AN EMPIRICAL INVESTIGATION OF THE EFFECTS OF PROCESS RESTRICTIVENESS SOURCES ON THE PERCEPTIONS AND PERFORMANCE OF DECISION-MAKING GROUPS IN A GROUP SUPPORT SYSTEM ENVIRONMENT

Bradley C. Wheeler

Submitted to the Faculty of the University Graduate School
in Partial Fulfillment of the Requirements
for the Degree
Doctor of Philosophy
in the School of Business
Indiana University

August, 1993

ACCEPTANCE

Accepted by the Graduate Faculty, Indiana University, in partial fulfillment of the requirements of the Degree of Doctor of Philosophy in Business.

Joseph S. Valacich, Chairman

Jeffrey A. Hoffer

Doctoral Committee

William C. Perkins

30 July 1993

Joseph N. Scudder

PREFACE AND ACKNOWLEDGEMENTS

Perhaps the allocation of pages in this dissertation, like most others, is a rather revealing sign of our culture. It seems silly to write 200+ pages about a research project and then write only a few paragraphs to recognize those important people who have shaped my journey to this point -- thus I make no effort to be brief.

I suspect that the road to academia really began in Marilyn Kletke's 7:30am *Management Information Systems* course at Oklahoma State University (OSU). Other faculty at OSU, especially Debra Nelson and Margaret White, also helped me to consider a career as a business school professor. Wayne Meinhart provided that first *testing of the teaching waters* when he gave me a teaching assistantship as I returned to OSU for an M.B.A. degree. One semester in the classroom and I was hooked. I loved the classroom and the challenges of teaching.

Ramesh Sharda became my mentor during the second year of the M.B.A. program. He aquainted me with several very ambitious research projects and coached while I worked through my ignorance. He gave me responsibility and treated me like a junior colleague. I am greatly indebted to his counsel. The research was fascinating -- again I was hooked.

Leaving Stillwater was not an easy decision for me. I loved the place, school, close friends -- like Barbara who *willingly* proofread this document-- and especially the congregation which had played such a vital role in my spiritual training. Bayard (Bye) Wynne helped make the transition to Indiana University much easier. He guided my early learning about research and did the single most important thing in defining my doctoral experience. He assigned a research project that has become fondly known as "The experiment from hell." My classmates and I learned many of the painful lessons of research by experience -- the best thing that we could have ever done.

I was fortunate to have entered the doctoral program with excellent classmates. Brian Mennecke and I have worked on virtually everything together. We complemented, balanced, and no doubt confused each other's strengths and weaknesses. We eventually gave up correcting the faculty and our colleagues when they confused our names. Reneé Wachter was the third member of our class trio. She helped to realign our thinking when it got out of bounds. Our common interests in technology and groups allowed the three of us to find a synergy in working together. We did it all together -- the experiment from hell, course work, field exams, conference papers, the hiring circus, and most importantly, we encouraged each other through the whole process.

I was also fortunate to have gained new and important friends in Bloomington. Leaving Barbara, Shane, Roger, Susan, Darren, Kellie, Paul and many other friends in Stillwater created a social and relational emptiness that busy-ness with classes and work

could not fill. Meeting Fred Ricketts, my roommate for nearly two years, was surely the work of providence. He is one of my most precious friends and the peer brother which I had missed in life. He was an encouragement through the ridiculous hours I spent at the lab, working on papers, and managing K201. Most importantly though, I think he challenged me as much as anyone I have ever known -- and I am the better because of it. Robby Schaffer, a dear spiritual brother and a fellow inmate in the French Literature doctoral program, was also a close friend that I needed. Our discussions of *things that matter* and countless meals together helped to keep this entire process in perspective. Kenda Childes, or *Little Muffin*, became a dear friend almost immediately. We learned much from our shared summers together doing mission work in Romania.

Returning to the education process, Brian, Reneé, and I are all greatly indebted to Libby Merry, Bethany Sprague, and Jan Lundy. These three ladies were the support staff in our department. They labored on our research projects, accepted last minute requests for copies, and did many other things that they did not have to do. Their invaluable assistance made things possible. Bob Rothchild did all of the facilitation for this experiment. Heikki Topi and Michele Giles gave laborious hours to coding the decision quality. Colleagues Karen Crooker, Gary Spurrier, Janet Phelps, and Lynn Adair again scored the new solutions from this experiment. The unselfish assistance of these people was critical to this research project. I thank them all very much.

I was also very fortunate to have been at IU while Jeffrey Hoffer was department chairman. As chairman, Jeff actively supported my projects and research initiatives. He read my papers and pointed out the holes which were too large for me to see. As a member of my dissertation committee, he read and reread, and greatly improved the consistency of this document. As a professor in my minor discipline (Small Group Communication), Joseph Scudder guided my learning about group process. He has greatly shaped my interest in the interplay of technology and groups, and he has been a fine person to work with during these three years. I did not have the opportunity to take a class from William (Bill) Perkins, yet he agreed to serve on my dissertation committee and his contribution has been invaluable. No comma, capitalization error, or weak flow of argument escaped his eye. He served as the "reality check" and editorial reviewer for this document. Any errors that remain are surely my mistakes in final editing which did not pass Bill's eyes. Jeff, Joe, and Bill -- thank you. Thank you.

Joseph Valacich, my committee chairman, and I began Indiana University together in 1990. He began as a professor at a major research institution, and I was still trying to learn exactly what a professor does. During the past 18 months Joe has been my closest mentor. He has taught me what a professor does and how to do it well. I believe that this *process* training was as important as all the *content* knowledge that I gained in this program. Joe read this document with the important balance of realizing the tradeoffs required to get good research done while critiquing it towards journal quality. He was always encouraging during our meetings, and I am proud to be his first Ph.D. graduate. I

count him among important personal friends. Could anyone ask for more in an advisor and mentor? I think not. Thank you Joe.

Finally, my mom and dad have both taught me much about life. Dad, especially, taught me a strong work ethic at an early age, and it has served me well during these demanding three years. Balancing it spiritually with the things that really matter has been even more important. I am thankful for that seed of faith in God which I first remember in my Great Grandmother Maggie Elrod. It was passed to my Grandmother Rachel Wade and to my mother, Sandra Kay. My life has been much richer because of it. Thank you mom and dad for your role in shaping who I am -- and for having to tell your friends for so long that, "Yes, Brad is *still* in school."

ABSTRACT

Group Support Systems (GSSs) have been advanced to improve group decision making. Much work on group decision making has advocated that groups use structured decision procedures or heuristics to enhance their decision processes. Organizational research, however, has documented that groups seldom adhere to structured decision procedures, instead they pattern group interaction in ways which are more familiar or less effortful. The present research extends adaptive structuration theory by investigating the role of process restrictiveness. An experiment evaluated the efficacy of facilitation-based, user-based (e.g., training), and technology-based sources of process restrictiveness to improve group outcomes. The process restrictiveness sources were investigated individually and in combinations. Five person groups worked on an intellective hidden-profile task and all groups used a GSS. Group level measures of decision quality and consensus along with individual member satisfaction were assessed among eight different process restrictiveness treatments.

The results found that the three sources of process restrictiveness frequently interacted to moderate decision quality, consensus, and satisfaction. In general, facilitation resulted in high decision quality, low process satisfaction, high outcome satisfaction, and no impact on consensus. User training resulted in low decision quality, low process satisfaction, high outcome satisfaction, and low consensus. System-based process restrictiveness resulted in low decision quality, high process satisfaction, low outcome satisfaction, and high consensus.

Facilitation was effective in correcting process deviations when the group strayed from the structured decision procedure. User training produced an awareness of the decision procedure, but did not sufficiently equip the groups to faithfully appropriate it. System-based process restrictiveness provided procedural focus for the group.

These results have implications for the design and organizational adoption of GSS technology. They can help guide efforts to embed group decision process expertise in GSSs.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION AND PROBLEM

While many paths to effective group decisions[1] may exist, researchers have extensively described the group processes that often accompany ineffective decisions. Post hoc analysis of group decisions from both controlled laboratory- and field-based groups has identified several factors which may potentially impede groups from achieving effective decisions. These factors include actions such as a lack of reflective thinking about opinions and assumptions, a lack of vigilance, faulty information processing, status and power differences that impede communication, and decision processes which are poorly matched to the task (Gouran, 1982; Hirokawa, 1987; Hirokawa & Pace, 1983; Janis, 1982).

The same research also suggests that certain decision-making procedures and philosophies can (if followed) inhibit these factors and improve group decision effectiveness (Hackman & Kaplan, 1974). These procedures, known as heuristics (also more generally referred to as process interventions), are rules of thumb or guidelines with sequenced stages and activities that increase the likelihood of solving a problem effectively

[1] Many terms have been used to differentiate between desirable (e.g., high quality, good, correct) and less desirable (e.g., low quality, poor, faulty, wrong) decisions. Each of these evaluative terms may be more or less appropriate to a particular type of group task. For consistency, the term "effective" will be used to refer to a desirable group decision based on the most applicable evaluation criterion for a particular task.

(VanGundy, 1988). They consist of structures which mandate certain *activities*, *sequences*, and *philosophies* in the decision process to reduce or limit behaviors considered detrimental to effective decision making. They also seek to promote the behaviors that are characteristic of effective decision making (Hirokawa, 1987). A variety of literature from the fields of management, organizational behavior, psychology, and speech communication supports the premise that process interventions can promote more effective decisions than those based on individuals' intuitively or socially acquired rules of thumb (Hackman & Kaplan, 1974; Hall & Williams, 1970; Hall & Watson, 1970; Janis, 1982; Maier & Maier, 1957; VanGundy, 1988).

Some participants in group decision making, however, believe that process interventions conflict with the way they would prefer to structure the decision process. In these cases, members will resist using imposed heuristics and will instead resort to their own ideas for structuring the group process (Hackman & Kaplan, 1974; Jablin & Siebold, 1978). Chapter 2 details some of the reasons for this behavior. Nutt's (1984) observations of organizational decision making support this assertion. He observed,

> Nothing remotely resembling the normative methods [heuristics] described in the literature was carried out. Not even hybrid variations were observed. Either managers have little knowledge of these methods or find them naive. The sequence of problem definition, alternative generation, refinement, and selection, called for by nearly every theorist, seems rooted in rational arguments, not behavior (p. 446).

Proponents of process interventions have sought to induce *faithful appropriation* (the act of using a heuristic's structures in a manner consistent with the spirit of the structure's design) by *restricting* the interaction within a decision-making group to the activities, sequences, and philosophies defined by the heuristic. Some previous research has used the

term *restrictiveness* to describe the degree to which a system (or heuristic) actively limits its users' decision processes to a subset of all possible processes (DeSanctis, D'Onofrio, Sambamurthy, & Poole, 1989; Silver, 1988, 1990). For this research, however, we focus on a group's *appropriation* of a heuristic rather than the degree to which a system (or heuristic) limits the available decision processes. *Process restrictiveness* is defined as the *manner of limiting a group's interaction to the activities, sequences, and philosophies specified by the heuristic*. A more detailed discussion of process restrictiveness is presented in Chapter 3.

Efforts to induce faithful appropriation traditionally have been encouraged via two mechanisms: 1) through group *training* in the proper use of the heuristic, and 2) through group process *facilitation* by a trained process facilitator. Group training attempts to implant process restrictiveness within the members of the group so that each member will understand the benefits of using a heuristic and will recognize when the group process significantly deviates from the guidelines of the heuristic. A second source is a process facilitator who provides an external source of restrictiveness. The facilitator usually does not contribute to the content of the group's discussion, but monitors the process and coaches the group to adhere to the structures of a particular decision-making heuristic. Of course, both of these sources of process restrictiveness may be employed concurrently.

Technology offers an additional way to deliver heuristics, suggesting a third potential source of process restrictiveness. Computer-based Group Support Systems (GSS, also Group Decision Support Systems [GDSS]) have been developed to improve many areas of group work including group decision making (DeSanctis & Gallupe, 1987).

By using these systems as the delivery vehicle for the heuristic's activities and sequences, some decision theorists have hoped to overcome many of the difficulties associated with implementing heuristics in non-computer-based settings (i.e., without computer support). The results of research on the success of GSSs to improve group decision-making outcomes, however, have been mixed. Dennis and Gallupe (1993) conducted an extensive review of GSS research and noted four major thrusts of investigation: anonymity, parallelism, structure, and facilitation. Of these four thrusts, structure and facilitation relate directly to the delivery and implementation of heuristics. They report that some studies have suggested the structure and facilitation aspects of GSSs improve decision outcomes, though these findings have not been universal.

Poole and DeSanctis (1990) have observed that "no matter what features are designed into a system, users mediate technological effects, adapting systems to their needs, resisting them, or refusing to use them at all" (p. 177). Thus, some of the inconsistencies in previous assessments of GSS decision effectiveness may have arisen from the manner in which the group appropriated the heuristic rather than the manner in which the group utilized the technology. While GSSs may make the process and structural components of a heuristic available, ultimately it is the manner in which the group implements these structures that moderates the heuristic's contribution to effective decisions.

The broad problem addressed by this research is to gain an understanding of *how to improve group outcomes (e.g., decision effectiveness, group member satisfaction, consensus) by increasing the likelihood that groups will faithfully appropriate*

decision-making heuristics. Task-appropriate heuristics can be delivered and mandated to groups by a variety of sources. Thus, the specific research question asks: What is the efficacy of various process restrictiveness sources (e.g., facilitation, training, technology) to promote effective group outcomes?

This research reports on a laboratory experiment which addresses this question. The experiment tested hypotheses which were drawn from multiple theories of group decision making and an integrated, testable research model.

IMPORTANCE OF THE TOPIC FOR THEORY AND PRACTICE

An investigation of process restrictiveness has implications for theories of group decision making and for the design of technologies to support group decision making. It also has implications for organizations who are using GSSs.

Theoretical

Many faulty decision processes have been well documented in manual group decision-making settings. Briefly stated, three theoretical schools of thought account for much of the literature on group decision making: the decision school, the technology-enhanced decision school, and the structurationalist school. The decision-school approach relates to the design and testing of specific process interventions in an effort to overcome common "deficiencies" in human decision making (Connolly, 1993). Most of this work has dealt with non-technology supported groups. The technology-enhanced decision school approach has focused on extending the process intervention research through the use of technology, e.g., parallel communication

channels, embedded process structuring, and anonymity (Dennis & Gallupe, 1993). The structurationalist approach also incorporates technology, but it takes a different view by examining how groups selectively use or appropriate structures (including those contained in a GSS) to meet their dynamic needs (DeSanctis & Poole, in press; Poole & DeSanctis, 1989, 1990).

All three schools of thought can find common ground under the concept of process restrictiveness. The activities, sequences, and philosophies embedded in process interventions can be delivered via GSSs in new and enhanced ways when compared to manual delivery means (e.g., visually linking sequenced decision activities to an on-screen agenda). Of course, if the structures designed into the heuristic are ignored or applied in a manner inconsistent with their design (unfaithful appropriation), the presumed benefits sought by the heuristic and GSS designers may not be realized (Poole, 1990). In the absence of restrictiveness, groups are free to faithfully or unfaithfully appropriate or to ignore the heuristics and tools. Thus, there is a need to understand which source(s) of restrictiveness has/have the most favorable implications for enhancing group outcomes via the faithful appropriation of heuristics.

This research maps new territory for understanding how process restrictiveness is related to GSSs and group interaction. While several studies have suggested that restrictiveness is an important factor in group research (Noel, 1992; Poole & DeSanctis, 1989), it has only been the focus of one empirical study (described in Chapter 2).

Practical

GSSs are rapidly evolving to assist both face-to-face and distributed group activities. There is a need for designers of GSSs to better understand if and how their systems should restrictively impose process interventions. The wide-spread use of facilitation as the primary source of process restrictiveness in today's same time and same place meetings will be difficult and expensive to deliver as organizations make increased use of different time or different place meetings. Thus, an investigation of other process restrictiveness sources (e.g., group member training, and system-based) is needed.

In a larger context, organizations also need to understand what matters when attempting to improve group processes and performance so that more objective applications of resources can be made. Results from this research should be useful in understanding the tradeoffs associated with allocating group process improvement expenditures between user and group training, facilitator training and usage, and GSS selection.

KEY ASSUMPTIONS AND LIMITATIONS

There are two key assumptions in the conceptualization of this dissertation. First, it is assumed that development and assessment of GSSs is bounded by our understanding of group decision processes. Walls, Widmeyer, El Sawy (1992) refer to this understanding as the *kernel theories* -- knowledge from the social sciences which governs information system design requirements. Thus, a thorough understanding of the group decision literature is a prerequisite to effectively designing or assessing the impacts of a

GSS. Second, it is assumed that technological feasibility imposes a subordinate constraint on the design and assessment of GSSs. For example, current technologies are limited in their ability to collect, interpret, and assess the meaning from the symbolic words and sentences which groups use to communicate. Thus, current GSSs cannot replicate those human process facilitation skills which rely on interpreting verbal communications or understanding the symbolic meaning of typed words.

While the literature review and theory development sections of this dissertation acknowledge that groups engage in other activities beyond task-oriented decision making, the focus of this research is limited to group decision making. Other group activities will be considered only in their relationship to the decision-making process. A discussion of the research approach and technique is presented in Chapter 4, Research Method.

DISSERTATION GUIDE

This research proposes a laboratory experiment to investigate the effects of restrictively imposing heuristics on group decision-making processes. This chapter has outlined the general nature of the problem.

Chapter 2 contains two sections which review relevant literature. The first section reviews group decision making in the absence of technology support. It is this literature which shapes our understanding of group decision processes. The second section reviews how group support systems have been developed to address the needs of decision-making groups.

Chapter 3 develops the theoretical model for the research and presents general propositions of the model. The chapter also enumerates a set of testable hypotheses for the laboratory experiment.

Chapter 4 presents the research methodology and describes the details of how the experiment was conducted. It includes descriptions of all independent, dependent, and control variables and specifies how those variables were operationalized, measured, or controlled.

Chapter 5 presents the quantitative and qualitative results of the experiment. It also describes the specific statistical procedures which were used to assess each dependent measure.

In Chapter 6, the results are interpreted in light of the model of group process restrictiveness and the specific hypotheses advanced for this experiment. The chapter also discusses the implications of these results for both theory and practice.

The final chapter, Chapter 7, describes the limitations of this work along with specific suggestions for further research on the topic of process restrictiveness.

CHAPTER 2

RELEVANT LITERATURE

Behavioral scientists from many disciplines (e.g., psychologists, management theorists, and political scientists) have researched the processes and outcomes of group activities. Since groups are often charged with making many important decisions, much of this research has been devoted to understanding group interaction processes and to improving group outcomes (e.g., decision quality, satisfaction with the process or outcome). During the 1980's the designers of information technologies also began to focus their efforts on understanding and supporting group decision making.

This literature review is presented in two sections. The first section surveys research on groups which were not using Group Support Systems (GSSs). This survey is organized around the following two questions:

- What is known about the process habits (i.e., the actual steps taken by a group to perform a task) of decision-making groups?
- How have process interventions been delivered to groups and have they been effective?

The second section addresses the role of GSSs in group decision making. It describes the theories which have driven the development of GSSs. An understanding of the first two questions and their answers is an important antecedent to addressing the role of

technology-support for groups. Therefore, this chapter will present a broad and somewhat detailed review of the group literature which addresses the first two questions. The last section of the chapter will describe how GSSs have been developed to support group decision processes and heuristics.

GROUP DECISION MAKING WITHOUT TECHNOLOGY SUPPORT

Group Tasks and Processes

The task facing a group has proved to be one of the chief moderators of group behavior and effectiveness (Hackman, 1968; Hackman & Morris, 1975; McGrath, 1984; Poole, Siebold, & McPhee, 1985). Since groups engage in many different collective activities, a number of task typologies have been presented to better understand the critical role of group tasks (McGrath, 1984, 1991; Steiner, 1972). Of particular interest for this dissertation is the distinction between *intellective* tasks, which have a demonstrably correct answer, and *value-oriented* tasks, which have no correct answer but rely on group consensus.[2] These two types of tasks have been the focus of much group research. They also provide a useful framework for matching task characteristics to particular heuristics (described below).

Descriptive Characteristics of Group Decision Making: Processes and Outcomes

In a recent review of group research, Bettenhausen (1991) observed that most of the learning about groups has come from two sources: laboratory experiments and

---

[2] Poole (1990b) has noted that the term *consensus* has been used with a variety of meanings. Poole views consensus as being both a decision agreement during the group process and a commitment to implement the decision. This view is adopted for this dissertation.

organizational (or field) settings. While organizational groups offer important realism (e.g., group history and future, political environments, time stresses from a multiplicity of concurrent tasks) that is difficult or impossible to simulate in a laboratory, research on these groups may be confounded by unique, unmeasured contextual factors.

Alternatively, laboratory experiments often use student subjects and attempt to manipulate some element of the group's activities while controlling for other factors. While laboratory experiments may lack the realism of organizational settings, Bettenhausen contends that results obtained from studying student groups in manipulated settings can often generalize to organizational settings equally well or better than organizational groups whose activities may be substantially influenced by their particularly unique context.

By observing decision-making groups in both laboratory and field settings, researchers have attempted to learn about the processes that groups invoke to make decisions and to isolate which factors, if any, promote effective decision making. The next section will review descriptive accounts of group decision making.

Descriptive Learning from Laboratory Research

Though these observations were gained from laboratory research, they are not the product of a traditional experimental design which manipulates some factor between sets of treatment groups. Rather, they are *descriptions of the interaction processes* that preceded both effective and ineffective group decisions when the groups were largely left to their own devices. The results from traditional experimental research will be presented in a later section.

Group Decision Processes - Sequences

Several researchers have investigated the *sequences* which groups use to make their decisions. Work by Poole and Roth (1988a, 1988b) documented the most frequent decision sequences for a variety of decision-making groups. The data for the analysis came from 47 decisions made by 29 groups in both laboratory and organizational settings. To be eligible for the study, the decision process had to last at least five minutes and be a decision on which the group could act. No measures of decision effectiveness were reported.

By using a complex coding scheme, Poole and Roth documented a wide variety of decision paths which they classified into three major types: unitary sequence (linear, nonrecurring sequence of activities), complex cyclic (nonlinear, recurring sequences of activities), and solution-oriented (almost all activities deal only with obtaining solutions). Each of these major types is further refined into several subtypes (Table 1). Eleven decisions followed a unitary sequence path which began with focused problem analysis. This was followed by solution-oriented work and later reinforcement of the decision. Four of these eleven decisions, however, began with a brief solution orientation then abandoned that direction ("false start") for either a simple or overlapping unitary sequence. All eleven unitary sequence decisions ended with attempts to confirm decisions. These unitary sequences most frequently occurred in larger groups with shared power and low cohesiveness who were facing an intellective problem which had no pre-established solutions nor any clear goals.

Table 1
Typology of Decision Paths
(after Poole & Roth, 1988a, p. 342)

MAIN TYPE	SUBTYPE	FREQUENCY
UNITARY SEQUENCE	Simple Unitary Sequence	3
	Overlapping Unitary Sequence	4
	Solution-Unitary Sequence	4
COMPLEX CYCLIC	Focused Complex Cycles	6
	Conflictive Complex Cycles	10
	Solution-Complex Cycles	6
SOLUTION-ORIENTED	Focused Solution-Oriented	4
	Conflictive Solution-Oriented	3
	Focused Solution-Confirmation Cycles	5
	Conflictive Solution-Confirmation Cycles	2

Twenty-two decisions followed complex cyclic paths that contained from two to seven cycles. About half of these cycles were iterations of a unitary sequence of problem identification followed by a solution activity, but the other half contained a mixture of activities. Six of the 22 complex cyclic decisions also began with a solution-oriented false start and then reverted to a focused or conflictive decision path. All complex cyclic paths tended to contain final confirmation behavior scattered throughout the session. Poole and Roth suggest that this indicates failed attempts to confirm the decision or that smaller parts of the decision were being resolved one by one. Though a number of group structural variables (size, power distribution, conflict history, cohesiveness) and task characteristics were linked to complex cyclic decision paths, groups facing value-oriented tasks with clear, familiar goals and with some degree of urgency were more likely to engage in cyclical behavior.

Finally, fourteen of the decisions followed a solution-oriented path in which there was almost no problem definition or analysis activity. Five of the fourteen had multiple solution-confirmation cycles, which again suggested that the group had broken the decision into multiple, smaller decisions. It is interesting to note that 24 out of the 47 decisions began with some form of a solution focus rather than engaging in any activity to define the problem. Only ten of the 24 groups abandoned the solution-oriented behavior in favor of an alternate activity. Solution-oriented behavior was more likely in smaller, cohesive groups with concentrated power and little previous conflict. It was also more likely when groups were doing a value-oriented task with clear goals, prespecified solutions, and little requirement for innovativeness.

Overall, this investigation of group decision paths clearly demonstrates that natural group processes are unlikely to be congruent with a normative, linear path of decision activities advocated by many process interventions (described below). Furthermore, solution-oriented processes appear to be the most frequent initial orientation of decision-making groups.

Process Characteristics of Effective and Ineffective Decisions: Activities and Philosophy

Other researchers have attempted to identify if any particular decision processes (i.e., activities) were more frequently associated with effective or ineffective group decisions. Hirokawa and Pace (1983) investigated this possibility by analyzing videotaped discussions from six effective and five ineffective group decisions. These decisions came from a pool of 50 groups which worked on a value-oriented decision case. Decision effectiveness was rated by a panel of experts. The researchers identified four

communication-related characteristics that distinguished the effective groups from the ineffective groups: (1) Effective groups rigorously examined the validity of assumptions advanced by group members and accepted only the assumptions that appeared to be valid. Conversely, ineffective groups did not appear to distinguish between facts, opinions, assumptions, and inferences. (2) Effective groups tended to carefully evaluate each alternative against predetermined criteria whereas the ineffective groups evaluated the alternatives against the criteria in a cursory, almost binary fashion. (3) Effective groups were judged to have based their final decision on facts, assumptions, and inferences that were reasonably consistent with the information while ineffective groups based their decision on premises that were not a factual part of the case. (4) Finally, effective groups were found to have influential members who exerted a positive, facilitative influence in guiding their group's decision process. Influential members in ineffective groups, however, tended to lead their group on irrelevant discussion tangents or to push the group into accepting erroneous assumptions.

In a similar study, Hirokawa (1987) used an intellective task (demonstrably correct solution) and group members who had been trained with special task-relevant skills to generate 130 decisions. These decisions were classified into 68 high quality and 29 low quality decisions. The decisions which were neither high nor low quality were dropped from the analysis. Again, four communication-based characteristics were found to differentiate the high and low quality decisions: (1) High quality decisions were characterized by vigilant (i.e., thoughtful) and in-depth evaluation of the pros and cons of each alternative. Low quality decisions were preceded by a superficial and careless

examination of the pros and cons associated with an alternative. (2) High quality decisions included elements of second-guessing or retrospective questioning of previous choices while none of the low quality decisions were preceded by second-guessing. (3) High quality decisions included discussions that rejected faulty information whereas the low quality decisions often rejected valid information and accepted faulty information. (4) Finally, low quality decisions were often preceded by extended, improbable fantasy chains. These extended discussions of the hypothetical were not characteristic of the high quality decisions.

Summary

Collectively, these laboratory investigations have identified several important factors that appear to be consistently associated with effective and ineffective group decision making. The Poole and Roth work described the processes which are common among decision-making groups -- especially a preference for solution-oriented processes -- and identified some task and group characteristics which are associated with certain decision paths. Hirokawa and colleagues described the activities which distinguished effective from ineffective group decisions. These observations, however, were largely gathered from groups performing intellective and value-oriented tasks in situations that were often stripped of contextual elements (e.g., time pressures). Are these same factors also common to organizational groups? The next subsection reviews similar analyses of group decision making in organizational settings.

Descriptive Learning from Field Research

Similar to the descriptive learning from the laboratory, this section presents three accounts of group decision-making in organizations. Janis (1982) coined the term "groupthink" to describe the antecedent conditions and observable consequences of seven major governmental policy decisions including Pearl Harbor, the Bay of Pigs invasion, and Watergate. Based on historical evidence, Janis documents how a high need for group cohesion, structural characteristics (e.g., insulation of the group, a lack of impartial leadership, and a lack of norms requiring methodological procedures), and a provocative situational context (e.g., high stress from external threats and temporarily induced low self-esteem) can produce an obsession with group concurrence seeking (i.e., the groupthink tendency). It is important to note that Janis describes these factors as *antecedent conditions*, not as causes of defective decision making. Symptoms of the groupthink tendency include an overestimation of the group's abilities and infallibility, shared close-minded collective rationalization, self-censorship with direct pressure on dissenters, and self-appointed mindguards. The final groupthink model included seven symptoms of defective decision making: (1) incomplete survey of alternatives, (2) incomplete survey of objectives, (3) failure to examine the risks of the preferred choice, (4) failure to reappraise initially rejected alternatives, (5) poor information search, (6) selective bias in processing in hand information, and (7) failure to work out contingency plans.

Mintzberg and colleagues (Mintzberg, Raisinghani, & Théorêt, 1976) reported on the decision processes associated with unstructured, strategic decisions in organizations.

They used interviews and source documents from a variety of organizations to describe seven decision paths prevalent among strategic decisions. These decision paths were not consistent with the normative views of decision phases (e.g., intelligence-design-choice) advanced by many decision theorists (Dewey, 1910; Simon, 1965). Evaluation of alternatives was described as "inextricably intertwined" as part of making a choice (p. 258). And the choices were more often a product of judgement, even the judgement of a single individual, than a product of thorough analysis. A group's selection of a decision path was moderated by the *degree of uncertainty in the task* and the *degree of initial consensus* on the interests and values among the group members.

Similar to Mintzberg and colleagues, Nutt's (1984) case study evaluation of decisions in 78 service organizations extensively documented managers' preferences for solution-oriented decision processes. His analysis reported that managers' chief source of decision processes came from imitation of familiar sources and from organizational traditions. Decision processes were selected because they fit the executive's notions of pragmatism with little or no regard for alternative processes that were a better fit to the situation. A *low tolerance for ambiguity* and *need for structure* seemed to accentuate managers' use of solution-oriented processes. Nutt concluded that solution-oriented processes "restricted innovation, limited the number of alternatives considered, and perpetuated the use of questionable tactics" (p. 414).

Summary

Organizational groups have a low tolerance for uncertainty and ambiguity. They will often invoke group processes which reduce uncertainty and ambiguity in the early stages

of the group's process. Most group's processes tended to be solution-oriented in nature and were acquired from imitation of other groups and the organization's culture.

Section Conclusions

In summary, both laboratory- and field-based accounts of group decision making have documented some processes which are associated with effective and ineffective decisions. Both accounts also point to an inherent inconsistency between groups' natural interaction patterns and the sequenced, normative methods of heuristics (described below).

Admittedly, scholars know more about the characteristics of ineffective groups than effective groups. While such descriptions are interesting, more useful advice would suggest how a group could promote the processes associated with effective group decisions while impeding processes which often accompany ineffective decisions. Given that a group's processes and outcomes tend to differ across types of task, such prescriptive advice would be contingent upon the type of task in which the group was engaged.

Process Interventions

Description and Purpose

Some group researchers have proposed that certain process interventions, or heuristics, can help groups avoid processes which are symptomatic of ineffective groups while promoting the processes of effective groups (Hackman & Kaplan, 1974; VanGundy, 1988). For example, Maier and Thurber (1969) have called for groups to become more skilled in procedures for "processing facts, locating obstacles [identifying problems], and withholding value judgements if the solution is to be prevented from becoming the

determiner of both the diagnoses and the factual evidence selected rather than being a product of them" (p. 655).

Heuristics are designed to pattern a group's decision process by prescribing and proscribing how group members should interact. They consist of structures which describe a particular *activity*, specify a *sequence of activities*, or describe a *philosophy* for communication. An example of an activity is to write ideas anonymously on note cards or to rank order a list of ideas. Sequence mandates that a particular activity must precede some other activity (e.g., idea generation precedes idea evaluation). A heuristic's sequence often implies separation (e.g., idea generation activities and idea evaluation activities should not be happening simultaneously). A philosophical structure describes the general advice for patterning communication content, such as fostering an atmosphere of participation and tolerance. Table 2 lists examples for each type of structure. Both the academic and popular press contain hundreds of heuristic prescriptions for improving group decision making (Doyle & Straus, 1976; VanGundy, 1988).

Table 2
Examples of Process Intervention Activities, Sequences, and Philosophies

ACTIVITY	SEQUENCE	PHILOSOPHY
Brainwriting Pool:	The Nominal Group Technique:	Group Consensus Method:
- Participants silently write ideas on cards - When a card has 4 ideas it is placed in the center of table for other participants - Participants take a card from the pool and add other ideas - Process continues for 20-30 minutes	1 Silent generation of ideas in writing 2 Round-robin recording of ideas 3 Serial discussion for clarification 4 Preliminary vote on item importance 5 Discussion of the preliminary vote 6 Final vote	- Avoid arguing for your own views - Avoid win-lose stalemates - Avoid giving in just to attain harmony - Avoid conflict reducing techniques like majority voting - View differences of opinion as natural - View initial agreement as suspect
VanGundy (1988)	Delbecq & Van de Ven (1971)	Hall & Watson (1970)

Do groups use these heuristics? Both Mintzberg et al. (1976) and Nutt (1984) have observed that organizational groups rarely follow the structured processes advocated by many decision heuristics. This is not to say that organizational groups do not follow consistent, structured group interaction processes, but that group's preferred processes are usually acquired from imitation of other groups and organizational culture rather than from literature-based, decision-making prescriptions. Thus, two questions seem apparent: How should heuristics be delivered to decision-making groups, and more importantly, do heuristics really improve group effectiveness? The following subsections will address these questions.

Delivery of Interventions

The structural and philosophical guidance of heuristics has traditionally been delivered to groups via *training the group members* or by a *process facilitator*.

Training

Training seeks to instruct group members in how to implement a heuristic's structures and why these structures are useful. This training may take the form of formal seminars on improving group processes, written instructions in books and pamphlets, or word of mouth among colleagues. Such training, however, only provides an *awareness* of the heuristic among the individual group members and in no way ensures that the heuristic's structures will be used by a group. Since group memberships are often volatile over time, and some groups (e.g., task forces) tend to be ad hoc in nature, a particular group's members may not have a uniform understanding of the heuristic. This lack of understanding among some members may be a source of procedural conflict regarding the group's adoption or abandonment of a heuristic.

Group members may be able to reduce procedural conflicts by learning about heuristics as a group. In a review of nine group development models, Mennecke, Hoffer and Wynne (1992) describe a common, normative phase where the *group* establishes a pattern of norms and roles for conducting group business. Researchers have observed that the pattern of norms varies greatly across different groups, even among groups within the same organization (Nutt, 1984). Thus, the potential for training to be an effective heuristic delivery mechanism may be enhanced when an entire group's membership is trained together. This should help to legitimize the heuristic as part of a group's procedural norms.

Facilitation

A third party (nongroup member) process facilitator presents a second and much more potent mechanism for delivering heuristics to a group. A third party process facilitator offers two distinct advantages over training the group members: He or she usually possesses special expertise in selecting effective decision processes to match the needs of the decision task. And since the facilitator is not substantively contributing to the group's content as a group member, the facilitator can devote his or her full mental resources to constructively aiding the group's process. Bostrom, Anson, and Clawson (1993) note that a facilitator's role in planning the meeting, per the requirements specified by the group or group leader, and in selecting appropriate decision techniques may be the most valuable contribution by a facilitator.

Alternatively, a heuristic may be delivered to a group via one of the group members. This member may serve in the dual role of group member, contributing to the content of the discussion, and the role of group facilitator, where he or she is concerned with the group's production of a decision and also the relationships among group members (see McGrath, 1991, for a more complete discussion of these intertwined group activities). This split role between content contributor as a group member and process facilitator as a group leader can produce mental overload, ineffective facilitation, and even an abuse of the facilitator's role. Bostrom et al. (1993) cite this triple responsibility (e.g., task, group process, and group relationship), combined with a lack of facilitation skills, as a major reason why traditional meetings are often viewed as ineffective and inefficient. Previous research has found that highly trained facilitators are more effective than untrained

facilitators (or facilitators with limited training) and that even a minimal amount of training for a group member can improve meeting effectiveness (Hall & Williams, 1970; Hoffman & Maier, 1959; Maier & Maier, 1957).

Summary

In summary, heuristics can be delivered to a group via training or by a process facilitator. The training of individual group members may be more effective when the group is trained in aggregate. Process facilitation can greatly improve meeting outcomes and is most effectively performed by a trained, third party facilitator.

Efficacy on Group Effectiveness

Once process interventions are made available to groups, do groups which use these heuristics produce more effective decisions than groups which are left to their own devices? Results to date neither conclusively support nor deny the relationship between heuristics and group effectiveness. And any such general statements are likely to be of little meaning in the absence of specific knowledge about the task, heuristic, group membership, and context that yielded a particular result. This subsection surveys some of the task, context, and group characteristics in studies which supported heuristic effectiveness and studies which did not. This survey also highlights the variety of tasks, contexts, group characteristics, and types of process interventions that have been used in this stream of research. The goal is to present a broad survey of research on process interventions while providing sufficient detail for proper interpretation of the results.

Supporting Evidence

Maier and Maier (1957) and later Maier and Hoffman (1960) investigated the use of trained discussion leaders to deliver a procedural problem-solving structure to a group. The groups performed an intellective task based on an employee promotion decision. In one condition the discussion leaders were to lead a "free" and participative discussion with no prescribed sequence of topics. The other conditions used a discussion leader who required each group to sequentially address five important issues for making a quality decision. One set of discussion leaders received only written instructions while a second set received both instructions and a demonstration of the technique. A third set of discussion leaders received the instructions accompanied by a demonstration and extensive training in group decision methods.

The first experiment demonstrated that directing a group to sequentially consider the important issues in a case can improve decision quality. A second experiment confirmed that more extensively trained discussion leaders could have an even greater impact on improving a group's decision quality. Maier and colleagues attributed this improved decision quality to the synchronization of thinking among group members and the systematic convergence on important issues brought about by structuring the discussion.

Since trained discussion leaders are not always available to groups, Maier and Thurber (1969) evaluated how three different heuristics impacted decision quality when compared to groups who were given no process instructions. Three member groups worked on an intellective business case under one of four experimental treatments: Groups in the first treatment had to select three solutions and were given no process

advice (baseline treatment). Groups in the second treatment were directed to separate idea-generating activities from idea-evaluation discussions. The third set of groups was told to record every possible solution, to link the solution to a problem that it was intended to overcome, to indicate the facts from the case that supported the diagnosis, and to rank order the group's top three solutions. Finally, the groups in the fourth treatment were directed to first identify and come to agreement about the major problem(s) in the case and then to identify and rank three solutions to overcome the problem.

Overall, the heuristics that required the groups to link the problem to the solutions (treatments three and four) had higher decision quality than the baseline or treatment two, but Maier and Thurber called the differences "short of impressive." Further investigation of the results revealed that the marginal improvement of the groups who separated idea-generation and evaluation activities was more a product of choosing low quality solutions than of failing to generate high quality solutions. Differences in the quality of ideas generated between treatments two and three suggest that the additional requirement to consider the problem and factual information in the case led to the generation of a higher quality set of ideas in treatment three than in treatment two. Groups in treatment four that identified a factual problem and then selected a congruent solution (the solution would address the problem without inadvertently creating other problems) had the best decision quality. Interestingly, the next best decision quality was obtained by groups that selected a nonfactual problem with an incongruent solution. The authors concluded that groups who followed instructions did better than those who did not; however, *the degree to which the instructions were followed varied greatly among the groups.*

Hall and Williams (1970) tested the hypothesis that groups composed of individuals who had received training in group dynamics would perform more effectively than groups composed of untrained members. They used three separate subject populations comprised of college students, managers from industry, and neuropsychiatric patients and also varied group history (established groups, ad hoc groups) within each of these subject populations. Trained groups learned about effective group dynamics by participating in a series of *instrumented exercises* designed to assist a group in self-learning about effective group processes. Hall and Williams note that "the instrumented approach is unique...in that it relies on the use of carefully constructed training instruments and exercises for identifying critical elements of group life, rather than on the expertise of group trainers (p.43)." The training did not include any specific instructions on decision-making activities or sequences.

All groups performed an intellective task and were assessed on both outcome and process measures. Trained groups in all populations yielded higher decision quality, made better use of their available resources, and more frequently achieved a synergy bonus (the group decision was superior to the best individual decision) than untrained groups. There was no statistically significant quality difference in the frequencies of majority (the group adopted a decision held by the prediscussion majority of its members), minority (the group adopted a decision held by the prediscussion minority of its members), or an emergent (group decision was not held by any member prior to the discussion) decision processes. One interesting observation, however, was that the use of emergent solutions had a debilitating effect on decision quality in untrained groups. This suggests that trained

groups could more effectively develop emergent judgements into quality solutions than untrained groups.

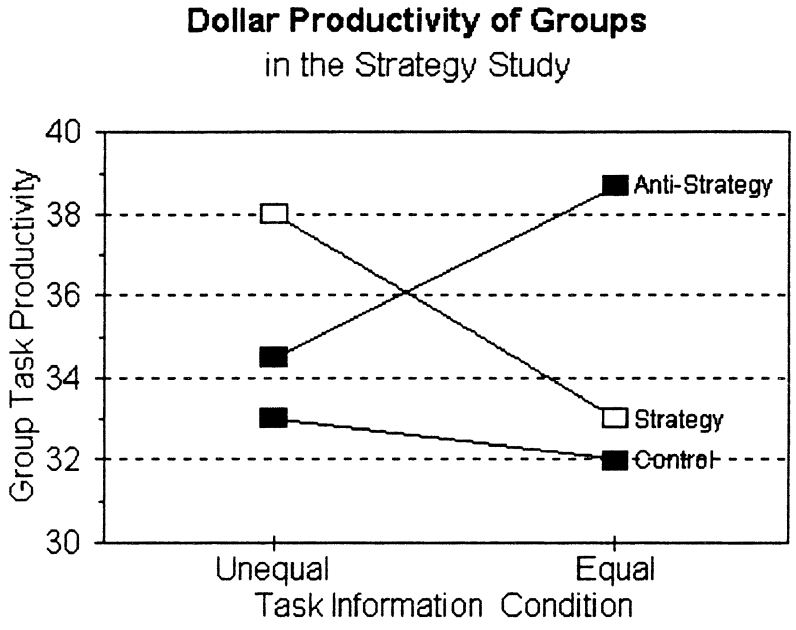
Hall and Watson (1970) sought to directly build on the earlier Hall and Williams (1970) work. They targeted a process intervention at the implicit group norms suspected to account for the effectiveness differences between groups. The heuristic sought to prevent a group from excessively focusing on convergence and to legitimize open conflict as a healthy part of the group process. The heuristic was delivered to 16 groups through six written philosophical statements (e.g., *avoid arguing for your own ranking* and *view initial agreement as suspect*) that were intended to incorporate these behaviors as part of a group's process norms. Sixteen baseline groups were left to their own devices for reaching a group decision. Each group worked on an intellective task.

Trained groups (those using the heuristic) were found to make significantly better decisions, to more fully utilize their creative resources, and to achieve a synergy bonus (group decision better than any individual's private decision) than untrained groups. There were no differences between treatments in the amount of time a group took to reach a decision. Though the heuristic only consisted of unenforced philosophical advice, Hall and Watson attributed the decision quality differences to successfully modifying the group's process norms. The groups incorporated the philosophical advice which inhibited premature consensus and legitimized open disagreement among group members.

Hackman and Kaplan (1974) conducted an experiment to test the effectiveness of two very different types of interventions. Groups of four male undergraduate students were instructed to assemble various kinds of electrical components (McGrath, 1984; task

type 8, *performances/psycho-motor tasks*). Some groups received a strategy intervention where they were instructed to "spend about 5 minutes...in an explicit discussion of what they were trying to achieve" (p. 467). The control set of groups were left to their own devices and an anti-strategy set of groups were told explicitly "not to waste any time" in discussions of strategy. Additionally, some groups in all three strategy treatments received equal information for all of their group members while the members of other groups each had unique information that necessarily had to be pooled to optimize the group's product. The results of the study are depicted in Figure 1.

Figure 1
Results of Strategy Intervention
(after Hackman & Kaplan, 1974, p. 469)



Hackman and Kaplan concluded that an intervention in the group interaction process can significantly modify task performance but the effectiveness of an intervention is "powerfully moderated by the nature of the group task" (p. 470). Figure 1 shows that the strategy intervention improved productivity only when the task (unequal information)

necessitated information sharing among group members. The study also reported that group members in the strategy treatment felt they had much more influence in their group's performance than did the other treatment groups.

Perhaps one of the most powerful examples regarding the effectiveness of a process intervention is the Kennedy administration's handling of the Cuban Missile Crisis. Janis (1982) documented how the Kennedy cabinet actively modified their decision process after the ill-fated Bay of Pigs invasion. The administration changed their decision process to guard against what they identified as the faulty processes which had allowed the Central Intelligence Agency's plan to proceed with the support of President Kennedy and his cabinet. Specifically, the following process changes were invoked during the Cuban Missile Crisis:

- New definitions of the participants' roles that dissolved hierarchical and functional boundaries
- Changes in the group atmosphere where critical assessment of all ideas by any member was the norm which meant tolerating subjective discomfort
- Inclusion of outsiders (noncabinet members) as vocal participants in the group
- Meetings of subgroups and leaderless sessions

Janis cites that cabinet members viewed these process changes as instrumental in improving the group's decision products, especially during the critical Cuban Missile Crisis.

