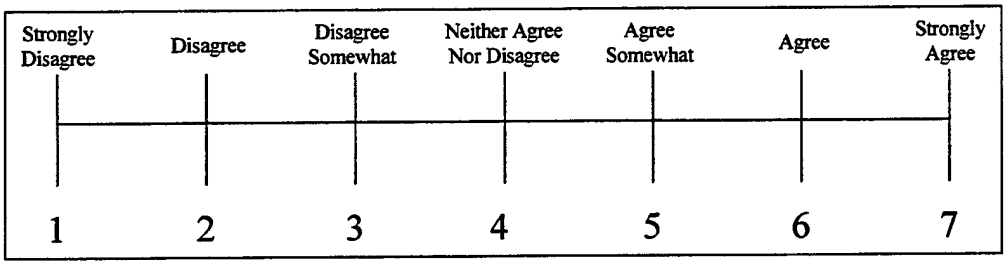
28. I trusted that the facilitator was helping all participants fairly during the experiment.



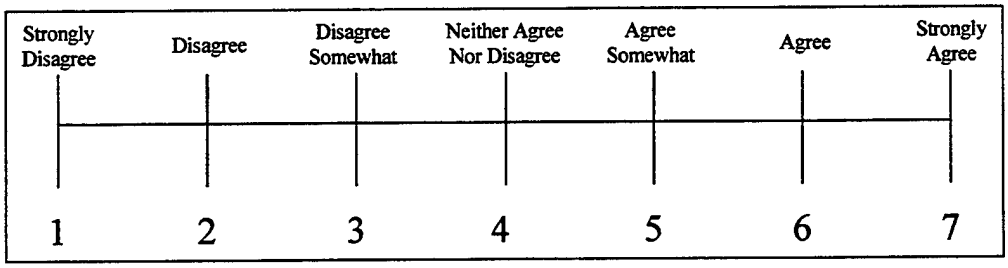
29. The facilitator had the ability to communicate with one experiment participant without the knowledge of the other participants.



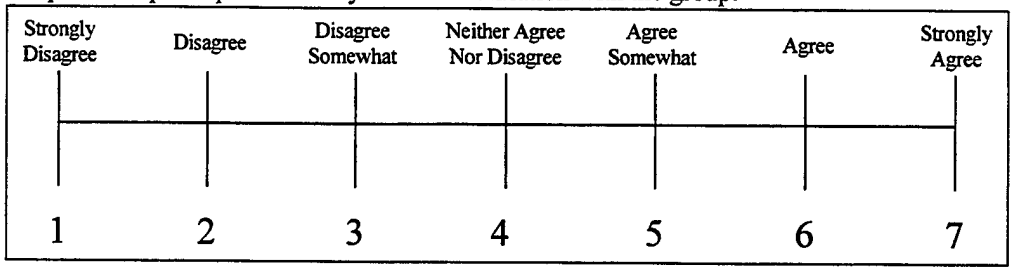
30. I feel the GDSS employed in the experiment was an aid to group efficiency.



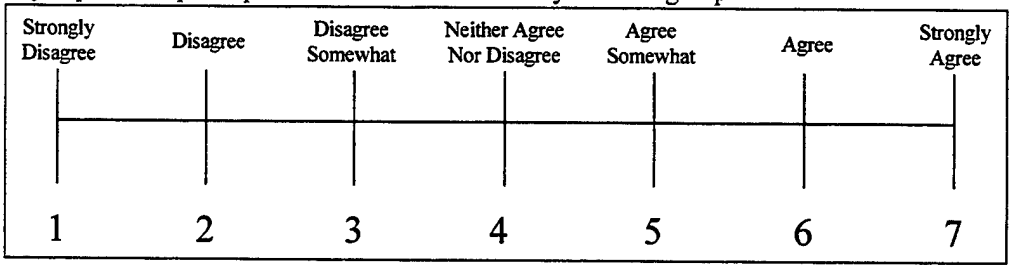
31. The facilitator had motivation to influence the experiment's outcome in favor of one experiment participant.