This account, which supports the effectiveness of process interventions, is clearly different from the evidence derived from the preceding laboratory-based experiments. In the Kennedy case, a nonstudent group, acting within the context of extreme situational

factors, actively identified its own process deficiencies and invoked process interventions. The interventions were delivered by the group members themselves and were actively incorporated as part of the group's procedural norms.

Other Evidence

All of the preceding studies have more or less supported the utility of various process interventions to improve group decision effectiveness. Alternatively, some studies have reported that interventions did not improve group effectiveness -- though the dissenting evidence is often interspersed with supporting evidence. For example, while Maier and Thurber (1969) reported statistically significant differences between their "no instructions" and "locating obstacles" treatments, there were no decision effectiveness differences associated with their other two process intervention conditions. They fault a lack of statistical power due to small sample sizes as the reason.

Hirokawa and colleagues (Hirokawa, Ice, & Cook, 1988) have suggested that the mixed support for process intervention effectiveness may be moderated by certain individual-level cognitive variables. They explored Putnam's (1979, 1982) *preference for procedural order construct* as one possible moderator. Using Putnam's Group Procedural Order Questionnaire (GPOQ), they contrived groups composed of either all high (HPO) or all low (LPO) preference for procedural order members (Putnam's GPOQ is described in greater detail below). The groups worked on a decision-making task and decision quality was evaluated by a panel of experts. Half of the HPO and LPO groups were instructed to reach a decision by following Dewey's (1910) reflective-thinking process (high structure) which consisted of six procedural steps to be executed in precise order.

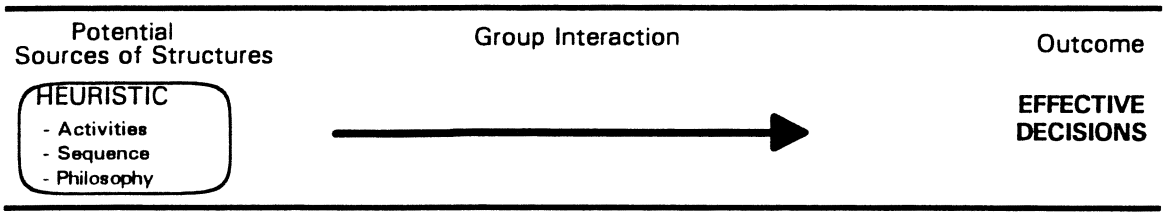
The intervention was delivered to the group via a written handout. The other half of the groups were given no process advice and left to their own devices to solve the problem (low structure).

The high structure treatment yielded more effective decisions for the HPO groups, but there was no difference in decision effectiveness for LPO groups in either structure treatment. Hirokawa and colleagues concluded that the effectiveness of interventions may be moderated by some individual level, cognitive variables such as an individual's predisposition for organizing group work.

Summary

In summary, most of the research literature neither conclusively supports nor denies the deterministic relationship between process interventions and group decision-making effectiveness. This deterministic view has been labeled as the "decision school approach" for improving outcomes (DeSanctis & Poole, in press; Orlikowski & Baroudi, 1991). Figure 2 portrays a simplified representation of the decision school approach which assumes that humans (interacting groups) seek to optimize, and thus the availability of a *proven process improvement* (i.e., a heuristic) will result in its use and in improved group outcomes.

Figure 2
The Decision School Approach



One caveat for interpreting this stream of research, however, results from the inconsistent methods used by various researchers to deliver and mandate the process intervention to the group. Few of the previous studies report any reliable assessment regarding the degree to which group members really understood the objectives or activities of the heuristic, or more importantly, the degree to which the group actually appropriated the heuristic's structures. Most treatment groups were directed to use the heuristic with only minimal or no process restrictiveness (i.e., the groups were free to use, partially use, or ignore the heuristic) during the actual decision process. Thus, a causal linkage between the *availability* of a heuristic and effective decisions has not been clearly established.

Gouran (1982) also contends that the benefits of process interventions can only be realized if the group adequately appropriates the "qualities of mind" represented by the intervention (p. 30). He writes,

> although... [process interventions]...can be very useful in keeping a decision-making discussion focused on the requirements of the question, you can fall prey to the belief that the sequence itself rather than the qualities of mind it represents is what determines a group's effectiveness. That is probably one reason why experimental tests of standard agendas and their effects on the quality of decisions have yielded inconsistent results...it would be a mistake for you to assume that by simply going through a set of steps a group will automatically make a good decision. What happens at each stage and how well necessary functions are executed are the real determinants of success (p. 30).

Group Acceptance or Rejection of Interventions

This subsection surveys some of the reasons why group members often choose to abandon or to partially use heuristics. A number of authors have commented on this phenomenon and suggested several possible reasons.

The gap between *availability* and *faithful appropriation* of a process intervention may be explained by group members' intransigence to incorporate processes which are less familiar or less comfortable. Several authors support this view. Steiner (1972) noted that

> Even when previous experience or a written manual has identified the most productive course of behavior, people may pursue a less efficient one that seems more interesting or less effortful. Members of a group may hold different views concerning the proper pattern of collective action... (p. 8).

McGrath (1991) also writes that a group is unlikely to change from its initial work strategy until forced to do so--usually by inadequate task performance.

A group's proclivity toward using a heuristic in a manner consistent with the heuristic's design, therefore, is likely contingent on the attributes of the task (e.g., type, complexity), attributes of the heuristic (e.g., ease of implementation, necessary training), perceived adequacy of prior group processes, and group members' preferences for certain types of group processes. Clearly, Poole and Roth's (1988a) finding that only 11 of the 47 decisions followed a unitary sequence suggests that most group members, or their leaders, do not prefer the linear activity sequences promoted by some heuristics.

In his discussion of procedures for managing meetings, Poole (1990) has reported five reasons why groups often reject process interventions:

1) "This is unnatural; it doesn't 'feel' right"

2) "This is too hard and too complicated; we don't need anything this complex"

3) "We are under severe time pressure and using this will only slow us down"

4) "Using this procedure will cause a conflict"

5) "Leadership is what makes the real difference in groups; procedures won't make much of an impact"

Poole further notes that the reasons groups reject procedures are the very reasons the procedures are useful.

Individual preferences, or cognitive variables, may also help to explain why some process interventions are not appropriated when groups are left to their own devices. The preference for procedural order (PPO) construct (Putnam, 1979, also in Hirokawa et al., 1988, above) is one example of this type of individual difference. Putnam (1982) observed that "individuals enter task-oriented groups with predispositions for particular work habits which vary from tightly-organized procedures to loosely structured ones" (p.197). The following properties are characteristic of high procedural order (HPO) and low procedural order (LPO) individuals:

Properties of High Procedural Order Message Patterns:

1. The use of planned, sequential patterns for organizing task activities
2. Concern for time management
3. An emphasis on regular, predictable procedures
4. An emphasis on clarifying group procedures

Properties of Low Procedural Order Message Patterns:

1. Use of chain-association or a cyclical procedural pattern
2. Flexibility in establishing and changing plans
3. Oblivious to time constraints
4. A tendency to vacillate between task and socio-emotional needs of the group

In a later study, Putnam (1982) confirmed that HPO and LPO work climates produce different communication interaction structures. HPO individuals announce labels to categorize substantive issues and to signal a switch in topic, whereas LPO individuals jump to content details without signaling a change in topic. The frequency and timing patterns of procedural messages were less recurring for the LPO types than HPO types, though cyclicity was present for both groups. These findings supported earlier observations that LPO individuals tended to use a chain-associative communication pattern more than a linear series of exchanges grouped by topics. Thus, the degree to which a heuristic is compatible with an individual's predisposition for organizing group work may mediate the degree to which the heuristic is actually used.

Nutt's (1984) field observations of organizational groups support Putnam's premise that some individuals have a predisposition for the manner in which they organize group work. Nutt observed that "Executives...seem to have had firm predispositions about how the process of looking for ideas should unfold. This suggests that a decision process is used because it fits the executive's notions of pragmatism..." (Nutt, 1984, p. 446).

The preceding research suggests that groups, or more specifically the group members, may resist the imposition of heuristics because they do not see the heuristics as necessary, practical, or because the heuristics may be incompatible with their individual preferences for certain group processes. Perhaps Poole and Roth (1988b) capture the essence of why groups often appear to resist normative heuristic procedures:

> ...decision paths are not directly determined by contingency factors [task, group, situational characteristics], but are a product of the group response to its interpretation of the contingency factors. Groups attempt to follow some normative model, adapting it to fit the needs of the situation (p. 553).

Groups which are *adapting the heuristic to the situation* may, however, modify it to such an extent that the activities, sequences, and philosophies of the heuristic are replaced by other group-preferred activities or structures for dealing with the situation. As McGrath (1991) suggested, researchers should study why groups choose to invoke these alternate structures which are not associated with effective decision making.

Groups may not use heuristics because the structures in the heuristic may be a poor fit for the decision task or the characteristics of the group. The next section summarizes appropriate strategies for matching heuristics to group decision tasks and group characteristics.

Matching Process Interventions to Group Decision-Making Needs

Poole (1990) has advanced three propositions for selecting heuristics:

1) Task-Procedure Fit: What procedures are suited for the tasks required in the meeting?

The tenet of this approach is that each heuristic was designed for a specific type of task and may be ineffective for other types of tasks. For example, the brainstorming technique was designed to generate ideas and is of little use for building group consensus on one idea. The task-procedure approach necessitates careful meeting planning (or quick on-the-fly decisions) and a broad knowledge of various heuristics so that logical choices can be made to match a heuristic to a group's task requirements.

2) Group-Procedure Fit: Is the group ready, able, and willing to use the procedure?

Even if the heuristic is a good fit for the task requirements, this approach mandates that the group's composition and context be considered when selecting a heuristic. For example, a heuristic that relies on cooperation and sharing is unlikely to be effective in a

group with distrustful attitudes and competing interests among its members. Status and power differences between group members may severely inhibit an open expression of ideas during a brainstorming session. Selecting heuristics that encourage effective relational behaviors may be equally as important as matching the heuristic and task in some situations.

3) Outcome-Procedure Fit: What outcomes are desired by the group?

This approach acknowledges that different heuristics can produce different outcomes. For example, if the goal for an intellective or decision-making task is to base the decision on the broadest range of information, then a lengthy heuristic that outlined an exhaustive data collection procedure would be a good choice. If the group's goal, however, is to efficiently make a decision which all group members can at least somewhat support, a less time-consuming technique that helps to evoke group members' commitment to the decision would be a better choice.

Section Summary

Groups are tremendously complex entities that are often charged with making important decisions. Several scholars have attempted to describe the types of group decision-making tasks and the processes which groups use to derive decisions. Some evidence suggests that the effectiveness of group decisions can be improved by using heuristics which impede processes that are associated with ineffective decisions or which promote other historically effective group decision processes. Table 3 summarizes a survey of this evidence. Group acceptance and appropriation of these heuristics, and thus the heuristic's potential to enhance the effectiveness of the decision process, may be

moderated by the manner in which the heuristics are delivered and the fit of the heuristic to the group's task, context, and goals.

Table 3
Summary of Process Intervention Benefits

Process Intervention	Presumed Benefit	Task Type	Source
Sequencing the discussion issues	Synchronization of thinking, systematic convergence	Intellective	Maier & Maier, 1957; Maier & Hoffman, 1960
Linking possible solutions to problems and factual information	Generation and selection of higher quality ideas	Intellective	Maier & Thurber, 1969
Group dynamics training	More effective use of emergent solutions	Intellective	Hall & Williams, 1970
Philosophical guidance	Better use of creative resources, synergy, inhibiting premature consensus, legitimizing open disagreement	Intellective	Hall & Watson, 1970
Process strategy planning	Helps when members have unequal information	Performances	Hackman & Kaplan, 1974
Revised role definitions, critical assessment, leaderless sessions	Egalitarian atmosphere, subjective discomfort became the norm	Value-oriented	Janis, 1982

Technological support for groups may be one way of improving the delivery and group appropriation of process interventions. The next section will discuss theories of employing technology to support effective group decisions.

GROUP DECISION MAKING WITH TECHNOLOGY SUPPORT

The previous section has surveyed the kernel theories (Walls, Widmeyer, & El Sawy, 1992) which must provide the basis for the design and assessment of group support technologies. This section introduces the technological aspects of group support systems.

This introduction is followed by a presentation of the two major schools of thought which have accounted for much of the research in this area.

Group Support Technologies

The label of group support systems has been applied to many different configurations of computer hardware and software (for extensive descriptions, see Dennis, George, Jessup, Nunamaker, & Vogel, 1988; Wagner, Wynne, & Mennecke, 1993). Designers and users of these systems have described the anticipated benefits of using GSSs (Table 4). All GSSs are not identical, however, as they provide different types of support for group activities. Huber (1984) observed that the designers of GSSs seemed to approach their design task with a decision-aiding approach already in mind and created software tools which automated the activities found in manual heuristics. Thus, each GSS -- or technical configuration of computer hardware and software -- embodies some underlying assumptions of how groups *do* or *should* make decisions.

Table 4
Anticipated GSS Benefits

ANTICIPATED GSS BENEFIT	SOURCE
Expanded idea generation through parallel communication channels	Nunamaker, Applegate & Konsynski, 1987
More equal distribution of influence	Zigures, Poole, & DeSanctis, 1988
Group memory	Dennis, George, Jessup, Nunamaker, & Vogel, 1988
Decision modeling and group decision techniques	DeSanctis & Gallupe, 1986
Anonymity	Connolly, Jessup, & Valacich, 1990

In their three level taxonomy for group decision support systems, DeSanctis and Gallupe (1987) propose three levels of system features to support group needs (Table 5).

Table 5
Three Levels of Group Support Technologies
(after DeSanctis & Gallupe, 1987)

Level	GSS Feature	Group Need
Level 1	Instantaneous display of ideas, voting solicitation and compilation, anonymity, messaging	Removing common communication barriers
Level 2	Decision modeling and group decision techniques	Reducing uncertainty and noise
Level 3	Machine-induced group communication patterns, expert advice	Structuring the content or timing of interpersonal exchange, e.g., parliamentary procedures

They suggest that group process structuring techniques (i.e., heuristics) can be administered more efficiently to groups through level 2 GSS technology (as compared to level 1). While many GSS studies have assessed outcomes (e.g., decision quality, member satisfaction, consensus; see Benbasat & Lim (1992) or Dennis & Gallupe (1993) for extensive recent reviews) and some studies have analyzed the group's interaction process (e.g., degree of conflict, domination, leadership; for examples, see DeSanctis & Poole (in press); Poole, Holmes, & DeSanctis (1991) only recent research has begun to assess the viability of GSSs as an effective means of delivering heuristics (DeSanctis & Poole, in press).

Groups which use GSSs often have different interaction patterns than their manual counterparts, and much of the improved outcomes attributed to the technology may be closely related to the manner in which the technology impacts the group's decision process. Pinsonneault & Kraemer (1989) contend that the positive relationships between GSSs and outcome variables reported by many studies may be more a function of the *imposed process structure* (i.e., sequencing and focusing the decision activities) rather

than benefits of technology support. They contend that much GSS research (i.e., comparisons of technology-supported groups to baseline groups) suffered from "a lack of control for the effect of greater structure on group processes resulting from the technological support..." (p. 209).

Theories and Frameworks for Group Support Technologies

Nunamaker and colleagues (Nunamaker, Dennis, Valacich, Vogel, & George, 1991) acknowledge that GSSs provide structure for group activities. They distinguish between *process support* (e.g., parallel communication channels) and *process structuring* (e.g., rules to direct the pattern or content of a communication) provided by a GSS. They have extended Steiner's (1972) notion of process losses[3] by documenting potential process gains and losses for GSS (Table 6). Unlike Steiner, however, this model of technology-supported group processes also includes a description of potential process gains (i.e., synergistic aspects of the meeting process to improve outcomes) that groups can realize through technology-supported interaction. Meeting outcomes are believed to be "contingent upon the balance of...process gains and losses" (p.45). The realization of process gains over process losses is referred to as the Balance of Forces Model (Connolly, Jessup, & Valacich, 1990). The paradigm of this model is to use GSSs to favorably impact the net balance of process gains and losses through process support and process structuring.

---

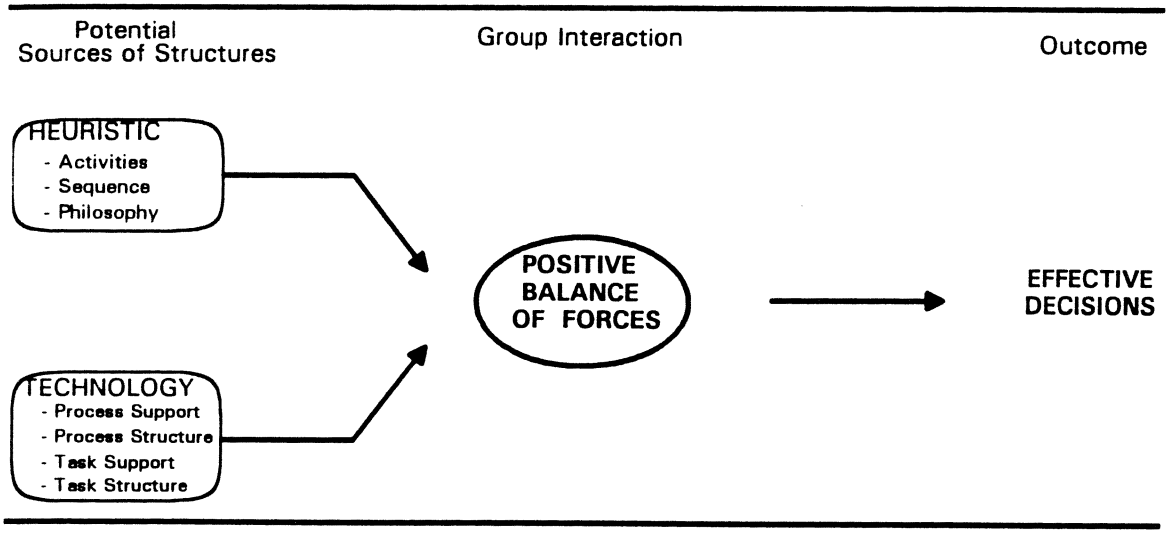
[3] Steiner (1972) theorized that a group's *actual productivity* was equal to its *potential productivity* (i.e., the best possible combination of the group's resources) minus *process losses* (i.e., ineffective processes of marshaling a group's resources to address a task).

Similar to the process interventions of the decision school, the Balance of Forces Model essentially assumes that users will transform the *availability* of process and structure support in the GSS and heuristic into faithful use, thus yielding a positive balance of forces. While the literature does reflect improved decision effectiveness for some technology-supported groups, it has not demonstrated that decision-making groups will choose to faithfully appropriate the technology or the process structuring that it represents. Figure 3 depicts a model of the technology-enhanced decision school.

Table 6
Common Process Gains and Losses in the Balance of Forces Model
(Nunamaker et al., 1991)

PROCESS GAINS	PROCESS LOSSES		
More Information	Air Time Fragmentation	Conformance Pressure	Domination
Synergy	Attenuation Blocking	Evaluation Apprehension	Information Overload
Objective Evaluation	Concentration Blocking	Free Riding	Coordination Problems
Stimulation	Attention Blocking	Cognitive Inertia	Incomplete Use of Information
Learning	Failure to Remember	Socializing	Incomplete Task Analysis

Figure 3
The Technology-Enhanced Decision School

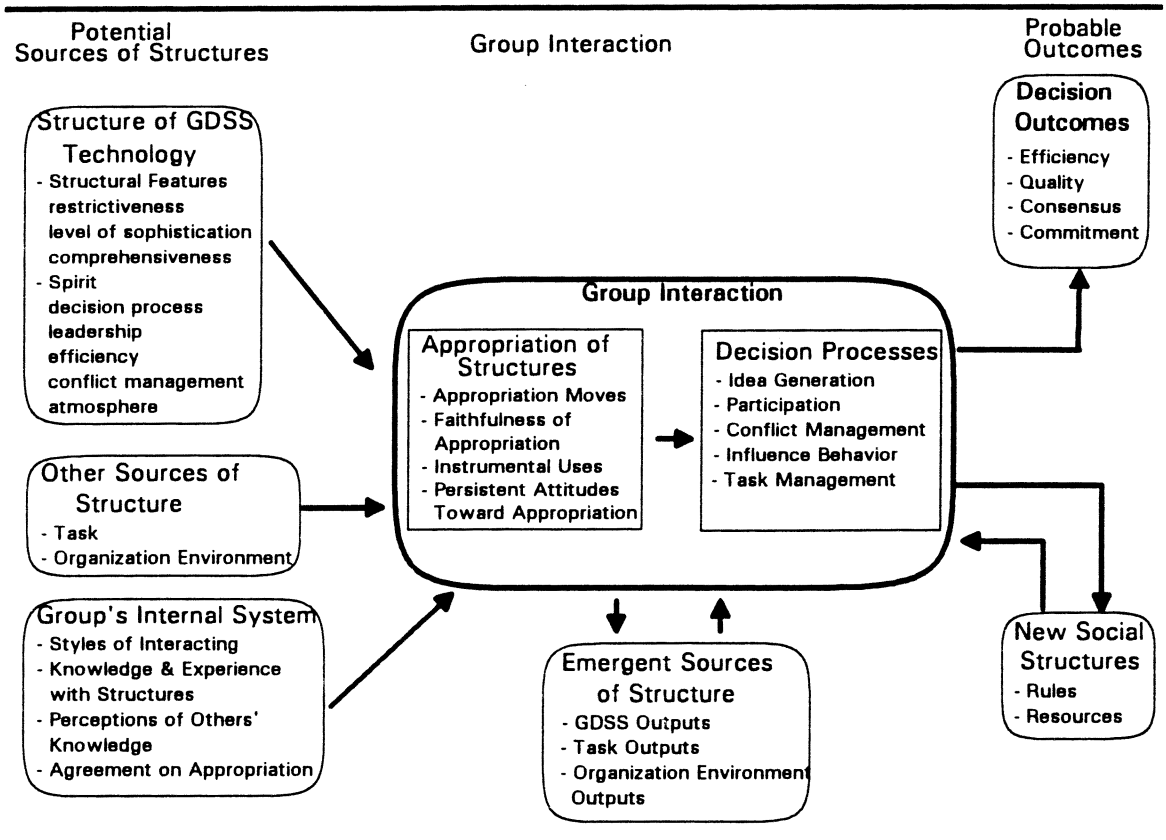


A second theoretical model is Adaptive Structuration Theory (AST) (Poole & DeSanctis, 1989, 1990; DeSanctis & Poole, in press), which extends previous social theory work by Giddens (1979). AST argues that GSSs are a social technology through which groups may choose to faithfully (as intended in their design) or unfaithfully (inconsistent with their design) appropriate the structures (rules and resources) provided by the GSS, the heuristic, the environment, and other sources (Figure 4). The theory posits that contextual variables, such as the group's task and members' agreement on values, impact the group's structuration process (the act of using a structure) and may also be a source of new structures. AST represents a markedly different theoretical approach from that of the decision school. While the decision school proposes that the use of GSSs and heuristics will lead to deterministic improvements in group outcomes, AST is generally nondeterministic and attempts to describe the relationships between structures, group interaction, and outcomes with no prediction towards favorable or unfavorable outcomes. Structurationalist theories have recently received increased attention as a basis

for information systems research, especially in the areas of system development and the assessment of the organizational impacts of information technology (Orlikowski & Robey, 1991; Orlikowski, 1992).

Consistent with both the Balance of Forces Model and the Adaptive Structuration Theory, GSSs have been designed as a technology-enhanced delivery vehicle for heuristics. GSS tools (e.g., computer-mediated idea generation) can provide the basic building blocks to implement many of the activities of heuristics while the availability (or unavailability) of tools can control the sequence of the meeting process. The efficacy of GSSs as a heuristic delivery vehicle is an unresolved question and is subject to some caution. Research among single-user decision support systems (DSS) has suggested that while heuristics often promote better decisions, computer delivery of the heuristic (to individuals) is not more effective than manual delivery (Cats-Baril & Huber, 1987).

Figure 4
Adaptive Structuration Theory (After DeSanctis & Poole, in press)

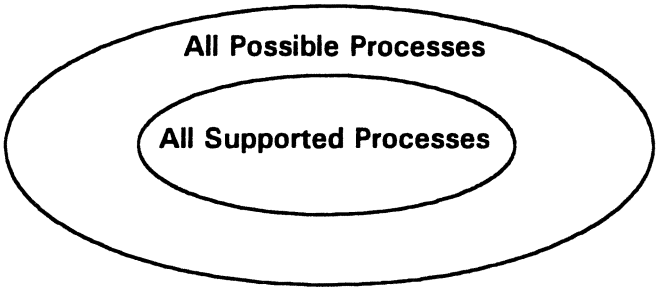


Technology and Heuristics as Sources of Restrictiveness

The final part of this section reviews previous work on the notion of restrictiveness. In his comments on single-user decision support systems, Silver (1990, 1991) has proposed the notion of system restrictiveness and defines it as "the degree to which and the manner in which a decision support system limits its user's decision-making processes to a subset of all possible processes" (1990, p. 53). The degree of restrictiveness can be conceptually depicted by the relative sizes of all the possible processes that could be used to structure a decision compared to the subset of processes supported by the system (Figure 5). A system is highly restrictive if the number of

system-supported processes is small relative to the number of possible processes. This definition embodies two implicit assumptions: 1) The degree of restrictiveness is innate to the technology, and 2) the system has the ability to restrict (impede the use of) other processes not supported by the system. Silver later notes that restrictiveness is a function of the *interaction between the system and the user*, which is not consistent with the earlier definition.

Figure 5
System Restrictiveness (after Silver, 1990)



Silver's notion of restrictiveness was extended to the GSS environment in an experiment conducted by DeSanctis et al. (1989). They defined restrictiveness as "the extent that the heuristic limits or channels the group's use of the resources inherent in the heuristic" (p. 132). This definition proposes that restrictiveness is innate to the heuristic and that the heuristic has the ability to limit other processes not contained in the heuristic. Like Silver, however, these authors later note that restrictiveness is more a characteristic of *the manner in which the heuristic is implemented than a description of the heuristic itself*, which also seems inconsistent with their earlier definition of restrictiveness.

The DeSanctis et al. experiment used three decision heuristics with differing degrees of structure and applied each one to a high and low restrictiveness treatment in a

3 x 2 factorial design. They attempted to vary restrictiveness by instructing groups to "adhere to the activities, sequences, and philosophy of the heuristic" (high restrictiveness) or to "select and use any of the heuristic's features in any manner or sequence" (low restrictiveness). The subject groups performed a value-oriented task for which there was no correct solution. The dependent variable was group consensus. The only statistically significant effect was increased decision consensus under the high restrictiveness treatment using a highly structured heuristic which contained both a philosophy and a specific set of decision activities. The authors conclude that restrictiveness may only provide a meaningful advantage for group consensus when the complexity of the heuristic is overwhelming to the groups.

Both the Silver (1990, 1991) and the DeSanctis et al. (1989) discussions of restrictiveness acknowledge that restrictiveness is a function of the *interaction* between the system (or heuristic) and the users, yet both definitions of restrictiveness lacked a process-based component. Chapter 3 will propose a new definition of *process restrictiveness* which serves as a linking mechanism between the Balance of Forces Model and the Adaptive Structuration Theory.

Section Summary

GSSs have been designed to improve group communication and processes. The Balance of Forces Model contends that GSSs improve group outcomes by promoting process gains and minimizing process losses. Adaptive Structuration Theory argues that availability of a technology-enhanced process is not sufficient to ensure faithful appropriation, but that users mediate the presumed benefits of GSSs during their use of

the system. System restrictiveness has been explored for single-user decision support systems, but has not been well adapted to the group decision-making domain.

CHAPTER SUMMARY

This chapter has reviewed the literature on group processes and the role of process interventions. While the evidence regarding the efficacy of a process intervention to promote effective decisions is not conclusive, several important observations can be drawn from this review.

- Groups often systematically employ ineffective decision processes when left to their own devices. These processes may cause the group to miss important information or to prematurely converge on a low quality decision.

- Process interventions are designed to promote effective group decision processes, though they do not deterministically guarantee effective group outcomes.

- The natural decision-making process in groups is largely incongruent with the structures mandated by process interventions.

- Group Support Systems can serve as a delivery vehicle for process interventions and may provide an opportunity to restrict a group's decision-making process to the structures advocated by a heuristic.

These conclusions have played an important role in directing the investigation of process restrictiveness. The next chapter will present a formal definition of process restrictiveness and will integrate it into a new theory called the Process Restricted Adaptive Structuration Theory.

CHAPTER 3

THEORETICAL RESEARCH MODEL

PROCESS RESTRICTIVENESS

Building on the work of Silver (1990, 1991) and DeSanctis and colleagues (1989), the term *process restrictiveness* is proposed to focus on a group's appropriation of a heuristic's structures. Thus,

> process restrictiveness is defined as the manner of limiting a group's interaction process to the activities, sequences, and philosophies specified by a heuristic.

This view of restrictiveness differs from Silver and DeSanctis and colleagues because it is anchored in the group's appropriation *process* rather than as an innate characteristic of the heuristic or technology itself. This definition is the key element in an integrated model of group process restrictiveness incorporating both the adaptive structuration theory and the Balance of Forces Model. The objective of this chapter is to broadly define the sources of group process restrictiveness and to set forth propositions for the integrative model. A preliminary experiment, testing some of the model's propositions, is briefly discussed prior to outlining the specific hypotheses for the dissertation research. The chapter concludes by setting forth specific hypotheses for an experimental test of the model's outcome-oriented propositions. Chapter 4, Research Method, will describe the laboratory experiment which tested the proposed hypotheses.

Restrictiveness Versus Guidance

An important distinction can be made between the general notions of restrictiveness and guidance. According to Silver (1991), restrictiveness is intended to *limit* the possible system-based options available to computer users while guidance is intended to *enlighten* or to *sway* users as they choose their decision-making process. In the context of group decision making, the heuristic structures are designed to provide guidance via their prescribed activities, sequences, and philosophies. Process restrictiveness comes into play when groups choose to ignore the guidance embodied in the heuristic. Thus, the focus of this dissertation is on the effects that various process restrictiveness sources have on group decision outcomes and processes.

Group Process Restrictiveness Sources and Stages

The model of group process restrictiveness builds on the premises that 1) task-appropriate heuristics[4] have the potential to improve group decision effectiveness, 2) group processes may need to be restricted to the structures in the heuristic if the intended benefits via faithful appropriations are to be realized, and 3) process restrictiveness can be invoked from three sources. These sources include facilitator-based, user-based (i.e., training), and system-based process restrictiveness. They may be employed individually or in combinations. Each source is expected (explained below) to differ in its effectiveness of promoting faithful use of heuristic and GSS structures. Thus, each source is likely to have

---

[4] Task-appropriate heuristics are those which carefully map the requirements for effective completion of the task to group processes which have been demonstrated to be effective for similar tasks. This matching also considers group and contextual factors. Chapter 2 documented three approaches for matching task requirements, contextual factors, and heuristics.

different effects on decision effectiveness, user satisfaction with the decision process and outcomes, and group consensus.

A heuristic's activities and sequences are designed to promote effective decision processes (amplifying potential process gains) while impeding ineffective processes (reducing potential process losses). If a group, however, does not adequately appropriate a heuristic's structures, then these benefits may not occur. Gouran (1982) noted that merely employing the steps of a heuristic (i.e., sequence) does not automatically lead to an effective decision, rather, it is the extent of appropriation at each stage which determines whether the heuristic's benefits will be realized. A heuristic's benefits must be considered in economic terms such that a realized process gain (or a suppressed process loss) makes a favorable contribution to the balance of forces, while an unrealized process gain (or an unsuppressed process loss) makes an unfavorable contribution to the balance of forces. A net positive balance of forces (i.e., the combining of all positive and negative elements in the Balance of Forces Model) is more likely to occur when the structures of a heuristic and any supporting technologies are faithfully appropriated. This assertion presumes that the heuristic and support technologies have been carefully selected to match the needs of the decision task and group characteristics.

The degree of process restrictiveness is a continuous dimension. A *high restrictiveness* environment can be described as an environment that strictly seeks to impose the structures of a heuristic on the decision-making process and which disallows any other processes. Thus, group members have little flexibility in using activities other

than those in the heuristic. Conversely, a *low restrictiveness* environment would allow the group members to fully use, partially use, or ignore a heuristic's structures.

Sources of Restrictiveness

As stated above, the enforcement of the heuristic can come from a third party process facilitator, the group members (users), or a technology-based system such as a GSS. These sources of restrictiveness primarily differ in their ability to affect a particular mode of group communication. The full communications bandwidth for group interaction is comprised of verbal interactions, nonverbal cues (e.g., a raised eyebrow or frown), and a computer-mediated communication mode for technology-supported groups. All group interaction happens through one or more of these communication modes. Table 7 maps the ability of each restrictiveness source to affect a particular mode of communication. Daft & Lengel (1986) noted that communication channels (e.g., the visual and audio carriers of the communication modes) vary in their capacity to convey information, their immediacy of feedback, and the variety of language and personalization which they support. Groups use these channels to send and receive information related to the task and intragroup relationships. The potential impacts of process restrictiveness on each communication mode are discussed below and are expected to be the chief moderator of a source's efficacy.

Table 7
Impacts of Process Restrictiveness Sources on Group Communication Modes

	GROUP COMMUNICATION BANDWIDTH		
Restrictiveness Source:	**Nonverbal Cues Mode**	**Computer-Mediated Mode**	**Verbal Mode**
Facilitator-Based	↓ to ↑	↑	↑
User-Based (Training)	↓ to ↑	↓ to ↑	↓ to ↑
System-Based	n/a	↑	n/a

n/a = no impact ↓ = low impact ↑ = high impact

Facilitator-Based Process Restrictiveness

Facilitator-based process restrictiveness is usually delivered via a specially trained nongroup member, though sometimes a group member may serve in this role. Facilitation usually segregates the responsibilities of directing the meeting's process from contributing to its content. The facilitator devotes his or her full time to monitoring the processes of the group interaction so that group members are freed from process concerns to concentrate on the content of the group's activities. The facilitator should be thoroughly trained in decision making and have excellent communication skills. He or she must be able to recognize when the group process significantly deviates from the heuristic so that process comments can be interjected to enforce the heuristic.

Facilitator-based process restrictiveness offers several advantages over other sources of restrictiveness. First, because the facilitator is not contributing to the discussion content, he or she can devote his or her full mental resources to monitoring and guiding the process via all communication modes. Second, a skilled process facilitator can look beyond the stated rules of the heuristic and can selectively interpret and apply the spirit of the heuristic's intentions to meet the dynamic needs of the group interaction,

though this implies a potential for misuse by a less skilled facilitator. Third, a skilled process facilitator can fulfill the role of leader in the absence of an appointed group leader. This may help to reduce friction in the group by providing focus and direction.

Facilitator-based process restrictiveness is expected to have the highest impact for imposing process restrictiveness. Table 7 shows that a facilitator can impose high levels of process restrictiveness across all three modes of communication, though his or her ability to restrict the nonverbal mode may be limited. When groups encounter facilitator-based restrictiveness, they are likely to defer to the facilitator's advice since he or she is often perceived as having expertise in this area. Alternatively, group members may express their disapproval with the process restrictiveness via the electronic or nonverbal cues communication modes and may in some cases engage in open procedural conflict with the facilitator.

User-Based Process Restrictiveness

User-based process restrictiveness can be naturally inherent in the group members, artificially created, or self-learned.

> Natural process restrictiveness will occur when the activities, sequences, and philosophies in a heuristic fit well with the manner in which an individual would have structured the group activities in the absence of the heuristic.

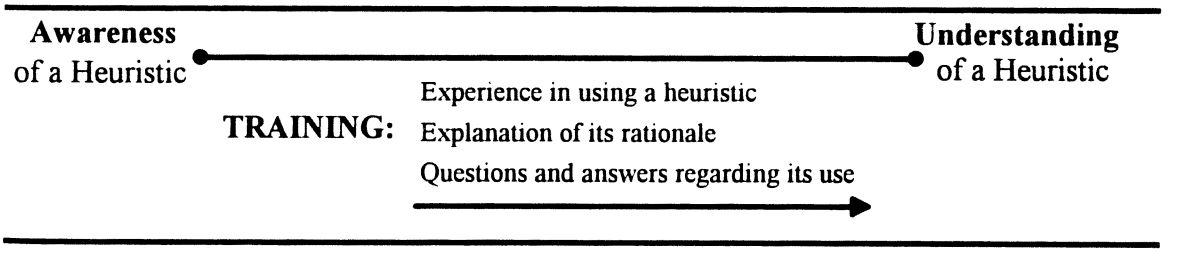
Nutt (1984) observed that group members often have very firm predispositions about how the decision process should proceed. If these predispositions are highly congruent with the structures of the heuristic, the presumed benefits from the heuristic should emerge naturally.

> Artificial process restrictiveness will occur when individuals have been sufficiently *trained* to use the structures of the heuristic and when they adequately appropriate this training during the decision process.

Previous research suggests that group members' predispositions are often incongruent with heuristics. Training can be used to educate and to promote the value of adhering to a heuristic, though group members may perceive such nonsolution-oriented activities as a waste of time. Ideally, training moves users from *ignorance* or *simple awareness of a heuristic* to *understanding* of a heuristic's structures.

Training may be delivered to group members in many ways. For example, some group members may learn about using heuristics from reading books or pamphlets. Other members may learn through group decision seminars which provide practice exercises in using a heuristic. Training which causes group members to experience using the activities, sequences, and philosophy of a heuristic; explains its rationale; and answers users' questions is likely to create *understanding,* and thus, a more powerful source of artificial restrictiveness than just reading about a heuristic (Figure 6).

Figure 6
User Training



> Learned process restrictiveness will occur when the individuals adopt the structures of a heuristic as part of their enduring cognitive map for structuring group decision processes.

Unlike natural and artificial process restrictiveness, which will operate in any given meeting, learned restrictiveness describes a process which may occur over time. If a user

(or group of users) believes that a heuristic operates successfully over time, repeated use of the heuristic and satisfaction with the decision process and outcome may eventually cause the user to adopt the heuristic as part of his or her *natural* way of structuring group decision-making activities. Thus, learned process restrictiveness can eventually mature into natural restrictiveness over time. As depicted in Table 7, user-based restrictiveness is expected to have an indeterminate effect across all communication modes in imposing process restrictiveness.

The efficacy of the user-based source to affect any group decision is contingent upon the degree of natural process restrictiveness, the sufficiency of the training to enable artificial process restrictiveness, and the adequacy of appropriation by the group[5]. Unlike facilitator-based process restrictiveness which clearly comes from a designated person, user-based restrictiveness is imposed by one or more group members. Individual group members will likely possess differing degrees of natural, artificial, and learned process restrictiveness. Thus, when a group encounters process restrictiveness from one or more of its own members, the restrictive comments (e.g., "we should not vote until we discuss the ideas") may be accepted or ignored by the group based on the status or charisma of the commenting member.

While facilitator- and user-based process restrictiveness can be implemented in both manual and technology-supported groups, only groups using a GSS can avail themselves of the third source of process restrictiveness.

---

[5] Since learned process restrictiveness describes a process which occurs over time, it does not affect a group's decision process in any one given meeting.

System-Based Process Restrictiveness

System-based process restrictiveness relies on the GSS to enforce the heuristic's structural components. Current GSS technologies accomplish this by disabling certain software supported processes (e.g., voting) until other processes (e.g., idea consolidation) have been completed or by enforcing the instructions for certain activities (e.g., must allocate 1000 points to various ideas). While GSSs have a very high potential to impose process restrictiveness on the activities and sequences in the computer-mediated channel, current systems have no ability to restrict the use of a heuristic's philosophical structures. For example, the philosophical rule that "all facts should be from reliable sources" cannot be system process restricted even though the facts are communicated via the computer-mediated mode.

When groups encounter system-based process restrictiveness, however, they may unfaithfully appropriate the GSS tools (and the heuristic activity that the tool represents) or they may circumvent the GSS entirely with verbal comments (i.e., use other less restricted communication modes). This circumvention to other communication modes may effectively reduce the use of a GSS to a charade. For example, the "real" group decisions and communication could take place in the unrestricted communication modes and the GSS tools are actually invoked post hoc merely to update the GSS transcripts. Current GSSs provide only a very limited ability to impose and enforce system-based process restrictiveness.

The current inefficacy of system-based process restrictiveness, however, may change in the near future. Techniques borrowed from the field of artificial intelligence

may allow the GSS to actually monitor group communication processes through the system and detect unhealthy process cues which may be embedded in evaluative tone, a low number of ideas, high similarity of ideas, or premature consensus.

Stages of Process Restrictiveness

Process restrictiveness can also be differentiated on the temporal dimension of pre-meeting, during the meeting, and post-meeting stages (Table 8). Different types of measures are needed to assess process restrictiveness in each of these stages.

Planned Process Restrictiveness

Prior to the meeting, the meeting leader usually develops either a formal plan for the meeting, such as written objectives and an agenda, or at least has an informal vision of what will happen at the meeting. Other group members may also share in the responsibility of planning the meeting. Heuristics are usually selected during the pre-meeting planning or the initial stages of a meeting, though emergent information may direct the group leader to invoke a particular heuristic to address an unforeseen situation. The meeting leader will also determine the degree of planned process restrictiveness for the meeting, though it is often implicit and rarely formally stated.

> Planned process restrictiveness is a qualitative, individual level variable which describes the degree of process restrictiveness *desired* for the meeting at the time of the pre-meeting planning.

The notion of planned process restrictiveness provides a way to distinguish between an intent to carefully adhere to a heuristic's structures versus an intent to loosely follow a heuristic's structures. Characteristics of the group (e.g., history and future likelihood of working together, previous experiences with heuristics, formality, group size) and

characteristics of the decision task (e.g., importance of the decision, degree of complexity) will likely guide the selection of planned process restrictiveness. High levels of planned process restrictiveness are better suited to large or ad hoc groups meeting in formal situations facing complex tasks than to small, established groups facing less complex tasks. Low levels of planned process restrictiveness are better suited to small or established groups and to low complexity tasks.

It is possible that individual group members may differ from the leader or other members in their understanding of planned process restrictiveness for the meeting. For example, a meeting leader may plan to keep the decision process task focused and sequenced to match a heuristic. Some group members, however, may feel that the group should only use the heuristic as a "rough outline" and should be free to pursue other discussions or evaluations at any time. Planned process restrictiveness could be assessed by asking the group leader or each member to characterize their *intent* to closely follow the heuristic.

Table 8
Stages and Measures of Process Restrictiveness

Variable	**PLANNED**	**ATTAINED**	**PERCEIVED**
Stage	Pre-meeting	Meeting	Post-Meeting
Focus	Individual	Group	Individual
Level	Perceptual	Objective	Perceptual

TIME →

Attained Process Restrictiveness

During the meeting, the planned process restrictiveness may or may not be attained.

> Attained process restrictiveness is defined as the *actual* degree of adherence to the heuristic's structures during the meeting.

Attained process restrictiveness can be measured objectively by comparing the actual group process to the structures specified by the heuristic. Such an analysis would be performed most effectively after the meeting from videotaped records of the meeting process and GSS-captured transcripts of the content. For example, if the heuristic specified that evaluative comments be contributed anonymously and a participant entered his or her name after a comment, then the guidelines of the heuristic have been violated. If this is an isolated infraction, then its effects on attained process restrictiveness may be minimal. If, however, a heuristic specifies that the group should begin with a problem definition activity or that a reflective thinking process be used to challenge assumptions and the group chooses to ignore these directions, then the process has significantly strayed from an important structure in the heuristic.

Such infractions may occur so extensively that the process benefits (realized gains and suppressed losses) embodied in the heuristic are unlikely to develop. This situation would be described as low in attained process restrictiveness. If the group followed the heuristic's mandates very closely then the group's process has high attained restrictiveness.

DeSanctis and Poole (in press) advocate that appropriation should be assessed for both the individual group members and the group as a whole. For example, an appropriation may occur in the form of a speech act from an individual (e.g., introducing

an opinion and arguing it as a fact) or it may occur as a group action (e.g., all members anonymously vote through the GSS).

Perceived Process Restrictiveness

After the meeting, each group member will have his or her own perceptions regarding the degree of process restrictiveness in the meeting. Thus,

> Perceived process restrictiveness is defined as the *perceptions* of individual group members regarding the degree of process restrictiveness present during the meeting.

It is an individual level variable that is measured with questionnaires and interviews after the meeting. For a multiphased group meeting, perceived restrictiveness can be viewed as a weighted average across the levels of process restrictiveness that a group member perceived during each period of the meeting. For example, an individual may have felt very constrained during the voting process if the heuristic specified voting via pair-wise comparison, but may have felt little restriction during a round-robin idea solicitation exercise.

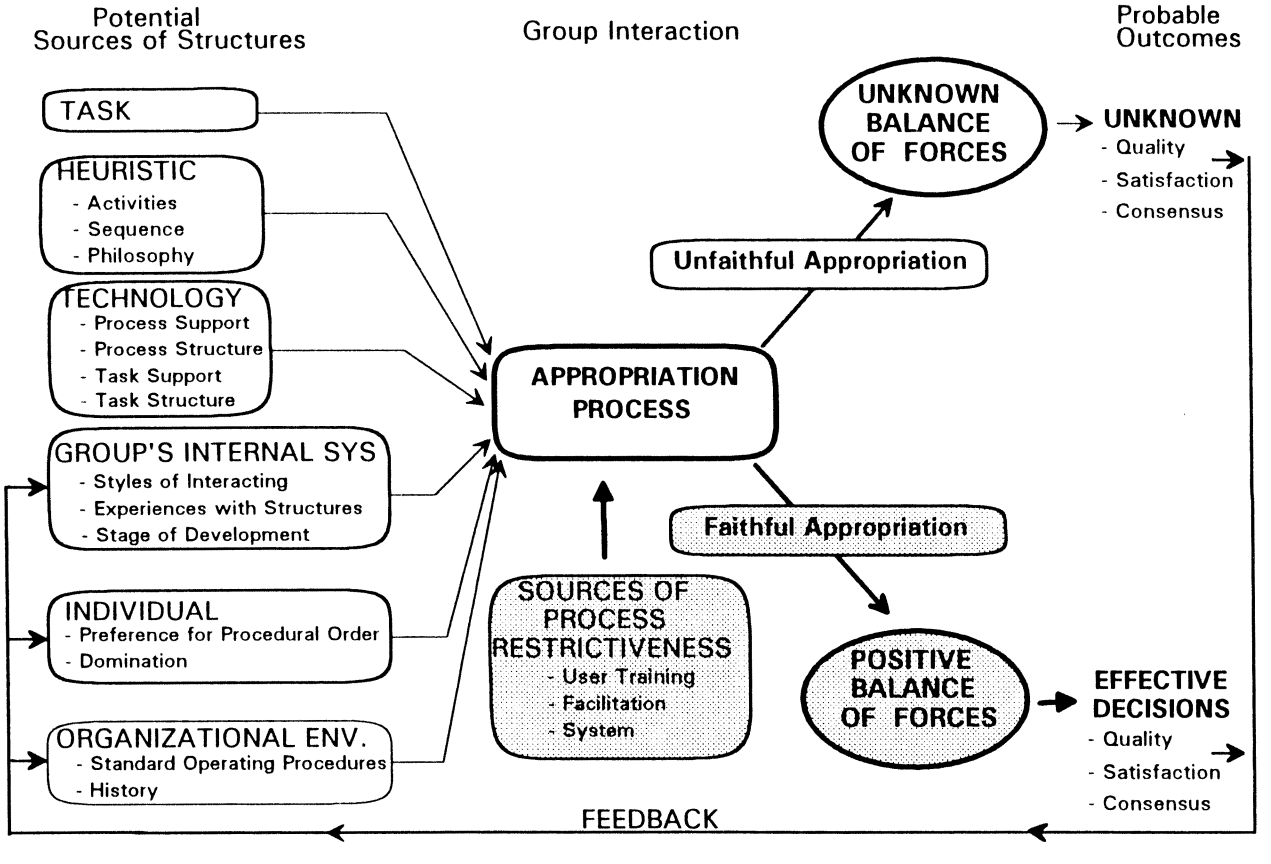
Post-meeting questionnaires and interviews should be designed to specify the stage of the meeting that the questions are addressing. Perceived process restrictiveness measures are very likely to be jaded by recency effects, the individual's unknown weighting system when recalling restrictiveness at various meeting stages, and a potential interaction with the decision process satisfaction construct. Since perceived process restrictiveness is likely to differ at various stages during the decision process, one might argue for interim measures after each stage is completed. Such measures, however, would be intrusive and might bias responses regarding later stages of the decision process. A reliable measure of

overall perceived process restrictiveness should measure the congruence between the user's pre-meeting expectations for the structure of the meeting the actual process that occurred during the meeting. If the actual meeting process was highly congruent with a member's natural expectations, the member is unlikely to suffer much dissonance between his or her expectations and the actual meeting process. Thus, this person would be unlikely to describe the process as highly restrictive. If a person felt very constrained during the actual decision process, however, the meeting's process was probably substantially different from his or her preconceived process structuring expectations, and the person would most likely describe the process as highly restrictive.

PRAST: AN INTEGRATED MODEL

Figure 7 depicts an integration of the Adaptive Structuration Theory and the Balance of Forces Model into a new input-process-output model for group decision making. This model is referred to as the Process Restricted Adaptive Structuration Theory (PRAST). The thin lines indicate *potential* sources of structures for the group's appropriation process. The sources of process restrictiveness box is linked to the appropriation process by a thick line to indicate an *imposed* source of structure. The central tenet of the PRAST model is that process restrictiveness can increase the likelihood of faithful appropriation. These faithful appropriations are the likely precursors to attaining a positive balance of forces which is often associated with effective decisions. This theoretical model reflects the deterministic impacts on group decision effectiveness sought by the decision school while still acknowledging that unfaithful appropriations can

Figure 7
Process Restricted Adaptive Structuration Theory: PRAST



have an unknown interaction with the Balance of Forces and, thus, result in indeterminate group outcomes.

Group outcome variables -- decision quality, satisfaction, consensus -- are not expected to always improve or diminish in unison. It is very possible that improved decision quality may be associated with lower process satisfaction. Decision quality is the *primary* focus of PRAST though other variables can also be interpreted in light of the following propositions.

PROPOSITIONS

The following propositions broadly define the expected implications of process restrictiveness sources on group decision-making processes and outcomes. They are stated in sets. The first proposition in each set addresses the degree of faithful appropriation of the heuristic. The other proposition(s) comment on expected group outcomes. When the anticipated effect on an *objective* outcome measure(s) (e.g., decision quality and consensus) is expected to be different than the effect on a *perceptual* outcome measure(s) (e.g., perceived satisfaction with the decision process or the decision outcome, perceived consensus), then the predictions are stated in separate outcome propositions.[6]

The first set of propositions focuses on the comparison of applying all forms of process restrictiveness -- facilitator-based (i.e., facilitation), user-based (e.g., training), and system-based -- to any one form or no process restrictiveness. The three-fold combination of process restrictiveness is expected to have a more favorable impact on

---

[6] The objective and perceptual group outcome measures are more explicitly defined in Chapter 4.

inducing faithful appropriations than single sources due to the full coverage of the group communication bandwidth. Favorable group objective outcomes are expected to be a product of faithful use of the heuristic because the group is essentially allowed no alternative processes. Lower perceived satisfaction is expected because the group feels excessively restricted

> *Proposition 1a:* For task-appropriate heuristics, the combination of facilitation, user training, and system-based process restrictiveness will lead to more faithful appropriations of a heuristic than will any single source (or absence) of process restrictiveness.
>
> *Proposition 1b:* For task-appropriate heuristics, the combination of facilitation, user training, and system-based process restrictiveness will lead to more favorable objective group outcomes (e.g., decision quality, consensus) than will any single source (or absence) of process restrictiveness.
>
> *Proposition 1c:* For task-appropriate heuristics, the combination of facilitation, user training, and system-based process restrictiveness will lead to less favorable perceptual group outcomes (e.g., satisfaction) than will any single source (or absence) of process restrictiveness.

The second set of propositions addresses facilitation. Facilitator-based process restrictiveness relies on a nongroup member to monitor the group's decision process and to interject restrictive comments when the group deviates from the heuristic. Since facilitator-based process restrictiveness has a greater impact on the full range of communication modes than any other single source (see Table 7), it is expected to have the most powerful effect on inducing faithful appropriation and improving associated group outcomes.

> *Proposition 2a:* Facilitator-based process restrictiveness will lead to more faithful appropriations of a heuristic than will any other <u>single</u> source (or absence) of process restrictiveness.
>
> *Proposition 2b:* Facilitator-based process restrictiveness will lead to more favorable objective and perceptual group outcomes than will any other <u>single</u> source (or absence) of process restrictiveness.

The third pair of propositions addresses system-based process restrictiveness. System-based process restrictiveness occurs when the GSS limits access to certain features or controls the sequence in which features are used. This source is expected to have a high impact on enforcing the heuristic's activities and sequences to the extent that the group's interaction occurs in the computer-mediated communication mode. The system is powerless, however, to affect group communications (and possible unfaithful appropriations) in other communication modes. Since the system only enables and disallows activities and sequences and has little ability to reinforce the group of the spirit of the heuristic, system-based process restrictiveness may frustrate group members who want to invoke other GSS tools or functions. Thus, system-based restrictiveness is expected to be associated with lower levels of process satisfaction and other outcome measures than other single sources which operate in richer communication modes.

> *Proposition 3a:* System-based process restrictiveness will lead to a lower degree of faithful appropriation of a heuristic than will any other single source of process restrictiveness.
>
> *Proposition 3b:* System-based process restrictiveness will lead to less favorable objective and perceptual group outcomes than will any other single source of process restrictiveness.

User-based process restrictiveness can be induced by training the user (i.e., group member) to adhere to the activities, sequences, and philosophy of a heuristic. While user training creates an understanding of a heuristic's structures, it does not mandate a structure's use in the actual decision process. Groups will be unimpeded in their opportunity to draw from any of the potential sources of structures, and thus, an indeterminate mix of faithful and unfaithful appropriations of the heuristic are expected.

The unknown mix of faithful and unfaithful appropriations makes prediction of decision quality and objective consensus undeterminable. Perceived satisfaction and perceived consensus are likely to be favorable as the group expresses approval with their own self-direction of the process.

> *Proposition 4a:* User training will generally lead to a mix of faithful and unfaithful appropriations of a heuristic (fewer faithful than propositions 1a and 2a, more than proposition 3a) as users selectively choose structures from the heuristic and from other potential sources.
>
> *Proposition 4b:* User training will have an unpredictable impact on objective group outcomes.
>
> *Proposition 4c:* User training will lead to favorable perceptual group outcomes.

The fifth set of propositions addresses an absence of process restrictiveness.[7] Groups which do not receive user training, are not process facilitated, and which do not experience system-based process restrictiveness are expected to be overwhelmed by the structures in the heuristic, and consequently, will be unlikely to use it in a faithful manner. This is likely to be more true of complex heuristics with many activities and sequences and less true for simpler heuristics.

> *Proposition 5a*: The absence of any source of process restrictiveness will lead to a lower degree of faithful appropriation of a heuristic than will any single source or combination of sources.
>
> *Proposition 5b:* The absence of any source of process restrictiveness will have an unpredictable impact on group outcomes.

The final pair of propositions addresses how individual differences may moderate the degree of faithful appropriation of the heuristic and individual outcome measures. A

---

[7] It can be reasonably argued that the *mere presence* of a GSS is a mild form of process restrictiveness. Availability may imply use and use -- even when appropriated in an unfaithful manner -- provides a source of structure to the group's decision process.

number of individual difference variables (i.e., cognitive or psychological traits) describe individuals' predispositions towards certain behaviors. One example is Putnam's (1979, 1982) preference for procedural order (PPO) construct which classifies how individuals generally prefer to organize group work (the PPO construct was more fully described in Chapter 2). Propositions 6a and 6b argue that when group members find the structures in a heuristic to be highly congruent with their individual preferences they are unlikely to suffer much cognitive dissonance between their preferences and the present group process. The degree of faithful appropriation is likely to be moderated by the congruence of the process mandated by the heuristic and the process generally preferred by the group or its more dominant members. When an individual's preferences and the group's process are congruent, favorable assessments of process satisfaction are likely while incongruence will likely yield unfavorable assessments of process satisfaction. Other outcome variables will also vary from favorable to unfavorable depending upon the congruence with a particular individual difference variable. Thus, propositions 6a and 6b do not argue the manner in which specific individual difference variables will moderate appropriation and outcome, but rather, serve as a higher level proposition which acknowledges the role of these differences.

Proposition 6a: Individual differences will moderate the degree of faithful appropriation of the heuristic.

Proposition 6b: Individual differences will moderate group outcomes.

The next section will report on a preliminary experiment that examined process restrictiveness and a particular instantiation of proposition 6b.

PRELIMINARY STUDY

A preliminary laboratory experiment (Wheeler, Mennecke, and Scudder; in press) was conducted during the spring of 1992 to test proposition 6b for the preference for procedural order individual difference variable. The study employed a 2 x 2 factorial design which manipulated high and low levels of restrictiveness and a user's preference for procedural order (Table 9). The task, heuristic, user training, group size, and GSS were controlled (Appendix H contains a more detailed description of the procedures and results). Ten pilot groups were used to test the experimental procedures and were not included in the data analysis. Twenty-eight ad hoc groups of undergraduate students who were enrolled in an introductory computer course completed the experiment.

Table 9
Design of Preliminary Study

	High Procedural Order Groups	Low Procedural Order Groups
Restrictive GSS	HPO / R	LPO / R
Non-Restrictive GSS	HPO / NR	LPO / NR

All groups used the same GSS and received training regarding the heuristic. The high restrictive condition was operationalized by imposing system- and facilitator-based process restrictiveness. The facilitator did not guide the group and only interjected scripted comments when the group process significantly deviated from the heuristic. The low restrictive condition was provided a GSS, but allowed the group to direct their decision-making process in any manner they chose.

The second factor, the preference for procedural order (PPO) construct, was used to form groups of either all HPO or all LPO individuals. Table 10 summarizes the hypotheses and results of the preliminary study.

The study found statistically significant differences (α=.05) between LPO and HPO individuals on process and outcome satisfaction. The restrictive condition was preferred to the nonrestrictive condition. The researchers believed that the highly complex task may have been overwhelming for the nonrestrictive groups which were left to their own devices to process the task. They employed a great variety of decision processes including many which were incongruent to the structures in the heuristic. Some group members abandoned the heuristic entirely and directed the GSS and discussions toward their preferred manner of group decision making while members of other groups attempted to follow the sequences of activities mandated by the heuristic. Nonrestricted groups had a strong solution orientation and spent little time defining the problem. The nonrestrictive groups had higher decision quality (α=.1) than the restrictive groups. This result seems highly incongruent with the normative group decision literature which advocates that a problem definition phase should precede a solution generation phase. The present research will provide opportunity for replication of this result.

Table 10
Summary Findings from Preliminary Study

Hypothesis / Finding	Support / Statistic
H1a: Overall, groups in the restrictive environment will produce higher quality decisions than groups in the nonrestrictive environment. *Nonrestrictive groups did better*	Opposite: F(1,24)=3.166, p=.088
H1b: There will be no differences in decision quality based on a group's preference for procedural order *LPO groups did better*	Not Supported: F(1,24)=3.814, p=.063
H2a: HPO group members will be more satisfied with the decision process in the restrictive environment than in the nonrestrictive environment *HPO members were equally satisfied in either condition*	Not Supported: F(1,68)=0.95, p=.33
H2b: LPO group members will be more satisfied with the decision process in the nonrestrictive environment than in the restrictive environment *LPO members were more satisfied in the restrictive environment*	Opposite: F(1,68)=5.27, p=.0247
H3: Overall, individuals in the nonrestrictive environment will be more satisfied with the decision process than individuals in the restrictive environment *Restricted group members were more satisfied*	Opposite: F(1,136)=8.7, p=.004
H4: Overall, individuals in the restrictive environment will be more satisfied with the decision outcome than individuals in the nonrestrictive environment *Restricted group members were more satisfied*	Supported: F(1,136)=6.75, p=.01

This investigation of the relationship between PPO and process restrictiveness supports the proposition that individual differences can moderate group outcomes (proposition 6b of the PRAST model). The researchers also observed qualitative support for proposition 6a as they noted that the nonrestrictive groups generally could not or chose not to faithfully appropriate the heuristic in their decision process. One of the most useful aspects of the preliminary study in relation to the proposed research, however, was the opportunity to test and evaluate the experimental task and procedures.

HYPOTHESES

The hypotheses for the dissertation research are derived from the group outcome propositions of the PRAST model. They will evaluate the efficacy of various sources of process restrictiveness for a particular decision-making task and context. An investigation of the outcome propositions should logically precede and guide the future investigation of the process propositions. The scope of this dissertation is limited to testing hypotheses drawn from the outcome propositions.

Decision Quality

The quality of group decisions is an important concern for both practitioners and academic researchers. Thus, the first set of hypotheses addresses the objective group outcome of decision quality. These hypotheses are premised on the assumption that higher levels of process restrictiveness will increase the likelihood of faithful appropriations and the realization of a positive balance of forces (Figure 7). Hypothesis 1c varies from the proposition 5b by directionally predicting that an absence of process restrictiveness will yield low decision quality. The complex nature of the research task (described in Chapter 4) was the primary reason for this prediction.

> H1a: Groups with user training, facilitation, and system-based process restrictiveness will have higher decision quality than will groups which experience any single source (or an absence) of process restrictiveness [Proposition 1b].
>
> H1b: Groups with facilitator-based process restrictiveness will have higher decision quality than will groups which experience any other single source (or an absence) of process restrictiveness [Proposition 2b].
>
> H1c: Groups with no source of process restrictiveness will have lower decision quality than will groups which experience any single source of process restrictiveness [Proposition 5b].

Satisfaction with the Process

Individuals' *perceptions* of the meeting process are important because they can influence whether or not a particular meeting process (i.e., heuristic) will be used for the present and future meetings. Since activating all three sources of process restrictiveness will effectively disallow the group from using alternative processes, the first hypothesis for process satisfaction expects the group to experience some frustration from this level of restrictiveness. The second hypothesis expects the richest source of process restrictiveness, facilitation (high impact in both verbal and computer-mediated communication modes), will have the most favorable ratings for process satisfaction. The last hypothesis expects groups to be less satisfied with the system-based source than the other single sources. Both training and facilitation provide a built-in rationale for why they restrict a group's interaction process; system-based restrictiveness, however, only appears rigid and inflexible with no ability to explain why.

> H2a: Group members with user training, facilitation, and system-based process restrictiveness will be less satisfied with the process than will group members who experience any single source (or an absence) of process restrictiveness [Proposition 1c].
>
> H2b: Group members with facilitator-based process restrictiveness will be more satisfied with the process than will group members who experience any other single source (or an absence) of process restrictiveness [Proposition 2b].
>
> H2c: Group members with only system-based process restrictiveness will be less satisfied with the process than will group members who experience any other source (or an absence) of process restrictiveness [Proposition 3b].

Satisfaction with the Solution

An individual group member who perceives high satisfaction with the group's solution may do so because of a high congruence between his or her preferred solution

and the solution selected by the group. Another reason for high solution satisfaction may be that the group member was truly convinced that the group's solution was the best in light of all available alternatives or constraints. If the group process supports a high degree of information sharing towards building a common understanding of the problem and solution among group members, higher levels of solution satisfaction are expected. Each source of process restrictiveness and its ability to affect communication modes is expected to moderate the extent to which groups are required by the heuristic's structures to engage in information sharing activities. Additionally, individuals who are satisfied with the group's solution are more likely to support and act on its implementation than those who are dissatisfied with the decision product.

> H3a: Group members with user training, facilitation, and system-based process restrictiveness will be less satisfied with the solution than will group members who experience any single source (or an absence) of process restrictiveness [Proposition 1c].
>
> H3b: Group members with facilitator-based process restrictiveness will be more satisfied with the solution than will group members who experienced any other single source (or an absence) of process restrictiveness [Proposition 2b].
>
> H3c: Group members with only system-based process restrictiveness will be less satisfied with the solution than will group members who experience any other single source (or an absence) of process restrictiveness [Proposition 3b].

Group Consensus

Group consensus is the percentage of group members who agree with and who are committed to enacting the group's solution. Consensus can be measured in terms of *perceived consensus,* which assesses the degree to which members believe they agree with the group solutions, and as *objective consensus*, which evaluates the degree of agreement in the group members' post hoc, individual decisions. In general, higher levels of

consensus are likely to occur when a majority of the group members are satisfied with the group's solution. Additionally, a group member may be more likely to support a decision in which she or he had a significant contribution. To the extent that heuristic structures (via process restrictiveness sources) can promote decision convergence through information sharing and persuasion, a higher percentage of the group's membership is expected to concur with the group's solution.

> H4a: Group members with user training, facilitation, and system-based process restrictiveness will attain higher group consensus than will group members who experience any single source (or an absence) of process restrictiveness [Proposition 1b].
>
> H4b: Group members with facilitator-based process restrictiveness will attain higher group consensus than will group members who experience any other single source (or an absence) of process restrictiveness [Proposition 2b].
>
> H4c: Group members with only system-based process restrictiveness will have lower group consensus than will group members who experience any other single source of process restrictiveness [Proposition 3b].

Chapter 4 describes a laboratory experiment designed to test these hypotheses. The first proposition from each pair of propositions in the model of group process restrictiveness speculated on the degree of appropriation for the activities, sequences, and philosophies which comprise a heuristic. Testing of, and formal hypotheses for, these propositions will be the topic of future research and is beyond the scope of the dissertation project.

SUMMARY

This chapter has defined process restrictiveness and distinguished it from guidance. It described three sources of process restrictiveness along with their implications for affecting modes of group communication. The Process Restricted Adaptive Structuration

theory was depicted along with a set of research propositions. The chapter summarized the results of a preliminary restrictiveness study and set forth hypotheses for the dissertation research. The next chapter will detail the research methods used to assess these hypotheses.

CHAPTER 4

RESEARCH METHOD

This chapter describes the research method used to test a subset of the PRAST model. Information systems researchers[8], like their colleagues in other social science fields, employ a variety of research approaches and techniques to investigate questions of interest.

RESEARCH APPROACH AND TECHNIQUE

The *research approach* frames the researcher's entire understanding of the problem. It embodies the manner of reasoning (e.g., deductive, inductive, causal relationships), the researcher's assumptions (e.g., objectivity or stated subjectivity, significance of historical context), and views of objective or relativistic reality (Orlikowski & Baroudi, 1991). The *research technique* is the methods used to gather and interpret information relevant to the research question. The research technique interacts with the research approach in terms of what is accepted as a guarantor of evidence (e.g., statistics,

---

[8] In the context of this dissertation, information systems research refers to the domain of inquiry which studies the interaction of technology with organizations and humans. Other types of information systems research which are based in computer science and engineering perspectives are not closely related to the social sciences and are not addressed in this discussion.

fit of competing theories to data, observational stories) (Mason & Mitroff, 1973). The selection of a research approach and technique should be congruent with the research objectives.

Theory testing is conducted in the positivist research approach or paradigm[9]. The research objective is to link specific theory-defined variables via laws of interaction to predicted theory states (i.e., measured variables) (Dubin, 1978). Research designed to test theories must make every attempt to rule out rival explanations for the predicted relationships. Rival explanations might include possible biases in the selection of subjects and assignments to groups, effects of time and historical events that differ between groups and subjects, interaction of the treatment and the subjects' behavior, and many others (see Campbell and Stanley, 1966, for a comprehensive enumeration of the possible threats to research validity). A controlled laboratory experiment is the technique which offers the researcher the greatest ability to control nuisance variables and other rival explanations that might affect the research results (Stone, 1978; Jenkins, 1984).

Since the specific objective of this dissertation is to better understand the theoretical relationships between process restrictiveness sources and outcome measures, a controlled laboratory experiment was the chosen research technique. As with most research design choices, the selection of a laboratory experiment implies some trade-offs. McGrath (1982) argues that while laboratory experiments produce the maximum possible control for the precise measurement of behavior, they often sacrifice the ability to generalize to other subject groups and contexts (c.f. Bettenhausen,1991). In the present

---

[9] Positivist research is based on the existence of theorized a priori relationships among variables which are usually investigated with structured instrumentation.

research, the selection of the research task and technologies is expected to help mitigate concerns regarding generalizability. While a controlled laboratory experiment is one of the stronger research techniques to support the theory testing approach, Orlikowski and Baroudi (1991) have argued that other research approaches (e.g., interpretive and critical studies) can also be employed in conducting information systems research. These alternate approaches may provide new insights regarding the contextual and historical factors which influence the use of information systems.

RESEARCH DESIGN

The investigation of process restrictiveness in the PRAST model calls for a factorial experimental design manipulating training, facilitation, and system-based sources of restrictiveness. While each of these sources can conceptually vary along a continuous dimension, the present experiment operationalized discrete levels of each source. For example, training regarding the use of the heuristic can be operationalized as training with practice exercises or only an introduction to the heuristic. Facilitation can be available via a skilled process facilitator or unavailable. System-based restrictiveness can be high, where the GSS actively restricts the process, or low, where the mere presence of a GSS imposes some degree of process restrictiveness just from interacting with a system. Appendix I enumerates the possible experimental treatments.

Limited subject availability necessitated no more than an eight cell experimental design with each treatment representing some combination of the two levels from each of the three sources of restrictiveness. Since the focus of the dissertation is on the effects of

technology support and process interventions, all selected treatments employ a GSS and a process intervention (described below). The eight selected treatments are depicted in Table 11. These treatments were chosen to test an important subset of the model which is most directly related to GSSs. The shaded items in Table 11 highlight the defining feature(s) of each treatment. The design allows for the assessment of the unique and combined effects of the three process restrictiveness sources. The complete omission of a heuristic or GSS (e.g., manual groups with no technology support) could be an additional level of these factors. In selecting which treatments to include, however, preference was given to testing the individual and combined process restrictiveness sources rather than manual group processes. This design choice acknowledges that many other experiments have described the differences in manual and GSS processes, but no other work has been done with process restrictiveness as it is used in this experiment. Thus, treatments which omit the GSS or heuristic are beyond the scope of this dissertation.

Table 11
Experimental Treatments (Independent Variables)

	Source(s) of Restrictiveness		
Treatment	**User Training**	**Facilitator**	**System**
1) Restrictive Baseline (RB)	**EXTENSIVE**	**ACTIVE**	**HIGH**
2) Training (T)	**EXTENSIVE**	N/A	Low
3) Facilitation (F)	Introduction	**ACTIVE**	Low
4) System (S)	Introduction	N/A	**HIGH**
5) Training + Facilitation (TF)	**EXTENSIVE**	**ACTIVE**	Low
6) Training + System (TS)	**EXTENSIVE**	N/A	**HIGH**
7) Facilitation + System (FS)	Introduction	**ACTIVE**	**HIGH**
8) Nonrestrictive Baseline (NRB)	Introduction	N/A	Low

Independent Variables: Treatments

The research design contrasted a maximally restrictive GSS environment (restrictive baseline) with a minimally restrictive GSS environment (nonrestrictive baseline) in an attempt to isolate the effects of the three primary sources of restrictiveness. The restrictive baseline (RB) treatment included user training, facilitator-based, and system-based sources of restrictiveness (described below). The RB groups received training in how and why to use the activities, sequences, and philosophy of the heuristic, and they practiced using these structures on a sample problem (Appendix B-3). They also received facilitation to enforce the structures of the heuristic (see Appendix D for the specific instructions to the facilitator). As long as the group followed the structures in the heuristic, referred to here as the Group Decision-Making Procedure (GDMP)(described below), the facilitator did not intervene in the group's decision process. The facilitator did not control the pace of a group's procession through the GDMP. When the group moved to the next agenda activity, the facilitator would read the instructions for that activity from the (GDMP). If the group began to deviate from the GDMP (e.g., entering solutions in the GSS during the problem generation activity, skipping the criteria identification or weighting activities, verbally voting or browbeating a dissenting group member), the facilitator would interject a restrictive comment to point the group back to the GDMP. In addition to user training and facilitation, the RB groups also used a high restrictive GSS which only supported the activities and sequences of the heuristic. The high restrictive GSS displayed a sequenced agenda on each participant's screen. The agenda items exactly matched the heuristic and were individually enabled in a sequential manner as the group

requested them, but only one item at a time (operationalization of system-based restrictiveness is further described in the procedures section). Group performance in this treatment was planned to serve as the high-end basis for comparison to the other treatments.

Like the RB condition, the user training (T) treatment employed user training in how and why to use the heuristic and had the group apply the heuristic to a sample problem. Unlike the RB groups, however, these groups were not process facilitated and were able to employ the GSS features in any manner they chose (i.e., low system restrictiveness). Groups in the third treatment, facilitation (F), received only an introduction to the heuristic and received facilitation. The introduction to the heuristic included an oral description of the five major goals of the heuristic and an introduction to the general format of the heuristic (see Appendix F, experimental script, and C-1, heuristic, for details). The introduction-only groups did not practice using the heuristic. The GSS was configured identically to the T treatment. Groups in the fourth treatment, system (S), received the same introduction to the heuristic as the F treatment, but used a high restrictive GSS that supported only the structural features of the heuristic. This treatment was not process facilitated.

The next three treatments were designed to evaluate the interactions of process restrictiveness sources. The pattern of the pilot data (described below) suggests that the efficacy and subject perceptions of a single process restrictiveness source may be moderated by the presence of other process restrictiveness sources. The training + facilitation treatment (TF) simultaneously activated both training and facilitation while

using a low restrictive GSS. The training + system (TS) treatment included training in the use of the heuristic and a high restrictive GSS. The final combination treatment, facilitation + system (FS), used facilitation along with a high restrictive GSS. The last treatment is the nonrestrictive baseline (NRB) condition without any manipulated process restrictiveness source beyond a low restrictive GSS. The nonrestrictive baseline groups received the same introduction to the heuristic as the F and S treatments and were free to employ the GSS or abandon it in any manner they chose.

A research assistant, who was not aware of the research hypotheses, served as the process facilitator for all facilitated groups. This was done to eliminate the effect of any differences in personality or facilitation styles from multiple facilitators. It also help to guard against possible researcher-induced bias. The independent variables and treatments are summarized in Table 12.

Controlled Variables

The experimental design controlled for the task, heuristic, and technology sources of structure available to the group (Figure 7). Each of these are described below.

Task

All groups received the same task for their decision process. Previous research has suggested that tasks with sufficient complexity are more likely to benefit from process interventions (Dennis & Gallupe, 1993). Therefore, the selected task was a revised version of the hidden-profile school of business (SOB) task (Wheeler & Mennecke, 1992; Mennecke & Wheeler, 1993; Appendix B-1). This task is classified as an ill-structured, decision-making task according to McGrath's (1984) task taxonomy and is highly complex

based on Wood's (1986) model of task complexity. The task also proved to be an effective stimulus in the preliminary study described in Chapter 3.

The SOB task has five unique roles with each role representing a stakeholder from the school of business. The five roles include:

- Associate Dean of the Business School
- Business Student Council President
- University Alumni Association Vice President
- Business School Faculty Council Chairperson
- University Vice President for Instruction.

Table 12
Independent Variables

Independent Variable	Operationalized Level(s)	Method
Source(s) of Restrictiveness	Restrictive baseline (RB)	Subjects were extensively trained regarding the spirit and procedure for the heuristic; they applied it to a practice problem (no GSS), then used same heuristic with a restrictive GSS and process facilitator
	Training + nonrestrictive GSS (T)	Subjects were extensively trained regarding the general goals and procedure for the heuristic; they applied it to a practice problem (no GSS), then used same heuristic with a low restrictive GSS; these groups were not facilitated
	Facilitator + nonrestrictive GSS (F)	Subjects were introduced to the general goals of the heuristic; a process facilitator restricted the group to the activities, sequences, and philosophy of the heuristic; they used a nonrestrictive GSS
	Restrictive GSS (S)	Subjects were introduced to the general goals of the heuristic; the GSS was configured to only support the activities and sequences of the heuristic; these groups were not facilitated
	Training + facilitation (TF)	Subjects were extensively trained regarding the general goals and procedure for the heuristic; they applied it to a practice problem (no GSS), then used same heuristic with a low restrictive GSS; a process facilitator restricted the group to the activities, sequences, and philosophy of the heuristic
	Training + system (TS)	Subjects were extensively trained regarding the general goals and procedure for the heuristic; they applied it to a practice problem (no GSS), then used same heuristic with a restrictive GSS; these groups were not facilitated
	Facilitation + system (FS)	Subjects were introduced to the general goals of the heuristic; a process facilitator restricted the group to the activities, sequences, and philosophy of the heuristic; they used a restrictive GSS
	Nonrestrictive baseline (NRB)	Subjects were introduced to the general goals of the heuristic and used a low restrictive GSS; these groups were not facilitated

Table 13
Task Roles with Associated Problems, Constraints, and Supporting Tables

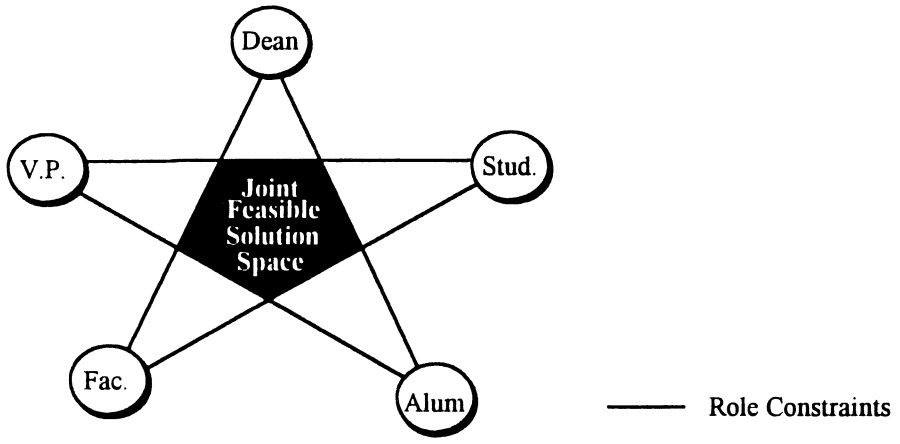
Position:	ASSOC. DEAN 1	STUDENT 2	ALUMNI 3	FACULTY 4	UNIV. VP 5
Constraints	1) Fixed budget 2) No reduction in revenue sources (out-of-state students)	1) Freeze cost of education 2) More "real world" teaching in class	1) Maintain high quality image of school 2) Less theory and more practical teaching	1) Reduce class size 2) Reduce teaching responsibility	1) Federal compliance with equal opportunity for higher education 2) State legislative mandate to focus on the educational needs of the state 3) Raising business school entrance requirements not effective 4 years ago
Concerns	No problem	Need to learn marketable job skills	Lack of critical thinking skills in grads	Students not equipped with good writing and math skills	Demographic composition of the student body
Tables	(P) No. students & No. instructors (C) Budget (C) Revenue sources by type of student (I) Cost of instruction by type of instructor	(P) Declining teaching evaluation by instruction source (C_5) BS no. in-state, out-of-state admissions (I) BS no. premajors, admits, graduates (D) Ratio of computers to students	(P) Declining school instruction rating from popular press ($C_{3,2}$) Constant overall image rating of school in popular press (I) Projected industry demand for majors (D) Grad placement by major	(P) Increasing no. students and no. courses taught (C_2) Sources of instruction % (C_3) Research publication data (I) Faculty turnover	(P) Teaching quality across all schools; BS declining (C) No. in-state, no. out-of-state admissions to univ (I) No. premajors, admits, grads to other schools (D) BS classroom utilization

P=Problem ID; C=Constraint Information; I= Informational; D=Distractor; Subscript #'s refer to roles

It was developed by starting with a root set of problems (Table 13) and assumptions about associated feasible solutions. Criteria were subsequently added to the case to impose constraints that would narrow the feasible solution space to a finite region while still leaving some possible solutions that would not violate the constraints (Figure 7).

Finally, descriptions of associated minor problems and irrelevant information were added as a distraction in order to mask the solution.

Figure 7
Intellective Nature of the SOB Task - Restricted Joint Feasible Solution Space



Committee roles are assigned to participants, and each participant is given a scenario describing his/her situation and role. Each participant receives a three page case which consists of a common cover memo and two pages of information unique to his or her role. The cover memo suggests that several complaints had been made regarding current policies but implies that these complaints may be unfounded. The group is instructed to evaluate all of the information that each person brings to the meeting, identify any real problems, and submit a concise, written statement of the group's recommendations. Each case (i.e., role) contains a description of its position and responsibilities in the organization along with a brief narrative of its concerns. Some information is provided in narrative form while other information must be derived from tables of numerical data. Each participant also receives unique information about the constraints and problems associated with his or her role as well as extraneous data which

is not applicable to identifying the problem nor to generating a solution. The constraints identify either quantitative limitations (e.g., reduced budget, student to teacher ratio) or qualitative limitations (e.g., "policy changes should not negatively impact the university's standing on federal equal opportunity regulations").

The fact that task-relevant information is divided among group members is important because it more closely simulates many *real world* settings in which information is disseminated among group members. This type of task has been labeled a hidden-profile task because "individuals in the group cannot see that the collective profile of information favors an alternative that to each individual appears to be inferior" (Stasser, 1992, p.56). This implies that the task possesses two important characteristics which make it unique among GSS research: First, the distribution of information facilitates manipulation of the logical group size[10] to more closely approximate the physical group size. This has been identified as a major difference between the findings of laboratory- and field-based GSS research (Mennecke & Wheeler, 1993; Dennis, Nunamaker, & Vogel, 1991). Second, the task is conjunctive and therefore *requires* that all group members participate and share ideas for the group to identify and select a feasible solution. Free-riding by one or more participants is likely to deprive the group of important information and perspectives

---

[10]The logical group size refers to the degree of overlap of task-relevant domain knowledge among group members. Nunamaker, Vogel, and Konsynski (1989) note that "a physically large group from a common culture... may have a high degree of overlapping domain knowledge that results in the group being logically small. Conversely, a physically small multi-cultural group exhibits characteristics of a much larger group because its members have multiple and often conflicting perspectives, points of view, diverse knowledge domains, and opinions that make it logically large" (p. 147).

regarding the joint feasible solution space. Process interventions and GSSs are especially well-suited to supporting the requirements of conjunctive tasks.

As mentioned above, the SOB task is an intellective task for which solution quality can be rated (as defined by expert judges). The feasible solution set can be identified by combining available information and constraints. Each of the five roles described in the case includes information about the underlying problems as well as minor side issues. The feasible solution set includes those solutions which address the problems (e.g., declining teaching quality) without violating one of the constraints (e.g., increasing the school's fixed budget) (Figure 7). The cover memo for the case states that the goal is to evaluate the available information, decide what (if any) are the problems in the school, and make a recommendation to address the problems (see Appendix B-1). Procedures to determine decision quality are explained in greater detail below.

Heuristic

The heuristic is a five step, multiple activity group decision-making procedure that has been specifically tailored to the demands of the task. The heuristic mandates both divergent and convergent phases of group activity and requires group agreement on the problem prior to generating solutions. The heuristic is outlined in Table 14 and the fit of the heuristic to the task requirements is summarized in Table15. While the task can be performed without acting on each requirement, groups in the preliminary experiment that did not build consensus about the problem often had an extremely difficult time in selecting a solution. The heuristic handouts are included in Appendices C-1 and C-2.

Table 14
Heuristic Goals and Specific Activities

Five Major Goals	Sequenced Activities
1) Identify the real problem	Generate problem statements, discuss and clarify, reduce the list by voting, choose the best problem statement, write the problem statement
2) Identify many possible solutions	Generate solutions, discuss and clarify
3) Identify and weight important constraints or opportunities	Generate opportunities and constraints, discuss and clarify, reduce the list by voting, assign relative weights
4) Reduce the list of potential solutions to <=5	Review the list of possible solutions, reduce the list by voting
5) Select the best solution	Compare the reduced list of possible solutions to the weighted opportunities and constraints

Table 15
Task Requirements and Fit of the Heuristic

Task Requirement	Heuristic Feature
Need to reduce case complexity	Five sequenced goals to divide the work into subtasks
Need to identify real problems in the case	First activity is to brainstorm the dominant problems; share unique perspectives / information with other group members; encourages divergent thinking
Need to build group consensus regarding which problems should be addressed	Iterative discussion and voting on the brainstormed list of problems until consensus; helps to surface and integrate minority views; encourages convergent thinking
Need to identify possible solutions	Brainstorm possible solutions; encourages divergent thinking
Need to identify policy opportunities and limitations	Brainstorm to identify opportunities and constraints presented in the case data; share unique perspectives / information with other group members
Need to evaluate the feasibility/acceptability of possible solutions	Weighted multicriteria model to compare possible solutions to policy opportunities and limitations

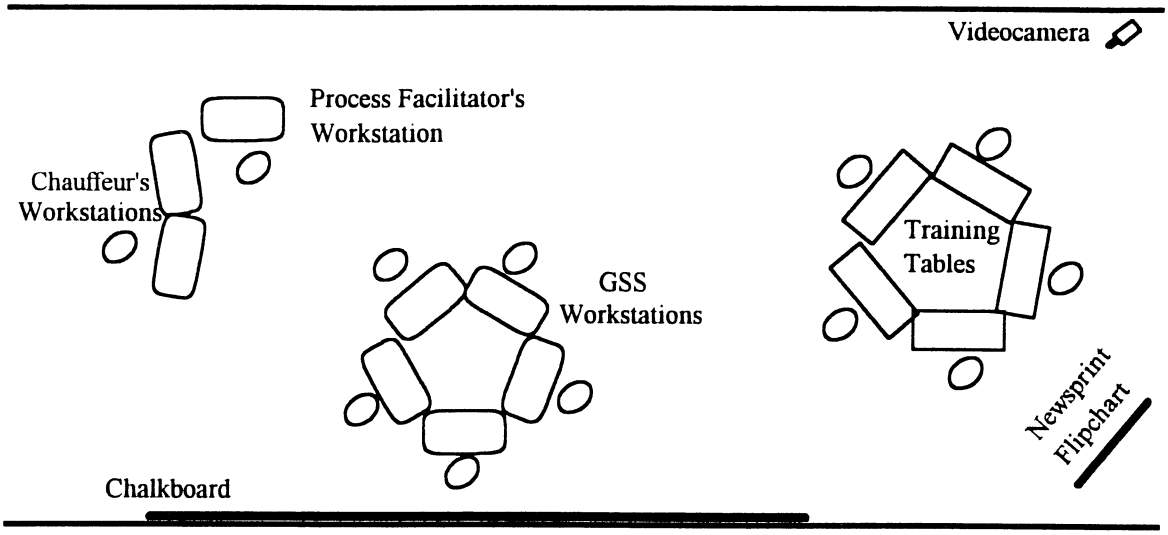
Technology

The GSS for the experiment, VisionQuest™ from Collaborative Technologies, is a commercially available software package. It was selected for its flexibility in manipulating relatively high and low levels of system-based restrictiveness. The Brainwriting, Voting, Ranking, Rating, Scoring, and Noncomputer-based (i.e., an agenda item with directions for a verbal activity such as discussion) tools were used in this experiment. Appendix G contains the meeting dialogue templates for both the high and low restrictiveness treatments. All groups were trained in how to use the GSS tools. A technical facilitator, or chauffeur, enabled and disabled certain GSS tools for the high system-based restrictiveness groups and created any tool which was requested by the low system-based restrictiveness groups.

Facilities

All experimental sessions were conducted in the Behavioral Laboratory of the Indiana University School of Business (BU317) and were videotaped with a visible, though unobtrusive camera. The room's physical layout is depicted in Figure 8. The researcher served as the system chauffeur.

Figure 8
Experimental Room Physical Layout



Subjects

The subjects were students enrolled in an introductory business school computer course (K201, The Computer in Business). They were required to earn course credit by participating in a Decision and Information Systems Department experiment or by writing a brief paper about a new technology.

The behavioral research literature contains some debate regarding the utility of students as research subjects (for an extensive discussion see Gordon, Slade, & Schmitt, 1986, 1987; Greenberg, 1987). For this research, however, the preliminary study and pilot tests demonstrated that students possessed sufficient domain knowledge, understanding, and motivation to perform the research task.

Four hundred and eighty subjects were required for the experiment. Subjects participated in five member, ad hoc groups[11]. A group size of five was selected to match

[11]The experiment did not attempt to measure nor control for students who may have known each other prior to the experiment. Given that the subjects were drawn from 32 sections of the course containing over 1,600 students during two different semesters, it is

the number of roles in the SOB task and because groups of this size have been sufficiently large enough to benefit from the parallelism and process support in GSS (Nunamaker et al., 1991). Each group participated only one time. Tangible financial incentives (e.g., gift certificates to a popular local restaurant) were offered as an additional source of subject motivation. A $20 first place gift certificate was awarded to each member of the team with the best overall decision quality while each member of the second place team received a $10 gift certificate. The control variables are summarized in Table 16.

Table 16
Controlled Variables

Controlled Variables	Operationalized Level	Method
Task	Hidden Profile	School of Business Task (Appendix B)
Heuristic	Comprehensive	A multiple-phase procedure that mandates periods of divergent and convergent thinking; tailored specifically for the task requirements of the SOB Policy Task (Appendix C)
Subjects	Undergraduate students	5 person student groups from K201
GSS/Technology	VisionQuest™	GSS tool supports predefined, restrictive or on-the-fly nonrestrictive agendas; 5 NCR 386sx/mc personal computers with color VGA displays mounted on portable workdesks (Appendix F)
Setting	Behavioral Laboratory (BU317)	5 tables arranged in a pentagon for the training; 5 computer workdesks also arranged in a pentagon for the GSS

reasonably assumed that few subjects had any substantive experience in working with the other subjects in their groups in the past or likelihood of working together in the future. These subjects had no prior exposure to this research task.