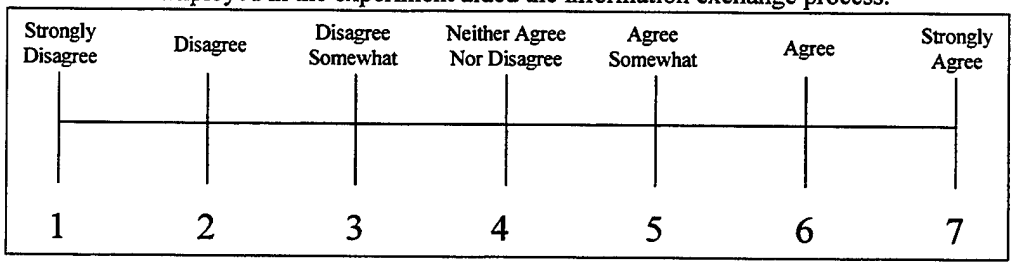
32. All experiment participants actively shared information with the group.



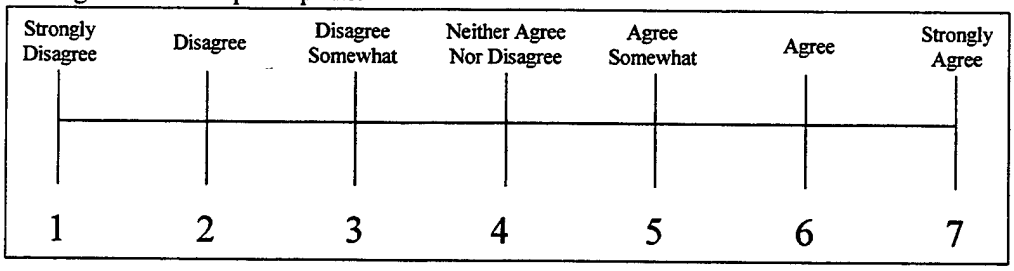
33. Every experiment participant shared information freely with the group.



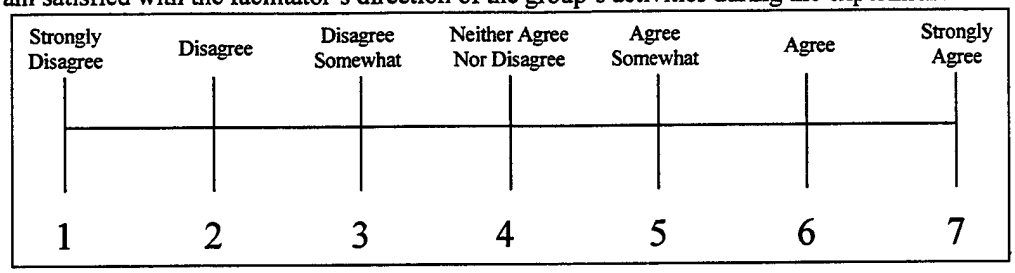
34. I feel the GDSS employed in the experiment aided the information exchange process.



35. One of the experiment participants had the ability to communicate with the facilitator without the knowledge of the other participants.



36. I am satisfied with the facilitator's direction of the group's activities during the experiment.



Appendix H: Sport of Kings Participant Betting Form

Individual Betting Form

Participant Identifier (A, B, or C): _____

Please enter your individual bet on the results of the Cooper Stakes.

First Place _____

Second Place _____

Third Place _____

Appendix I: Sport of Kings Facilitator Script

Sport of Kings Experiment
Script

[Upon arrival, escort individual participants to their respective rooms based on Treatment (Participant A should be co-located with the facilitator when conducting tests under Treatments 3 and 4). Administer release forms. Collect release forms, instruct participants on headphone use, ask them to don headphones and wait for further instructions from the facilitator.]

[When all participants are situated and you are ready to begin, deliver the following instructions via the headphone intercom system.]