Dependent Variables

Decision Quality

The experiment assessed decision quality by scoring the groups' solutions on the two decision quality indices of the School of Business Task (Appendix E describes the decision quality assessment procedures from the SOB task manual). The first index assesses the degree to which a solution solves the problems in the case on a scale of 0 to 100. A second and separate index scores the extent to which a solution is feasible within the constraints of the case. It also uses a 0 to 100 scale. In addition to the 289 known and previously scored solutions to the SOB task, the current experiment was expected to yield a few new solutions. The solution memorandums from each group were coded by multiple judges to match the groups' solutions to the scored solutions in the task manual. Solutions which were not found in the original set of 289 were then scored by a panel of judges in the same manner as described in Appendix E. The coding procedures and interrater reliability for this process are reported in Chapter 5.

Satisfaction

Green and Taber's satisfaction instrument (1980) was used to assess user satisfaction with the process and the decision outcome (Appendix A-4). The five item satisfaction with process scale had a reliability of .93 (Cronbach's alpha) in the preliminary study. The satisfaction with the decision outcome scale, which also had five items, had a reliability of .87.

Consensus

Group consensus was assessed with multiple measures via an eight item questionnaire and open-ended questions (Appendices A-5 & A-6). The Likert scale questions sought to discern the degree of support that group members perceived for the group's decision. The open-ended questions were a redundant measure to assess consensus in a more objective different manner. The questions asked the participant to recount the problem and the solution proposed by the group and then to express what he or she thought was the real problem and the best solution. The open-ended questions were examined by trained judges for their degree of agreement across all group members. Details of this procedure are described in Chapter 5. Table 17 contains a summary of the dependent variables.

Table 17
Dependent Variables

Dependent Variable	Operationalized Measure	Measurement Method
Solution Quality	Solution Feasibility	A panel of judges evaluates each solution against each of the weighted constraints from the case to yield a quantitative score
	Solves the Problem	A panel of judges evaluates each solution for its ability to solve each of the weighted problems from the case to yield a quantitative score
Satisfaction	Process	Green & Taber process satisfaction scale; 5 questions
	Solution	Green & Taber solution satisfaction scale; 5 questions
Group Consensus	Commitment to the group's decision	Poole's method, i.e., commitment to implement the decision; 8 question scale + open-ended

EXPERIMENTAL PROCEDURE

Student subjects were recruited via class visits and electronic mail. All subjects had a course requirement to enroll in the K201 subject pool via IDEAS (Appendix J), which gathered demographic information and administered some general questionnaires for the entire K201 subject pool. Approximately 500 subjects[12] were recruited and randomly assigned (within scheduling constraints) to a group of five subjects. These groups were randomly assigned to one of the eight treatments.

The experimental procedures varied depending upon the treatment to which a group was assigned. All instructions to the groups throughout the study followed a written script (Appendix F contains the detailed script for each treatment). In general, the subjects reported to the behavioral lab at their appointed time. They were greeted by the researcher and seated at the five tables arranged in a pentagon configuration (no computers). The subjects were asked to read and sign the "Informed Consent Statement" (Appendix A-1) that described the general purpose of the experiment and noted that the sessions would be videotaped. The researcher answered any questions.

The researcher distributed the SOB task. The five roles in the case were randomly assigned to the participants. The subjects had 10 minutes to individually read the case and to respond on paper to two preliminary, open-ended question (Appendix A-2). The first asked about the problem and the second asked the subject's recommendation regarding the

---

[12]Some intentional overbooking was done to guard against the possible "no shows." If all six subjects attended, a random number was used to select one subject to work on an alternate exercise in a different room.

case. These questions were used to record each subject's initial impressions of the problem(s) and solution(s) to the case prior to interacting with the group.

All subjects received a handout introducing the heuristic, the Group Decision-Making Procedure or GDMP (Appendix C-1), and were allowed five minutes to read through the GDMP. Subjects who were in treatments with training worked through a practice problem (Appendix B-3) using the heuristic with a flip chart (no technology). Subjects who were in treatments with only introductory training did not practice using the heuristic. The researcher answered any questions regarding how to use the GDMP.

Following the introduction or training for the heuristic, the groups moved to the adjacent cluster of personal computers (PCs). Each PC was already logged into the VisionQuest software at the dialogue level. All groups received the GSS version of the GDMP (Appendix C-2) with specific GSS tools listed beside each of the heuristic's activities (e.g., generate ideas is linked to the Brainwriting tool). The process facilitator read the training instructions to the facilitated groups while the researcher did it for the nonfacilitated groups. The groups were directed to select the training exercise from the menu on their screen and then complete a series of six brief training sessions for the Brainwriting, Voting, Non-Computer Based (for verbal discussions), Ranking, Rating, and Scoring tools (see Appendix G-1 for the VisionQuest Training Dialogue). The training was designed to acquaint the subjects with the purpose for each tool and the VisionQuest keystrokes rather than a decision-making procedure. With the exception of Scoring, each of the five training exercises was independent of the others (e.g., subjects generated a list of possible summer jobs using the Brainwriting tool, then used the Ranking tool to order

their preference for Big Ten schools). The Scoring tool imported data from the Ranking and Rating tools to demonstrate the tool integration feature. The researcher paused for questions and answers after each tool.

The subjects were then directed to take a few minutes to reread the case. The researcher or facilitator directed each group member to introduce his or her role to the others. The subjects' roles and relative seating positions were recorded on the chalkboard. This process served to set the tone for the meeting and to remind the group of their varied perspectives on the case. The researcher gave the group a blank memorandum form that had been pre-addressed as a reply to the originator of the cover memo in the case. The group was instructed that they would have 55 minutes to use the GDMP to reach a group decision. The researcher would announce when there were only ten minutes remaining. The group's objectives were to use the GDMP and to decide what to write on the reply memo. These two objectives were repeated twice in the final instructions to the group. Each group received only one reply memo. The researcher explained the responsibilities and limitations of his role (and that of the facilitator for treatments with facilitation). Both the researcher and the facilitator refrained from answering any questions about the case or the quality of the group's solution. The facilitator, however, did restate the goal of each step in the GDMP when the group initiated a new activity (see Appendix D for a description of the facilitator's role).

The groups began to solve the case and received process restrictiveness from the various sources associated with each treatment (see Appendices G-2 & G-3 for the VisionQuest Dialogues). The researcher served as the system chauffeur for all conditions

and answered questions related to using the GSS. The chauffeur for VisionQuest makes the GSS tools available (i.e., activating requested tools for low system-based restrictiveness groups and activating the next tool for high system-based restrictiveness groups) and imports data between tools at the group's direction. He did not give any process advice or guidance.

After the group had completed its reply memo (Appendix A-3), all group members used IDEAS to answer the satisfaction and consensus scales (Appendix A-4). The subjects then returned to the training tables to answer open-ended questions for the consensus measure (Appendix A-5). Upon completion of all instruments by all group members, the subjects were debriefed, thanked for participating in the experiment, and dismissed. The entire experimental session usually lasted between 135 and 150 minutes.

PILOT STUDY

The purpose of the pilot study was to assess procedures and instruments for the actual experiment. At least two groups for each experimental treatment participated in the pilot study. Experience with these groups led to several minor revisions of the experimental script and procedures (e.g., clarification of instructions, corrections on experimental materials). The small number of groups in each treatment precluded any useful statistical analysis, but the researcher did observe considerable differences in the decision processes among groups in different treatments. Briefly, groups which had high system-based restrictiveness appeared to follow the heuristic's sequences and activities with less effort than other groups. This is likely due to the heuristic's activities and

sequences being displayed on their computer screens. Groups with low system restrictiveness often had difficulty in coordinating what to do next. Groups with user training in how to use the heuristic demonstrated a much better understanding of what the group should be doing at each step, though they often began doing other things after talking about the goal of the current step.

The pilot study demonstrated that the procedures, instructions to subjects, and manipulation of the process restrictiveness sources appeared to be operating as planned. Execution of the experiment proceeded after the pilot study. Since there were no procedural differences between the last six pilot groups and the groups in the regular experiment, the last six pilot groups were retained in the data analysis.

SUMMARY

This chapter has described the research approach and technique used to assess the theory presented in Chapter 3. The experimental treatments were described along with all control and dependent variables. The chapter described the specific procedures used to collect the data and reported on the pilot study. The next chapter, Chapter 5, will describe the procedures used to analyze the data and report the results of the analyses.

CHAPTER 5

ANALYTICAL PROCEDURES AND RESULTS

This chapter describes the analytical procedures used to evaluate the experimental data and reports the results from these analyses. The chapter begins by describing the characteristics of the subject population. This is followed by a description of the manipulation checks and the assumptions of the statistical methods. The results of the statistical analyses are then presented in the next two sections. The first analysis section describes the data coding procedures and the a priori planned comparisons used to test the hypotheses. It is important to note the the hypotheses only addressed a portion of the research design. Therefore, a second analysis section reports on an evaluation of the full research design using analysis of variance techniques and post hoc pairwise comparisons. Since the post hoc analysis revealed some interactions between process restrictiveness sources, any conclusions drawn from this research must also consider the post hoc analysis. Chapter 6, Discussion, will integrate and interpret the two analyses. Chapter 5 concludes with a summary of the results.

DESCRIPTIVE DATA ABOUT GROUPS AND SUBJECTS

A total of 480 subjects participated in the experiment. There were twelve groups randomly assigned to each of the eight treatment conditions for a total of ninety-six ad hoc

groups. All groups had five members, and group history (i.e., knowing other group members outside of the experiment) was neither measured nor controlled. All subjects were enrolled in K201, The Computer in Business, during the First or Second Semester of the 1992-93 academic year. More than 1,600 students enrolled in the subject pool and were randomly recruited via electronic mail[13] announcements to participate in a Decision and Information Systems Department experiment. Table 18 summarizes the subjects' demographic information by treatment.

[13]The regular use of electronic mail was a course requirement.

Table 18
Subject Demographic Characteristics by Treatment

	Treatment							
Attribute*	**RB**	**T**	**F**	**S**	**TF**	**TS**	**FS**	**NRB**
Academic Standing								
Freshman	18	12	21	27	23	20	20	16
Sophomore	35	34	27	27	25	30	29	28
Junior	5	6	5	2	7	3	10	8
Senior	2	8	6	3	5	2	1	3
Gender								
Female	23	28	29	28	30	19	24	25
Male	38	32	31	31	30	36	36	30
Age	19.3	19.4	19.7	19.9	19.6	19.7	19.4	19.4
Business Major								
Yes	52	46	41	50	49	48	51	45
No	8	14	19	10	11	7	9	10

*Some subjects did not answer all demographic questions

Key: RB=restrictive baseline; T=training; F=facilitation; S=system; TF=training+facilitation; TS=training+system; FS=facilitation+system; NRB=nonrestrictive baseline

Separate chi-square tests were conducted for academic standing, gender, and major to check for possible demographic differences among the treatment groups. The results of these tests are summarized in Table 19 and reveal no demographic differences between the treatment groups (i.e., the $\mathbf{X}^2$ value for the test is less than the critical χ^2 value for the distribution).

Table 19
Chi-square Test for Treatment Independence

Variable	X^2	α, d.f.	χ^2
Academic Standing	28.087	.05, 21	32.670
Gender	5.205	.05, 7	14.070
Major	10.618	.05, 7	14.070

STATISTICAL METHOD

Manipulation Checks

Manipulation checks are usually included in experiments to assess the adequacy of the treatment manipulations. The first manipulation in this experiment was training. Half of the groups received training in using the group decision making procedure. The trained groups received an introductory overview of the heuristic and its general goals; they practiced using its activities, sequences, and philosophy on a practice problem; and the researcher answered any questions they had about how to use it. The other half of the groups only received a brief introduction to the procedure and were given time to read it on their own. Since the sufficiency of the training would be difficult to assess directly, a surrogate assessment which evaluated the *behaviors* of trained and untrained groups was employed. The GSS transcripts from the nonrestrictive baseline (NRB) treatment (no training) and the training only (T) treatment were compared. These were the only two treatments which allowed isolation of training effects without complications from the other sources of process restrictiveness. The researcher reviewed each group's GSS transcript and separated them into two sets: one which generally did follow the group decision making procedure (GDMP) and one which did not. The source of the transcripts

was not marked, and thus the researcher did not know which transcript belonged to which treatment group during the sorting process. The criteria for sorting the transcripts were based on the sequence of tool selection and the types of comments (e.g., problem statements, solutions, facts from the case) in the first idea generating exercise. Sequence (i.e., defining the problem before generating solutions) is a key structure in the group decision making procedure and is believed to be a reasonable assessment of the group's attempt to act on their understanding of the group decision making procedure. The researcher assigned 13 transcripts to the trained pile, nine to the untrained pile, and could not make an adequate determination for two of the transcripts. Eight of the groups which were actually in the trained treatment were correctly classified and three were not. The three incorrect classifications were made because those groups spent the early stages of the group process by generating possible solutions rather than problem statements. Six groups which were actually in the NRB condition were correctly classified and five were assigned to the wrong pile. Both the T and NRB groups experienced low system-based restrictiveness and were not facilitated. Both were free to fully use, partially use, or completely abandon the GDMP. The only difference was training. The results of this manipulation check indicate that trained groups were more likely to follow the GDMP than untrained groups -- eight out of eleven trained groups appeared to follow it while only five out of eleven untrained groups did.

The second treatment involved the presence or absence of a facilitator. Since the physical presence or absence of a facilitator can be taken at face value, the manipulation concern becomes the consistency of behavior from the facilitator for all facilitated groups.

Since facilitation is by its very nature a fluid and responsive process to the needs of the group, the facilitator was given very specific instructions (Appendix D) about how and when to interject process restrictive comments. A single facilitator was used for all groups and the researcher monitored the consistency of his comments to the groups.

The last manipulation was the level of system-based restrictiveness. The sufficiency of this treatment is also self-evident. Group members in the low system restrictiveness condition were free to request any GSS tool in any sequence. They began working on the task with a blank VisionQuest agenda screen (see Appendix G-2) listing no GSS tools and were told to request any tool from the chauffeur when they wanted to use it. Group members in the high system restrictiveness condition had a VisionQuest agenda on their computer screens which sequentially listed all steps in the group decision making procedure (see Appendix G-1) with only one item active at a time. They were not allowed to request additional tools beyond asking that the next tool on the list be activated. The system did not allow them to skip to future or previous steps[14].

Statistical Assumptions

A priori planned comparisons, analysis of variance (ANOVA), and multiple analysis of variance (MANOVA) were used to assess the experimental data. Klockars and Sax (1986) advocate the use of a priori planned comparisons (as specified by formal hypotheses) when investigating hypothesized differences between a small number of means. The procedure provides a more powerful test than post hoc pairwise methods

---

[14] VisionQuest did allow group members to view the results of any previous activity (e.g., a list of ideas or number of votes), but they could only enter ideas or vote in the single tool which had been activated.

(e.g., Tukey or Scheffé method) for comparing specific treatment means. It also allows for contrasts between linear combinations of means (e.g., RB treatment mean alone compared to the combination of the T, F, and NRB treatment means). Increased power (i.e., protection from Type II error) is important when theory has guided the a priori selection of comparisons as opposed to the need for Type I error protection when post hoc results are guiding the analysis. When the number of planned comparisons is at least one less than the number of treatment means, the per comparison error rate should be set at α=.05 (Klockars & Sax, 1986, p. 38; Lindman, 1990, p. 75). Planned comparisons are specified by positively weighting one or more means and comparing them to one or more negatively weighted means. The sum of the weights must equal zero. Planned comparisons have the same general assumptions as the ANOVA model (described below) and the critical value can be expressed as either a t or F value where $t = \sqrt{F}$. All three hypotheses tests for each dependent variable were conducted using the planned comparisons technique.

The assumptions of ANOVA require that all observations are independent of other observations, the variance within each treatment is homogeneous, and the observations within each treatment have a normal distribution (Welkowitz, Ewen & Cohen, 1971). While the F test is generally robust to violations of the normality and homogeneity of variance assumptions when sample sizes are equal (Neter & Wasserman, 1974), Lindman (1990) notes that a violation of the equal variances assumption can be problematic for planned comparisons. Lindman advocates using the separate variance estimate in place of the pooled variance estimate and adjusting the degrees of freedom when treatments with

unequal variances are compared[15].

In addition to the ANOVA assumptions, MANOVA also requires that all dependent variables have a multivariate normal distribution within each treatment. All three statistical procedures assume that the dependent variable(s) are interval and the independent variables are nominal. The nominal variables in this experiment were the eight treatment conditions created by the two levels for each of the three independent sources of process restrictiveness: Training (no, yes), facilitation (no, yes), and system restrictiveness (low, high). The resulting model is a 2 x 2 x 2 full factorial design. ANOVA and MANOVA will be used for post hoc analyses. The dependent variables along with verification of the assumptions are presented below.

METHODS AND RESULTS OF PLANNED STATISTICAL ANALYSIS

This section describes the data coding procedures and testing of the a priori planned comparisons specified by the hypotheses. Post hoc statistical analyses using the full ANOVA and MANOVA models will be presented in a later section. Unless otherwise noted, higher values are associated with more favorable scores for all dependent variables.

Decision Quality

Coding and Scoring Procedures

As was described in Chapter 4, the School of Business (SOB) Policy Task had 289 known, scored solutions prior to this experiment (Wheeler & Mennecke, 1992). Two

[15] The adjusted degrees of freedom are based only on the variances and sample sizes of the means which are being compared (see Lindman, 1990, p. 70 for the formulas) rather than the full set of means used for the pooled variance method. SPSS provides both the pooled and separate variance results as part of the standard planned comparisons test.

coders, who were blind to both the hypotheses and treatments of this experiment, independently read each group's solution memo and matched the group's solution(s) to the known list. Any new solutions were recorded on a separate list. The coders were instructed to code for "actionable solutions." For example, the following text contains two actionable solutions: "The school should hire more junior professors to increase the quality of instruction and raise entrance requirements to reduce the number of students." Hiring more junior professors and raising the admission requirements were coded as solutions, whereas the *possible* outcomes of these actions might be to increase the quality of instruction and to reduce the number of students. The solution memos contained an average of 2.125 solutions. The two coders had perfect agreement for 48 of the groups on both the *number of actionable solutions* and *which solutions matched the existing list*. The two coders met and reconciled their coding discrepancies for the other 48 groups. Most of these discrepancies were due to initial disagreement on the number of actionable solutions on a memo rather than disagreement in matching the existing solutions to a group's recommendations. This process yielded 37 new solutions.

The new solutions were scored in the same manner as the original set of 289 (see Appendix E for a description of the multi-criteria scoring procedures). All new solutions were scored by at least three raters, and all raters were members of the team which scored the original set. Inter-rater reliability for the entire set of solutions to the SOB case was calculated using Ebel's (1951) intraclass correlation statistic for both the *solves the problem* and *feasibility* indices. Reliability was .753 and .863, respectively. These relatively high reliabilities suggest that the raters were largely in agreement in their

assessment of decision quality. Appendix B-2 contains the complete list of scored solutions, and Appendix B-3 lists the frequency of solutions which were selected for this experiment. Solution key numbers larger than 289 were added from this experiment.

The number of actionable solutions on the solution memos ranged from one to six, which complicated the issue of determining decision quality for each group. Two approaches were employed to address this issue. The first approach was to average the scores (i.e., both the solves the problem and feasibility scores) across a group's multiple solutions. This approach, however, may mask the value of any high quality solutions since a group may have proposed one high quality solution along with two low quality ones. An alternative approach is to analyze the single best solution (i.e., the solution with the highest solves the problem and feasibility score) from each group. The dependent variables for the first approach are referred to as the *average solves the problem* and *average feasibility* scores and the variables for the second approach are referred to as the *best solves the problem* and *best feasibility* scores.

Hypotheses Testing

All cells had equal sample sizes for the decision quality analysis and were assessed at the group level. Kolmogorov-Smirnov tests of normality within each treatment were not significant for any of the four dependent variables, thus satisfying the normality assumption. A Bartlett-Box F test revealed unequal variances among the treatments for the best feasibility score (F=2.472, p=.016 with a maximum / minimum variance ratio=9.657). The variances for average solves the problem, average feasibility, and best solves the problem score were homogeneous. In accordance with Lindman (1990), the

separate variance estimate was used to interpret the best feasibility score. Otherwise, the statistical assumptions were deemed satisfied. Table 20 presents the treatment means and standard deviations for the four decision quality dependent variables.

Table 20
Decision Quality Means and Standard Deviations

Dependent Variable:	Avg. Problem		Avg. Feasibility		Best Problem		Best Feasibility	
Treatment (n=12)	**Mean**	**Std. Dev**	**Mean**	**Std. Dev**	**Mean**	**Std. Dev**	**Mean**	**Std. Dev**
Restrictive Baseline (RB)	75.708	14.162	73.600	14.300	78.750	13.060	77.750	13.949
Training (T)	70.625	9.000	68.900	12.338	74.333	10.316	73.417	8.328
Facilitation (F)	75.683	7.298	79.183	8.719	83.917	9.995	90.167	5.982
System (S)	68.483	8.337	68.450	13.383	74.000	9.789	76.750	11.986
Training + Facilitation (TF)	73.250	8.382	73.667	12.565	74.500	8.339	76.833	12.364
Training + System (TS)	71.892	8.586	72.158	8.829	76.250	5.987	82.583	8.480
Facilitation + System (FS)	74.658	8.096	71.042	16.514	80.333	11.657	77.167	18.591
Non-Restrictive Baseline (NRB)	73.683	10.135	74.208	10.143	80.500	10.808	81.083	11.712

Three hypotheses addressed decision quality. Hypothesis 1a posited that groups in the RB treatment would have higher decision quality than groups in the T, F, S, or NRB treatments:

> H1a: Groups with user training, facilitation, and system-based process restrictiveness will have higher decision quality than will groups which experienced any single source (or an absence) of process restrictiveness.

The planned comparison weights to test this hypothesis are presented in Table 21 along with the statistical results. Since the significance of t is greater than .05 for all four measures of decision quality, hypothesis 1a is not supported.

Table 21
H1a Planned Comparisons for Decision Quality

	Contrasts Among Treatments										Sig.
Dependent Variable	**RB**	**T**	**F**	**S**	**TF**	**TS**	**FS**	**NRB**	***t* value**	**d.f.**	**of *t***
Average solves the problem	4	-1	-1	-1	0	0	0	-1	1.175	88	0.243
Average feasibility	4	-1	-1	-1	0	0	0	-1	0.229	88	0.819
Best solves the problem	4	-1	-1	-1	0	0	0	-1	0.171	88	0.865
Best feasibility	4	-1	-1	-1	0	0	0	-1	-0.610	13.8[1]	0.503

[1] The degrees of freedom for the *best feasibility* score are based on separate variance estimates.

Hypothesis 1b predicted that groups in the F treatment would have higher decision quality than groups in the T, S, or NRB treatments:

> H1b: Groups with facilitator-based process restrictiveness will have higher decision quality than will groups which experienced any other single source (or an absence) of process restrictiveness.

Table 22 presents the planned comparison weights and statistical results. Both the best solves the problem and best feasibility scores are significant at the .05 level along with the average feasibility score. These three results, along with an inspection of the treatment means, provide support for hypothesis 1b that facilitation is a more effective means of enhancing decision quality than any other single source or absence of process restrictiveness. Thus, hypothesis 1b is supported.

Table 22
H1b Planned Comparisons for Decision Quality

	Contrasts Among Treatments										Sig.
Dependent Variable	**RB**	**T**	**F**	**S**	**TF**	**TS**	**FS**	**NRB**	***t* value**	**d.f.**	**of *t***
Average solves the problem	0	-1	3	-1	0	0	0	-1	1.507	88	0.136
Average feasibility	0	-1	3	-1	0	0	0	-1	2.102	88	0.038
Best solves the problem	0	-1	3	-1	0	0	0	-1	2.490	88	0.027
Best feasibility	0	-1	3	-1	0	0	0	-1	5.244	33.6	0.000

Hypothesis 1c expected groups in the NRB condition to have lower decision quality than groups in the T, F, or S treatments:

> H1c: Groups with no source of process restrictiveness will have lower decision quality than will groups which experience any single source of process restrictiveness.

Table 23 presents the planned comparison weights and results.

Table 23
H1c Planned Comparisons for Decision Quality

	Contrasts Among Treatments										Sig.
Dependent Variable	**RB**	**T**	**F**	**S**	**TF**	**TS**	**FS**	**NRB**	***t* value**	**d.f.**	**of *t***
Average solves the problem	0	-1	-1	-1	0	0	0	3	0.661	88	0.051
Average feasibility	0	-1	-1	-1	0	0	0	3	0.493	88	0.623
Best solves the problem	0	-1	-1	-1	0	0	0	3	0.908	88	0.367
Best feasibility	0	-1	-1	-1	0	0	0	3	0.262	14.5	0.796

Similar to the results for hypothesis 1a, none of the four measures of decision quality provide statistical support for hypothesis 1c, though the average solves the problem measure approaches significance (p=.051). Hypothesis 1c is not supported.

Satisfaction with the Process and Outcome

Scale Assessment

Green and Taber's (1980) process and outcome satisfaction scales were used to assess each individual group member's perceived satisfaction. Appendix K-1 contains the results of a factor analysis for the scales. Each scale contained five items which were answered on a five point, Likert-type response scale. The process and outcome satisfaction scales had reliabilities of .9011 and .8753, respectively. All cells had equal sample sizes and were analyzed at the individual level. The data conformed to the

assumptions of normality and homogeneity of variance. The means and standard deviations for the two scales are reported in Table 24.

Table 24
Means and Standard Deviations for Satisfaction Scales

Dependent Variable:	Process		Outcome	
Treatment (n=60)	**Mean**	**Std. Dev**	**Mean**	**Std. Dev**
Restrictive Baseline (RB)	3.513	0.725	2.320	0.850
Training (T)	3.573	0.722	2.503	0.910
Facilitation (F)	3.533	0.785	2.683	0.803
System (S)	3.823	0.508	2.213	0.807
Training + Facilitation (TF)	3.687	0.586	2.160	0.784
Training + System (TS)	3.660	0.679	2.070	0.667
Facilitation + System (FS)	3.827	0.636	2.323	0.828
Non-Restrictive Baseline (NRB)	3.733	0.665	2.157	0.691

Hypothesis Testing

Process Satisfaction

Three hypotheses made predictions about perceived process satisfaction. Hypothesis 2a expected that group members in the RB treatment would be less satisfied with the process than groups in the T, F, S, or NRB treatments:

> H2a: Group members with user training, facilitation, and system-based process restrictiveness will be less satisfied with the process than will group members who experience any single source (or an absence) of process restrictiveness.

Table 25 reports the comparison weights and statistics for all three process satisfaction hypotheses.

Table 25
Planned Comparisons for Process Satisfaction

	Contrasts Among Treatments										Sig.
Hypothesis	**RB**	**T**	**F**	**S**	**TF**	**TS**	**FS**	**NRB**	***t* value**	**d.f.**	**of *t***
2a: RB > T ,F, S ,NRB	4	-1	-1	-1	0	0	0	-1	-1.581	472	0.115
2b: F > T, S, NRB	0	-1	3	-1	0	0	0	-1	-1.774	472	0.077
2c: S < T, F, NRB	0	-1	-1	3	0	0	0	-1	2.108	472	0.036

Hypothesis 2a is not supported at the .05 level.

Hypothesis 2b posited that group members in the F treatment would report more process satisfaction than group members in the T, S, or NRB treatments:

> H2b: Group members with facilitator-based process restrictiveness will be more satisfied with the process than will group members who experience any other single source (or an absence) of process restrictiveness.

The second row in Table 25 reveals that hypothesis 2b is also not supported at the .05 level. Since p=.077 does approach statistical significance, it is interesting to observe that the pattern of means would have contradicted the hypothesis had the t value been significant.

The final hypothesis for process satisfaction expected that group members in the S treatment would be less satisfied with the process than group members in the T, F, or NRB treatments:

> H2c: Group members with only system-based process restrictiveness will be less satisfied with the process than will group members who experience any other single source (or an absence) of process restrictiveness.

Table 25 reports a significant effect for hypothesis 2c. Inspection of the means in Table 24, however, reveals that group members in the S treatment reported *more* process satisfaction than the other treatments. Thus, hypothesis 2c is contradicted.

Outcome Satisfaction

Three hypotheses also made predictions about treatment differences in perceived outcome satisfaction. Similar to hypothesis 2a, hypothesis 3a expected group members in the RB treatment to express more satisfaction with the outcome than group members in the T, F, S, or NRB treatments:

> H3a: Group members with user training, facilitation, and system-based process restrictiveness will be less satisfied with the solution than will group members who experience any single source (or an absence) of process restrictiveness.

Table 26
Planned Comparisons for Outcome Satisfaction

	Contrasts Among Treatments										Sig.
Hypothesis	**RB**	**T**	**F**	**S**	**TF**	**TS**	**FS**	**NRB**	***t* value**	**d.f.**	**of *t***
3a: RB > T ,F, S ,NRB	4	-1	-1	-1	0	0	0	-1	-0.602	472	0.547
3b: F > T, S, NRB	0	-1	3	-1	0	0	0	-1	3.306	472	0.001
3c: S < T, F, NRB	0	-1	-1	3	0	0	0	-1	-1.976	472	0.049

Table 26 reveals that hypothesis 3a is not supported at the .05 level.

Hypothesis 3b expected group members in the F treatment to be more satisfied with the outcome than groups in the T, S, or NRB treatments:

> H3b: Group members with facilitator-based process restrictiveness will be more satisfied with the solution than will group members who experience any other single source (or an absence) of process restrictiveness.

The large *t* value for hypothesis 3b in Table 26 provides strong support for the hypothesis. The pattern of means from Table 24 confirms that the F treatment had the largest mean of the four treatments, and thus hypothesis 3b is supported.

The final outcome satisfaction hypothesis expected group members in the S condition to report lower outcome satisfaction than members in the T, F, or NRB treatments:

> H3c: Group members with only system-based process restrictiveness will be less satisfied with the solution than will group members who experience any other single source of process restrictiveness.

The third row in Table 26 provides support for this hypothesis. An inspection of the means reveals that the S treatment is much lower than the F or T treatments, but it is slightly larger than the NRB treatment. Based on the size of the *t* value and the magnitude of differences between the means, hypothesis 3c is supported.

Consensus

Scale Assessment and Coding Procedures

Consensus was assessed from two perspectives via two very different methods. The first method used an eight question, Likert-type scale to measure the subject's perceived consensus or agreement with the group's solution. This scale is analyzed at the individual level since it is a measure of an individual subject's perceptions. The individual level was preferred to the approach of averaging the scores within each group because averaging tends to mask the real individual differences which are the primary interest of the research hypotheses. The second method used coders to classify the degree of agreement among statements written by each group's five members and was conducted at the group level. The results of both procedures are described below.

The eight perceptual questions were included in two separate factor analyses. The first included only the consensus questions by themselves and the second included them

with the ten questions from the Green and Tabor satisfaction scales. The results of these analyses are included in Appendices K-2 and K-3. In both analyses the consensus questions loaded quite high on a single factor. One question was dropped to improve the scale's reliability to .8982. Additionally, some outcome satisfaction questions had moderate secondary loadings (e.g., .3 to .46) on the consensus scale. A Pearson correlation revealed that the consensus and outcome satisfaction scales were highly correlated (r=.748, p=.000) though the planned comparisons tests which assessed similar hypotheses on both measures yielded different results (see below).

The second method for assessing consensus involved coding the open-ended solution question which was part of the final questionnaire. The question asked the subject to write what he or she thought was the best solution to the case. Two coders, who were blind to the hypotheses and treatments of this experiment, each coded half of the groups. The coding process began by listing each actionable solution from one of the subjects in the group. The questionnaire from the next subject was then examined for actionable solutions. If a solution matched one of the previously listed solutions, an additional tally mark was placed by the solution. This effectively counted the number of subjects who answered the question by advocating that particular solution. Otherwise, any new actionable solutions were added to the list. The process was continued for the responses from the remaining three group members. A new list was compiled for each group. This process yielded three measures. The *number of solutions* is the total number unique, actionable ideas listed by all group members which can vary from zero to an undefined upper limit. A <u>low</u> number of ideas would usually indicate more agreement

among the group members. The *maximum votes for one idea* ranges from one (no agreement) to five (perfect agreement) and is the highest number of votes supporting any single, actionable solution. The *agreement* measure takes the total number of votes cast for all solutions and divides it by the number of solutions listed. It ranges from one (complete lack of agreement across all solutions) to five (complete agreement on all solutions). A t-test of the means between the two coders for each of the three measures found no statistically significant differences.

A Pearson correlation test was conducted to assess the relationship between the perceptual consensus scale and each of the three objective measures from the subjects' written responses. Interestingly, all correlations were less than .1 and none were statistically significant. Assuming that both measures are valid means of assessment, this suggests that perceived consensus is likely different from the true consensus in the group.

Hypothesis Testing

Table 27 reports the means and standard deviations for all consensus measures. This table differs from the preceding means tables in that it contains both individual level means with some missing data (i.e., unequal cell sizes) for the perceptual scale and group level means for the coded measures. The assumptions of normality and homogeneity of variance were deemed to be satisfied for all measures except the agreement variable. Agreement had a significant Bartlett-Box F test (F=2.218, p=.030 with a maximum / minimum variance ratio=4.915). Accordingly, the separate variance estimate was used to interpret the planned comparisons for this variable.

Table 27
Means and Standard Deviations for Consensus Variables

Dependent Variable →		Perceptual Consensus Scale		Number of Solutions		Maximum Votes on One Idea		Agreement: #Votes / #Sol	
Treatment (n=12)	**n**[1]	**(ind) Mean**	**Std. Dev**	**(grp) Mean**	**Std. Dev**	**(grp) Mean**	**Std. Dev**	**(grp) Mean**	**Std. Dev**
Restrictive Baseline (RB)	34	36.824	7.763	5.167	1.801	2.417	0.900	1.567	0.481
Training (T)	35	38.000	6.589	5.333	2.015	2.333	0.985	1.448	0.449
Facilitation (F)	31	38.073	7.932	5.083	1.730	3.000	1.045	1.690	0.362
System (S)	35	40.771	4.015	5.000	1.477	3.167	1.115	1.639	0.494
Training + Facilitation (TF)	60	39.083	5.685	3.909	1.640	3.364	1.120	1.900	0.652
Training + System (TS)	60	37.450	6.071	4.583	1.564	3.000	1.279	1.909	1.038
Facilitation + System (FS)	60	38.850	6.759	4.000	1.128	2.917	0.996	1.740	0.652
Non-Restrictive Baseline (NRB)	60	38.783	5.305	4.333	2.103	3.417	1.311	2.315	1.359

[1] The perceptual consensus scale was not administered to the pilot test groups. Since there were no procedural differences regarding the collection of data from the pilot and the later groups, the pilot groups were subsequently included in the experimental data.

Hypothesis 4a contends that group members in the RB treatment would have higher consensus than group members in the T, F, S, or NRB treatments:

> H4a: Group members with user training, facilitation, and system-based process restrictiveness will attain higher group consensus than will group members who experience any single source (or an absence) of process restrictiveness.

Table 28 contains the planned comparison weights and statistical results for testing the hypothesis. These results do not provide any support for hypothesis 4a.

Table 28
H4a Planned Comparisons for Consensus Variables

	Contrasts Among Treatments										Sig.
Dependent Variable	**RB**	**T**	**F**	**S**	**TF**	**TS**	**FS**	**NRB**	***t* value**	**d.f.**	**of *t***
Consensus scale	4	-1	-1	-1	0	0	0	-1	-1.754	377	0.080
Number of solutions	4	-1	-1	-1	0	0	0	-1	0.416	87	0.679
Maximum votes for one idea	4	-1	-1	-1	0	0	0	-1	-1.582	87	0.117
Agreement	4	-1	-1	-1	0	0	0	-1	-1.155	23.9	0.260

Hypothesis 4b expected group members in the F treatment to have higher consensus than group members in the T, S, or NRB treatments:

> H4b: Group members with facilitator-based process restrictiveness will attain higher group consensus than will group members who experience any other single source (or an absence) of process restrictiveness.

Table 29 contains the comparison weights and statistical results. Hypothesis H4b is also not supported.

Table 29
H4b Planned Comparisons for Consensus Variables

	Contrasts Among Treatments										Sig.
Dependent Variable	**RB**	**T**	**F**	**S**	**TF**	**TS**	**FS**	**NRB**	***t* value**	**d.f.**	**of *t***
Consensus scale	0	-1	3	-1	0	0	0	-1	-0.977	377	0.329
Number of solutions	0	-1	3	-1	0	0	0	-1	0.342	87	0.733
Maximum votes for one idea	0	-1	3	-1	0	0	0	-1	0.076	87	0.940
Agreement	0	-1	3	-1	0	0	0	-1	-0.619	23.9	0.541

The final hypothesis expected that group members in the S treatment would have lower consensus than group members in the T, F, and NRB treatments:

> H4c: Group members with only system-based process restrictiveness will have lower group consensus than will group members who experience any other single source of process restrictiveness.

Table 30 presents the contrasts and statistical results for testing hypothesis 4c. The perceptual scale provides support for the hypothesis. An inspection of the means reveals that group members in the S treatment reported higher consensus than members in any other treatment. The more objective measures based on how the group members responded to the open-ended question, however, do not support the hypothesis. This pattern of data suggests that the S treatment may have led to higher perceptions of consensus than were actually present in the group. In any case, hypothesis 4c is not supported.

Table 30
H4c Planned Comparisons for Consensus Variables

	Contrasts Among Treatments										Sig.
Dependent Variable	**RB**	**T**	**F**	**S**	**TF**	**TS**	**FS**	**NRB**	***t* value**	**d.f.**	**of *t***
Consensus scale	0	-1	-1	3	0	0	0	-1	2.071	377	0.039
Number of solutions	0	-1	-1	3	0	0	0	-1	0.342	87	0.733
Maximum votes for one idea	0	-1	-1	3	0	0	0	-1	0.076	87	0.940
Agreement	0	-1	-1	3	0	0	0	-1	-0.089	25.4	0.383

Summary of Planned Statistical Analysis

Table 31 summarizes the support for each of the research hypotheses. Predictions regarding the RB condition were not supported for any of the dependent measures. Facilitation alone did yield higher quality decisions and higher levels of outcome satisfaction than did other single sources (or an absence) of process restrictiveness. Subjects in the S treatment reported higher levels of process satisfaction, the opposite of the hypothesis, and lower levels of outcome satisfaction than other treatment group members. A more detailed discussion of these results is contained in Chapter 6. The next

section presents the post hoc analysis of the full research model including all combination treatments.

Table 31
Summary of Planned Hypothesis Testing

Dependent Variable	Hypothesis	Support
Decision Quality	H1a: RB > T, F, S, NRB	Not supported
	H1b: F > T, S, NRB	Supported
	H1c: NRB < T, F, S	Not supported
Process Satisfaction	H2a: RB < T, F, S, NRB	Not supported
	H2b: F > T, S, NRB	Not supported
	H2c: S < T, F, NRB	Not supported ,Contradicted
Outcome Satisfaction	H3a: RB > T, F, S, NRB	Not supported
	H3b: F > T, S, NRB	Supported
	H3c: S < T, F, NRB	Supported
Consensus	H4a: RB > T, F, S, NRB	Not supported
	H4b: F > T, S, NRB	Not supported
	H4c: S < T, F, NRB	Not supported

METHODS AND RESULTS OF POST HOC STATISTICAL ANALYSIS

The purpose of the post hoc analysis was to explore possible relationships in the 2 x 2 x 2 factorial design. The analyses were conducted as an *exhaustive comparison* between all factors, factor levels, and mean combinations as opposed to an exploration guided by the significant results in the data. While α=.05 will be used to assess statistical significance, this section will also note any effect where p is less than or equal to .1. Statistically significant interactions between factors will be interpreted by using the Duncan method for comparing means. Klockars and Sax (1986) note that requiring a

significant treatment effect before using the Duncan test will effectively control the experimentwise error rate to the selected level of α=.05[16]. The section is organized by dependent variable.

Decision Quality

The four measures of decision quality -- average solves the problem, average feasibility, best solves the problem, and best feasibility -- were each included in four separate 2 x 2 x 2 ANOVA models. The results of these ANOVAs with factor and cell level means are presented in Tables 32 to 39 The only statistically significant result is a training by system effect ($F[1,88]=7.837$, $p=.006$) for the best feasibility score. This same effect at the α=.1 level and this same pattern of means (i.e., the direction and magnitude of the relationships between the treatment means) are also present for the average feasibility ($F[1,88]=2.866$, $p=.094$) and the best solves the problem ($F[1,88]=3.814$, $p=.054$) scores. For all three variables, untrained groups using a low restrictive GSS outperformed either single source of restrictiveness (i.e., activating either training alone or high system-based restrictiveness alone). The means were not statistically different from simultaneously activating both the training and system sources of process restrictiveness. The training by system effect was not influenced by the presence or absence of facilitation. Other interesting effects for decision quality at the α=.1 level include a main effect for facilitated groups scoring higher than nonfacilitated groups for the average solves the problem score ($F[1,88]=3.578$, $p=.062$); untrained groups outperforming trained groups for the best

[16]In the absence of requiring a significant treatment effect before using the Duncan test, the true experimentwise error rate becomes inflated as the number of comparisons increases.

solves the problem score ($F[1,88]=3.214$, $p=.076$); and an interaction between facilitation and system for the best feasibility score ($F[1,88]=2.984$, $p=.088$) although the Duncan test did not reveal any differences between the four cell means.

The training by system interaction is the only effect with consistent statistical support and a consistent pattern of means across the four decision quality measures. The lack of consistency across the four measures for the other effects casts serious doubt on their validity.