"You all have a copy of the introductory materials which describe the task scenario, experimental design, and agenda for this experiment. At this point I'd like you all to read that package and when done reading, to complete the section marked "Exercise" at the back. The purpose of this exercise is to familiarize you with experimental procedures. As I just did, I will visit each of you individually in a few minutes to review your completed exercise forms.

I'll briefly describe the task once more once everyone has had a chance to review the introductory materials and complete the "Exercise" section. Please remove your headphones and begin."

[Allow Participants time to read through introductory materials and complete "Exercise" section. Visit each personally and confirm a score of 100% on the treatment-specific exercise. Reexplain instructions to clear up any confusion indicated by incorrect answers. When all participants have finished these tasks, visit each and tell them to don their headphones again. Deliver the following instructions via the headphone intercom system.]

"OK participants, we are ready to proceed.
(Participant A, are you there?)
Participant B?
Participant C?"

"Today each of you will attempt to identify the top 3 finishers from a field of 9 horses running in a fictional horse race called the Cooper Stakes. In a moment I will open your individual workstations to the GSS Topic Commenter Screen- which is very much like a chat room- and brief you on system operation. Then I will instruct you to open the envelopes marked "Racing Form" at your workstations. I will then allow you 40 minutes to discuss the problem of identifying the race winners using Topic Commenter. All discussion of the experimental problem will take place using Topic Commenter. You will not be able to discuss the problem using the headphone intercom system.

When that 40 minutes is up, I will close Topic Commenter, and then reopen the page, allowing you 10 minutes to review the comments submitted to the group. You will not be able to submit comments to the group during this time.

When the 10 minutes are up, I will again close Topic Commenter. I will then instruct you to open the envelopes marked "Survey" at your workstations and complete the betting form and survey enclosed. I will visit you individually when both forms are complete and brief you on the purpose and results of the experiment.

[Ask participants if they have any questions at this time- respond appropriately.]

Remember, the purpose of this experiment is to gather data on your estimation of system utility, your satisfaction with me, the facilitator, and your satisfaction with the performance of the participant group.

Please keep these facts in mind- you will be asked about them at the end of the experiment when you complete the post-experimental questionnaire.

[Ask participants if they have any questions at this time- respond appropriately. Open Topic Commenter screens at participant workstations. Illustrate navigation of Topic Commenter using script below.]

"I'm now opening the Topic Commenter page at your computer workstation. As I told you earlier, Topic Commenter is very much like a chat room. To navigate the page you must first click yes to the 2 on-screen prompts asking you if you want to join the activity. Please do so now.

Next please select or type in your Participant identifier (A, B, or C- this information will be clearly marked at your station) and again click "OK." This will attach your participant identifier to all comments you submit via the GSS. Please do this now.

Finally, you must double click on "Cooper Stakes" to open comment page. Please do this now."

"You may enter comments by typing in the box at the bottom of the page and submit comments by clicking the "submit" button. Please type and submit the phrase, "I'm Here" now.

[Verify that all participants enter comment.]

Once more comments are submitted to the system than the page will hold, a scroll bar will appear on the right of the screen. You must use this scrollbar to view the most recently-submitted comments, as the page view does not advance automatically.

You will have 40 minutes to discuss the experimental task as a group. I will give you updates on time remaining every 5 minutes or so. Any questions?"

[Pause for Questions. Respond as appropriate.]

"Please open the envelope marked "Racing Form" at your station. During this part of the experiment all communication will take place over the GSS only. I will give you about one minute to review the form and then I will indicate over the Topic Commenter page that time has begun. Please remove your headset and begin reviewing your racing form."

In 30 seconds enter comment:

> "TIME HAS BEGUN. YOU HAVE 40 MINUTES TO DISCUSS THE PROBLEM AS A GROUP USING TOPIC COMMENTER."

At 3 minutes into task submit the following message via system, as appropriate:

> "YOU WILL BE MOST PRODUCTIVE AS A GROUP IF YOU EMPLOY A STRUCTURED APPROACH TO INFORMATION EXCHANGE- FOR EXAMPLE, HORSE-BY-HORSE, OR CONDITION-BY-CONDITION. PARTICIPANT A, WHAT APPROACH WOULD YOU LIKE THE GROUP TO USE?

1. **Wait for Participant A's response. If Participant A suggests an information exchange methodology, submit the following comment:**

   "THAT SOUNDS REASONABLE PARTICIPANT A.
   I'D LIKE THE GROUP TO USE THIS APPROACH FOR THE REMAINDER OF THE TASK, AND PARTICIPANT A, I'D LIKE YOU TO LEAD THE GROUP. PLEASE TAKE IT FROM HERE."

2. **If Participant A fails to respond to your prompt, submit the following comment:**

   "PARTICIPANT A, WHAT APPROACH WOULD YOU LIKE THE GROUP TO USE?"

   If Participant A should again fail to respond to your query, enter the comment:

   "PARTICIPANT A?"

   and then:

   "PARTICIPANT A, WHAT APPROACH WOULD YOU LIKE THE GROUP TO USE?"

   if Participant A should again fail to respond. If finally you decide that Participant A will not respond, enter the comment:

   "PARTICIPANTS PLEASE CONTINUE WITH INFORMATION EXCHANGE AS BEFORE."

3. **Respond to any questions/complaints about your motive with the comment:**

   "I'M ONLY TRYING TO SUGGEST AN ORGANIZED MEANS OF INFORMATION TRANSFER."

-OR-

"I'M SIMPLY TRYING TO HELP YOU STRUCTURE THE INFORMATION EXCHANGE PROCESS."

-OR-

"I'M ONLY TRYING TO HELP YOU WORK EFFECTIVELY AS A GROUP."

Use each as appropriate, in order, if you can. If possible, use each only once.

At 5 minutes into task submit the following comment via system:

"35 MINUTES REMAINING PARTICIPANTS."

At 10 minutes into task submit the following comment via system:

"30 MINUTES REMAINING PARTICIPANTS."

At 13 minutes into task submit comment:

"GOOD JOB DIRECTING THE GROUP PARTICIPANT A. YOU'RE DOING WELL."

At 15 minutes into task submit comment:

"25 MINUTES REMAINING PARTICIPANTS."

At 18 minutes into task submit comment:

"YOU'RE ALL DOING VERY WELL. PARTICIPANTS B AND C I APPRECIATE YOUR COOPERATION WITH PARTICIPANT A."

At 20 minutes into task submit comment:

"20 MINUTES REMAINING PARTICIPANTS."

At 23 minutes into task submit comment:

"PARTICIPANT B, YOU SEEM TO BE HOLDING BACK SOME INFORMATION- REMEMBER- IT'S TO THE GROUP'S BENEFIT THAT YOU SHARE YOUR INFORMATION FREELY AND IN ITS ENTIRETY."

At 25 minutes into task submit the following comment via system:

"15 MINUTES REMAINING PARTICIPANTS."

At 28 minutes into task, submit the following comment via system:

"PARTICIPANT A, WHAT INFORMATION DO YOU STILL NEED?"

*** Respond by entering the comment:**

"REMEMBER PARTICIPANTS B AND C, THE FREE SHARING OF INFORMATION BENEFITS THE GROUP AS A WHOLE!"

*** If Participant A fails to respond, repeat question.**

At 30 minutes into task submit the following comment via system:

"10 MINUTES REMAINING PARTICIPANTS."

At 32 minutes into task submit the following comment via system:

"8 MINUTES REMAINING PARTICIPANTS. PARTICIPANT A, BETTER START THINKING ABOUT WRAPPING THINGS UP."

At 35 minutes into task submit the following comment via system:

"5 MINUTES REMAINING PARTICIPANTS."