Table 32
Average Solves the Problem ANOVA Results

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	331.447	3	110.482	1.233	.302
TRAIN	1.602	1	1.602	.018	.894
FACIL	320.470	1	320.470	3.578	.062
SYSTEM	9.375	1	9.375	.105	.747
2-Way Interactions	196.212	3	65.404	.730	.537
TRAIN FACIL	4.507	1	4.507	.050	.823
TRAIN SYSTEM	148.504	1	148.504	1.658	.201
FACIL SYSTEM	43.202	1	43.202	.482	.489
3-Way Interactions	13.350	1	13.350	.149	.700
TRAIN FACIL SYSTEM	13.350	1	13.350	.149	.700
Explained	541.010	7	77.287	.863	.539
Residual	7882.070	88	89.569		
Total	8423.080	95	88.664		

Table 33
Average Feasibility ANOVA Results

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	487.796	3	162.599	1.063	.369
TRAIN	31.168	1	31.168	.204	.653
FACIL	284.626	1	284.626	1.861	.176
SYSTEM	172.003	1	172.003	1.125	.292
2-Way Interactions	489.833	3	163.278	1.068	.367
TRAIN FACIL	2.768	1	2.768	.018	.893
TRAIN SYSTEM	438.188	1	438.188	2.866	.094
FACIL SYSTEM	48.878	1	48.878	.320	.573
3-Way Interactions	1.330	1	1.330	.009	.926
TRAIN FACIL SYSTEM	1.330	1	1.330	.009	.926
Explained	978.959	7	139.851	.915	.499
Residual	13455.801	88	152.907		
Total	14434.760	95	151.945		

Table 34
Average Solves the Problem Factor and Cell Means

TOTAL POPULATION*

73.00	
(96)	

TRAIN

0	1
73.13	72.87
(48)	(48)

FACIL

0	1
71.17	74.83
(48)	(48)

SYSTEM

0	1
73.31	72.69
(48)	(48)

	FACIL 0	FACIL 1
TRAIN 0	71.08	75.17
	(24)	(24)
TRAIN 1	71.26	74.48
	(24)	(24)

	SYSTEM 0	SYSTEM 1
TRAIN 0	74.68	71.57
	(24)	(24)
TRAIN 1	71.94	73.80
	(24)	(24)

	SYSTEM 0	SYSTEM 1
FACIL 0	72.15	70.19
	(24)	(24)
FACIL 1	74.47	75.18
	(24)	(24)

SYSTEM = 0

	FACIL 0	FACIL 1
TRAIN 0	73.68	75.68
	(12)	(12)
TRAIN 1	70.62	73.25
	(12)	(12)

SYSTEM = 1

	FACIL 0	FACIL 1
TRAIN 0	68.48	74.66
	(12)	(12)
TRAIN 1	71.89	75.71
	(12)	(12)

LEGEND:

Train: 0=No Training
1=Training
Facil: 0=No Facilitation
1=Facilitation
System: 0=Low System Restrict.
1=High System Restrict.
(n) = number of observations per cell

*Higher scores are more favorable

Table 35
Average Feasibility Factor and Cell Means

TOTAL POPULATION*

72.65
(96)

TRAIN

0	1
73.22	72.08
(48)	(48)

FACIL

0	1
70.93	74.37
(48)	(48)

SYSTEM

0	1
73.99	71.31
(48)	(48)

	FACIL 0	FACIL 1
TRAIN 0	71.33 (24)	75.11 (24)
TRAIN 1	70.53 (24)	73.63 (24)

	SYSTEM 0	SYSTEM 1
TRAIN 0	76.70 (24)	69.75 (24)
TRAIN 1	71.28 (24)	72.88 (24)

	SYSTEM 0	SYSTEM 1
FACIL 0	71.55 (24)	70.30 (24)
FACIL 1	76.42 (24)	72.32 (24)

SYSTEM = 0

	FACIL 0	FACIL 1
TRAIN 0	74.21 (12)	79.18 (12)
TRAIN 1	68.90 (12)	73.67 (12)

SYSTEM = 1

	FACIL 0	FACIL 1
TRAIN 0	68.45 (12)	71.04 (12)
TRAIN 1	72.16 (12)	73.60 (12)

LEGEND:

Train: 0=No Training
1=Training
Facil: 0=No Facilitation
1=Facilitation
System: 0=Low System Restrict.
1=High System Restrict.
(n) = number of observations per cell

*Higher scores are more favorable

Table 36
Best Solves the Problem ANOVA Results

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	588.031	3	196.010	1.887	.138
TRAIN	333.760	1	333.760	3.214	.076
FACIL	231.260	1	231.260	2.227	.139
SYSTEM	23.010	1	23.010	.222	.639
2-Way Interactions	512.698	3	170.899	1.646	.185
TRAIN FACIL	75.260	1	75.260	.725	.397
TRAIN SYSTEM	396.094	1	396.094	3.814	.054
FACIL SYSTEM	41.344	1	41.344	.398	.530
3-Way Interactions	.510	1	.510	.005	.944
TRAIN FACIL SYSTEM	.510	1	.510	.005	.944
Explained	1101.240	7	157.320	1.515	.173
Residual	9138.750	88	103.849		
Total	10239.990	95	107.789		

Table 37
Best Feasibility ANOVA Results

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	495.865	3	165.288	1.149	.334
TRAIN	319.010	1	319.010	2.217	.140
FACIL	98.010	1	98.010	.681	.411
SYSTEM	78.844	1	78.844	.548	.461
2-Way Interactions	1735.531	3	578.510	4.021	.010
TRAIN FACIL	178.760	1	178.760	1.243	.268
TRAIN SYSTEM	1127.510	1	1127.510	7.837	.006
FACIL SYSTEM	429.260	1	429.260	2.984	.088
3-Way Interactions	.260	1	.260	.002	.966
TRAIN FACIL SYSTEM	.260	1	.260	.002	.966
Explained	2231.656	7	318.808	2.216	.040
Residual	12660.250	88	143.866		
Total	14891.906	95	156.757		

Table 38
Best Solves the Problem Factor and Cell Means

TOTAL POPULATION*

77.82
(96)

TRAIN

0	1
79.69	75.96
(48)	(48)

FACIL

0	1
76.27	79.38
(48)	(48)

SYSTEM

0	1
78.31	77.33
(48)	(48)

	FACIL 0	FACIL 1
TRAIN 0	77.25 (24)	82.13 (24)
TRAIN 1	75.29 (24)	76.63 (24)

	SYSTEM 0	SYSTEM 1
TRAIN 0	82.21 (24)	77.17 (24)
TRAIN 1	74.42 (24)	77.50 (24)

	SYSTEM 0	SYSTEM 1
FACIL 0	77.42 (24)	75.13 (24)
FACIL 1	79.21 (24)	79.54 (24)

SYSTEM = 0

	FACIL 0	FACIL 1
TRAIN 0	80.50 (12)	83.92 (12)
TRAIN 1	74.33 (12)	74.50 (12)

SYSTEM = 1

	FACIL 0	FACIL 1
TRAIN 0	74.00 (12)	80.33 (12)
TRAIN 1	76.25 (12)	78.75 (12)

LEGEND:

Train: 0=No Training
1=Training
Facil: 0=No Facilitation
1=Facilitation
System: 0=Low System Restrict.
1=High System Restrict.
(n) = number of observations per cell

*Higher scores are more favorable

Table 39
Best Feasibility Factor and Cell Means

TOTAL POPULATION*

79.47
(96)

TRAIN

0	1
81.29	77.65
(48)	(48)

FACIL

0	1
78.46	80.48
(48)	(48)

SYSTEM

0	1
80.38	78.56
(48)	(48)

	FACIL 0	FACIL 1
TRAIN 0	78.92 (24)	83.67 (24)
TRAIN 1	78.00 (24)	77.29 (24)

	SYSTEM 0	SYSTEM 1
TRAIN 0	85.63 (24)	76.96 (24)
TRAIN 1	75.13 (24)	80.17 (24)

	SYSTEM 0	SYSTEM 1
FACIL 0	77.25 (24)	79.67 (24)
FACIL 1	83.50 (24)	77.46 (24)

SYSTEM = 0

	FACIL 0	FACIL 1
TRAIN 0	81.08 (12)	90.17 (12)
TRAIN 1	73.42 (12)	76.83 (12)

SYSTEM = 1

	FACIL 0	FACIL 1
TRAIN 0	76.75 (12)	77.17 (12)
TRAIN 1	82.58 (12)	77.75 (12)

LEGEND:

Train: 0=No Training
1=Training
Facil: 0=No Facilitation
1=Facilitation
System: 0=Low System Restrict.
1=High System Restrict.
(n) = number of observations per cell

*Higher scores are more favorable

Satisfaction with the Process and Outcome

The preliminary study (described in Chapter 3) found a high correlation between the process and outcome satisfaction scales when using the SOB task. A Pearson correlation test was used to assess this relationship and found the scales to be positively correlated at r=.5025, p=.000. Based on this moderately high correlation and similar correlations reported in other GSS research (Noel, 1992), a MANOVA procedure was selected to evaluate the full factorial model for both satisfaction variables. The Bartlett-Box F test for multivariate homogeneity of variance was significant (F=1.674, p=.027). However, this test can be overly sensitive when N is large (480 cases in this analysis). Since the MANOVA F tests are considered robust to violations of this assumption when the sample sizes are equal (Bray & Maxwell, 1985), the additional MANOVA assumptions were deemed to have been satisfied.

Tables 40 through 42 present the MANOVA results along with factor and treatment level means. There is a significant multivariate, three-way effect for both process and outcome satisfaction (F[2,471]=6.042, p=.003). The univariate F tests for this effect are statistically significant for outcome (F[1,472]=12.08, p=.001) and approach significance for process (F[1,472]=3.606, p=.058). Outcome satisfaction was significantly higher for subjects in the F treatment than for subjects in the TS, NRB, TF, S, RB, or FS treatments (ordered from the lowest to highest means). Outcome satisfaction was also higher in the T treatment than in the TS, NRB, or TF treatments. The pattern of means is different for process satisfaction. Subjects in the FS or S treatments reported higher process satisfaction than subjects in the RB or F treatments.

Table 40
Satisfaction MANOVA Results

```
* * * * * * A N A L Y S I S   O F   V A R I A N C E -- DESIGN   1 * * * * * *

 EFFECT .. TRAIN BY FACIL BY SYSTEM
 Multivariate Tests of Significance (S = 1, M = 0, N = 234 1/2)

 Test Name          Value    Exact F Hypoth. DF   Error DF  Sig. of F
 Pillais           .02502    6.04251       2.00     471.00       .003
 Hotellings        .02566    6.04251       2.00     471.00       .003
 Wilks             .97498    6.04251       2.00     471.00       .003
 Roys              .02502

 Univariate F-tests with (1,472) D. F.
 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F
 PROCESS       1.61008  210.75133    1.61008     .44651    3.60595       .058
 OUTCOME       7.65075  298.93267    7.65075     .63333   12.08016       .001
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

 EFFECT .. FACIL BY SYSTEM
 Multivariate Tests of Significance (S = 1, M = 0, N = 234 1/2)

 Test Name          Value    Exact F Hypoth. DF   Error DF  Sig. of F
 Pillais           .00080     .18802       2.00     471.00       .829
 Hotellings        .00080     .18802       2.00     471.00       .829
 Wilks             .99920     .18802       2.00     471.00       .829
 Roys              .00080

 Univariate F-tests with (1,472) D. F.
 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F
 PROCESS        .02408  210.75133     .02408     .44651     .05394       .816
 OUTCOME        .23408  298.93267     .23408     .63333     .36961       .544
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

 EFFECT .. TRAIN BY SYSTEM
 Multivariate Tests of Significance (S = 1, M = 0, N = 234 1/2)

 Test Name          Value    Exact F Hypoth. DF   Error DF  Sig. of F
 Pillais           .00989    2.35159       2.00     471.00       .096
 Hotellings        .00999    2.35159       2.00     471.00       .096
 Wilks             .99011    2.35159       2.00     471.00       .096
 Roys              .00989

 Univariate F-tests with (1,472) D. F.
 Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F
 PROCESS       1.65675  210.75133    1.65675     .44651    3.71047       .055
 OUTCOME        .00675  298.93267     .00675     .63333     .01066       .918
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

 EFFECT .. TRAIN BY FACIL
 Multivariate Tests of Significance (S = 1, M = 0, N = 234 1/2)

 Test Name          Value    Exact F Hypoth. DF   Error DF  Sig. of F
 Pillais           .01417    3.38426       2.00     471.00       .035
 Hotellings        .01437    3.38426       2.00     471.00       .035
 Wilks             .98583    3.38426       2.00     471.00       .035
 Roys              .01417
```

*** continued next page ***

Table 40
Satisfaction MANOVA Results (continued)

Univariate F-tests with (1,472) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
PROCESS	.20008	210.75133	.20008	.44651	.44811	.504
OUTCOME	3.99675	298.93267	3.99675	.63333	6.31067	.012

- -

EFFECT .. SYSTEM
Multivariate Tests of Significance (S = 1, M = 0, N = 234 1/2)

Test Name	Value	Exact F	Hypoth. DF	Error DF	Sig. of F
Pillais	.00841	1.99654	2.00	471.00	.137
Hotellings	.00848	1.99654	2.00	471.00	.137
Wilks	.99159	1.99654	2.00	471.00	.137
Roys	.00841				

Univariate F-tests with (1,472) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
PROCESS	.66008	210.75133	.66008	.44651	1.47833	.225
OUTCOME	2.49408	298.93267	2.49408	.63333	3.93804	.048

- -

EFFECT .. FACIL
Multivariate Tests of Significance (S = 1, M = 0, N = 234 1/2)

Test Name	Value	Exact F	Hypoth. DF	Error DF	Sig. of F
Pillais	.00735	1.74426	2.00	471.00	.176
Hotellings	.00741	1.74426	2.00	471.00	.176
Wilks	.99265	1.74426	2.00	471.00	.176
Roys	.00735				

Note.. F statistics are exact.

Univariate F-tests with (1,472) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
PROCESS	.39675	210.75133	.39675	.44651	.88856	.346
OUTCOME	2.21408	298.93267	2.21408	.63333	3.49593	.062

- -

EFFECT .. TRAIN
Multivariate Tests of Significance (S = 1, M = 0, N = 234 1/2)

Test Name	Value	Exact F	Hypoth. DF	Error DF	Sig. of F
Pillais	.02050	4.92806	2.00	471.00	.008
Hotellings	.02093	4.92806	2.00	471.00	.008
Wilks	.97950	4.92806	2.00	471.00	.008
Roys	.02050				

Univariate F-tests with (1,472) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
PROCESS	1.75208	210.75133	1.75208	.44651	3.92398	.048
OUTCOME	.78408	298.93267	.78408	.63333	1.23803	.266

Table 41
Process Satisfaction Factor and Cell Means

TOTAL POPULATION*

3.67
(480)

TRAIN

0	1
3.73	3.61
(240)	(240)

FACIL

0	1
3.70	3.64
(240)	(240)

SYSTEM

0	1
3.63	3.71
(240)	(240)

	FACIL 0	FACIL 1
TRAIN 0	3.78 (120)	3.68 (120)
TRAIN 1	3.62 (120)	3.60 (120)

	SYSTEM 0	SYSTEM 1
TRAIN 0	3.63 (120)	3.83 (120)
TRAIN 1	3.63 (120)	3.59 (120)

	SYSTEM 0	SYSTEM 1
FACIL 0	3.65 (120)	3.74 (120)
FACIL 1	3.61 (120)	3.67 (120)

SYSTEM = 0

	FACIL 0	FACIL 1
TRAIN 0	3.73 (60)	3.53 (60)
TRAIN 1	3.57 (60)	3.69 (60)

SYSTEM = 1

	FACIL 0	FACIL 1
TRAIN 0	3.82 (60)	3.83 (60)
TRAIN 1	3.66 (60)	3.51 (60)

LEGEND:

Train: 0=No Training
1=Training
Facil: 0=No Facilitation
1=Facilitation
System: 0=Low System Restrict.
1=High System Restrict.
(n) = number of observations per cell

*Higher scores are more favorable

Table 42
Outcome Satisfaction Factor and Cell Means

TOTAL POPULATION*

2.30	
(480)	

TRAIN

0	1
2.34	2.26
(240)	(240)

FACIL

0	1
2.24	2.37
(240)	(240)

SYSTEM

0	1
2.38	2.23
(240)	(240)

	FACIL 0	FACIL 1
TRAIN 0	2.19 (120)	2.50 (120)
TRAIN 1	2.29 (120)	2.24 (120)

	SYSTEM 0	SYSTEM 1
TRAIN 0	2.42 (120)	2.27 (120)
TRAIN 1	2.33 (120)	2.19 (120)

	SYSTEM 0	SYSTEM 1
FACIL 0	2.33 (120)	2.14 (120)
FACIL 1	2.42 (120)	2.32 (120)

SYSTEM = 0

	FACIL 0	FACIL 1
TRAIN 0	2.16 (60)	2.68 (60)
TRAIN 1	2.50 (60)	2.16 (60)

SYSTEM = 1

	FACIL 0	FACIL 1
TRAIN 0	2.21 (60)	2.32 (60)
TRAIN 1	2.07 (60)	2.32 (60)

LEGEND:

Train: 0=No Training
1=Training
Facil: 0=No Facilitation
1=Facilitation
System: 0=Low System Restrict.
1=High System Restrict.
(n) = number of observations per cell

*Higher scores are more favorable

The MANOVA also found a significant two-way interaction effect between training and facilitation ($F[2,471]=3.384$, $p=.035$) for the outcome scale ($F[1,472]=6.31$, $p=.012$) without respect to system-based restrictiveness. Untrained, facilitated group members reported higher outcome satisfaction than untrained and unfacilitated, trained and unfacilitated, or both trained and facilitated group members.

The final satisfaction result was a main effect for training ($F[2,471]=4.928$, $p=.008$). The univariate F test revealed that untrained groups reported more process satisfaction than did trained groups ($F[1,472]=3.924$, $p=.048$) without respect to facilitation or system-based restrictiveness.

Consensus

The consensus measures were assessed in separate 2 x 2 x 2 ANOVA models. Tables 43 through 50 report the ANOVA results and means. The perceptual consensus scale had a statistically significant interaction effect between the training and system-based sources of process restrictiveness ($F[1,377]=4.424$, $p=.036$). Subjects who experienced high system-based process restrictiveness reported higher consensus than did subjects who experienced both training and system-based process restrictiveness. The three objective measures of consensus -- the number of solutions, maximum votes for one idea, and the agreement index -- all found a significant or near significant[17] three-way interaction, though the pattern of means for the three measures was not uniform. The three-way effect for the number of solutions ($F[1,87]=7.18$, $p=.009$) was significant although there were no statistically significant pairwise differences between means at the $\alpha=.05$ level. The

[17]The three-way interaction for the *maximum votes for one idea* measure approached statistical significance ($p=.052$).

maximum votes for one idea ($F[1,87]=3.872$, $p=.052$) found that NRB groups more frequently recorded the same idea than did groups in the T treatment. The agreement index ($F[1,87]=5.982$, $p=.016$) similarly found that the NRB groups expressed more agreement across the list of recorded solutions than did groups in the T or RB treatments. Similar to the consensus results from the planned hypothesis testing, the post hoc analysis did not yield consistent findings between the perceptual and objective measures of consensus.

Table 43
Perceptual Consensus Scale ANOVA Results

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	113.488	3	37.829	.953	.415
TRAIN	106.812	1	106.812	2.690	.102
FACIL	3.894	1	3.894	.098	.754
SYSTEM	3.122	1	3.122	.079	.779
2-Way Interactions	276.187	3	92.062	2.319	.075
TRAIN FACIL	54.239	1	54.239	1.366	.243
TRAIN SYSTEM	175.626	1	175.626	4.424	.036
FACIL SYSTEM	47.617	1	47.617	1.199	.274
3-Way Interactions	1.399	1	1.399	.035	.851
TRAIN FACIL SYSTEM	1.399	1	1.399	.035	.851
Explained	391.074	7	55.868	1.407	.201
Residual	14967.160	377	39.701		
Total	15358.234	384	39.995		

Table 44
Number of Solutions ANOVA Results

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	2.199	3	.733	.251	.860
TRAIN	.600	1	.600	.206	.651
FACIL	1.577	1	1.577	.541	.464
SYSTEM	.001	1	.001	.000	.983
2-Way Interactions	1.644	3	.548	.188	.904
TRAIN FACIL	.447	1	.447	.153	.697
TRAIN SYSTEM	1.154	1	1.154	.396	.531
FACIL SYSTEM	.069	1	.069	.024	.878
3-Way Interactions	20.941	1	20.941	7.180	.009
TRAIN FACIL SYSTEM	20.941	1	20.941	7.180	.009
Explained	24.784	7	3.541	1.214	.304
Residual	253.742	87	2.917		
Total	278.526	94	2.963		

Table 45
Maximum Votes for One Idea ANOVA Results

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	3.649	3	1.216	1.002	.396
TRAIN	3.047	1	3.047	2.510	.117
FACIL	.105	1	.105	.087	.769
SYSTEM	.477	1	.477	.393	.532
2-Way Interactions	4.759	3	1.586	1.306	.277
TRAIN FACIL	1.774	1	1.774	1.461	.230
TRAIN SYSTEM	.008	1	.008	.007	.936
FACIL SYSTEM	3.020	1	3.020	2.488	.118
3-Way Interactions	4.701	1	4.701	3.872	.052
TRAIN FACIL SYSTEM	4.701	1	4.701	3.872	.052
Explained	13.108	7	1.873	1.542	.164
Residual	105.629	87	1.214		
Total	118.737	94	1.263		

Table 46
Agreement ANOVA Results

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	1.120	3	.373	.650	.585
TRAIN	.494	1	.494	.860	.356
FACIL	.275	1	.275	.479	.491
SYSTEM	.344	1	.344	.599	.441
2-Way Interactions	1.467	3	.489	.852	.469
TRAIN FACIL	.564	1	.564	.982	.324
TRAIN SYSTEM	.883	1	.883	1.538	.218
FACIL SYSTEM	.004	1	.004	.007	.935
3-Way Interactions	3.434	1	3.434	5.982	.016
TRAIN FACIL SYSTEM	3.434	1	3.434	5.982	.016
Explained	6.021	7	.860	1.498	.179
Residual	49.949	87	.574		
Total	55.970	94	.595		

Table 47
Perceptual Consensus Scale Factor and Cell Means

TOTAL POPULATION*

38.49
(385)

TRAIN

0	1
39.01	37.96
(196)	(189)

FACIL

0	1
38.58	38.41
(190)	(195)

SYSTEM

0	1
38.59	38.40
(196)	(189)

	FACIL 0	FACIL 1
TRAIN 0	39.52 (95)	38.53 (101)
TRAIN 1	37.65 (95)	38.27 (94)

	SYSTEM 0	SYSTEM 1
TRAIN 0	38.50 (101)	39.56 (95)
TRAIN 1	38.68 (95)	37.22 (94)

	SYSTEM 0	SYSTEM 1
FACIL 0	38.49 (95)	38.67 (95)
FACIL 1	38.67 (101)	38.12 (94)

SYSTEM = 0

	FACIL 0	FACIL 1
TRAIN 0	38.78 (60)	38.07 (41)
TRAIN 1	38.00 (35)	39.08 (60)

SYSTEM = 1

	FACIL 0	FACIL 1
TRAIN 0	40.77 (35)	38.85 (60)
TRAIN 1	37.45 (60)	36.82 (34)

LEGEND:

Train: 0=No Training
1=Training
Facil: 0=No Facilitation
1=Facilitation
System: 0=Low System Restrict.
1=High System Restrict.
(n) = number of observations per cell

*Higher scores are more favorable

Table 48
Number of Solutions Factor and Cell Means

TOTAL POPULATION*

4.68	
(95)	

TRAIN

0	1
4.60	4.77
(48)	(47)

FACIL

0	1
4.81	4.55
(48)	(47)

SYSTEM

0	1
4.68	4.69
(47)	(48)

	FACIL 0	FACIL 1
TRAIN 0	4.67 (24)	4.54 (24)
TRAIN 1	4.96 (24)	4.57 (23)

	SYSTEM 0	SYSTEM 1
TRAIN 0	4.71 (24)	4.50 (24)
TRAIN 1	4.65 (23)	4.88 (24)

	SYSTEM 0	SYSTEM 1
FACIL 0	4.83 (24)	4.79 (24)
FACIL 1	4.52 (23)	4.58 (24)

SYSTEM = 0

	FACIL 0	FACIL 1
TRAIN 0	4.33 (12)	5.08 (12)
TRAIN 1	5.33 (12)	3.91 (11)

SYSTEM = 1

	FACIL 0	FACIL 1
TRAIN 0	5.00 (12)	4.00 (12)
TRAIN 1	4.58 (12)	5.17 (12)

LEGEND:

Train: 0=No Training
1=Training
Facil: 0=No Facilitation
1=Facilitation
System: 0=Low System Restrict.
1=High System Restrict.
(n) = number of observations per cell

*Lower scores are more favorable

Table 49
Maximum Votes for One Idea Factor and Cell Means

TOTAL POPULATION*

2.95
(95)

TRAIN

0	1
3.13	2.77
(48)	(47)

FACIL

0	1
2.98	2.91
(48)	(47)

SYSTEM

0	1
3.02	2.88
(47)	(48)

	FACIL 0	FACIL 1
TRAIN 0	3.29 (24)	2.96 (24)
TRAIN 1	2.67 (24)	2.87 (23)

	SYSTEM 0	SYSTEM 1
TRAIN 0	3.21 (24)	3.04 (24)
TRAIN 1	2.83 (23)	2.71 (24)

	SYSTEM 0	SYSTEM 1
FACIL 0	2.88 (24)	3.08 (24)
FACIL 1	3.17 (23)	2.67 (24)

SYSTEM = 0

	FACIL 0	FACIL 1
TRAIN 0	3.42 (12)	3.00 (12)
TRAIN 1	2.33 (12)	3.36 (11)

SYSTEM = 1

	FACIL 0	FACIL 1
TRAIN 0	3.17 (12)	2.92 (12)
TRAIN 1	3.00 (12)	2.42 (12)

LEGEND:

Train: 0=No Training
1=Training
Facil: 0=No Facilitation
1=Facilitation
System: 0=Low System Restrict.
1=High System Restrict.
(n) = number of observations per cell

*Higher scores are more favorable

Table 50
Agreement Factor and Cell Means

TOTAL POPULATION*

1.77
(95)

TRAIN

0	1
1.85	1.70
(48)	(47)

FACIL

0	1
1.83	1.72
(48)	(47)

SYSTEM

0	1
1.84	1.71
(47)	(48)

	FACIL 0	FACIL 1
TRAIN 0	1.98 (24)	1.72 (24)
TRAIN 1	1.68 (24)	1.73 (23)

	SYSTEM 0	SYSTEM 1
TRAIN 0	2.00 (24)	1.69 (24)
TRAIN 1	1.66 (23)	1.74 (24)

	SYSTEM 0	SYSTEM 1
FACIL 0	1.88 (24)	1.77 (24)
FACIL 1	1.79 (23)	1.65 (24)

SYSTEM = 0

	FACIL 0	FACIL 1
TRAIN 0	2.32 (12)	1.69 (12)
TRAIN 1	1.45 (12)	1.90 (11)

SYSTEM = 1

	FACIL 0	FACIL 1
TRAIN 0	1.64 (12)	1.74 (12)
TRAIN 1	1.91 (12)	1.57 (12)

LEGEND:

Train: 0=No Training
1=Training
Facil: 0=No Facilitation
1=Facilitation
System: 0=Low System Restrict.
1=High System Restrict.
(n) = number of observations per cell

*Higher scores are more favorable

SUMMARY OF POST HOC ANALYSIS

Table 51 summarizes the ANOVA and MANOVA effects at the α=.05 and α=.1 levels. The performance column reports the directional differences between any of the treatments or factors.

Table 51
Summary of Post Hoc Analysis

Dependent Variable	Effect at α=.05	Effect at α=.1	Performance
Avg. solves the problem		Facilitation	Facilitated > unfacilitated
Average feasibility		Train. x System	Untrained + low system > trained + low system, untrained + high system
Best solves the problem		Train. x System	Untrained + low system > trained + low system, untrained + high system
Best solves the problem		Training	Untrained > trained
Best feasibility	Train. x System		Untrained + low system > trained + low system, untrained + high system
Best feasibility		Facil. x System	No significant differences
Process satisfaction		Three-way	FS, S > RB, F
Process satisfaction	Training		Untrained > trained
Outcome satisfaction	Three-way		F > TS, NRB, TF, S, RB, FS; T > TS, NRB, TF
Outcome satisfaction	Train. x Facil.		Untrained + facilitated > untrained + unfacilitated, trained + unfacilitated, trained + facilitated
Perceptual consensus	Train. x System		System > Training and system
Number of solutions	Three-way		No significant differences
Max. votes for one idea	Three-way		NRB > T
Agreement	Three-way		NRB > T, RB

CHAPTER SUMMARY

The planned statistical analysis generally compared the single sources of process restrictiveness to the three-way combination or to no source of process restrictiveness. This analysis found some support for two of the facilitation-based and one of the system-based hypotheses. Most of the hypotheses, however, were not supported.

The post hoc analysis, which included the data from all eight treatments, seems to present a rather diverse picture -- at least at face value -- for the impacts of process restrictiveness sources on various measures of group outcomes. Chapter 6 will interpret the results from both the planned and post hoc analyses.

CHAPTER 6

DISCUSSION

The broad problem addressed by this research was to gain an understanding of how to improve group outcomes (e.g., decision effectiveness, group member satisfaction, consensus) by increasing the likelihood that groups would faithfully appropriate decision-making heuristics. The Process Restricted Adaptive Structuration Theory (PRAST) described how *process restrictiveness* was expected to promote faithful use of heuristics. PRAST was formulated to encompass a broad range of group, task, and technology characteristics (i.e., *potential sources of structures* in Adaptive Structuration Theory vocabulary). Propositions from the model posited that various sources of process restrictiveness would promote faithful appropriations of a heuristic and, consequently, would yield favorable group outcomes.

Since a comprehensive test of PRAST was beyond the scope of this dissertation project[18], the specific research question asked: What is the efficacy of various process restrictiveness sources (e.g., training, facilitation, and technology-based) to promote effective group outcomes? Specific, PRAST-derived hypotheses which were applicable to

---

[18]PRAST is based on structuration theory which heavily relies on a detailed understanding of the appropriation process. A comprehensive evaluation of PRAST would necessitate process coding of how groups used the available structures (i.e., the appropriation moves). An example of this type of coding is provided in DeSanctis and Poole (in press) and is further addressed in Chapter 7.

a particular type of group, task, and context were tested in a controlled laboratory experiment. The next section will interpret the results presented in Chapter 5 and, when appropriate, will draw insights from PRAST. The final section of this chapter will discuss the implications of this research for both theory and practice.

INTERPRETATION OF RESEARCH RESULTS

Each of the four dependent measures is interpreted below. The assessment of decision quality will receive extra attention since it is a primary concern both for organizations and for this research.

Decision Quality

The hypotheses for decision quality expected that the most restrictive treatment (RB) would yield the highest quality decisions compared to single sources or an absence of process restrictiveness; that facilitation alone would be the most efficacious single source (among single sources or an absence of process restrictiveness); and that an absence of process restrictiveness (NRB) would yield the lowest decision quality (among single sources or an absence of process restrictiveness). These hypotheses are based on several assumptions from the group decision-making literature:

- Effective group decisions can be distinguished from ineffective group decisions by characteristics of a group's decision process. For example, groups which carefully examined the validity of assumptions; could distinguish fact from opinion; rigorously evaluated alternatives against predetermined criteria; and had at least one influential member who asked appropriate questions, challenged assumptions, and kept the group from going off on tangents have been shown to produce more effective decisions than groups which did not in engage these processes (Hirokawa, 1987; Hirokawa & Pace, 1983).

- Based on these characteristics, process interventions are designed to prescribe and to proscribe the processes which promote effective decisions (VanGundy, 1988).

- Process interventions should be carefully selected to match the task requirements and characteristics of the group (Poole, 1990).

- Group members will often prefer more familiar interaction processes over those mandated by process interventions and will often abandon (or only partially follow) a process intervention.

Based on PRAST, process restrictiveness was expected to improve the likelihood of faithful appropriation of the group decision making procedure. A positive balance of forces and effective decisions were the anticipated outcomes via the faithful appropriation path (Figure 7).

Interpretation

The hypothesis that the most restrictive treatment (RB) would yield the highest decision quality was not supported. Decision quality in the RB treatment was usually in the middle range of the eight treatment means and was generally no worse nor better than the combination of any two process restrictiveness sources. Thus, activating a combination of any two process restrictiveness sources appears to be as beneficial as the RB treatment.

The single source treatments provided the most insightful look at each source's unique efficacy. Facilitation was supported as having the greatest ability to improve decision quality. It consistently had the highest or second highest mean on all four measures of decision quality among both the single and combined sources. One probable explanation is that facilitation has the greatest ability to impact all three group communication modes (Chapter 3). For example, the facilitator could monitor the content

of ideas entered in a Brainwriting activity to ensure that they were relatively consistent with the particular goal of the heuristic (e.g., identifying problems or identifying opportunities and constraints). The facilitator could also monitor the verbal communication mode and interject restrictive comments when the group strayed from the heuristic. The relative advantages found in the facilitation-only treatment (i.e., higher decision quality) were eliminated when it was combined with any other process restrictiveness source.

The system-based source of process restrictiveness, however, had no ability to restrict the *content* communicated via the electronic or verbal modes. While system-based process restrictiveness could make a particular GSS tool available to support a particular activity, it had no impact on the actual communication messages sent through any of the communication modes. Similarly, the training treatment relied on the group members themselves to provide any form of process restrictiveness (i.e., procedural comments which reminded the group to follow the heuristic). The researcher observed that some group members did periodically interject process restrictive comments -- some comments were correct and some were erroneous -- but these comments did not occur with any consistency in a single group or in the T or NRB treatments.

While not the focus of any a priori hypotheses, it is interesting to note that training alone (T) and system-based process restrictiveness alone (S) consistently had the lowest scores for decision quality among all eight treatments. Apparently, activating only one of these sources was less fruitful than activating all, none, or some combination of any two sources. In comparison, the NRB and F treatments were significantly better than either

training or system-based restrictiveness alone. The next section will observe that group members in the F or T treatments reported more outcome satisfaction than members of other treatments. Based on the decision quality results, the F treatment group members accurately recognized a high quality decision and were satisfied with it. Conversely, group members in the T treatment had a low quality decision product but reported the same high levels of outcome satisfaction as the F treatment group members.

The third hypothesis, that the absence of process restrictiveness (NRB) would yield lower quality decisions than single sources of process restrictiveness, was not supported. In fact, the NRB groups were always in the top half of the eight means for all measures of decision quality. These groups were entirely free to abandon the GDMP, partially use it, or to fully follow it in every detail. On average, the researcher observed that these groups did not closely follow the activities or sequences mandated by the GDMP. This was evident from the sequences of GSS tools requested, the manner in which the tools were used, and the group members' verbal discussions. To illustrate this observation, the following account provides an example of how one NRB group conducted its decision process. The account is based on the GSS transcripts and the researcher's journal notes which were written during the experimental session:

> The group requested the following sequence of GSS tools: Brainwriting, Voting, Brainwriting, Voting, Rating, and Ranking (compare this to the GDMP in Appendix C-2). The first Brainwriting transcript reveals that the subjects began the decision process by considering possible solutions. All 25 entries in the Brainwriting transcript were proposed solutions. The researcher's notes recorded that the group spent five minutes generating these solutions and then 10 minutes verbally discussing them. They voted on each idea (a binary yes or no vote) and then spent 15 minutes discussing the vote. The notes commented that it was a "very vigilant discussion" with some members correcting assertions by other members. The group

> then spent about six minutes in a procedural discussion regarding what to do next. They requested a second Brainwriting tool, but directed each person to verbally share their ideas while one person was designated as the group's scribe to enter these ideas in the second Brainwriting tool. Two solutions and the word "faculty" were entered. The group requested a second Voting tool, but did not use it. They requested a Rating tool, but canceled the request before the chauffeur activated it. The group finally used the Ranking tool to rank the three entries from the second Brainwriting tool. They ranked, viewed and discussed the results, and then ranked again.

This account illustrates how the NRB groups were free to use or abandon the GDMP (or the GSS). This group did not explicitly engage in problem definition, in criteria definition, or in comparing potential solutions to predetermined criteria as prescribed by the GDMP. It is interesting to note that the group ultimately recorded two solutions on its recommendation memo. The first solution scored relatively low on both the solves the problem and feasibility indices. The second solution, however, was one of the best solutions in the list and placed the group among the top 10 groups based on the *best* solution scores. This high quality decision was clearly not a product of following the GDMP. In fact, the group's decision process was almost the antithesis of the activity and sequence structures advocated by the heuristic. While the entire set of NRB groups, and particularly the account above, do not provide support for H1c, this is not incompatible with PRAST. The theory posits that faithful appropriation -- as promoted by process restrictiveness -- will likely produce a positive balance of forces and effective decisions. The theory does not, however, link an absence of faithful appropriation to ineffective decisions (see Figure 7); rather, the probable outcomes along this path are unknown.

The manipulation check for training (Chapter 5) demonstrated that five of the eleven NRB groups followed the GDMP (as evidenced from their GSS transcripts) in a

manner equal to the process used by groups in the T treatment. Six NRB groups clearly did not adhere to the GDMP. Thus, NRB groups did employ a variety of decision processes using a mix of faithful and unfaithful appropriations of the heuristic and GSS. In retrospect, the choice to make hypothesis 1c directional may have been inappropriate given proposition 5b (an absence of process restrictiveness will have unpredictable impact on group outcomes).

Explanatory Factors in this Experiment

Factors in this experiment (e.g., task, subjects, heuristic, GSS technology, or experimental procedures) may account for some of these results. The nature of the task and the subjects may have interacted in an unexpected manner. While the school of business task specifically stated that it was not representing any particular university, the student subjects clearly processed the case as if it were Indiana University. The task was designed so that subjects could incorporate their own biases which would work to increase the logical size of the group in relation to task requirements. However, since most subjects viewed the case as representing their own school, this behavior may have worked to homogenize the distinct roles and undermined the hidden-profile nature of the case. If the subjects relied on a largely common set of nontask experiences (e.g., their experiences as students regarding the problems of the Indiana University School of Business) they would likely have generated a smaller set of possible solutions than if they had relied on the specific information in the task stimulus.

The real stakeholders in the decision (e.g., the real Dean of a business school, an alumni association officer, etc.) would have different perspectives and would have surely

generated some solutions which were not included in this set. Thus, while the contextual setting of the task stimulus did prove engaging and within the knowledge domain of the student subjects, it may have unintentionally drawn on a common set of nontask experiences which reduced the range of proposed solutions. A broader range of solutions could have affected the treatment differences -- or lack of differences -- for decision quality.

A second factor in this experiment which may have affected the results was the use of ad hoc groups in relation to the heuristic and technology support. A key structure of the heuristic is to surface task-relevant information, ideas, and perspectives. Members of natural groups, which have a history and a future for working together, often must wrestle with the *political implications* of asserting ideas and sharing information. These political implications include how other group members will be affected by a comment, possible repercussions against the speaker for saying things which are unfavorable to politically powerful group members, or concern for how the speaker became aware of certain information. Nunamaker et al. (1991) identified *evaluation apprehension* as a process loss which can be overcome by the anonymity in a GSS. It was expected that the combination of anonymity and sequenced activities for sharing information (i.e., the GDMP) would enhance decision quality when they were faithfully appropriated. The ad hoc nature of the student subject groups used in this experiment, however, did not have any political structure which would impede information sharing. These subjects could expect no reward nor repercussions for anything that they said in the meeting and likely experienced much less evaluation apprehension than natural groups. Thus, the utility of

anonymity and sequenced activities to promote information sharing were likely undervalued in this experiment relative to their role in natural groups.

Process Satisfaction

Process satisfaction was the only dependent measure which was not directly associated with a group's decision outcome. The other three measures -- decision quality, outcome satisfaction, and consensus -- were linked to the group's decision product. Process satisfaction assessed each member's feelings regarding the group's manner of making a group decision.

The hypotheses for process satisfaction expected that group members in the most restrictive condition would be less satisfied than group members with any single source or an absence of process restrictiveness; that facilitation alone would be associated with the highest process satisfaction (among single sources or no process restrictiveness); and that system-based restrictiveness would have the lowest process satisfaction (among single sources or no process restrictiveness). None of these hypotheses were statistically supported. The pattern of means for all eight treatments, however, does provide additional insight for understanding the relationship between process satisfaction and process restrictiveness sources.

Interpretation

The RB group members did report the lowest process satisfaction of all treatments, but they were not significantly less satisfied than group members in the F treatment and were very close to the levels of process satisfaction reported in the T treatment. System-based process restrictiveness yielded the highest satisfaction scores

(S=3.823, FS=3.827) which was directionally the opposite of the hypothesis. The combinations of process restrictiveness sources interacted in peculiar ways to raise or lower process satisfaction. Note that the FS and S group members were significantly more satisfied than the RB (i.e., training + facilitation + system) and F members. The difficulty here is that facilitation and system-based sources appear in *both* the high and low satisfaction groups. Training may provide a partial explanation. There was a main effect for training (without respect to the presence or absence of facilitation or system-based restrictiveness) with untrained groups having higher satisfaction than trained groups. Training was present in two of the three lowest means and was absent from the three highest means. The addition of facilitation or system-based process restrictiveness to training appeared to generally improve process satisfaction.

Why did system-based process restrictiveness yield high process satisfaction while training was associated with low process satisfaction? It seems intuitive that trained groups would better understand both the spirit and mechanics of the GDMP compared to untrained groups. Such an understanding should help to reduce any cognitive dissonance between the GDMP and the group members' understanding of the decision process. Actually, the training may have created a process burden in the group members. All groups were instructed to use the GDMP to solve the case. Since trained group members had actually practiced using the activities, sequences, and processes in the GDMP, they may have been frustrated in trying to actually implement these structures in their group's process whereas the untrained groups were less aware of when their group was not actually following the GDMP structures. Thus, trained group members were likely more

aware than untrained group members of both the *process* and *content* aspects of their group's interaction. This awareness of process management may have contributed to lower process satisfaction. Similarly, the F treatment group members may have been less satisfied because they had no awareness (beyond the introduction to the GDMP or their own reading of it) of the underlying rationale for why the facilitator was correcting their group's actions.

The presence of system-based restrictiveness likely provided a passive form of process guidance. Chapter 3 noted that restrictiveness is intended to limit the possible options available to GSS users while guidance is intended to enlighten users as they choose their decision process. System-based restrictiveness did effectively limit the users' options regarding which GSS tools could be invoked at which times. But in doing so, it provided a redundant source of interactive guidance which paralleled the GDMP. Since the full agenda of the GDMP was displayed on each group member's screen, it likely served as a procedural focal point for the group and reduced the process management burden. Table 52 summarizes how system restrictiveness interacted with other process restrictiveness sources. The influences described here will be considered further in a later section of this chapter.

Table 52
System-Based Restrictiveness Influences on Process Satisfaction

Treatment	Influences	Process Satisfaction Mean
S	Procedural focus, but free to use or abandon	3.823
FS	Procedural focus with enforcement	3.827
TS	Procedural focus with awareness	3.687
RB	Procedural focus, awareness, and enforcement	3.513

Overall, these results suggest that the presence of system-based restrictiveness has a strong ability to enhance process satisfaction while training tends to reduce process satisfaction. Facilitation alone was associated with low satisfaction. Facilitation in combination with other sources of process restrictiveness does not exhibit any coherent pattern of effects beyond those attributable to training and system.

Explanatory Factors in this Experiment

The process satisfaction outcomes reported here may be related to the nature of the subjects, the sufficiency of the training, or the type of GSS. The experiment did not assess the subjects' degree of experience with decision-making meetings. Based on the average subject age and classification, however, it can be reasonably assumed that most students had little experience with the type of decision-making meeting used in this experiment. Thus, group members who have more experience with the difficulties of decision-making meetings in organizations are likely to have a much broader base for assessing *relative* process satisfaction than the subjects used in this experiment.

A second concern related to this experiment was the sufficiency of the training. While the training exercise did explain the heuristic and allow the group to practice using it on a sample problem, it was one-time training with no follow up instruction to reinforce the rationale for the heuristic. It afforded almost no opportunity for *learned process restrictiveness* (Chapter 3) to develop, and the group was assessed during its first attempt to appropriate the training. Training which affords additional time to explain the difficulties or process losses in group decision making and which allows more

opportunities to practice using the structured decision activities is likely to be more effective than the relatively brief training used in this experiment.

The GSS employed in this experiment required the use of a chauffeur to activate the tools. Therefore, group members had to informally seek group approval before giving direction to the chauffeur to activate a certain tool. The assessments of process satisfaction may have been different if the GSS had been completely user-driven so that any group member could activate a tool without the assistance of a chauffeur. As previously noted, the onscreen agenda in the high system-based restrictiveness treatment may have induced unanticipated effects due to its guidance features.

Outcome Satisfaction

The outcome satisfaction hypotheses found more support than those hypotheses previously covered. They expected that group members in the most restrictive condition would be more satisfied with the outcome than members who experienced any single source or no process restrictiveness; that facilitation alone would be associated with the highest outcome satisfaction compared to other single sources or no source of process restrictiveness; and that system-based restrictiveness would have the lowest outcome satisfaction (among single sources or an absence of process restrictiveness).

Interpretation

The threefold combination of process restrictiveness sources did not yield higher outcome satisfaction scores than single sources (or no source). Facilitation alone resulted in higher outcome satisfaction than six of the other seven treatments, though it was not significantly higher than training alone. As previously noted, group members in the F

treatment expressed high outcome satisfaction which was consistent with their group's high quality decision. Group members in the T treatment expressed similarly high satisfaction with the outcome, but actually had a low quality decision.

The outcome satisfaction results are very different from the findings for process satisfaction. Training alone or facilitation alone yielded high outcome satisfaction, but the combination of these two sources drastically reduced outcome satisfaction to an almost identical level with no source of process restrictiveness. In fact, the combination of training and system-based sources had the lowest score of all eight treatments.

The message in the pattern of means among single sources or an absence of process restrictiveness is generally clear: Training or facilitation alone results in higher outcome satisfaction than either system-based process restrictiveness or no source of process restrictiveness. There is no coherent pattern among the other combinations.

Explanatory Factors in this Experiment

The outcome satisfaction results may have been different had the group members had a greater stake in the outcome. The subjects in this experiment did not have to justify their decision to outside constituencies nor did they have to bear the responsibility of allocating scarce resources among competing interests. This absence of accountability and responsibility for the decision outcome likely makes these results different than would be reported by real organizational members.

The subjects' favorable assessments of outcome satisfaction in the F or T treatment could also be an artifact of the students believing what they were told. The experimental script stated that the facilitator was there to "assist their group" and that the GDMP,

which the subjects likely did not distinguish from the training, was "useful when groups are dealing with a complex problem" (Appendix F). Subjects in the F and T treatments, which reported the highest levels of outcome satisfaction, were not exposed to multiple sources of process restrictiveness which may have diluted the weight of these statements.

Consensus

The interpretation of consensus in conjunction with an intellective task warrants careful attention. Unlike decision quality or process satisfaction, where higher levels of these variables are reasonably viewed as more favorable, higher levels of consensus are not always favorable. For example, a group could have complete unanimity among its members and still have a poor solution. Conversely, group members may reluctantly agree to a relatively good solution which addresses the important problems and constraints of a decision; yet, privately, each group member may not agree (i.e., low consensus) with the group's decision. Groups who achieve high consensus early in their decision process may systematically ignore information which is incongruent with the group's present direction (Janis, 1982). Premature consensus is likely carry through to the final decision unless it is altered by new information.

The consensus hypotheses were not supported. These hypotheses predicted that group members in the most restrictive condition would have the highest consensus (compared to single sources or an absence of process restrictiveness); that facilitation alone would yield higher consensus than other single sources or an absence of process restrictiveness; and that system-based restrictiveness would have the lowest consensus among single sources or no process restrictiveness.

Interpretation

The perceptual measure of consensus found an interaction between the training and system-based sources without respect to the presence or absence of facilitation. System-based process restrictiveness without training was associated with higher perceived consensus than the combination of the training and system-based sources. The general pattern here is similar to process satisfaction. The activation of the system-based source tended to raise perceived consensus while the activation of the training source tended to reduce it. Both the system-based and training sources of process restrictiveness had generally low quality decisions. Thus, it appears that system-based restrictiveness contributed towards high perceived consensus when the group actually had a low quality solution. From the perspective of improving group decisions, this was a most undesirable combination of outcomes (i.e., high agreement for a poor decision).

The objective consensus measures -- number of solutions, maximum votes for one idea, and agreement -- generally found that groups with no source of process restrictiveness (NRB) had the highest consensus while groups in the T and RB treatments had the lowest. One probable explanation for these results is directly related to the nature of the hidden-profile research task. Since much of the task-relevant information is hidden from any one group member (i.e., each member only had one-fifth of the information), the group's decision process mediates the degree of information sharing among the group. If the group process had led each group member to share his or her information with the others, the real complexity and difficulty of resolving the case likely became more apparent (i.e., many obvious solutions to the problems were blocked by constraints known

to other group members). If the group's process did not prompt the individuals to communicate or to think about the relevance of their information, the group was likely to develop a decision based on incomplete information. In terms of the research task, the perceived feasible solution space for the SOB task will be larger (i.e., providing more room for agreement among group members) if the group is not fully aware of all the problems and constraints for the case. The GDMP was designed to promote information sharing among the group members. Trained groups likely had a better understanding of how to attain the goals of the GDMP (e.g., identify the real problem, identify and weight opportunities and constraints) than untrained groups. Thus, it appears that an increased awareness of the GDMP's information sharing structures actually reduced consensus. Since the trained groups were often selecting relatively low quality solutions, lower consensus may actually have been a favorable group outcome for these groups because it should signal the group to keep trying for an answer which elicits more agreement in the group. Group members who experienced no process restrictiveness or only the system-based source, however, had no *mandate* to faithfully pattern their group's decision process in accordance with the GDMP.

Explanatory Factors in this Experiment

Similar to outcome satisfaction, the subjects' absence of real responsibility and accountability for this decision may have influenced the degree of consensus in the group. Members of real organizations would be risking their professional reputation when they endorsed a group decision and would likely bear the future consequences of poor decisions. Thus, the levels of consensus reported by the student subjects who had no real,

direct stake in the decision may not parallel group decisions when the members bear a real responsibility and accountability for their decision.

The levels of consensus reported here may have also been influenced by the length of the experiment. Most groups were in the laboratory for over 120 minutes and knew that group agreement regarding what to write on the solution memorandum was a prerequisite to finishing the experiment unless they ran out of time. Even groups who were approaching or who reached the time limit still elicited some form of agreement from all group members before writing the memorandum. Members of natural groups in organizations may have been more willing to leave the memorandum unsigned and call for a second meeting rather than consenting to a decision they did not truly endorse.

ANALYSIS OF THE RESEARCH RESULTS

Process Restrictiveness Sources Revisited

Chapter 3 described three sources of process restrictiveness and their expected efficacy in each mode of group communication. The results of this experiment have suggested additional insights about the important features of each source.

User-based process restrictiveness, or training as it was operationalized in this experiment, proved to be an ineffectual source of process restrictiveness for improving group outcomes. Trained subjects practiced using the activities, sequences, and philosophical structures of the GDMP with the goal of activating artificial restrictiveness (Chapter 3). The results indicated that training was generally associated with low decision quality, low process satisfaction, low consensus, and high outcome satisfaction.

Training appeared to create an *awareness* of a group's process and of the activities, sequences, and philosophy advocated by the heuristic. It did not, however, effectively *enable* groups to use these structures.

Facilitation, as used in the experiment, only addressed the restrictive aspects of using a process facilitator (see Appendix D). Most group process facilitation involves a much richer process where the facilitator helps to guide the group when it encounters procedural or relational obstacles. In this experiment, facilitation was associated with high decision quality, low process satisfaction, high outcome satisfaction, and no impact on consensus. Facilitation's main feature was to detect when a group's process deviated from the heuristic and to remind the group to implement the heuristic. Thus, facilitation corrected deviations from the heuristic.

The system-based source restricted a group's access to the GSS tools by mandating that they be sequenced in accordance with the heuristic. System-based process restrictiveness was associated with low decision quality, high process satisfaction, low outcome satisfaction, and high perceived consensus. With system-based process restrictiveness, the sequence of activities was always visible on the group members' screens (assuming they were not engaged in a particular tool such as Brainwriting) and the current group activity was also highlighted. This source's main feature was to provide procedural focus for the group. Table 53 contrasts the key features for each source of process restrictiveness.

Table 53
Key Features of Process Restrictiveness Sources

Process Restrictiveness Source	Key Feature		
	Awareness	Correcting of Process Deviations	Process Focus
No Process Restrictiveness			
Training	√		
Facilitation		√	
System			√
All Sources	√	√	√

Combined Sources of Process Restrictiveness

While Table 53 accurately reflects the key features most frequently associated with each single source, combining these process restrictiveness sources rarely proved to be an additive process. For some dependent measures, combining two singularly favorable sources yielded an unfavorable result. The opposite was also true. Activating all three sources generally yielded low to moderate scores across the entire set of dependent measures. Thus, one conclusion is clear: More process restrictiveness -- activating all sources -- did not improve outcomes beyond those associated with a single source or some dual combinations.

IMPLICATIONS OF THE RESEARCH RESULTS

The results of this experiment have implications for both theory and practice.

Theory

The Adaptive Structuration Theory (AST) (Poole & DeSanctis, 1990) posits that "no matter what features are designed into a system, users mediate technological effects, adapting systems to their needs, resisting them, or refusing to use them at all" (p. 177).

The Process Restricted Adaptive Structuration Theory (PRAST) extended AST to better encompass the determinism associated with the Balance of Forces Model (BOFM) (Connolly et al., 1990; Nunamaker et al., 1991). Since the experimental treatments in this dissertation yielded some predicted and some unpredicted levels of decision quality, satisfaction, and consensus, the concept of process restrictiveness merits further consideration as an important GSS research topic. This dissertation has conceptualized, empirically tested, and reported on the single and joint effects of process restrictiveness sources.

PRAST Revisited

The experimental results have implications for the future testing and further development of PRAST. The independent and control variables in this experiment (e.g., source(s) of process restrictiveness and the task, heuristic, subjects, technology, and setting) attempted to rule out rival explanations for group outcome differences. The *deterministic* aspects of making a structure available (see Figure 7 for a list of potential sources of structure) and the various forms of mandating the faithful appropriation of a structure (i.e., process restrictiveness sources) did not fully account for the outcome differences between treatments. Thus, we conclude that the *availability* of a structure and *process restrictiveness* do not adequately explain *why* these groups produced different levels of decision quality, satisfaction, and consensus. This conclusion has two implications for PRAST.

The first implication is to rethink PRAST's deterministic component of linking faithful appropriation -- if, in fact, it did occur (see below) -- to effective outcomes via the

Balance of Forces Model. The process gains and losses which comprise the BOFM (Table 6) list the processes which are believed to enhance and impede group performance. Nunamaker et al. (1991) links various GSS structures (e.g., anonymity, parallelism, etc.) to these gains and losses. While the BOFM acknowledges that the utility of a particular process gain or loss is likely moderated by the requirements of the task, characteristics of the group, and context of the decision, it does not specify the conditions under which a particular process gain or process loss impacts group outcomes. For example, the process gain of *reducing evaluation apprehension* via anonymity (a feature of the technology process support) appeared to yield little, if any, benefit for the ad hoc groups used in this experiment. Since these group members faced no political repercussions for their comments and opinions, faithful appropriation of the anonymity structure -- and its presumed positive contribution to the balance of forces equation -- was not a meaningful determinant of effective outcomes. This leads to the second implication for PRAST.

What we do not yet know, in terms of testing PRAST, is which of the two decision paths -- *faithful* or *unfaithful* -- more frequently represented a group's appropriation process. Process restrictiveness sources were enacted to enhance the likelihood of faithful appropriation of the heuristic and GSS structures. Further analysis (described in Chapter 7) is needed to assess if the process restrictiveness sources did increase the number of faithful appropriations. Testable propositions for this were enumerated in the PRAST model.

While group researchers have long known that inputs alone (i.e., sources of structures) do not adequately explain outcomes, PRAST contributes a theoretical model to guide process research for technology-supported group decision making.

GSS Research Agenda

This research joins with that of DeSanctis and colleagues in pushing the GSS research agenda beyond the initial question of *"Do technology-supported groups do better or worse than manual groups?"* to *"What are the conditions which cause users to faithfully or unfaithfully appropriate a particular heuristic or GSS structure*?" Chapter 7 will more fully address future research directions.

Practice

If the goal is to improve decision quality for complex group decisions, facilitation -- even the weak form of facilitation used in this experiment -- is without a challenger. The training and system-based sources of process restrictiveness (as used in this experiment) were not effective. Obviously, this implication is limited to decisions made by technology-supported groups using some form of a heuristic (Chapter 7 more fully discusses the important limitations of this work). The inefficacy of system-based restrictiveness is especially discouraging for GSS proponents as these systems move beyond the same time and same place meeting. Since it is difficult or very expensive to deliver facilitation (in its currently practiced form) for temporally or spatially distributed meetings, it was hoped that system-based process restrictiveness would be able to serve as a surrogate for human facilitation in these meetings. Other empirical work, however, has assessed multiple forms of system-based guidance for a nonintellective task (Limayem,

1992; Limayem, Lee-Partridge, Dickson, & DeSanctis, 1993). They found that automated guidance can be embedded in GSSs with results which are equally favorable to the use of human facilitation. Their results suggest a more promising role for GSSs.

SUMMARY

This chapter has interpreted the statistical results presented in Chapter 5. In some cases, these numerical results were augmented with observational evidence from the researcher's laboratory journal and GSS transcripts. No single source or combination of process restrictiveness sources was associated with more favorable results across all four dependent measures. The pattern of results did suggest new insights regarding the dominant feature of each process restrictiveness source. The implications of these results for theory and practice were also presented. Chapter 7 will detail important limitations for interpreting and generalizing these results to other situations. It also describes future research directions for PRAST.

CHAPTER 7

LIMITATIONS AND FUTURE DIRECTIONS

This chapter describes some of the strengths and important limitations for interpreting the results. It reports on the *lessons learned* from this research regarding the school of business (SOB) task and the assessment of consensus. The dissertation concludes with directions for future research.

STRENGTHS AND LIMITATIONS

Strengths

The use of a controlled laboratory experiment is believed to be a strength of this research. While this choice imposed some limitations for generalizing the results (described below), it allowed the research to isolate the effects of each source of process restrictiveness. Every effort was made to control intervening influences which might threaten the experimental manipulation as the reason for the results. Efforts to control possible intervening influences included the use of a single source for research subjects, only one group size, one technology, a common physical environment, structured instrumentation, a single task, scripted experimental instructions, and a single facilitator.

The SOB task is also believed to be a strength of this research. The task was well-suited to the student subjects and proved to be highly engaging. More important,

however, the hidden-profile nature of the task effectively induced a larger logical group size (Valacich et al., 1993) than much previous GSS research (Nunamaker et al., 1989). The task's high complexity also makes it different from other GSS research (Mennecke & Wheeler, 1993). Thus, by inducing a larger logical group size and by increasing task complexity, this research has addressed two important criticisms of laboratory-based GSS research (Dennis et al., 1991).

Limitations

As a controlled laboratory experiment, however, this research inherits some of the limitations of the laboratory technique. There are also important limitations which are specific to this study. These limitations provide important guidance for generalizing these results to other group decision-making contexts.

The pros and cons of using university students as subjects in behavioral research has been long debated (see Gordon et al., 1986, 1987; Greenberg, 1987). The relevant issue in this controversy is the purpose of the study. This dissertation experiment sought to learn if decision-making groups, aided by a GSS and a heuristic, would produce different outcomes based on various sources of process restrictiveness. Student subjects proved to be adequate decision makers to investigate this question. Prior to generalizing these results to other populations, however,the reader should consider possible differences in the decision-making abilities of business students and the target population.

The most important limitation of this study in relation to other decision-making groups is the one-time, ad hoc nature of the research groups. Group development can play an important role in mediating the manner in which GSSs are used (Mennecke,

Hoffer, & Wynne, 1992). The groups used in this research were ad hoc groups with no history or future of working together. While the SOB task did embed the decision scenario in a familiar context for students, it did not sufficiently replicate the many competing goals and projects which occur over time for organizational groups (McGrath, 1991).

Time factors are also a key limitation of this work. First, these groups only had one exposure to using the heuristic and the GSS. PRAST posits that feedback from experience will moderate the appropriation process for future uses. Decision makers who have spent more time with the heuristic and the GSS may produce different results. A second time-related issue was the limited time available for performing the SOB task in the laboratory. Most groups used all or nearly all of the 55 minutes[19] allotted to make a group decision. The availability of additional time may have changed some groups' performance on the SOB task. Conversely, the time limit may have made the decision setting similar to that in organizational groups, which rarely have unlimited time to make group decisions.

Finally, accuracy of the decision quality scores for the SOB task is an important factor. The five roles in the case all contained information regarding various problems and constraints which precluded the development of an obvious and suitable solution. The validity of the decision quality results is contingent upon the accuracy of the multicriteria and multiple-judge scoring procedure used.

---

[19]Group members also had ten minutes to read the task and to make private notes before the heuristic was introduced. They were additionally given two to three minutes to reread the task prior to beginning the group decision process.

LESSONS LEARNED

In the process of conducting any major research project, the investigator inevitably gains new insights regarding certain elements of his work. This section reports additional insights regarding the SOB task and assessments of group consensus.

School of Business Task

The SOB task proved to be a very effective stimulus for evoking an engaging group decision-making process. The researcher observed groups employing a variety of decision strategies to solve the case. The hidden-profile nature of the case is believed to have evoked very different group processes than tasks which provide a common stimulus to all group members. One primary difference is that the real problem(s) in the case are not obvious to all group members, the group must identify which problem(s) to solve in addition to choosing a solution. The researcher concludes that the task is useful when the research question is concerned with the group decision *process*.

As noted in Chapter 6, the set of common experiences among the subjects with the Indiana University School of Business may have reduced their reliance on the facts in the case. This reliance on their nontask experiences may have caused the groups to be less vigilant in surfacing the task-relevant information in the case. Thus, researchers may be wise to choose tasks which offer either complete contextual reality (i.e, this case *is* the Indiana University School of Business) or to create situations where the common experiences among the subject pool will be less likely to affect their processing of the task. Future uses of the SOB task would also benefit from enhancing the quality of the role play among the subjects. This could be facilitated by asking each subject *to describe their*

responsibilities and important constituencies to the other group members when they introduce their role. A second improvement, in terms of increasing the generalizability of the task, would be developing some method of a political power structure in the group. Use of the task with intact groups may facilitate this. If the case were used with intact groups who have an internal power structure, however, the researcher should consider how the roles in the case would match the group's political structure (i.e., the group would probably find it awkward if the most powerful and influential member of the group received the student's role). Any selection and operationalization of a research task imposes critical tradeoffs. *Awareness* of these tradeoffs is essential for making informed decisions regarding research task and other design choices (see the *Three-Horned Dilemma* in McGrath, Martin, & Kulka, 1982).

Research questions which focus on group outcomes with less interest in evoking a variety of decision processes may be better served by other research tasks which are less complex and which offer simpler methods of assessing decision quality.

Consensus as a Dependent Measure

The lack of a relationship between perceived consensus and the more objective measures of consensus used in this study proved insightful. The self reports of perceived consensus bore no relationship to what the subjects actually recorded as their group's solution. Thus, objective measures of consensus -- asking the subject to write what the group agreed to do -- provide a better foundation for assessing consensus than perceptual measures.

A second observation is that consensus was not an effective surrogate for decision quality for the type of task used in this experiment. Finally, when research subjects have no real stake in the outcome nor will they bear accountability or responsibility for their decision, consensus may be a less meaningful outcome measure than objective decision quality as the basis of GSS design or the assessment of GSS effectiveness. Future research on GSSs might investigate how the technology could influence group members' perceptions of consensus to better match the real levels of consensus in the group.

FUTURE RESEARCH DIRECTIONS

The treatments used in this experiment resulted in different outcomes, thus the next logical step is to identify specifically what factors may be moderating the appropriation process. Process coding of the specific appropriation moves (i.e., the acts of appropriating a heuristic, technology or other source of structure) is the next logical step. The outcome measures only gave a general indication of which path in the PRAST model that a group may have traversed. Coding of the appropriation moves will allow further testing of the research propositions and refinement of the PRAST model. DeSanctis and Poole (in press) have described a scheme for coding appropriation moves. While such coding is extremely time and resource intensive, it will offer the best detailed explanation for the differences found in this experiment.

A second direction for investigating process restrictiveness is to test the restrictiveness sources with other types of groups, tasks, technologies, and heuristics. Tests with other subject populations, especially groups with a history and a future for

working together, could prove to be insightful. In terms of PRAST, these groups would be able to draw on the structures in the *group's internal system* and *organizational environment* boxes (Figure 7). If the process restrictiveness sources could be evaluated with groups who used a GSS over a period of time, each source's ability to create *learned restrictiveness* could also be assessed. Similarly, other types of tasks are expected to yield different insights about the role of process restrictiveness.

Empirically investigating process restrictiveness and process guidance are important first steps toward the next generation of group support technologies. Current GSSs enable process structuring techniques. Future systems may include expert advice on selecting meeting processes and impose machine induced communication patterns (DeSanctis & Gallupe, 1987). Research in theory building, systems development, experimentation, observation, and the interplay of these four endeavors (Nunamaker, 1992) will likely shape these future systems.

REFERENCES

Benbasat, I., and Lim, L., (1992). The effects of group, task, context, and technology variables on the usefulness of group support systems: A meta-analysis. Working paper #91-MIS-20. University of British Columbia, Vancouver, B.C.

Bettenhausen, K. L. (1991). Five years of groups research: What we have learned and what needs to be addressed. *Journal of Management*. 17, 345-381.

Bostrom, R. P., Anson, R., and Clawson, V. K. (1993). Group facilitation and group support systems. In L. Jessup and J. Valacich, (Eds.), *Group support systems: New perspectives*, New York: Macmillan.

Bray, J. H., and Maxwell, S. E. (1985). *Multivariate analysis of variance*. Beverly Hills: Sage.

Campbell, D. T., and Stanley, J. C. (1966). *Experimental and quasi-experimental designs for research*. Boston: Houghton Mifflin.

Cats-Baril, W. L., and Huber, G. P. (1987). Decision support systems for ill-structured problems: An empirical study. *Decision Sciences,* 8, 350-372.

Connolly, T. M., (1993). Behavioral decision theory and group support systems. In L. Jessup and J. Valacich, (Eds.), *Group support systems: New perspectives*, New York: Macmillan.

Connolly, T. M., Jessup, L. M., and Valacich, J. S. (1990). Effects of anonymity and evaluative tone on idea generation in computer-mediated groups. *Management Science*, 36(6), 689-703.

Daft, R. L., and Lengel, R. (1986). Organizational information requirements, media richness, and structural design. *Management Science*, 32(5), 554-571.

Delbecq, A. L., and Van de Ven, A. H. (1971). a group process model for problem identification and program planning. *Journal of Applied Behavioral Science*, 7, 466-492.

Dennis, A. R., George, J. F., Jessup, L. M., Nunamaker Jr., J. F., and Vogel, D. R. (1988). Information technology to support electronic meetings. *MIS Quarterly*, 12, 591-624.

Dennis, A. R., and Gallupe, R. B. (1993). A history of GSS empirical research: Lessons learned and future directions. In L. Jessup and J. Valacich (Eds.), *Group support systems: New perspectives*. New York: Macmillan.

Dennis, A. R., Nunamaker Jr., J. F., and Vogel, D. R., (1991). A comparison of laboratory and field research in the study of electronic meeting systems. *Journal of Management Information Systems*, 7(2), 107-135.

DeSanctis, G. R., D'Onofrio, M. J., Sambamurthy, V., and Poole, M. S. (1989). Comprehensiveness and restrictiveness in group decision heuristics: Effects of computer support on consensus decision making. In *Proceedings from the Tenth Annual International Conference on Information Systems*. 131-140.

DeSanctis, G. R. and Gallupe, R. B. (1987). A foundation for the study of group decision support systems. *Management Science*, 33(5), 589-609.

DeSanctis, G. R. and Poole, M. S. (in press). Capturing the complexity in advanced technology use: Adaptive structuration theory. *Organization Science*.

Dewey, J. (1910). *How we think*. Boston, MA: D. C. Heath.

Doyle, M., and Straus, D. (1976). *How to make meetings work*. New York: Wyden.

Dubin, R. (1978). *Theory building*. Revised edition, New York: Free Press.

Ebel, R. L. (1951). Estimation of the reliability of ratings. *Psychometrika*, 16(4), 407-424.

Giddens, A. (1979). *Central problems in social theory*. Berkeley, CA: University of California Press.

Gordon, M. E., Slade, L. A., and Schmitt, N. (1986). The 'science of the sophomore' revisited: From conjecture to empiricism, *Academy of Management Review*, 11(1), 191-207.

Gordon, M. E., Slade, L. A., and Schmitt, N. (1987). Student guinea pigs: Porcine predictors and particularistic phenomena, *Academy of Management Review*, 12(1), 160-163.

Gouran, D. S. (1982). *Making decisions in groups: Choices and consequences*. Prospect Heights, IL: Waveland.

Green, S. G., and Taber, T. D. (1980). The effects of three social decision schemes on decision group process. *Organizational Behavior and Human Performance*, 25, 97-106.

Greenberg, J. (1987). The college sophomore as guinea pig: Setting the record straight, *Academy of Management Review*, 12(1), 157-159.

Hackman, J. R. (1968). Effects of task characteristics on group products. *Journal of Experimental Social Psychology*, 4, 162-187.

Hackman, J. R., and Kaplan, R. E. (1974). Interventions into group process: An approach to improving the effectiveness of groups. *Decision Sciences*, 5, 459-480.

Hackman, J. R., and Morris, C. G. (1975). Group tasks, group interaction process, and group performance effectiveness: A review and proposed integration. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 8, pp. 45-99). New York: Academic Press.

Hackman, J. R., and Morris, C. G. (1978). Group process and group effectiveness: A reappraisal. In L. Berkowitz (Ed.), *Group processes*. New York: Academic Press.

Hall, J. and Watson, W. H. (1970). The effects of a normative intervention on group decision-making performance. *Human Relations*, 23, 299-317.

Hall, J., and Williams, M. (1970). Group dynamics training and improved decision making. *Journal of Applied Behavioral Science*, 6, 39-68.

Herschel, R. T. (1991). An assessment of the effects of varying group gender composition on group performance and group member attitudes in an electronic meeting system environment. Unpublished thesis (Ph. D.), Indiana University, Bloomington, IN.

Hirokawa, R. Y. (1987). Why informed groups make faulty decisions: An investigation of possible interaction-based explanations, *Small Group Behavior*, 18, 3-29.

Hirokawa, R. Y., and Gouran, D. S. (1989). Facilitation of group communication, A critique of prior research and an agenda for future research, *Management Communication Quarterly*, 3, 71-92.

Hirokawa, R. Y., Ice, R., and Cook, J. (1988). Preference for procedural order, discussion structure and group decision performance. *Communication Quarterly*, 36, 217-226.

Hirokawa, R. Y., and Pace, R. C. (1983). A descriptive investigation of the possible communication based reasons for effective and ineffective group decision making. *Communication Monographs*, 50, 363-379.

Hoffman, L., and Maier, N. (1959). The use of a group decision to resolve a problem of fairness. *Personnel Psychology*, 12, 545-559.

Huber, G. P. (1984). Issues in the design of group decision support systems. *MIS Quarterly*, 195-204.

ICIS Panel (1992). Structuration theory in information systems research: Dilemmas and solutions. *Panel Discussion at the Thirteenth International Conference on Information Systems*, Dallas, TX.

Jablin, F. M. and Siebold, D. R. (1978). Implications for problem solving groups of empirical research on 'brainstorming': A critical review of the literature. *The Southern States Speech Communication Journal*, 43, 327-356.

Janis, I. L. (1982). *Groupthink* (2nd ed.). Boston: Houghton Mifflin.

Jenkins, A. M. (1984). Research methodologies and MIS research. Discussion paper #277, Indiana University Graduate School of Business.

Johansen, R., Sibbet, D., Benson, S., Martin, A., Mittman, R., and Saffo, P. (1991). *Leading business teams: How teams can use technology and process to enhance group performance*. Reading, MA: Addison-Wesley.

Klockars, A. J., and Sax, G. (1986). *Multiple comparisons*. Beverly Hills:Sage.

Limayem, M. (1992). *Automating decision guidance: Design and impacts in a group decision support environment*. Unpublished docotoral dissertation, University of Minnesota.

Limayem, M., Lee-Partridge, J. E., Dickson, G. W., DeSanctis, G. R (1993). Enhancing GDSS effectiveness: Automated versus human facilitation. In J. F. Nunamaker, Jr. and R. H. Sprague, Jr., *Proceedings of the Twenty-Sixth Annual Hawaii International Conference on System Sciences* (pp. 95-101), Volume IV, Los Alamos, CA: IEEE Society Press.

Lindman, H. R. (1990). *Analysis of variance in experimental design*. Psychology department, Indiana University.

Maier, N. R. F., and Maier, R. A. (1957). An experimental test of the effects of "developmental" vs. "free" discussions on the quality of group decisions. *Journal of Applied Psychology*, 41, 320-323.

Maier, N. R. F., and Hoffman, L. (1960). Using trained 'developmental' discussion leaders to improve further the quality of group decisions. *Journal of Applied Psychology*, 44, 247-251.

Maier, N. R. F., and Thurber, J. A. (1969). Limitations of procedures for improving group problem solving. *Psychological Reports*, 25, 639-656.

Mason, R. O., and Mitrroff, I. I. (1973). A program for research on management information systems. *Management Science*, 19(5), 475-487.

McGrath, J. E. (1982). Dilemmatics: The study of research choices and dilemmas. In J.E. McGrath, J. Martin, and R. A. Kulka (Eds.), *Judgment calls in research*. Beverly Hills: Sage.

McGrath, J. E. (1984). *Groups: Interaction and performance*, Englewood Cliffs, NJ: Prentice-Hall.

McGrath, J. E. (1991). Time, interaction, and performance (TIP): A theory of groups. *Small Group Research*, 22, 147-174.

Mennecke, B. E., and Wheeler, B. C. (1993). Task matters: Modeling group task processes in experimental CSCW research. In J. F. Nunamaker, Jr. and R. H. Sprague, Jr., *Proceedings of the Twenty-Sixth Annual Hawaii International Conference on System Sciences* (pp. 71-80), Volume IV, Los Alamos, CA: IEEE Society Press.

Mennecke, B. E., Hoffer, J. A., and Wynne, B. E. (1992). The implications of group development and group history for GSS theory and practice. *Small Group Research*, 23:4, 524-572.

Mintzberg, H., Raisinghani, D., and Théorêt, A. (1976). The structure of "unstructured" decision processes. *Administrative Science Quarterly*, 21, 246-275.

Neter, J., and Wasserman, W. (1974). *Applied linear statistical models*, Homewood, IL: Irwin.

Noel, T. D. (1992). *Effects of anonymity on intact group performance and member attitudes in a group support system environment: An empirical assessment*. Unpublished thesis (Ph. D.), Indiana University, Bloomington, IN.

Nunamaker, Jr., J. F. (1992). Build and learn, evaluate and learn. *Informatica*, 1, 1-6.

Nunamaker, Jr., J. F., Applegate, L. M., and Konsynski, B.. R. (1987). Computer-aided deliberation: Model management and group decision support. *Journal of Operations Research*, 36(6), 826-848.

Nunamaker, Jr., J. F., Dennis, A. R., Valacich, J. S., Vogel, D. R., and George, J. F. (1991). Electronic meeting systems to support group work. *Communications of the ACM*, 34, 41-61.

Nunamaker, Jr., J. F., Vogel, D. R., and Konsynski, B. (1989). Interaction of task and technology to support large groups. *Decision Support Systems*, 5(2), 139-152.

Nutt, P. C. (1984). Types of organizational decision processes, *Administrative Sciences Quarterly*, 29, 414-450.

Orlikowski, W. J. (1992). The duality of technology: Rethinking the concept of technology in organizations. *Organization Science*, 3(3), 398-427.

Orlikowski, W. J., and Baroudi, J. J. (1991). Studying information technology in organizations: Research approaches and assumptions, *Information Systems Research*, 2(1), 1-28.

Orlikowski, W. J., and Robey, D. (1991). Information technology and the structuring of organizations, *Information Systems Research*, 2(2), 143-169.

Pinsonneault, A., and Kraemer, K. L. (1989). The impact of technological support on groups: An assessment of the empirical research. *Decision Support Systems*, 5(2), 197-216.

Poole, M. S. (1990). Procedures for managing meetings: Social and technological innovation. University of Minnesota Training and Development Research Center, February.

Poole, M. S. (1990b). The process of group decision making. In B. A. Fisher and D. G. Ellis (Eds.), *Small group decision making: Communication and the group process (3rd Edition)*. New York: McGraw-Hill.

Poole, M. S., and DeSanctis, G. R. (1989). Use of group decision support systems as an appropriation process. In the *Proceedings of the Twenty-Second Annual Hawaii International Conference on System Sciences*, Volume IV, Los Alamos, CA: IEEE Society Press.

Poole, M. S., and DeSanctis, G. R. (1990). Understanding the use of group decision support systems: The theory of adaptive structuration. In C. Steinfield and J. Fulk (Eds.), *Theoretical approaches to information technologies in organizations*. Beverly Hills, CA: Sage.

Poole, M. S., Holmes, M., and DeSanctis, G. R. (1991). Conflict management in a computer-supported meeting environment. *Management Science*, 37(8), 926-953.

Poole, M. S., and Roth, J. (1988a). Decision development in small groups: IV. A typology of group decision paths. *Human Communication Research*, 15, 323-356.

Poole, M. S., and Roth, J. (1988b). Decision development in small groups: V. Test of a contingency model. *Human Communication Research*, 15, 549-589.

Poole, M. S., Siebold, D. R., and McPhee, R. D. (1985). Group decision-making as a structurational process,. *Quarterly Journal of Speech*, 71, 74-102.

Putnam, L. L. (1979). Preference for procedural order in task-oriented small groups. *Communication Monographs*, 1979, 193-218.

Putnam, L. L. (1982). Procedural messages and small group work climates: A lag sequential analysis. *Communication Yearbook 5*, 331-350.

Shavelson, R. J. (1986). *Statistical reasoning for the behavioral sciences (2nd edition)*.Needham Heights, MA: Simon and Schuster.

Silver, M. S. (1988). On the restrictiveness of decision support systems. In R. M. Lee, A. M. McCosh, and P. Migliaresse (Eds.), *Organizational Decision Support Systems*, North-Holland, Elsevier Science, 259-270.

Silver, M. S. (1990). Decision support systems: Directed and nondirected change. *Information Systems Research*, 1, 47-70.

Silver, M. S. (1991). *Systems that support decision makers*, New York: Wiley.

Simon, H. A. (1965) *The shape of automation*. New York: Harper and Row.

Stasser, G. (1992). Information salience and the discovery of hidden profiles by decision-making groups: A thought experiment. *Organizational Behavior and Human Decision Processes*, 52, 156-181.

Steiner, I. D. (1972). *Group process and productivity*, New York: Academic Press.

Stone, E. F., (1978). *Research methods in organizational behavior*. Santa Monica, California: Goodyear.

Valacich, J. S., Mennecke, B. E., Wachter, R., and Wheeler, B. C. (1993). Computer-mediated idea generation: The effects of group size and group heterogeneity. In J. F. Nunamaker, Jr. and R. H. Sprague, Jr., The *Proceedings of the Twenty-Sixth Annual Hawaii International Conference on System Sciences* (pp. 152-160), Volume IV, Los Alamos, CA: IEEE Society Press.

VanGundy, A. B. (1988). *Techniques of structured problem solving*. New York: Van Nostrand Reinhold.

Venkatesh, M., and Wynne, B. E. (1991). Effects of problem formulation and process structures on performance and perceptions in a GDSS environment: An experiment. In J. F. Nunamaker, Jr. (Ed.), *Proceedings of the Twenty-Fourth Annual Hawaii International Conference on System Sciences*, (Vol. 3, pp. 564-572). Los Alamitos, CA: IEEE Computer Society Press.

Wagner, G. R., Wynne, B. E, and Mennecke, B. E. (1993). Group support systems facilities and software. In L. Jessup and J. Valacich, (Eds.), *Group support systems: New perspectives*, New York:Macmillan.

Walls, J. G., Widmeyer, G. R., and El Sawy, O. A., (1992). Building an information system design theory for vigilant EIS. *Information Systems Research*, 3(1), 36-59.

Welkowitz, J., Ewen, R. B., and Cohen, J. (1971). *Introductory statistics for the behavioral sciences*. Acadmeic Press:New York.

Wheeler, B. C., Mennecke, B. E., and Scudder, J. N. (in press). Restrictive group support systems as a source of process structure for high and low procedural order groups. *Small Group Research*.

Wheeler, B. C., and Mennecke, B. E. (1992). The school of business policy task manual: Working paper #92-524b. Indiana University Graduate School of Business, Bloomington, IN.

Wood, R. E. (1986). Task complexity: Definition of the construct, *Organizational Behavior and Human Decision Processes*, 37, 60-82.

Zigurs, I., Poole, M. S., and DeSanctis, G. R. (1988). A study of influence in computer-mediated group decision making. *MIS Quarterly*, 12(4), 625-644.

APPENDIX A: CONSENT STATEMENT & INSTRUMENTS

Appendix A-1: Informed Consent Statement

IUB Informed Consent Statement

If you decide to participate, you will receive some training in decision techniques and in how to use the computer system. Then your group will be asked to solve a common business problem and then make a recommendation. Finally you will complete a questionnaire at the end of the session. Your total time in this experiment should be between two and two and a half hours. Participation in this experiment is one way to fulfill the K201 research requirement (the K201 syllabus describes the other ways). In addition to the course credit, you will benefit from learning about a new technology and participating in a group decision making exercise. This experiment poses no known risks to its participants.

The information from this experiment will be kept confidential. All records of this experiment will be safely stored in a secure cabinet and no one will have access to this information except the researchers. No reference will be made in any written reports that could link you to the study. Only aggregate results will be reported. By signing this form you agree to allow the researchers to videotape this experiment. The video tapes will be used for research purposes and will allow the researchers to better understand how groups make decisions. The tapes are the property of the researchers and will only be viewed by the researchers and their graduate student assistants. The tapes will be kept for up to three years as part of an ongoing research program.

If you have any questions at any time about the study or the procedures, you may contact Brad Wheeler (the experimenter) at 855-9703. If you have questions about your rights as a participant in this study you may contact the office for the Human Subjects Committee, Bryan Hall 10, 855-3067. You will be given a copy of this form to keep. Your participation in this experiment is voluntary. Your decision whether or not to participate will not affect your future relations with your instructors in any way. If you decide to participate, you are free to discontinue participation at any time without affecting such relationships. If you do withdraw prior to the completion of the study, your data will not be used and you will not receive any course credit for participation.

You may withdraw at any time without prejudice after signing this form. If you choose to discontinue participation your data will be erased from the experiment. If you do decide to participate, we ask that you not discuss with your fellow students any aspect of this experiment. It is in the best interest of scientific inquiry not to discuss the experiment, as such discussion may lead to possible distortions of the data and may in effect cause the entire experiment to be abandoned. Thank you.

I have read and understand the above and agree to participate in this experiment.

Subject's Signature _____ Date _____

Subject's Social Security #: _____-_____-_____

Appendix A-2: Preliminary Questionnaire

Your Student ID: _____-_____-_____

A PRELIMINARY QUESTION

Please answer this question individually prior to working on the case as a group.

_____

_____

What do you think is the main problem in the case: (be brief)

Write a brief, concise statement describing how you would respond to the committee chairperson's directive.

_____

_____

_____

_____

Appendix A-3: Green & Taber's Satisfaction Scales

Participation (*not used in this experiment)*

1 I made suggestions about doing the task.

1	2	3	4	5
Not at all	To a little extent	To some extent	To a great extent	To a very great extent

2 I gave information about the problem.

1	2	3	4	5
Not at all	To a little extent	To some extent	To a great extent	To a very great extent

3 I asked others for their thoughts and opinions.

1	2	3	4	5
Not at all	To a little extent	To some extent	To a great extent	To a very great extent

4 I showed attention and interest in the group's activities.

1	2	3	4	5
Not at all	To a little extent	To some extent	To a great extent	To a very great extent

5 I asked for suggestions from others in the group.

1	2	3	4	5
Not at all	To a little extent	To some extent	To a great extent	To a very great extent

Solution Satisfaction

6 How satisfied or dissatisfied are you with the quality of your group's solution?

1	2	3	4	5
Very Dissatisfied	Somewhat Dissatisfied	Neither Satisfied nor Dissatisfied	Somewhat Satisfied	Very Satisfied

7 To what extent does the final solution reflect your inputs?

1	2	3	4	5
Not at all	To a little extent	To some extent	To a great extent	To a very great extent

8 To what extent do you feel committed to the group's solution?

1	2	3	4	5
Not at all	To a little extent	To some extent	To a great extent	To a very great extent

9 To what extent are you confident that the group solution is correct?

1	2	3	4	5
Not at all	To a little extent	To some extent	To a great extent	To a very great extent

10 To what extent do you feel personally responsible for the correctness of the group solution?

1	2	3	4	5
Not at all	To a little extent	To some extent	To a great extent	To a very great extent

Decision Scheme Satisfaction

11 How would you describe your group's problem solving process?

1	2	3	4	5
Efficient				Inefficient

12 How would you describe your group's problem solving process?

1	2	3	4	5
Coordinated				Uncoordinated

13 How would you describe your group's problem solving process?

1	2	3	4	5
Fair				Unfair

14 How would you describe your group's problem solving process?

1	2	3	4	5
Confusing				Understandable

15 How would you describe your group's problem solving process?

1	2	3	4	5
Satisfying				Dissatisfying

Appendix A-4: Solution Memo

To: Academic Policy Committee Chairperson

From: Undergraduate Business Policy Committee

Re: Policy Recommendation

Our specific recommendation to address the situation is the following:

(Write a BRIEF, CONCISE statement of your group's recommendation)

_____

_____

_____

Signed (Your Names)

_____

_____

_____

_____

_____

Appendix A-5: Final Questionnaire (Consensus)

Your student ID Number:_____-_____-_____

Which problem(s) do **YOU** think that your group addressed?

_____

_____

What do **YOU** think is the **REAL** problem in the case?

_____

_____

What would **YOU** be willing to do personally (in real life OR if you held the position of your role in the case) to make your GROUP'S solution a real policy?

_____

_____

What do **YOU** think is the best solution for the case?

_____

_____

What are the five major steps (or goals) in the "Group Decision Making Procedure"? (Write as many as you can think of below in the order they are to be conducted in.)

What do you think was the purpose of the experiment?

Appendix A-6: Consensus Questions

1 My recommendation for the case is

1	2	3	4	5	6
Very different from the group's solution					Very similar to the group's solution

2 Considering all the factors in the case, how do you feel about the group's solution?

1	2	3	4	5	6
I strongly oppose the solution					I strongly support the solution

3 I fully endorse our group's recommended solution.

1	2	3	4	5	6
Strongly agree					Strongly disagree

4 To what extent do you support your group's solution?

1	2	3	4	5	6
I strongly oppose the solution					I strongly support the solution

5 Regarding our group's solution to the case

1	2	3	4	5	6
I support the group's solution					I do not support the group's solution

6 I think the group's recommendation was

1	2	3	4	5	6
Very similar to my preferred solution					Very different from my preferred solution

7 When I consider our group's written recommendation, I

1	2	3	4	5	6
Strongly agree					Strongly disagree

8 Our group's final recommendation is

1	2	3	4	5	6
Very different from my personal solution					Very similar to my personal solution

APPENDIX B: EXPERIMENTAL TASK & SOLUTIONS

Appendix B-1: School of Business Policy Task

Disclaimer: This scenario is fictitious. Any resemblance to real organizations is purely coincidental.

To: Undergraduate Business Policy Committee
Dr. R.U. Crazy, Associate Dean of the Business School
M.I. Nuts, Business Student Council President
P.R. DuStinks, University Alumni Association Vice-President
Dr. I.N. Exess, Chairperson, Business School Faculty Council
Dr. M.C. Mallet, University Vice President for Undergraduate Instruction

From: Dr. Polly Wannacracker, Academic Policy Chairperson
Re: 5 Year Business School Policy Recommendation(s)

The Undergraduate Business Policy Committee is charged with setting policies for the School of Business (SOB). We have recently received several complaints about the effects of some current policies. These include complaints related to limited SOB physical resources, a shortage of classrooms, quality of instruction, overcrowding in classes, quality of students, limited computer resources, and others. While it is possible that the current policies may have some undesirable effects, I believe that the bulk of these complaints may be unfounded.

With this in mind, your committee's task is to evaluate all of the information that each of you bring to the meeting. You should identify the real problems (if there are any) that should be addressed through revising SOB policy. After deliberating on this issue, you should submit a concise written statement of your recommendations to me. Each of you should carefully consider how any proposed policy changes might affect the interests that you represent.

The following pages contain information relevant to the case. Do not pass or show these forms to other participants.

Role: Dr. R.U. Crazy, Associate Dean of the Business School

Your job in this meeting is to assume the role of the **Associate Dean** of the Business School.

You work closely with the Dean on important policy matters and are responsible for managing many of the Business School physical and personnel resources. This position has responsibilities which are similar to those of a vice-president of a corporation.

In working with the school's financial matters, you allocate the financial resources assigned to the Business School through the budget (See the Budget Table below), work to keep costs within budgetary constraints, and seek policies to maintain school revenues (from tuition and the state legislature) at current levels (See the Tuition Revenue Table below).

BUDGET TABLE

	1985-86	1986-87	1987-88	1988-89	1989-90	Projected 1991
Salaries & Wages	4,918,910	5,672,921	6,523,320	6,848,949	7,214,923	7,300,000
Fixed	1,538,162	1,612,910	1,654,832	1,698,321	1,708,293	1,700,000
Total	6,457,072	7,285,831	8,178,152	8,547,270	8,923,216	9,000,000
Increase Over Last Year		12.8%	12.2%	4.5%	4.4%	0.9%
Inflation		4.1%	3.8%	3.5%	3.1%	3.0%

BUSINESS SCHOOL TUITION REVENUE TABLE

	1985-86	1986-87	1987-88	1988-89	1989-90
In-State	$1,084,608	$1,275,072	$1,692,072	$1,872,012	$1,994,448
Out of state	1,271,832	1,777,152	2,420,244	2,957,640	3,802,572
Total	$2,356,440	$3,052,224	$4,112,316	$4,829,652	$5,797,020

You are aware of the instruction costs for various types of teachers (see the Cost Per Teaching Hour Table below). You also have information about the number of students in the Business School and the teachers by category within the school (see the Business School Enrollment & Teachers Table below).

COST PER TEACHING HOUR BY TYPE

	1985-86	1986-87	1987-88	1988-89	1989-90
Senior Professors	$6,524	$6,592	$6,870	$6,991	$7,012
Junior Professor	3,195	3,812	4,105	4,341	4,688
Adjunct Faculty	1,081	1,129	1,170	1,192	1,248
Associate Instructors	987	1,014	1,054	1,070	1,105

Senior Professors: Faculty with a Ph.D. who do research, teach, consult with industry, and serve on many administration/graduate committees
Junior Professors: Faculty with a Ph.D. who do research, teach, serve on committees, and sometimes do work with industry
Adjunct Faculty: Faculty with Masters degree and work experience hired for teaching. No administrative responsibilities
Associate Instructors: Doctoral and M.B.A. students. Teach undergraduate courses part-time and take graduate classes part-time

BUSINESS SCHOOL ENROLLMENT AND TEACHERS

	1985-86	1986-87	1987-88	1988-89	1989-90
Enrollment	2,152	2,544	2,837	3,143	3,479
Senior Professors	51	54	57	52.000	54
Junior Professors	85	84	91	92	95
Adjunct Faculty	17	19	23	22	26
Associate Instructors	142	131	136	120	114
Total Instructors	295	288	311	289	289

In general, the Dean has been quite satisfied with the results of the current policies and has not perceived that any major problems exist. Since some schools in the university actually had a budget cut, the Dean is very pleased to be able to maintain next year's budget at about the same level.

Disclaimer: This scenario is fictitious. Any resemblance to real organizations is purely coincidental.