At 37 minutes into task submit the following comment via system:

"3 MINUTES REMAINING PARTICIPANTS."

At 39 minutes into task submit the following comment via system:

"1 MINUTE REMAINING.

IN 1 MINUTE I WILL CLOSE THE TOPIC COMMENTER SCREEN AND THEN REOPEN IT SO YOU MAY REVIEW THE COMMENTS SUBMITTED TO THE GROUP FOR 10 MINUTES.

ONCE I CLOSE THE SCREEN, PLEASE PUT ON YOUR HEADSET AGAIN. I WILL THEN VERIFY THAT EVERYONE IS WEARING THE HEADSET."

AT 40 minutes close Topic Commenter screen and announce via intercom system that time is up. Change user privileges so that participants cannot submit comments in Topic Commenter.

VIA INTERCOM SYSTEM:

Time is up.

(Participant A, are you there?)
Participant B?
Participant C?

I'm closing Topic Commenter and will open it back up in just one minute so that you can review the comments submitted to the group. You will be unable to submit comments during this portion of the experiment- only review past comments. You will have 10 minutes to review this information. Remember to double click "Cooper Stakes" to open the Topic Commenter screen. I will keep you informed of time remaining for this task via the intercom system."

[Open Topic Commenter. Give time hacks at 5, 8, 9 minutes, and 9.5 minutes. Close screen at 10 minutes.]

VIA INTERCOM SYSTEM:
"I am now closing the Topic Commenter screen. At this time I'd like you to open the envelope marked "Survey" at your workstation and complete the betting form and survey inside. Be sure to write your participant identifier on the front of each of these forms.

I will visit you individually in a few minutes to collect the betting form and survey from you and to brief you on the purpose and results of this experiment."

[Print Topic Commenter transcript with time stamp, save session to folder, perform materials collection and individual debriefing (script next page). Collect all experiment materials in a manila envelope. Complete and include Data Collection Cover Sheet and seal envelope.]

References

Air Force Research Laboratory Sustainment Logistics Branch. "Depot Operations Modeling Environment," Technology Description. Wright-Patterson AFB OH, 1997.

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	September 1998	Master's Thesis

4. TITLE AND SUBTITLE
IMPACT OF FACILITATOR CO-LOCATION AND ALIGNMENT ON THE EFFICACY OF GROUP SUPPORT SYSTEMS EMPLOYED IN A DISTRIBUTED SETTING

5. FUNDING NUMBERS

6. AUTHOR(S)
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2950 P Street
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8. PERFORMING ORGANIZATION REPORT NUMBER
AFIT/GIR/LAL/98S-7

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
AFRL/HESS
Attention: Captain Cassie Barlow
2698 G. Street
WPAFB, OH 45433

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (*Maximum 200 Words*)

Group Support Systems (GSSs) are a combination of hardware, software, and human facilitation designed and employed to increase the effectiveness and efficiency of decision-making groups. Engineers at the Sustainment Logistics Branch of the Air Force Research Laboratory have recently proposed employing the technology in a distributed setting to conjoin geographically-separated members of decision-making groups in order to facilitate the reengineering of logistics processes in an any place/any time environment.

To date GSSs have been studied and employed primarily in the same time/same place setting. Consequently, little is known or understood of the effects that use of these systems may have on the group dynamic when employed in the distributed setting. This thesis examines how two elements of GSS configuration, the location and alignment of the meeting facilitator, may impact system users' perceptions of situational equity, their attitudes towards the efficacy of the technology, their information-sharing behavior, and the quality of decisions reached by user-groups. The results of the work evidence that isolation of the facilitator from meeting members is desirable, and that facilitator neutrality is essential to the efficacy of such systems deployed in the distributed setting.

14. Subject Terms	15. NUMBER OF PAGES
Group Support Systems, Group Facilitation, Computer-Mediated Communications, Decision-Making	134
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

AFIT Control Number AFIT/GIR/LAL/98S-7

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