To: Undergraduate Business Policy Committee
Dr. R.U. Crazy, Associate Dean of the Business School
M.I. Nuts, Business Student Council President
P.R. DuStinks, University Alumni Association Vice-President
Dr. I.N. Exess, Chairperson, Business School Faculty Council
Dr. M.C. Mallet, University Vice President for Undergraduate Instruction

From: Dr. Polly Wannacracker, Academic Policy Chairperson
Re: 5 Year Business School Policy Recommendation(s)

The Undergraduate Business Policy Committee is charged with setting policies for the School of Business (SOB). We have recently received several complaints about the effects of some current policies. These include complaints related to limited SOB physical resources, a shortage of classrooms, quality of instruction, overcrowding in classes, quality of students, limited computer resources, and others. While it is possible that the current policies may have some undesirable effects, I believe that the bulk of these complaints may be unfounded.

With this in mind, your committee's task is to evaluate all of the information that each of you bring to the meeting. You should identify the real problems (if there are any) that should be addressed through revising SOB policy. After deliberating on this issue, you should submit a concise written statement of your recommendations to me. Each of you should carefully consider how any proposed policy changes might affect the interests that you represent.

The following pages contain information relevant to the case. Do not pass or show these forms to other participants.

Role: M.I. Nuts, Business Student Council President

Your job in this meeting is to assume the role of the **Business School Student Council President**.

As a representative of the population of business students at the University, you know that many students are concerned about current and potential future tuition costs (see Tuition Rates Table below) and availability of computer resource (see Computers Table below). In addition, students have also expressed a desire to see more relevant, real world, issues taught in the classroom.

TUITION RATES

	1985-86	1986-87	1987-88	1988-89	1989-90
In-State	56	58	71	73	74
Out-of-State	197	208	237	245	257

RATIO OF LAB COMPUTERS TO STUDENTS

	1985-86	1986-87	1987-88	1988-89	1989-90
	1:33	1:32	1:30	1:29	1:26

Because of the student body's concern about the future of the Business School, you and your associates have conducted significant research on the issues and therefore possess information that may be relevant to the policy meeting. For instance, you have information about the number of business students admitted to the Business School from instate and out-of-state (see the Sources of Admissions Table below), the number of students who enter the university to major in business and the number that actually graduate in business (see Business School Admissions and Graduations Table below), and teaching evaluations (see the Student Evaluation of Instructors Table Below), .

SOURCES OF BUSINESS SCHOOL ADMISSIONS

	1985-86	1986-87	1987-88	1988-89	1989-90
In-State	1,614	1,832	1,986	2,137	2,246
Out-of-State	538	712	851	1,006	1,233
Total	2,152	2,544	2,837	3,143	3,479

BUSINESS SCHOOL ADMISSIONS AND GRADUATIONS

	1985-86	1986-87	1987-88	1988-89	1989-90
Applications	1,454	1,719	1,953	2,340	2,710
Admits	1,119	1,322	1,425	1,634	1,945
Graduates	1,032	1,221	1,412	1,508	1,534

STUDENTS' EVALUATIONS OF INSTRUCTORS

10 Point Scale

	1985-86	1986-87	1987-88	1988-89	1989-90
Senior Professors	8.0	8.1	7.4	7.2	7.1
Junior Professors	7.8	8.2	7.5	6.8	6.5
Adjunct Faculty	7.7	7.6	7.4	7.1	7.1
Associate Instructors	6.5	6.8	6.3	6.7	6.4

Senior Professors: Faculty with a Ph.D. who do research, teach, consult with industry, and serve on committees

Junior Professors: Faculty with a Ph.D. who do research, teach, and serve on committees, and do some work with industry

Adjunct Faculty: Faculty with Masters degree and work experience hired for teaching. No administrative responsibilities.

Associate Instructors: Doctoral & M.B.A. students. Teach undergraduate courses part-time & take graduate classes part-time.

One final concern is that some students want more learning of what they call "real world" job skills.

Disclaimer: This scenario is fictitious. Any resemblance to real organizations is purely coincidental.

To: Undergraduate Business Policy Committee
Dr. R.U. Crazy, Associate Dean of the Business School
M.I. Nuts, Business Student Council President
P.R. DuStinks, University Alumni Association Vice-President
Dr. I.N. Exess, Chairperson, Business School Faculty Council
Dr. M.C. Mallet, University Vice President for Undergraduate Instruction

From: Dr. Polly Wannacracker, Academic Policy Chairperson
Re: 5 Year Business School Policy Recommendation(s)

The Undergraduate Business Policy Committee is charged with setting policies for the School of Business (SOB). We have recently received several complaints about the effects of some current policies. These include complaints related to limited SOB physical resources, a shortage of classrooms, quality of instruction, overcrowding in classes, quality of students, limited computer resources, and others. While it is possible that the current policies may have some undesirable effects, I believe that the bulk of these complaints may be unfounded.

With this in mind, your committee's task is to evaluate all of the information that each of you bring to the meeting. You should identify the real problems (if there are any) that should be addressed through revising SOB policy. After deliberating on this issue, you should submit a concise written statement of your recommendations to me. Each of you should carefully consider how any proposed policy changes might affect the interests that you represent.

The following pages contain information relevant to the case. Do not pass or show these forms to other participants.

Role: P.R. DuStinks, Business Vice-President of the University Alumni Association

Your job in this meeting is to assume the role of the **University Alumni Association Vice-President**.

As a representative of the University alumni, you are responsible for representing the concerns of former university students. One issue that has recently been brought to your attention is the type of instruction provided at the university. For instance, at a recent alumni party, several recent graduates said that they wished they had received more practical instruction and less theory while attending school. In addition, most alumni believe it is very important that the Business School maintain its image as a prestigious & quality institution. They know this influences the placement of graduates and the future marketability of their degrees (the ratings for the Business School are in the table below).

***BUSINESSWEAK* ANNUAL RATING OF BUSINESS SCHOOL**
(10 point scale)

	1985-86	1986-87	1987-88	1988-89	1989-90
Reputation	8.6	8.7	8.8	8.5	8.6
Research	8.3	8.6	9.0	9.5	9.3
Instruction	8.9	8.7	8.2	7.8	7.4
Graduate Placement	7.2	8.2	7.5	7.9	7.8
Overall	8.3	8.6	8.4	8.4	8.3

You also possess other information that may be relevant to the policy meeting such as industry demand data for majors from the various departments in the Business School (see Industry Demand Table below).

INDUSTRY DEMAND FOR BUSINESS MAJORS

(10 point scale)

	1988-89	1989-90	1990-91	1991-92(P)	1992-93(P)
Accounting	7	7	9	8	7
Finance	7	6	4	3	4
Information Systems	7	7	8	8	8
Market	6	7	6	6	5
Management	6	6	5	6	5

(P)=projected

Finally, a very influential employer of the school's graduates expressed a concern that some recent graduates seemed to have poorly developed critical thinking and problem solving skills.

Disclaimer: This scenario is fictitious. Any resemblance to real organizations is purely coincidental.

To: Undergraduate Business Policy Committee
Dr. R.U. Crazy, Associate Dean of the Business School
M.I. Nuts, Business Student Council President
P.R. DuStinks, University Alumni Association Vice-President
Dr. I.N. Exess, Chairperson, Business School Faculty Council
Dr. M.C. Mallet, University Vice President for Undergraduate Instruction

From: Dr. Polly Wannacracker, Academic Policy Chairperson
Re: 5 Year Business School Policy Recommendation(s)

The Undergraduate Business Policy Committee is charged with setting policies for the School of Business (SOB). We have recently received several complaints about the effects of some current policies. These include complaints related to limited SOB physical resources, a shortage of classrooms, quality of instruction, overcrowding in classes, quality of students, limited computer resources, and others. While it is possible that the current policies may have some undesirable effects, I believe that the bulk of these complaints may be unfounded.

With this in mind, your committee's task is to evaluate all of the information that each of you bring to the meeting. You should identify the real problems (if there are any) that should be addressed through revising SOB policy. After deliberating on this issue, you should submit a concise written statement of your recommendations to me. Each of you should carefully consider how any proposed policy changes might affect the interests that you represent.

The following pages contain information relevant to the case. Do not pass or show these forms to other participants.

Role: Dr. I.N. Exess, Chairperson, Business School Faculty Council

Your job in this meeting is to assume the role of the **Chairperson of the Business School Faculty Council**.

You are responsible for representing the concerns of faculty from within the School of Business. You are aware that faculty are concerned about large class sizes and how this influences their teaching and ability to perform their other responsibilities, especially research and publication in scientific journals. In addition, at a recent faculty meeting, you noted that a number of faculty voiced strong opposition to a proposal to increase teaching responsibilities beyond current levels. Some faculty are concerned about the faculty turnover rate (see Faculty Resignations table).

AVERAGE NUMBER STUDENTS TAUGHT PER INSTRUCTOR

	1985-86	1986-87	1987-88	1988-89	1989-90
Senior Professors	116	158	197	216	232
Junior Professors	274	293	343	398	419
Adjunct Faculty	485	602	665	707	767
Associate Instructors	89	112	135	179	193

AVERAGE NUMBER CREDIT HOURS TAUGHT PER INSTRUCTOR

	1985-86	1986-87	1987-88	1988-89	1989-90
Senior Professors	12.4	14.8	16.0	16.6	16.6
Junior Professors	22.8	23.1	25.1	28.4	28.6
Adjunct Faculty	18.2	21.0	22.4	22.8	23.0
Associate Instructors	7.4	8.4	9.2	11.4	11.6

You also have information that may be relevant to the policy meeting. For instance, in cooperation with the Registrar's Office, you have collected data defining the sources of instruction for Business School courses (see Sources of Classroom Instruction below) as well as data describing the number of students and the courses taught in the Business School (see Table below).

SOURCES OF CLASSROOM INSTRUCTION

	1985-86	1986-87	1987-88	1988-89	1989-90
Senior Professors	27%	26%	26%	24%	24%
Junior Professors	28%	26%	23%	21%	20%
Adjunct Faculty	5%	7%	9%	8%	9%
Associate Instructors	40%	41%	42%	47%	47%

Senior Professors: Faculty with a Ph.D. who do research, teach, consult with industry, and serve on many administration/graduate committees
Junior Professors: Faculty with a Ph.D. who do research, teach, serve on committees, and sometimes do work with industry
Adjunct Faculty: Faculty with Masters degree and work experience hired for teaching. No administrative responsibilities
Associate Instructors: Doctoral and M.B.A. students. Teach undergraduate courses part-time and take graduate classes part-time

TOTAL RESEARCH PUBLICATIONS IN SCIENTIFIC JOURNALS

	1985-86	1986-87	1987-88	1988-89	1989-90
Senior Professors	47	46	46	43	41
Junior Professors	98	102	105	101	104
Adjunct Faculty	N/A	N/A	N/A	N/A	N/A
Associate Instructors	21	34	41	36	28

SENIOR & JUNIOR FACULTY RESIGNATIONS

(Does not include retirements and transfers)

	1985-86	1986-87	1987-88	1988-89	1989-90
Professors	8	17	16	10	14

One other concern is that some faculty believe some Business School students are not adequately equipped in the basic math and writing skills necessary for business courses.

Disclaimer: This scenario is fictitious. Any resemblance to real organizations is purely coincidental.

To: Undergraduate Business Policy Committee
Dr. R.U. Crazy, Associate Dean of the Business School
M.I. Nuts, Business Student Council President
P.R. DuStinks, University Alumni Association Vice-President
Dr. I.N. Exess, Chairperson, Business School Faculty Council
Dr. M.C. Mallet, University Vice President for Undergraduate Instruction

From: Dr. Polly Wannacracker, Academic Policy Chairperson
Re: 5 Year Business School Policy Recommendation(s)

The Undergraduate Business Policy Committee is charged with setting policies for the School of Business (SOB). We have recently received several complaints about the effects of some current policies. These include complaints related to limited SOB physical resources, a shortage of classrooms, quality of instruction, overcrowding in classes, quality of students, limited computer resources, and others. While it is possible that the current policies may have some undesirable effects, I believe that the bulk of these complaints may be unfounded.

With this in mind, your committee's task is to evaluate all of the information that each of you bring to the meeting. You should identify the real problems (if there are any) that should be addressed through revising SOB policy. After deliberating on this issue, you should submit a concise written statement of your recommendations to me. Each of you should carefully consider how any proposed policy changes might affect the interests that you represent.

The following pages contain information relevant to the case. Do not pass or show these forms to other participants.

Role: Dr. M.C. Mallet, University Vice President for Undergraduate Instruction

You are to assume the role of the **University Vice President for Undergraduate Instruction**.

As the University Vice President for Undergraduate Instruction, you are responsible for representing the Administration of the University and of the Board of Regents. This position has responsibilities which are similar to those of a vice-president of a corporation. In this regard, you are responsible for developing and enacting policies and strategies which affect undergraduate students in various university divisions.

You know that the university has an important legislative mandate to structure policies so that a priority is given to instate residents in allocating state tax revenues for education (see the Sources of University-wide Enrollment Table below). In addition, any policy changes should not negatively impact the university position on Federal Equal Opportunity regulations which mandate that all students should have a very fair opportunity to attend the university. This is of particular concern since the Business School unsuccessfully attempted to curb enrollment four years earlier by raising entrance requirements.

SOURCES OF UNIVERSITY-WIDE ENROLLMENT

	1985-86	1986-87	1987-88	1988-89	1989-90
In-State	18,287	18,710	18,557	18,197	17,847
Out-of-State	6,096	7,272	7,952	8,566	9,798
Total	24,382	25,982	26,509	26,763	27,645

You also possess other pieces of information that may be relevant to the policy meeting. For instance, data about the quality of teaching across the university has been collected for this meeting (see the Average Student Teaching Evaluation by School Table below). In addition, data about the utilization of classroom resources has been collected (see the Business School Classroom Utilization Table below).

AVERAGE STUDENT TEACHING EVALUATION BY SCHOOL
(10 point scale)

	1985-86	1986-87	1987-88	1988-89	1989-90
Arts & Sciences	8.1	8.3	8.2	8.4	8.3
Business	7.3	7.6	7.0	6.9	6.7
Education	6.8	6.8	6.9	7.1	7.0

BUSINESS SCHOOL CLASSROOM UTILIZATION
1989-1990

	Morning	Afternoon	Evening
Monday	95%	85%	18%
Tuesday	98%	87%	12%
Wednesday	94%	89%	19%
Thursday	97%	88%	5%
Friday	45%	21%	0%
Saturday	5%	0%	0%

You have also heard some complaints about the completion rate for degrees for the professional schools (see the Admission and Graduation for Professional Schools Table below).

ADMISSION AND GRADUATION FOR PROFESSIONAL SCHOOLS
UNIVERSITY WIDE

	1985-86	1986-87	1987-88	1988-89	1989-90
Applications	11,120	11,716	12,091	11,546	12,141
Admitted	8,558	9,010	8,822	8,062	8,714
Graduates	7,893	8,322	8,741	7,440	6,872

Appendix B-2: Scored Solutions to the SOB Policy Case

Key#	Solution	Solves Problem Score	Feas-ibility Score
1	Decrease senior professors pay and increase adjunct pay	59	31
2	Raise sports ticket prices	69	89
3	Make all professors have a PHD in their field	71	19
4	Have senior professors serve as guest or weekly lecturers in large classrooms	71	45
5	Guarantee students a job when they are admitted to the SOB	48	41
6	Limit teacher responsibilities to teaching	94	51
7	Offer job training programs	55	26
8	Hire teachers with degrees from respected schools in their field of teaching	59	22
9	Teach less theory more real world	58	35
10	Make instructors be made available for a certain, required number of office hours each week	84	52
11	Make VAX geeks pays for computer time	66	41
12	Pay faculty for research only after the topic and methods are approved	41	14
13	Don't give the Academic Staff that are doing research as many classes as to those who aren't doing research	64	3
14	Offer a lot of help sessions at many different times	88	30
15	Make each student buy a computer	80	63
16	Have lower teacher-student ratio	68	13
17	Decrease the number of executive positions	79	69
18	Lower Dean's/Other faculty's salary	62	29
19	More applicable methods of teaching need to be used	100	67
20	Increase controls on the quality of teaching	79	26
21	Start a teacher exchange program with other universities	58	52
22	Raise tuition for students from other countries	98	59
23	Use AI's for assisting professors rather than for teaching in the place of professors	52	0
24	Offer salary bonuses to instructors who would take on a heavier classload than is the average	50	24

Key#	Solution	Solves Problem Score	Feas-ibility Score
25	Give professors frequent tests to see if they still "have it"	77	44
26	Provide an equal chance for out-of-state students to be admitted to sob like in-staters	66	47
27	Get rid of AIs who can't teach	97	36
28	Foreign prof's and ai's should have to pass a verbal and written tests	87	40
29	Require a public relations course in every major	59	44
30	Majority of the material should be taught in the discussion sections and not just reviewed	73	48
31	There should be less pre-requisite classes	50	44
32	Update each area of study frequently	85	31
33	Buy more computers	57	41
34	Lower general admission standards for SOB	20	9
35	The University should rent computers to the students.	80	55
36	Increase number admitted to SOB	17	12
37	Give students more practical assignments/projects	81	77
38	Increase the number and quality of counselors	68	61
39	Encourage retirement of professors too old to teach	84	51
40	Require business experience as a requirement for graduation	62	63
41	Have an agreement with surrounding states to charge in-state fees to those living in these states, such as Ohio, Illinois, and Kentucky	31	15
42	Attract out-of-state students by lowering standards for them	37	37
43	Let the student be able to chose which class to take on the basis of class size (let them be aware before enrolling)	68	84
44	Encourage more student input regarding the allocation of financial resources	53	64
45	Cut down the publication of research in journals	76	59
46	Special business math and business writing classes	93	61
47	Require extra-curricular activities for students to be admitted	56	75
48	Gear homework and tests to the needs of the students	85	73
49	More group problem solving sessions are needed to improve critical thinking and problem solving skills	75	73

Key#	Solution	Solves Problem Score	Feas-ibility Score
50	Advertising all the good qualities the school possesses	47	50
51	Increase workload of AI's/TA's so profs have more time to teach	64	52
52	Make it possible for students to log on to some of the schools software, such as lotus and paradox, from their personal computers at home	60	60
53	Hire more adjunct faculty	96	73
54	Get feedback from grads on courses/advice for students	67	79
55	Provide an equal chance for out-of-state students to be admitted to sob like in-staters	49	51
56	Change business school prerequisites to include more basic math & writing skills	88	66
57	Tuition does NOT need to increase	34	33
58	Cut back on number of AI's	53	37
59	Stop the use of AI's	47	34
60	Personal interviews for acceptance into the business school should be weighted more heavily	73	75
61	Publish/publicize SOB requirements	60	82
62	Give more personal attention to the students	75	71
63	Offer student discounts on computers to increase individual ownership	62	76
64	Set higher standards for the instructors who want to teach in the Business School	80	70
65	Hire teachers that make the class interesting	79	77
66	Each student should be behind a computer in every class	49	33
67	Decrease the amount of research done by Junior Profs	73	74
68	Allocate more teaching responsibilties to the professors and adjunct faculty	54	46
69	Test students on the relevant information learned in class	71	86
70	Have smaller pay raises for teachers	57	65
71	Have business school classes in other university buildings	56	82
72	Take student evaluations seriously	73	89
73	Decrease the number of unnecessary staff	67	82
74	Improve teacher knowledge	74	84

Key#	Solution	Solves Problem Score	Feas-ibility Score
75	Have student input in hiring process	66	83
76	Inform applicants of the almost steady industry demand for business majors and the increasing enrollment in the SOB.	57	82
77	Increase recruitment of 30 - 45 year olds to fill unused night time classroom space	60	72
78	Give tests to instructors to determine teaching aptitude	72	83
79	Leave SOB the way it is	0	54
80	Require students to attend presentations by business people as part of certain classes	77	88
81	Hire more English speaking teachers	73	77
82	Have top administrators evaluate faculty on a regular basis	67	78
83	Provide an equal chance for out-of-state students to be admitted to sob like in-staters	56	50
84	Tell the dean not to wear those stupid bowties because it takes away some of the creditability of our institution	56	82
85	Solicit corporate donations for computers	81	90
86	Develop more contacts with firms across the country, especially in the Midwest	67	69
87	Limit class size	84	56
88	Limit class size to 10 or less	79	49
89	Offer incentives for teaching quality	78	94
90	Have other business schools evaluate and make suggestions for improvement of the business school	84	67
91	Build new building/classrooms/addition	41	39
92	Pre-requesite courses should provide an overview picture of how all of the classes work together in teaching	74	87
93	Move more people into information systems and less into finance and marketing	49	69
94	Entrance exam to business school	92	69
95	Increase in-state tuition	73	51
96	Decrease out-of-state tuition	23	21
97	Have businessmen teach classes	79	89

Key#	Solution	Solves Problem Score	Feas-ibility Score
98	Teaching about the responsibilities you'll have to deal with in the real world	71	75
99	Limit the hours taught by adjunct faculty	43	36
100	Decrease money spent on advertising for Indiana University.	62	96
101	Make class times shorter	39	62
102	Increase out-of-state tuition	78	63
103	Require adjunct faculty and Associate Instructors to consult with the industry and/or serve on committees.	38	58
104	Make the SOB smaller and more elite	97	75
105	Keep tuition rates more stable.	43	50
106	Cut operating costs by shutting off lighting, not watering the grass, etc.	66	85
107	Teach students how to interview.	57	100
108	Find out from the students what the business school could do to make them feel like they are learning what they feel they need to know. Not what the teachers feel they need to know	59	69
109	Lobby the industry for more funding	81	87
110	Set up a counseling system for the SOB which allows students to come in and talk about whatever problems they may be having	65	82
111	Reduce the amount of students admitted to the business school	84	69
112	Provide an equal chance for out-of-state students to be admitted to sob like in-staters	43	56
113	Require professors to have real world experience	73	85
114	Encourage students to study a greater variety their first 2 years	60	92
115	Institute strict guidelines that student teachers must follow	80	67
116	Use the money from selling Folgers coffee in the SOB to fund the SOB	63	84
117	Increase spending in the Business Placement Office	57	56
118	Have students evaluate teachers at anytime in the year without the professors knowledge	55	93
119	Make those that know they will not get into the b-school stop taking the pre-recs	75	92

Key#	Solution	Solves Problem Score	Feas-ibility Score
120	Have upper echelon administrators begin the process by first recruiting teachers from prominent companies and educational backgrounds to come to IU to teach, then in turn, offer to the same companies the students taught by their colleagues	54	59
121	Reduce the SOB bureaucracy	78	99
122	Decrease # of credit hours taught by Junior Professors	70	72
123	Offer more scholarships	45	31
124	Instructors should assign homework more frequently	75	65
125	Less teaching responsibilties to AI's	45	40
126	Utilize the classroom space on Mon-Wed evening 25%, 20% on Thurs. evening, and 25% on Friday afternoon	63	74
127	SOB should stress writing and other skills to high schools to let them know what students are lacking	71	84
128	Professors can be mandated to attend seminars of businessmen	57	60
129	Students who are weak in math and writing skills should be weeded out at the beginning	84	81
130	Have class projects which focus on criticial thinking/writing skills	75	92
131	Look for enthusiastic AIs, not those who want to get this part of their lives over with	71	70
132	Require more liberal arts courses to produce well rounded students	83	96
133	Hire better instructors-minimum standard for communication skills etc./ stricter interviews	83	88
134	Requiring foreign language study for students	57	97
135	Hire faculty that are more interested in teaching than working on research and trying to get published in a journal	66	69
136	Hire more associate professors that have been working in the business environment	72	95
137	Offer the older professors who have lost touch with their students good retirement programs	62	84
138	Give faculty more leeway to teach other courses	64	89
139	Alumni Association would donate some of the funds	67	100
140	Provide an equal chance for out-of-state students to be admitted to sob like in-staters	58	58

Key#	Solution	Solves Problem Score	Feas-ibility Score
141	Bring in an independent firm to study the problem	68	96
142	It may be worth considering having students apply to SOB as freshmen	54	100
143	Lower emphasis on NCAA.	60	84
144	Promote the Graduate school	53	100
145	Keep number of students accepted the same	55	62
146	Put the best teachers in the beginning classes	74	79
147	Limit rapid increase of salaries of junior professors	52	88
148	Increase quality of teachers by using fewer foreigners	62	87
149	Schedule more night/Friday/weekend classes	65	66
150	Change from semesters to quarters	62	86
151	Increase funding for university through higher taxes	79	85
152	Get rid of excess of poor teachers	80	80
153	Keep computer centers open longer	58	81
154	Increase the # of credit hours taught by Senior Professors.	60	68
155	Get students internships	66	89
156	More practical instructions within the class such as solving cases, having presentations, and having discussions	89	93
157	Hire more AIs and adjunct faculty	66	78
158	Look at extracurricular activities and leadership abilities when admitting students into the school	65	90
159	The work load of the Junior professors should be lessened	64	84
160	Evaluate internships with student and corporate surveys designed to compare what is taught to what is needed on the job.	80	93
161	Spread the time of classes more evenly throughout the day.	61	100
162	Do not let leading researchers teach	53	62
163	Talk to resigning professors to get their input	62	95
164	Reduce funding to satellite schools	57	98
165	Students could be assinged to work in groups at the start of the semester and be given the task of running a mock business.	73	97
166	Have a student evaluation after the first test in the class so the teacher can understand student complaints	68	99

Key#	Solution	Solves Problem Score	Feas-ibility Score
167	Admit students based on more than just grades (reputation, recommendations, work experience)	68	96
168	Provide an equal chance for out-of-state students to be admitted to sob like in-staters	67	77
169	Provide the professor with the time and the means (funding) to do research	52	65
170	Increase teaching standards of AI's	77	99
171	Offer incentives for teachers to stay -- better pay/research facilities	63	69
172	Lower administrative responsibilities of professors	64	93
173	Profs spend less time on research/more time teaching	86	89
174	Increase aid to both in- and out-of-state students to fill classes, increase enrollment, and therefore generate money	48	41
175	Eliminate courses with low industry demand	66	87
176	Increase the number of hours required for graduation by creating classes specifically to work with cases of real life firms	69	86
177	More learning done by role-playing	62	95
178	Give some kind of requirements for professors other than how well they do research	77	97
179	Teachers need to begin to care more	80	100
180	Improve the Finance, marketing & management course so that students will be able to find a job after graduation	70	97
181	Train AIs	75	94
182	Faculty members should teach the number of credit hours they can handle	68	79
183	Employ associate instructors to replace professors in all lower-level classes	57	77
184	Provide students the opportunity to talk to IU B-school alumni	57	100
185	Guaranteed Cost Plan if you chose to, freshman could pay $500 dollars the first year (in addition to tuition of course) and it would guarantee that tuition would be what you paid that first year every year. I think it used the basic time value of money	49	77
186	Teach soft skills - leadership, communication, etc.	63	77

Key#	Solution	Solves Problem Score	Feas-ibility Score
187	Threaten professors that receive bad evaluations, if they do not change their teaching techniques then fire them	72	73
188	Classes with computers should charge fee	65	75
189	Ask for donations from public sector: alumni, parents of students	71	73
190	Allow only students from IU-Bloomington into the business school	44	33
191	Every professor for a particular class, say x204, should have the same assignments and requirements	55	68
192	More instructional devices	66	65
193	Make the SOB's instructors more consistant in their teaching ways and grading procedures	65	86
194	Have a specific night set aside each week so that all the faculty and students can go to the Bowl-R-Rama	62	81
195	Reduce money spent on research	54	66
196	Provide an equal chance for out-of-state students to be admitted to sob like in-staters	46	37
197	Evaluating department structure	60	88
198	Get younger instructors to teach to classes	56	78
199	Offer foreign exchange programs	58	88
200	Have more of the Junior professors teach the courses	56	69
201	Lower tuition	15	13
202	Admission requirements should be increased to include at least one additional math course and possibly a writing course.	83	89
203	Go back and see how things worked in 87-88, where few people did not graduate	83	87
204	Force teachers to be more active in the classroom other than following a set lesson plan that they have had for the past several semesters	78	100
205	Allow students more input in policy decisions	75	74
206	Instructional help should be better "advertised" and encouraged	90	82
207	The school of business should check other departments to see if they have resources that are being wasted or unused	73	97
208	Emphasize the strengths of other departments so that students are attracted to areas other than business	58	62

Key#	Solution	Solves Problem Score	Feas-ibility Score
209	Have instructor evaluations more frequently	80	91
210	Better test formats-make them to apply what students have learned	77	96
211	Make statistics an optional class	53	49
212	Put more computers in the dorms and maybe even an off-campus computer lab	51	67
213	Make the Accounting, Finance, and Information Systems departments more appealing since there is a greater demand for them	56	84
214	Offer encouragement and monitoring program to students to improve graduation rate	87	77
215	Scrap the whole system and start over	68	59
216	Encourage students to take summer classes.	77	95
217	Conduct a national survey of the nations top businesses to evaluate what skills they would like to see graduates possess	70	100
218	Teachers should review for tests so the student knows what to expect	75	97
219	Admit more graduate students	58	87
220	Hire more junior and senior professors for the more advanced courses and leave only the basic courses for the A.I.'s	57	87
221	Admit students earlier than sixty credit hours to avoid waisting classroom space	55	90
222	Reduce professors salaries	58	63
223	Have students grade each other.	59	98
224	Offer credits to student that go out and get internships for themsevles before they graduate	70	91
225	Offer more "perks" to the Junior and Senior Professors	48	79
226	Provide an equal chance for out-of-state students to be admitted to sob like in-staters	53	65
227	Put less emphasis on HYPER, SPEA, and Telecom so as to become more of a business, English and math dominated school	59	70
228	Instructors should come to class prepared.	92	98
229	Hire more faculty	61	64

Key#	Solution	Solves Problem Score	Feas-ibility Score
230	Create one building for all computer facilities to reduce overcrowding.	62	70
231	Re-staff the SOB in a way that will benefit the school, but costs will be low	76	63
232	Could cut out on a lot of the cushion courses, bowling, pool etc.,	66	93
233	Give students a real company's project to work on. Then compare the students results with the company's own employees and correct the students (or employees) mistakes	64	90
234	Let more undergraduate students help with research	62	73
235	Pay AI's more	55	61
236	Increase in-state requirements for admissions	72	65
237	Create a staff that evaluates Academic Staff members	74	81
238	Increase the number of AIs teaching small supplement discussion classes to the lectures	76	66
239	Students should offer oral evalutations of their teacher's performance.	67	96
240	Incoming freshmen should be required, or strongly encouraged, to attend a carreer planning	75	77
241	Offer a job placement program	55	66
242	Hold Fundraisers	73	81
243	Business classes should also be linked more with the computer technology of today	65	69
244	Stricter Admission Standards to SOB	77	82
245	Submission of a statement of intent prior to admission	59	100
246	Advertise more in other states to attract more out-of-state tuition.	55	84
247	Hire more senior faculty	63	65
248	We need to admit anyone with a real desire to be a business major into the school	24	40
249	Don't hire adjunct faculty to teach	52	38
250	Have more junior profs and less senior profs	42	75
251	Less out-of-state students should be admitted	59	65
252	Limit number of hours teachers can teach	60	45

Key#	Solution	Solves Problem Score	Feas-ibility Score
253	Recruit instructors from other prestigious schools	77	58
254	Provide an equal chance for out-of-state students to be admitted to sob like in-staters	50	37
255	The technology fee should be increased so that more labs can be set up	88	61
256	Have a set student-teacher ratio which cannot be exceeded	79	44
257	Decrease general requirements and spend more time on focused Business classes.	53	60
258	Advertise majors offered in the SPEA department	57	66
259	Pay AI's on flat fee rate	57	75
260	Monitor faculty/AIs in the classrooms to improve evaluations	72	80
261	There should be a restriction placed on research or else have some other kind of incentive for them to teach	78	70
262	Utilize more junior professors and AI's	48	58
263	Set up additional computer-aided education programs for students to learn on	73	62
264	Concentrate on finding out why the number of students accepted decrease as that same number graduates	76	71
265	Fund the school through a special beer tax	73	82
266	Decrease the amount of "assigned work" so that teachers have less grading so they can increase the number of hours taught	61	54
267	Make teachers more accountable for the grades they give and low curves	47	71
268	Conduct teaching improvement seminars	87	68
269	Decrease in-state tuition	38	8
270	Eliminate business school prerequisites	46	67
271	Reduce the workload of senior professors to allow them to do research and publish articles	45	49
272	Raise out-of-state tuition at an equal rate to in-state students	72	70
273	Have businessmen share ideas with the students.	73	85
274	Student evaluations of teachers should be heavily-weighted criteria upon employment of that individual	71	68
275	Have tuition based on the amount of credit hours students take and not on a flat fee	76	42

Key#	Solution	Solves Problem Score	Feas-ibility Score
276	Allocate money from each student to a fund for computer labs.	69	63
277	Business classes should be harder so prestige will be raised.	47	58
278	More communication between instructors and their AIs	77	85
279	There should be a quicker way for students to know if they will be accepted into the business school	59	69
280	Give discounts to the students that have their own computers	59	45
281	Lengthen number of years to graduate	59	54
282	Reduce the cost per teaching hour	43	55
283	Find industry demand and encourage students to go into those fields	55	65
284	Admit more in-state students	28	22
285	Admit more out-of-state students	51	43
286	Seek additional government (state/fed) funding	100	98
287	Offer more sections of classes	58	52
288	Hire more junior faculty	76	78
289	Raise tuition	77	87
290	Improve utilization of SOB resources (classrooms, teaching facility, univ. services etc.)	63	69
291	Improve quality of technology and SOB facilities	74	57
292	Standardize procedures and curriculum	55	58
293	Increase teacher work hours so they can teach night classes	50	48
294	Increase teaching standards of faculty	83	71
295	Review SOB prerequisite curriculum	83	68
296	Decrease spending on non-academic pursuits	84	78
297	Decrease the number of junior professors	53	34
298	Admit more international students	47	34
299	Increase transportation fees	68	82
300	Use classrooms more efficiently	82	89
301	Redistribute enrollment among sections	76	85
302	Involve the students more in the course	91	80
303	Increase the technology	63	55
304	Revise the course organization	75	79

Key#	Solution	Solves Problem Score	Feas-ibility Score
305	Part of tuition should go towards improving facilities	50	48
306	Hire more well-trained grad-students	66	61
307	Request federal tax dollars to aid in business school development	93	87
308	Better teaching materials	78	68
309	Increase the number of AIs and professors available for tutoring	82	61
310	Force professors and AIs to teach more classes	36	36
311	Schedule more night/Friday/weekend classes	81	66
312	Require students to do internships	78	85
313	Use the more qualified professors to teach lectures and AIs to lead discussion sections	80	67
314	Offer retirement to 3 senior professors and hire 17 AIs	62	68
315	The curriculum should be developed by business executives	79	84
316	Increase the number of adjunct faculty teaching to 31% and thus reduce the number of associate instructors to 25%	78	72
317	A further study of the allocation of funds	59	78
318	A redistibution of students among existing faculty members	65	78
319	Using adjuct and junior profs to alleviate senior professor burdens	75	66
320	Begin planning for long-run expansion	53	70
321	Take suggestions from outside sources, such as businesses and alumni	76	87
322	Increase the responsibilities give to AIs	62	60
323	Decrease the responsibilities give to higher level faculty (than AIs)	52	63
324	Get more money without increasing tuition	80	86
325	Hire more AIs	54	56
326	Institute a ratio of 3 AIs per professor hired	60	59
327	Cut back on spending	49	52

Appendix B-3: Training Task

PRACTICE PROBLEM

(This task was used for the trained groups which practiced using the Group Decision Making Procedure.)

The Situation:

- Susan is up for a promotion at her company
- She has an important meeting at 8 a.m.
- Her boss and the regional manager will be there
- Susan wakes up at 7:20 (alarm did not go off, it was set for 6)
- She had planned to get to work early to polish her presentation
- It takes at least 20 minutes to drive to her office, though it is only about 2.5 miles away
- It takes 35 minutes to take the bus
- Her car will not start, it may be out of gas

Appendix B-4: Frequencies of Scored Solutions

The table below lists the 79 solutions from Appendix B-2 which were selected by groups in this experiment. It also reports the frequency for each solution.

Key#	Solution	Solves Problem Score	Feas-ibility Score	Freq ency
9	Teach less theory more real world	58	35	3
10	Make instructors be made available for a certain, required number of office hours each week	84	52	1
16	Have lower teacher-student ratio	68	13	1
20	Increase controls on the quality of teaching	79	26	7
37	Give students more practical assignments/projects	81	77	2
51	Increase workload of AI's/TA's so profs have more time to teach	64	52	1
53	Hire more adjunct faculty	96	73	3
58	Cut back on number of AI's	53	37	1
64	Set higher standards for the instructors who want to teach in the Business School	80	70	1
68	Allocate more teaching responsibilties to the professors and adjunct faculty	54	46	1
71	Have business school classes in other university buildings	56	82	1
78	Give tests to instructors to determine teaching aptitude	72	83	1
81	Hire more English speaking teachers	73	77	1
87	Limit class size	84	56	8
89	Offer incentives for teaching quality	78	94	3
91	Build new building/classrooms/addition	41	39	1
94	Entrance exam to business school	92	69	2
95	Increase in-state tuition	73	51	2
109	Lobby the industry for more funding	81	87	3
111	Reduce the amount of students admitted to the business school	84	69	2
113	Require professors to have real world experience	73	85	2
122	Decrease # of credit hours taught by Junior Professors	70	72	1
125	Less teaching responsibilties to AI's	45	40	1
130	Have class projects which focus on criticial thinking/writing skills	75	92	1

Key#	Solution	Solves Problem Score	Feas-ibility Score	Freq ency
133	Hire better instructors-minimum standard for communication skills etc./ stricter interviews	83	88	12
135	Hire faculty that are more interested in teaching than working on research and trying to get published in a journal	66	69	1
136	Hire more associate professors that have been working in the business environment	72	95	1
137	Offer the older professors who have lost touch with their students good retirement programs	62	84	1
149	Schedule more night/Friday/weekend classes	65	66	4
152	Get rid of excess of poor teachers	80	80	2
153	Keep computer centers open longer	58	81	1
154	Increase the # of credit hours taught by Senior Professors.	60	68	1
156	More practical instructions within the class such as solving cases, having presentations, and having discussions	89	93	3
157	Hire more AIs and adjunct faculty	66	78	4
161	Spread the time of classes more evenly throughout the day.	61	100	1
181	Train AIs	75	94	3
189	Ask for donations from public sector: alumni, parents of students	71	73	7
208	Emphasize the strengths of other departments so that students are attracted to areas other than business	58	62	1
209	Have instructor evaluations more frequently	80	91	1
229	Hire more faculty	61	64	5
244	Stricter Admission Standards to SOB	77	82	38
250	Have more junior profs and less senior profs	42	75	1
262	Utilize more junior professors and AI's	48	58	1
268	Conduct teaching improvement seminars	87	68	5
285	Admit more out-of-state students	51	43	2
286	Seek additional government (state/fed) funding	100	98	6
287	Offer more sections of classes	58	52	9
288	Hire more junior faculty	76	78	1
289	Raise tuition	77	87	14
290	Improve utilization of SOB resources (classrooms, teaching facility, univ. services etc.)	63	69	5

Key#	Solution	Solves Problem Score	Feas-ibility Score	Freq ency
291	Improve quality of technology and SOB facilities	74	57	1
292	Standardize procedures and curriculum	55	58	2
293	Increase teacher work hours so they can teach night classes	50	48	1
295	Review SOB prerequisite curriculum	83	68	1
296	Decrease spending on non-academic pursuits	84	78	1
297	Decrease the number of junior professors	53	34	1
298	Admit more international students	47	34	1
302	Involve the students more in the course	91	80	1
303	Increase the technology	63	55	2
304	Revise the course organization	75	79	1
305	Part of tuition should go towards improving facilities	50	48	2
306	Hire more well-trained grad-students	66	61	1
307	Request federal tax dollars to aid in business school development	93	87	1
308	Better teaching materials	78	68	1
309	Increase the number of AIs and professors available for tutoring	82	61	1
310	Force professors and AIs to teach more classes	36	36	3
312	Require students to do internships	78	85	1
313	Use the more qualified professors to teach lectures and AIs to lead discussion sections	80	67	1
315	The curriculum should be developed by business executives	79	84	2
316	Increase the number of adjunct faculty teaching to 31% and thus reduce the number of associate instructors to 25%	78	72	1
317	A further study of the allocation of funds	59	78	1
318	A redistibution of students among existing faculty members	65	78	1
319	Using adjuct and junior profs to alleviate senior professor burdens	75	66	1
320	Begin planning for long-run expansion	53	70	1
321	Take suggestions from outside sources, such as businesses and alumni	76	87	1
324	Get more money without increasing tuition	80	86	1
325	Hire more AIs	54	56	4
326	Institute a ratio of 3 AIs per professor hired	60	59	1
327	Cut back on spending	49	52	1

APPENDIX C: HEURISTIC

Appendix C-1: Group Decision Making Procedure for Training

GROUP DECISION MAKING

Purpose: *To help your group organize its decision process towards 5 goals*

1. Identify the Real Problem
2. Identify Many Possible Solutions
3. Identify and Weight Important Constraints or Opportunities
4. Reduce the List of Potential Solutions to no More Than 5
5. Select the Best Solution

Goal: Identify the Real Problem

SPECIFIC ACTIVITIES

1) **Generate Problem Statements:**
   What is the real problem? Each person identifies what they see as the dominant problem(s). Generate as many problems as possible; do not worry about the quality. Do *not* comment on the quality of the problems

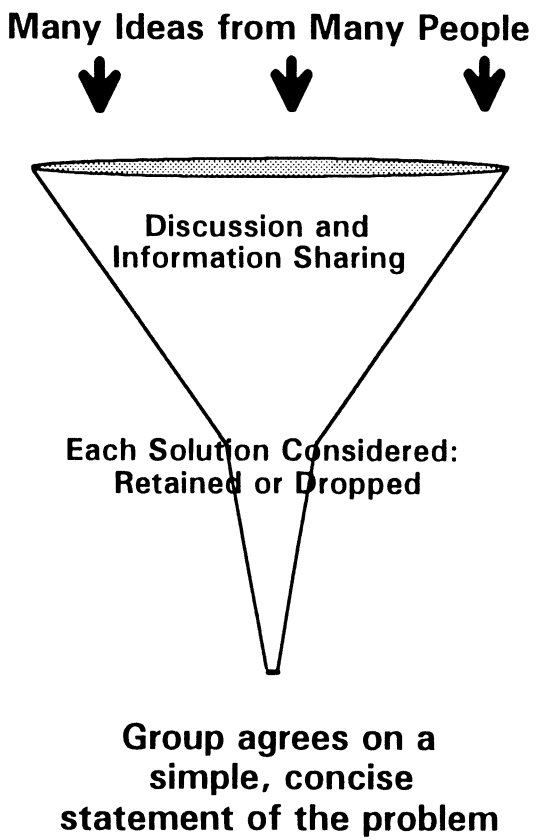
2) **Discuss & Clarify Ideas:**
   Discuss each problem. Share information to clarify why a problem is important or unimportant

3) **Reduce the List of Problem Statements:**
   Narrow the list to no more than 3 important problems. Discuss the voting results. Is your group sure?

4) **Choose the Best Problem Statement:**
   Select the most important problem statement by rank ordering the short list. Discuss the results. Is your group sure?

5) **Group Agrees on Problem Statement:**
   Write a short, concise statement of the problem to be solved

SPIRIT OF THE ACTIVITIES



Goal: Identify Many Possible Solutions

SPECIFIC ACTIVITIES

1) **Generate Solutions:**
   How could the problem be solved? Generate as many solutions as possible; do not worry about the quality. Do *not* comment on the quality of the solutions

2) **Discuss & Clarify Solutions:**
   Share information to clarify why a potential solution either does or does not solve the problem; Generate additional solutions / discussions if desired

3) **Group has a List of Potential Solutions: Do** <u>not</u> attempt to choose a solution at this time

SPIRIT OF THE ACTIVITIES

Many Ideas from Many People

Discussion and Information Sharing

Many Potential Solutions
Do NOT Choose a Solution

Potential solution...	Potential solution...
Potential solution...	Potential solution...
Potential solution...	Potential solution...
Potential solution...	Potential solution...

Goal: Identify / Weight Opportunities & Constraints

SPECIFIC ACTIVITIES

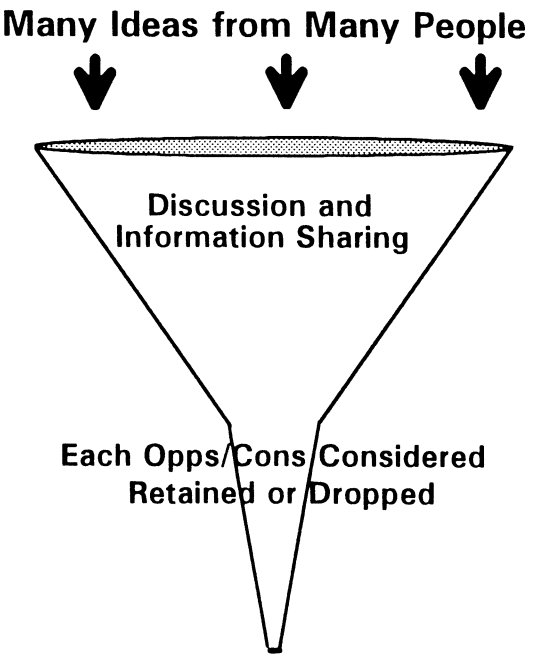
1) **Generate Opportunities & Constraints:**
   How will you recognize a good solution? Are there opportunities that a good solution must address or are facts from the case that constrain possible solutions? Generate as many ideas as possible; do not worry about the quality. Do *not* comment on the quality of the ideas

2) **Discuss & Clarify Opps/Cons:**
   Share information to clarify why an opportunity or constraint (Opps/Cons) is important or unimportant

3) **Reduce the List of Opps/Cons:**
   Narrow the list to no more than 15 important opps/cons. Discuss the results. Is your group sure?

4) **Assign Weights to the Opps/Cons:**
   Some opps/cons are likely more important than others; Assign a weight from 0 (unimportant) to 10 (extremely critical) to each opps/cons

SPIRIT OF THE ACTIVITIES



Group agrees on a short list of opps/cons

Opportunity or Constraint	Weight
Constraint #1.....	10.0
Constraint #2....	8.5
Opportunity #3...	7.0
Constraint #4....	6.0

Goal: Reduce the List of Potential Solutions

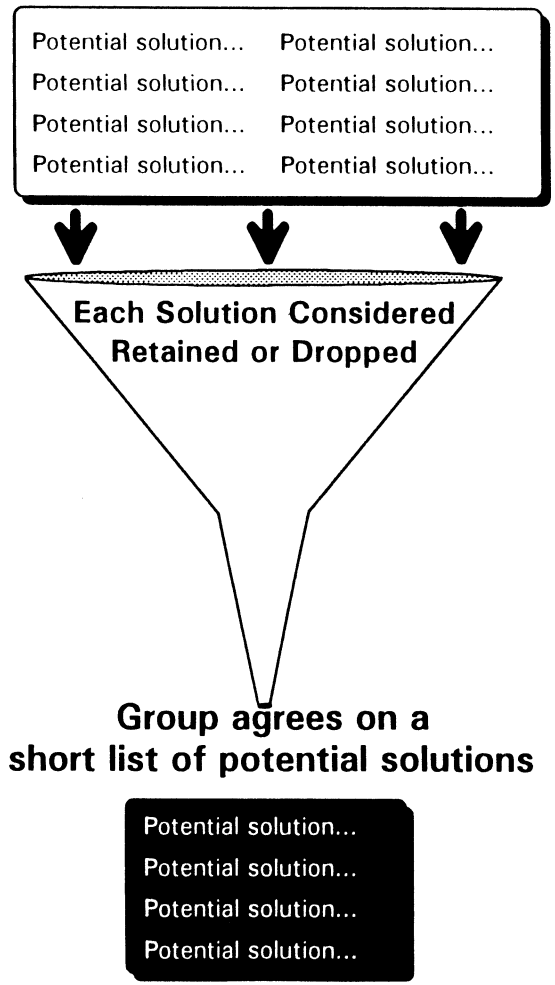
SPECIFIC ACTIVITIES

1) **Review the List of Potential Solutions: Decide if** each potential solution merits further consideration OR if it should be dropped at this point

   Narrow the list to no more than 5. Discuss the results. Is your group sure?

2) **Group has a Short List of Potential Solutions: Do** not attempt to choose a solution at this time

SPIRIT OF THE ACTIVITIES



Goal: Select the Best Solution

SPECIFIC ACTIVITIES

1) **Compare Short List of Potential Solutions to Weighted Opportunities & Constraints:** How well does EACH solution address EACH opportunity and EACH constraint? Use the scoring matrix to calculate a weighted average for each potential solution.

2) **Discuss & Clarify the Numbers:** Share information and discuss the meaning of the solution with the best score. Discuss the results. Does the solution solve the problem? Is your group sure?

3) **Group Agrees on Final Recommendation: If all** group members support the solution, write the recommendation in a short, concise form

   If there is not group consensus, discuss and clarify the meaning of the scores or calculate new scores by voting again

SPIRIT OF THE ACTIVITIES

Weighted Scoring Matrix

Opportunites & Constraints from Step #3

Short List of Potential Solutions from Step #4

	Weight	Solution #1	Solution #2	Solution #3
Cons #1	10.0	5.0	10.0	2.0
Cons#2	8.5	2.0	10.0	1.0
Opp #3	7.0	8.0	3.0	10.0
Cons #4	6.0	10.0	1.0	3.0
WEIGHTED SCORE		183.0	212.0	116.5

Example:
183 = (10x5) + (8.5x2) + (7x8) + (6x10)

Discuss the meaning of the scores

Has the group reached consensus?

NO

Y E S

Write the solution memo

Appendix C-2: Group Decision Making Procedure for Group Support System

GROUP DECISION MAKING

Purpose: *To help your group organize its decision process towards 5 goals*

1. Identify the Real Problem
2. Identify Many Possible Solutions
3. Identify and Weight Important Constraints or Opportunities
4. Reduce the List of Potential Solutions to no More Than 5
5. Select the Best Solution

Goal: Identify the Real Problem

SPECIFIC ACTIVITIES	*COMPUTER TOOL*	*SPIRIT OF THE ACTIVITIES*
1) Generate Problem Statements: What is the real problem? Each person identifies what they see as the dominant problem(s). Generate as many problems as possible; do not worry about the quality. Do *not* comment on the quality of the problems	BRAINWRITING	**Many Ideas from Many People**
2) Discuss & Clarify Ideas: Discuss each problem. Share information to clarify why a problem is important or unimportant		**Discussion and Information Sharing**
3) Reduce the List of Problem Statements: Narrow the list to no more than 3 important problems. Discuss the voting results. Is your group sure?	VOTING *(3 YES VOTES REQUIRED FOR FURTHER CONSIDERATION)*	**Each Solution Considered: Retained or Dropped**
4) Choose the Best Problem Statement: Select the most important problem statement by rank ordering the short list. Discuss the results. Is your group sure?	RANKING	
5) Group Agrees on Problem Statement: Write a short, concise statement of the problem to be solved		**Group agrees on a simple, concise statement of the problem**

Goal: Identify Many Possible Solutions

SPECIFIC ACTIVITIES	*COMPUTER TOOL*	*SPIRIT OF THE ACTIVITIES*
1) Generate Solutions: How could the problem be solved? Generate as many solutions as possible; do not worry about the quality. Do *not* comment on the quality of the solutions	BRAINWRITING	**Many Ideas from Many People**
2) Discuss & Clarify Solutions: Share information to clarify why a potential solution either does or does not solve the problem; Generate additional solutions / discussions if desired		**Discussion and Information Sharing**
3) Group has a List of Potential Solutions: Do <u>not</u> attempt to choose a solution at this time		**Many Potential Solutions Do NOT Choose a Solution**

Potential solution...	Potential solution...
Potential solution...	Potential solution...
Potential solution...	Potential solution...
Potential solution...	Potential solution...

Goal: Identify / Weight Opportunities & Constraints

SPECIFIC ACTIVITIES	*COMPUTER TOOL*	*SPIRIT OF THE ACTIVITIES*
1) Generate Opportunities & Constraints: How will you recognize a good solution? Are there opportunities that a good solution must address or are facts from the case that constrain possible solutions? Generate as many ideas as possible; do not worry about the quality. Do *not* comment on the quality of the ideas	BRAINWRITING	**Many Ideas from Many People**
2) Discuss & Clarify Opps/Cons: Share information to clarify why an opportunity or constraint (Opps/Cons) is important or unimportant		**Discussion and Information Sharing**
3) Reduce the List of Opps/Cons: Narrow the list to no more than 15 important opps/cons. Discuss the results. Is your group sure?	VOTING *(3 YES VOTES REQUIRED FOR FURTHER CONSIDERATION)*	**Each Opps/Cons Considered Retained or Dropped**
4) Assign Weights to the Opps/Cons: Some opps/cons are likely more important than others; Assign a weight from 0 (unimportant) to 10 (extremely critical) to each opps/cons	RATING	**Group agrees on a short list of opps/cons**

Opportunity or Constraint	Weight
Constraint #1.....	10.0
Constraint #2....	8.5
Opportunity #3...	7.0
Constraint #4....	6.0

Goal: Reduce the List of Potential Solutions

SPECIFIC ACTIVITIES

1) **Review the List of Potential Solutions: Decide if** each potential solution merits further consideration OR if it should be dropped at this point

   Narrow the list to no more than 5. Discuss the results. Is your group sure?

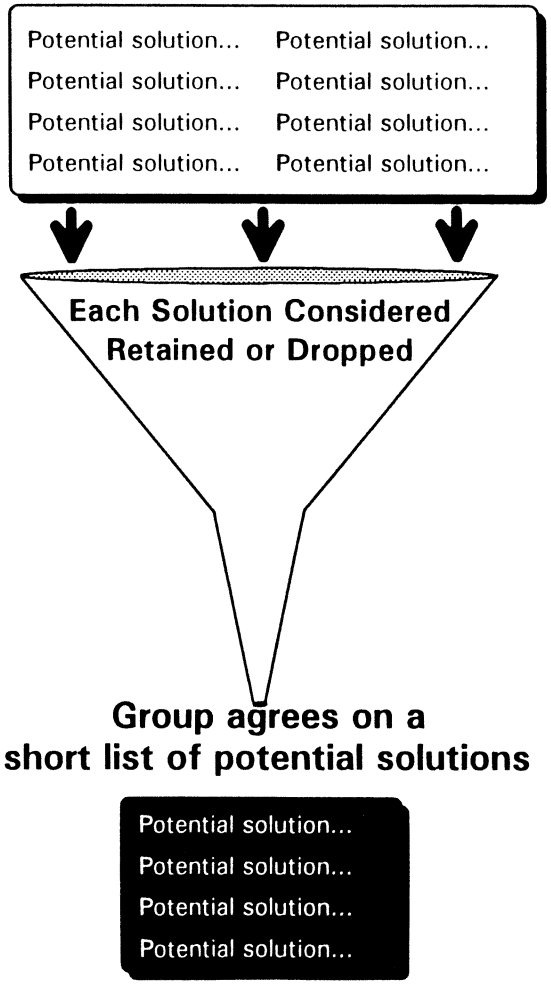
2) **Group has a Short List of Potential Solutions: Do** not attempt to choose a solution at this time

COMPUTER TOOL

VOTING

(3 YES VOTES REQUIRED FOR FURTHER CONSIDERATION)

SPIRIT OF THE ACTIVITIES



Goal: Select the Best Solution

SPECIFIC ACTIVITIES

1) **Compare Short List of Potential Solutions to Weighted Opportunities & Constraints:** How well does EACH solution address EACH opportunity and EACH constraint? Use the scoring matrix to calculate a weighted average for each potential solution.

2) **Discuss & Clarify the Numbers:** Share information and discuss the meaning of the solution with the best score. Discuss the results. Does the solution solve the problem? Is your group sure?

3) **Group Agrees on Final Recommendation: If all** group members support the solution, write the recommendation in a short, concise form

   If there is not group consensus, discuss and clarify the meaning of the scores or calculate new scores by voting again

COMPUTER TOOL

SCORING

SPIRIT OF THE ACTIVITIES

Weighted Scoring Matrix

Opportunites & Constraints from Step #3

Short List of Potential Solutions from Step #4

	Weight	Solution #1	Solution #2	Solution #3
Cons #1	10.0	5.0	10.0	2.0
Cons#2	8.5	2.0	10.0	1.0
Opp #3	7.0	8.0	3.0	10.0
Cons #4	6.0	10.0	1.0	3.0
WEIGHTED SCORE		183.0	212.0	116.5

Example:
183 = (10x5) + (8.5x2) + (7x8) + (6x10)

Discuss the meaning of the scores

Has the group reached consensus?

NO

Y E S

Write the solution memo

List of Computer Tools:

TOOL NAME	WHEN TO USE IT
BRAINWRITING	Allows all group members to simultaneously enter ideas about a topic. Use this when the group wants to gather ideas from each member and share them with the group.
VOTING	Use to decide whether or not to keep an idea for further consideration. Vote "Yes" to retain or "No" to drop it. The *Group Results* option will tally and display the overall group vote.
RANKING	Use to rank order a list of ideas from most preferred to least preferred. The *Group Results* option will tally and display the overall group ranking
RATING	Use to assign relative weights between 0 and 10 to a list of ideas. Ten means "very important" while 0 means "unimportant". The *Group Results* option will tally and display the overall group ranking.
SCORING	Use to evaluate ideas (alternatives) by a list of opportunities or constraints (criteria). The *Group Results* option will tally and display the overall group ranking.

APPENDIX D: INSTRUCTIONS TO FACILITATOR

Your objective is to restrict the group's interaction to the activities, sequences, and philosophy of the *Group Decision Making Procedure*. Your behavior needs to be consistent across groups, but it should also be natural and unscripted as you respond to the needs of each group.

Appropriate Facilitator Actions:

- Starting or stopping a group on a particular activity by asking the group (or each member) if they are ready to proceed to the next activity
- Prompting the group to explore areas where they may disagree, but not leading the discussion
- Reminding the group not to skip a step, such as to discuss the meaning of each idea or the significance of a vote
- Answering questions regarding the GDMP activities, sequences, or philosophy
- Answering questions regarding the use of the computer tools
- Monitor the remaining time by announcing when there are 20 minutes and 10 minutes remaining
- Politely disallowing violations of the GDMP, such as

  - remember, you should not comment on other people's ideas while your group is generating ideas
  - remember, your group's present objective is to generate a list of ideas, not to choose a solution
  - you should be entering statements that describe the problem, not that propose solutions
  - the voting activity is anonymous, please withhold your comments until everyone has finished voting
  - has your group agreed on a problem statement?

- As the group moves to a new step in the GDMP, **you should state the objective of the step (as written on the GDMP)**; you may also clarify the objective and respond to questions
- You should frequently refer the group to the GDMP and ensure that each member has it open to the current group activity

Inappropriate Facilitator Actions:

- Making any comment on the content of the case or the implications of a group's proposal
- Referring in any way to another group's process or solution
- Commenting on the quality of a group's ideas

APPENDIX E: DECISION QUALITY SCORING PROCEDURE

The procedure for assessing decision quality for the SOB Policy Task was used in previous research (Valacich, Mennecke, Wachter, & Wheeler, 1993). The following description of the procedure is largely an excerpt from the Valacich et al. paper and describes the procedure to be used for the dissertation.

Assessing idea quality for a complex task with multiple roles is particularly difficult because of the different perspectives and information possessed by each group member. A team of 13 raters used a multi-attribute scoring tool to assess each proposed solution in terms of how well the solution solved each of the nine problems and the extent to which the idea could be implemented within each of the 13 constraints. Due to the size of this rating problem, which consisted of over 6,000 individual rating decisions, each rater only evaluated about 75-130 ideas. At least three raters assessed each idea. Inter-rater reliability for each set of problem ratings and set of constraint ratings for each unique solution was calculated using Ebel's intraclass correlation statistic (Ebel, 1951). The intraclass correlation statistic yields a statistic that varies between zero and one and assesses the reliability of multiple sets of ratings. The average inter-rater reliability for the sets of problem ratings across all 289 solutions was .76 and the average inter-rater reliability for the constraint sets was .87. These relatively high reliabilities suggest that the raters were largely in agreement in their assessment of the quality ratings (problem score and constraint score) assigned to each idea.

APPENDIX F: EXPERIMENTAL SCRIPT

EXPERIMENTAL SESSION PROCEDURES

Introduction:

Welcome to the School of Business Behavioral Laboratory.

Please take a seat around the table.

As you know, participating in this session today will fulfill your research requirement for K201.

Your total time here today will take approximately 2-2.5 hours total. When you are finished, your instructor will be notified of your participation at the end of the semester.

Subject Consent Form:

[DISTRIBUTE CONSENT FORMS]

Please take a moment to carefully read this information and consent form. I will be glad to answer any questions you have regarding the experiment or your participation. If you agree to participate, please sign the form and place it on the corner of your table. I will be giving you several handouts and you can put each one in that stack when you are finished.

Your group has the opportunity for each of you to win $20 (first place) or $10 (second place) gift certificates to the Border Grill (or cash equivalent). The prize money will be awarded to the group which reaches the best solution to a case.

For part of today's exercise your group will be asked to resolve a situation in a case. You will have 10 minutes to carefully read this case. Please do not write on the case, but you can use this scratch paper to make notes of important information. In a few minutes I will give you a question to complete regarding your understanding of the case. Please do not discuss or comment on the case at this time.

[DISTRIBUTE CASE]

[WAIT 5 MINUTES, DISTRIBUTE PRELIMINARY QUESTIONNAIRE, 5 MINUTES]

[COLLECT PRELIMINARY QUESTIONNAIRE

Introductions

Heuristic

As you know, groups are often used to make important decisions. You have all participated in group decisions in the past--perhaps as part of a formal committee or just in an informal way. You also know that there are many different ways that groups can use to make decisions. Today your group will look at one way called the Group Decision-Making Procedure.

[DISTRIBUTE HEURISTIC]

Please do not turn the page until directed to do so. The Group Decision-Making procedure is useful when groups are dealing with a complex problem. It consists of five steps--or interim goals for your group.

- First, your group must identify and come to agreement on which problem and the nature of the problem that your are trying to solve. It is difficult to agree on a solution if the group does not agree on the problem.
- Second, your group will want to consider as many possible solutions as you can think of.
- Third, your group should identify if there are any constraints (or limitations) on which solutions are feasible OR any important opportunities that the solution must address.
- Fourth, your group should reduce the large list of possible solutions that you generated in step two down to a short list (no more than 5) for serious consideration.
- Finally, your group will select the best solution by comparing each possible solution to the list of constraints from step 3.

Please turn the page to step #1. Each of the five steps in the GDMP is further explained on a single sheet. You are now looking at the instructions for how to identify the problem. In the left column of the page you see the specific activities that your group should do to reach the first goal of identifying the problem. In the right column you see a visual representation of what this step accomplishes.

You will now have five minutes to carefully read and understand the five steps and specific activities of the Group Decision Making Procedure. I will answer any questions you have regarding the GDMP. Your group will later use the GDMP to resolve the case.

[WAIT 5 MINUTES FOR READING]

[FOR EXTENSIVE TRAINING GROUPS ONLY]

Now that you have had a chance to read the GDMP, your group will practice using it on a sample case.

[DISTRIBUTE TRAINING CASE]

** Guide the group through the GDMP and the sample case

** *Introduce facilitator for facilitated groups*

** *Facilitator will do this for facilitated groups;*
** *BCW to do it for non-facilitated groups*

You you should move and take a seat at one of the computer workstations. Feel free to leave your backpacks and coats at these tables.

The system in front of you is a Group Support System. It has been designed to assist your group with sharing ideas and making decisions. It is NOT designed to replace people talking to each other, but rather to help you with certain parts of your group's work. It operates by using a collection of tools such as voting and brainwriting (e.g. brainstorming) to assist with your group's process.

Beside your terminal you will see the Group Decision Making Procedure handout. As you take a moment to look through it you will notice that it is almost identical to the one you looked at earlier with the addition of a center column. The tools referred to in the center column are part of the Group Support System. The last page of the handout has a brief description of the purpose for each tool.

We will now take a few minutes to aquaint you with the tools. Make sure the highlighed bar is on the "Training Exercise" and then press the enter key.

** Demonstrate the use of Brainwriting, Voting (timer), Ranking, Rating (timer), & Scoring tools
** Demonstrate iterative voting and ranking
** Exit the training exercise

<u>Reread the case (2-3 minutes)</u>

Before you begin to work on the case as a group, take a moment to introduce your role to the other group members. Your role is checkmarked on the cover memo.

** Record roles on chalkboard

Each of your roles has been invited to this meeting because you have important information and perspectives regarding the case. This is a complex case. Your group's objective is to use the GDMP to reach a group decision regarding your group's recommendation back to the academic policy committee chairperson. Your group's specific recommendation should be written on this form and signed by all members. It should be brief and concise. Your group will now have up to 55 minutes to resolve the case and I will notify you when there are only 10 minutes remaining. Manage your time wisely. Remember, you should diligently represent the interests and perspectives of your role in the case (rather than your role in real life). Your group has two goals: use the group decision-making procedure and to reach a recommendation for the case. It is this part of the experiment that will determine which group wins the prizes.

[T or NRB] Use the arrow keys to highlight the School of Business Policy case and press enter. Your group is on your own as you deliberate the case. I will not be able to answer any questions about the case or procedures during the hour. You may request any computer tools you need and I will serve as your "chauffeur" to have the GSS make the tools available on your screen.

[S or TS] Use the arrow keys to highlight the School of Business Policy case and press enter. Your group is on your own as you deliberate the case. The GSS will make each activity (or tool) available in order as you complete the previous activity. I will serve as your "chauffeur" for the GSS as you move through the activities, so you should tell me when you want the GSS to activate the next tool. The specific activities from the GDMP are displayed on your screen. I will not be able to answer any questions about the case or procedures during the hour. I can, however, answer questions if you have trouble operating one of the computer tools.

[RB] ** *Read by the facilitator*
Use the arrow keys to highlight the School of Business Policy case and press enter. I will serve as a process facilitator to help your group use the GDMP. While I can assist your group with the procedures and specific activities of the GDMP, you should remember that I am not a member of your group and cannot contribute to your group's actual recommendation nor answer any specific questions about the case. Your group is on your own as you deliberate the case, but I will help to guide your group as you use the GDMP. The specific activities from the GDMP are displayed on your screen. Brad will serve as your "chauffeur" for the GSS as you move through the activities so you should tell me when you want the GSS to activate the next tool.. The GSS will make each activity (or tool) available in order as you complete the previous activity.

[F or TF] ** *Read by the facilitator*
Use the arrow keys to highlight the School of Business Policy case and press enter. I will serve as a process facilitator to help your group use the GDMP. While I can assist your group with the procedures and specific activities of the GDMP, you should remember that I am not a member of your group and cannot contribute to your group's actual recommendation. Your group is on your own as you deliberate the case. I will not be able to answer any questions about the case or procedures during the hour. You may request any computer tools you need and Brad will serve as your "chauffeur" to have the GSS make the tools available on your screen.

- - - [55 MINUTES; ANNOUNCEMENT AT 45 & 50 MINUTES] - - -

Now that your group has completed the case, I would like for you to answer some questions.

Highlight the menu option that says questionnaires and press enter. Type in your student ID and course of K201, press the F2 key. The system will now present you with two sets of questions. Please pause to read the instructions when they are given. As you answer the questions, just respond with your first impression. When you are finished you should see a thank you message on the screen. Please wait patiently if you finish ahead of your other group members.

[DISTRIBUTE FINAL QUESTIONNAIRES]

We are just about finished. I would like for you to write your comments to the following questions. After that, we will spend a few minutes talking and then your group will be done.

** *Questions or Comments*

Thank you for participating in today's session. Your participation today will help us to better understand how people make decisions. Your instructor will be notified at the end of the semester regarding your participation today. I would ask that you not discuss the experiment in detail with others who may be enrolled in K201.

The case is fictitious.

You are dismissed.

APPENDIX G: VISIONQUEST DIALOGUES

Appendix G-1: VisionQuest Training Dialogue

"K201 Computer System Training"
Wednesday October 07, 1992 at 12:00 PM
Called By
Brad Wheeler

PURPOSE:
LOCATION:

DIALOGUE AGENDA

DIALOGUE TITLE: K201 Computer System Training

ACTIVITY	DESCRIPTION	ACTIVITY
1	Generate Ideas	Brainwriting
2	Discuss & Clarify Ideas	Non-Computer Based
3	Vote to retain or discard ideas	Voting
4	Rank a list into the preferred order	Ranking
5	Rate the relative importance of each criteria	Rating
6	Scoring ideas by criteria	Scoring

< END OF REPORT >

GROUP BRAINWRITING RESULTS

AGENDA TEXT: Generate Ideas

INSTRUCTIONS: What could you do with your summer? Enter as many ideas as possible. Do not be concerned about quality, the emphasis is on quantity. Press enter to continue and then INSERT to begin entering ideas. Press ESC to exit this tool when you are finished.

ALTERNATIVES

< END OF REPORT >

GROUP VOTING RESULTS - FREQUENCY COUNTS

AGENDA TEXT: Vote to retain or discard ideas

INSTRUCTIONS: Which of the following careers would you consider? Use the arrow keys to mark each item as Yes or No. Press ESC to leave the tool when you are finished.

ALTERNATIVES		YES	NO	ABSTAIN
1	work on wallstreet	0	0	0
2	get an MBA	0	0	0
3	work for the government	0	0	0
4	financial analyst	0	0	0
5	stock broker	0	0	0
6	go to graduate school	0	0	0
7	work for a volunteer organization	0	0	0
8	get a job on wallstreet	0	0	0
9	homemaker	0	0	0
10	join the peace corp	0	0	0
11	high school teacher	0	0	0
12	professional pilot	0	0	0
13	senator	0	0	0
14	psychologist	0	0	0
15	state senator	0	0	0
16	run a poodle store	0	0	0
17	mafia hit person	0	0	0
18	carpenter	0	0	0
19	be a clown	0	0	0
20	engineer	0	0	0
21	doctor	0	0	0
22	ditch digger	0	0	0
23	salesperson	0	0	0
24	manage a mcdonalds	0	0	0
25	undertaker	0	0	0
26	salesman	0	0	0
27	labor union lobbyist	0	0	0
28	police man/woman	0	0	0
29	dentist	0	0	0
30	swing a hammer	0	0	0
31	civil engineer	0	0	0
32	ambulance driver	0	0	0
33	work in a circus	0	0	0

< END OF REPORT >

GROUP RANKING RESULTS

AGENDA TEXT: Rank a list into the preferred order

INSTRUCTIONS: Place the following list of schools in order from your favorite at the top of the list to your least favorite at the bottom. Use the up/down arrow keys and the ENTER key. Highlight the item, press ENTER, move it up or down, press ENTER. Press ESC to close the tool when you are finished.

ALTERNATIVES		LOW	HIGH	AVERAGE
1	Indiana	0	0	0.00
2	Michigan	0	0	0.00
3	Purdue	0	0	0.00
4	Iowa	0	0	0.00
5	Illinois	0	0	0.00
6	Kentucky	0	0	0.00
7	Ohio State	0	0	0.00

< END OF REPORT >

GROUP RATING RESULTS

AGENDA TEXT: Rate the relative importance of each criteria

INSTRUCTIONS: If you were choosing a university, which criteria would be the most important to you. Rate the relative importance of each criteria. Use the right/left arrow keys to increase or decrease the points you assign to each criterion (10=highest). Press ESC to exit the tool when you have finished and then YES to submit your vote.

ALTERNATIVES		LOW	HIGH	AVERAGE
1	History of Getting Grads Hired	0	0	0.00
2	Tutition Costs	0	0	0.00
3	Location	0	0	0.00
4	Social Life	0	0	0.00
5	Research Reputation	0	0	0.00

< END OF REPORT >

GROUP SCORING RESULTS

AGENDA TEXT: Scoring ideas by criteria

INSTRUCTIONS: Enter a value from 0-10 (10=highest) for how well each university meets each criteria. The lower left of your screen will show the complete text for the university and the criterion. Use the down arrow key to move to the next criterion and then the right arrow key to move to the next university after you have rated all criteria for a university. Press ESC when you have finished and then YES to submit your vote.

ALTERNATIVES	LOW	HIGH	AVERAGE

<end of report>

Appendix G-2: VisionQuest Low System-Based Restrictiveness Dialogue

"Low System-Based Restrictiveness Agenda"
Tuesday October 13, 1992 at 02:00 AM

Called By
Brad Wheeler

PURPOSE:

LOCATION:

DIALOGUE AGENDA

DIALOGUE TITLE: Low System-Based Restrictiveness Agenda

ACTIVITY DESCRIPTION ACTIVITY

< END OF REPORT >

Appendix G-3: VisionQuest High System-Based Restrictiveness Dialogue

"High System-Based Restrictiveness Agenda"
Wednesday October 28, 1992 at 03:00 PM
Called By
Brad Wheeler

PURPOSE:

LOCATION:

DIALOGUE AGENDA

DIALOGUE TITLE: High System-Based Restrictiveness Agenda

ACTIVITY DESCRIPTION	ACTIVITY
1. IDENTIFY THE PROBLEM	Topic
a. What is the real problem? Generate ideas	Brainwriting
b. Discuss and clarify ideas	Non-Computer Based
c. Reduce the list of problems	Voting
d. Rank the problem statements	Ranking
e. Group agrees on problem statement	Non-Computer Based
2. IDENTIFY MANY POTENTIAL SOLUTIONS	Topic
a. How could the problem be solved? Generate ideas	Brainwriting
b. Discuss & clarify solutions	Non-Computer Based
c. Group has a list of potential solutions	Non-Computer Based
3. IDENTIFY IMPORTANT OPPORTUNITIES & CONSTRAINTS	Topic
a. Identify opportunities and constraints. Generate ideas	Brainwriting
b. Discuss and clarify opportunities & constraints	Non-Computer Based
c. Reduce the list of opportunities & constraints	Voting
d. Assign weights to the opportunities and constraints	Rating
4. REDUCE THE LIST OF POTENTIAL SOLUTIONS	Topic
a. Reduce the list of potential solutions	Voting
b. Group agrees on short list of solutions	Non-Computer Based
5. SELECT THE SOLUTION	Topic
a. Score how well each solution addresses each opportunity or constraint	Scoring
b. Discuss & clarify the numbers	Non-Computer Based
c. Group agrees on final recommendation	Non-Computer Based

< END OF REPORT >

GROUP BRAINWRITING RESULTS

AGENDA TEXT: a. What is the real problem? Generate ideas

INSTRUCTIONS: What is the real problem? Type in as many ideas as possible. Do not worry about the quality of the idea. Type in brief phrases and then press ENTER after each idea. Do NOT comment on the quality of any idea.

ALTERNATIVES

< END OF REPORT >

GROUP VOTING RESULTS - FREQUENCY COUNTS

AGENDA TEXT: c. Reduce the list of problems

INSTRUCTIONS: Vote YES or NO (use the left/right arrow keys) to decide if the idea should be retained or dropped. Group Goal: To narrow the list to no more than 3 potential problem statements.

Only ideas that get at least 3 yes votes will be carried to the next step. If you support an idea that is listed multiple times, vote YES the first time you see it and no if it is later repeated in the list.

ALTERNATIVES YES NO ABSTAIN

< END OF REPORT >

GROUP RANKING RESULTS

AGENDA TEXT: d. Rank the problem statements

INSTRUCTIONS: Select the most important problem statement by rank ordering the list from the most favorable one (at the top) to the least favorable one (at the bottom).

To move an idea, highlight the idea, press ENTER, use the up/down arrow keys, press ENTER

ALTERNATIVES LOW HIGH AVERAGE

< END OF REPORT >

GROUP BRAINWRITING RESULTS

AGENDA TEXT: a. How could the problem be solved? Generate ideas

INSTRUCTIONS: Type in as many potential solutions as you can think of. Do not worry about the quality of the idea. Type in brief phrases and then press ENTER after ech idea. Do NOT comment on the quality of any idea

ALTERNATIVES

< END OF REPORT >

GROUP BRAINWRITING RESULTS

AGENDA TEXT: a. Identify opportunities and constraints. Generate ideas

INSTRUCTIONS: Are there OPPORTUNITIES that a good solution must address or are there CONSTRAINTS that limit the feasibility of a potential solution? Type in as many ideas as possible. Do not worrry about the quality of the idea. Type in brief phrases and then press ENTER after each idea. Do Not comment on the qulity of any idea.

ALTERNATIVES

< END OF REPORT >

GROUP VOTING RESULTS - FREQUENCY COUNTS

AGENDA TEXT: c. Reduce the list of opportunities & constraints

INSTRUCTIONS: Vote YES or No (use the left/right arrow keys) to decide if the idea should be retained or dropped. Group Goal: To narrow the list of to no more than 15 important opportunities or constraints

Only ideas that get at least 3 yes votes will be carried to the next stop. If you support an idea that is listed multiple times, vote YES the first time you see it and NO if it is later repeated in the list.

ALTERNATIVES YES NO ABSTAIN

< END OF REPORT >

GROUP RATING RESULTS

AGENDA TEXT: d. Assign weights to the opportunities and constraints

INSTRUCTIONS: Some opportunities or constraints are likely more important than others. Assign a weight from 0 (unimportant) to 10 (extremely critical) to each opportunity or constraint.

ALTERNATIVES	LOW	HIGH	AVERAGE

< END OF REPORT >

GROUP VOTING RESULTS - FREQUENCY COUNTS

AGENDA TEXT: a. Reduce the list of potential solutions

INSTRUCTIONS: Vote YES or NO (use the left/right arrow keys) to decide if the solutions should be retained or dropped. Group Goal: To narrow the list to no more than 5 potential solutions.

Only solutions that get at least 3 yes votes will be carried to the next step. If you support an idea that is listed multiple times, vote YES the first time you see it and no if it is later repeated in the list.

ALTERNATIVES	YES	NO	ABSTAIN

< END OF REPORT >

GROUP SCORING RESULTS

AGENDA TEXT: a. Score how well each solution addresses each opportunity or constraint

INSTRUCTIONS: Consider how well each potential solution (alternative) addresses each opportunity or constraint. Assign a large number (10) if the solution addresses the opp/cons or a small number (0) (or somewhere between 10 & 0) if it does not adequately address the opp/cons.
Work down each column then move to the right.

ALTERNATIVES	LOW	HIGH	AVERAGE

<end of report>

APPENDIX H: PRELIMINARY STUDY PROCEDURES

Research Methodology

A laboratory experiment was conducted to evaluate the impact of GSS- and facilitator-based restrictiveness on group processes and outcomes. The study was a 2x2 factorial design which manipulated restrictiveness and the group's preference for procedural order composition.

Seven hundred students from a business computer course completed Putnam's (1979) Preference for Procedural Order (PPO) questionnaire. Individuals who scored one standard deviation above (below) the mean of the sample were classified as HPOs (LPOs). Twenty-eight groups composed entirely of all HPO individuals (14 groups) or all LPO individuals (14 groups) were randomly assigned to either a restrictive or nonrestrictive treatment. All groups had five members.

The restrictive treatment was operationalized by activating three sources of restrictiveness: user-based training, facilitator-based process guidance (spirit of the GSS and heuristic), and GSS-based (activities and sequences). The nonrestrictive treatment did not specifically impose any form of restrictiveness.

The experiment created a decision-making environment appropriate for a comprehensive decision heuristic (described below). Observations of pilot groups indicated the need for a better fit between the task and the proposed comprehensive heuristic. The SOB Policy Task was developed to address the following objectives: (1) the task should contain sufficient complexity to imply a fit for a comprehensive heuristic that includes problem identification, criteria generation, and solution phases; (2) it should distribute unique domain knowledge among the group members, and therefore necessitate a conjunctive group interaction process to find an acceptable problem definition and solution; (3) it should be appropriate for and engaging to the student subjects; (4) it should yield some meaningful index of relative solution quality between groups.

The task assigns each group member to a specific role in which they receive a common cover memo plus unique information pertinent to their role. Information from all five roles is essential to identifying the dominant problem and to finding a jointly acceptable solution. Finally, since each role imposes constraints upon the feasible solution space, relative decision quality can be assessed by the degree to which a group's solution meets or violates the constraints.

The comprehensive heuristic was a modification of Dewey's reflective thinking process (1910). The heuristic was designed to induce divergent thinking and a sequence of problem solving activities that ensured problem definition and identification of solution criteria would precede choosing a solution. Hirokawa (1987) and others (Venkatesh & Wynne, 1991; Gouran, 1982; Hackman & Morris, 1975) have noted the importance of identifying the problem before proposing solutions. Specifically, the heuristic mandated the following steps and activities:

1) Identify the Problem (generate ideas, discuss and clarify, anonymously vote to reduce the list, rank the ideas, group comes to agreement on a problem statement).

2) Identify the Criteria for an Acceptable Solution (generate ideas, discuss and clarify, anonymously vote to reduce the list, assign a relative weights to criteria).

3) Identify Potential Solutions (generate ideas, discuss and clarify, anonymously vote to reduce the list).

4) Select the Best Solution (score solutions against criteria, discuss the results, group comes to agreement on a solution statement).

Both treatments used a level 2 GSS. The VisionQuest groupware from Collaborative Technologies was selected because it provided a way to deliver both a restrictive and a nonrestrictive implementation of the GSS tools. All results from the GSS tools, such as idea generation and voting, could be viewed by each group member on his or her own screen. Five networked personal computers were positioned on a hexagon shaped table. This arrangement was conducive to face-to-face verbal communication. All group sessions were videotaped.

Procedure

1) Subjects arrived at the training room (no computer technology) and completed a consent form. They were then given a five page "Group Decision Making" handout that described the heuristic. The cover page listed the four major steps and each subsequent page detailed the activities and philosophies of each specific activity associated with a major step. The group then applied the full heuristic to a training exercise as the facilitator trained them regarding the spirit and purpose of each activity on the agenda. The facilitator used a newsprint tablet to record group responses during certain parts of the heuristic, such as idea generation and voting. Non-technology supported training was included to assist the subjects in understanding how to use the heuristic without embedding the heuristic in the GSS.

2) Subjects moved to the GSS room and were given a "Group Decision Making" handout which was almost identical to the training handout, except the new handout included the name of a GSS tool, such as Brainwriting or Voting, beside each of the heuristic's activities. The subjects practiced using the five GSS tools specified in the heuristic, Brainwriting, Voting, Ranking, Rating, and Scoring. Each tool was demonstrated independently of the other tools. The entire training process was the same for all groups and required 65 to 70 minutes.

3) Subjects were randomly assigned to a task role and were given a memorandum (the task) appropriate to their role. Subjects spent about 10 minutes reading the case and answering a preliminary question regarding their individual recommendation to address the case. The preliminary questionnaires were collected and each subject's role was written on a chalkboard. They were told that "your group should follow the Group Decision Making procedure in the handout" and to request any computer tools they needed from the facilitator.

4) Groups in the restrictive treatment received a detailed, multi-level agenda on their screen that listed all four major steps of the heuristic with indented descriptions of each activity linked to a computer tool. Each group was restricted to specifically following the agenda with only one agenda item enabled at a time. The facilitator interjected pre-scripted restrictive comments when the group violated the heuristic. For example, if a group member entered a solution into the GSS or verbally proposed a solution during the problem identification phase, the facilitator reminded the group to focus on generating problem statements rather than proposing solutions and then the solution was deleted from the list of ideas. The facilitator only activated tools when the group requested them and did not lead the group through the agenda.

The nonrestrictive groups did not receive a system-based agenda. They had to direct the process by following their training and the Group Decision Making handout. They were allowed to request any (or no) tools and proceed in any manner.

5) After completing the task, the subjects answered a questionnaire designed to measure the perceived restrictiveness associated with the facilitator, the GSS, and the heuristic during various activities of the meeting. Subjects also responded to Green and Tabor's (1980) satisfaction scale and to some open-ended questions regarding their personal agreement with the problem and solution identified by the group. The experimental sessions lasted between 135 to 150 minutes.

APPENDIX I: FULL FACTORIAL DESIGN TREATMENTS

The eight treatments for the experiment were selected from a complete enumeration of the possible combinations (Appendix Table 1) assuming discrete levels for each factor. They were selected because they represent the best contrasts for interpreting the results. The boldfaced items represent sources of restrictiveness. Rows with an asterisk in the first column are included in the experimental design.

Appendix Table1
Potential Treatments
Training (3 levels), Facilitation (2 levels), and System (3 levels)

(* = Included in Research Design)		Factor Levels: Source(s) of Restrictiveness		
		USER TRAINING	FACILITATOR	SYSTEM
*	Restrictive Baseline (RB)	**Extensive**	**Active**	**High**
*	Training + System (TS)	**Extensive**	N/A	**High**
		Extensive	**Active**	Low
*	User Training (T)	**Extensive**	N/A	Low
*	Training + Facilitation (TF)	**Extensive**	**Active**	N/A
		Extensive	N/A	N/A
*	Facilitation + System (FS)	Introduction	**Active**	**High**
*	System (S)	Introduction	N/A	**High**
*	Facilitation (F)	Introduction	**Active**	Low
		Introduction	N/A	Low
		Introduction	**Active**	N/A
*	Nonrestrictive Baseline (NRB)	Introduction	N/A	N/A
		No Heuristic	**Active**	**High**
		No Heuristic	N/A	**High**
		No Heuristic	**Active**	Low
		No Heuristic	N/A	Low
		No Heuristic	**Active**	N/A
		No Heuristic	N/A	N/A

APPENDIX J: INSTRUMENT DELIVERY AND EXPERIMENT ADMINISTRATION SYSTEM (IDEAS)

IDEAS (Instrument Delivery and Experiment Administration System) is a LAN-based system for interactively administering Likert scale questions and for scheduling subject participation. The system can deliver a variety of questions with custom response headings for each question.

The system was developed and tested by Brad Wheeler and Brian Mennecke to assist with data collection and subject scheduling during the spring of 1992. It was used successfully for the preliminary study. It was also used to collect the satisfaction and consensus scales for this dissertation.

APPENDIX K: FACTOR ANALYSES

Appendix K-1: Factor Analysis for Green & Taber Satisfaction Scales

- - - - - - - - - - - - F A C T O R A N A L Y S I S - - - - - - - - - - - -

ANALYSIS NUMBER 1 LISTWISE DELETION OF CASES WITH MISSING VALUES

EXTRACTION 1 FOR ANALYSIS 1, PRINCIPAL-COMPONENTS ANALYSIS (PC)

INITIAL STATISTICS:

VARIABLE	COMMUNALITY	*	FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
		*				
G1	1.00000	*	1	5.10361	51.0	51.0
G2	1.00000	*	2	1.74014	17.4	68.4
G4	1.00000	*	3	.73816	7.4	75.8
G5	1.00000	*	4	.52034	5.2	81.0
G10	1.00000	*	5	.44154	4.4	85.4
G11R	1.00000	*	6	.36917	3.7	89.1
G12R	1.00000	*	7	.31114	3.1	92.2
G13R	1.00000	*	8	.29404	2.9	95.2
G14R	1.00000	*	9	.26136	2.6	97.8
G15R	1.00000	*	10	.22050	2.2	100.0

PC EXTRACTED 2 FACTORS.

FACTOR MATRIX:

	FACTOR 1	FACTOR 2
G1	.52387	.60524
G2	.57257	.56807
G4	.74226	.34771
G5	.76073	.40932
G10	.79754	.22411
G11R	.72330	-.37591
G12R	.74262	-.42791
G13R	.70242	-.35614
G14R	.72568	-.37029
G15R	.80060	-.35224

FINAL STATISTICS:

VARIABLE	COMMUNALITY	*	FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
		*				
G1	.64076	*	1	5.10361	51.0	51.0
G2	.65054	*	2	1.74014	17.4	68.4
G4	.67185	*				
G5	.74626	*				
G10	.68629	*				
G11R	.66447	*				
G12R	.73459	*				
G13R	.62023	*				
G14R	.66373	*				
G15R	.76503	*				

VARIMAX ROTATION 1 FOR EXTRACTION 1 IN ANALYSIS 1 - KAISER NORMALIZATION.

VARIMAX CONVERGED IN 3 ITERATIONS.

ROTATED FACTOR MATRIX:

	FACTOR 1 "Process"	FACTOR 2 "Outcome"
G1	.01497	.80034√
G2	.07617	.80296√
G4	.34760	.74231√
G5	.32235	.80147√
G10	.46920	.68275√
G11R	.79630√	.17427
G12R	.84443√	.14670
G13R	.76761√	.17610
G14R	.79453√	.18012
G15R	.84053√	.24195

FACTOR TRANSFORMATION MATRIX:

	FACTOR 1	FACTOR 2
FACTOR 1	.76821	.64020
FACTOR 2	-.64020	.76821

Appendix K-2: Factor Analysis for Consensus Scale

- - - - - - - - - - - F A C T O R A N A L Y S I S - - - - - - - - - - -

ANALYSIS NUMBER 1 REPLACEMENT OF MISSING VALUES WITH THE MEAN

EXTRACTION 1 FOR ANALYSIS 1, PRINCIPAL-COMPONENTS ANALYSIS (PC)

INITIAL STATISTICS:

VARIABLE	COMMUNALITY	*	FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
		*				
C1	1.00000	*	1	4.29360	61.3	61.3
C2	1.00000	*	2	.68476	9.8	71.1
C4	1.00000	*	3	.59371	8.5	79.6
C5R	1.00000	*	4	.50143	7.2	86.8
C6R	1.00000	*	5	.33777	4.8	91.6
C7R	1.00000	*	6	.31579	4.5	96.1
C8	1.00000	*	7	.27292	3.9	100.0

PC EXTRACTED 1 FACTORS.

FACTOR MATRIX:

	FACTOR 1 "Consensus"
C1	.79124
C2	.81218
C4	.82349
C5R	.68944
C6R	.81384
C7R	.80963
C8	.73253

FINAL STATISTICS:

VARIABLE	COMMUNALITY	*	FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
		*				
C1	.62606	*	1	4.29360	61.3	61.3
C2	.65963	*				
C4	.67814	*				
C5R	.47532	*				
C6R	.66234	*				
C7R	.65550	*				
C8	.53660	*				

VARIMAX ROTATION 1 FOR EXTRACTION 1 IN ANALYSIS 1 - KAISER NORMALIZATION.