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No. 4419

COGNITIVE COMPLEXITY IN GROUP
PERFORMANCE AND SATISFACTION

DISSERTATION

Presented to the Graduate Council of the
University of North Texas in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

Bradley W. Mayer, B.B.A., B.S.ED., M.B.A.

Denton, Texas

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In this study, a comparison was made between the various levels of group cognitive complexity and its relationship to task performance and task satisfaction. The goal of this research is to answer the general question, "Should decision-making groups consist of individuals who are similar in the way they differentiate and/or integrate various stimuli in order to increase performance and satisfaction?"

The preceding research problem was analyzed in a laboratory setting using a 2 X 2 factorial design blocked on the variable, cognitive complexity. The Repertory Grid was used to measure the cognitive complexity of 228 student subjects. These subjects were stratified into groups of three based on their cognitive complexity score on the Repertory Grid (Kelly, 1955). Each group was treated randomly with one of two levels of task complexity (complex or not complex). Moreover, the groups received an imposed

group structure that incorporated centralized or decentralized decision-making.

Results indicated that groups consisting of cognitively complex members outperformed groups consisting of noncomplex members. No support was obtained for the two-way interaction between group cognitive complexity and either task complexity or group structure. Support was obtained for the interaction between task complexity and group structure on both task satisfaction measures. The highest satisfaction levels occurred with a complex task in a decentralized structure. In addition, the three-way interaction effect on the task satisfaction scale between group structure, task complexity, and group cognitive complexity was significant. The means, however, were not in the predicted direction. For cognitively simple groups, a complex task with a decentralized structure lead to the highest task satisfaction level; whereas, a less complex task with a decentralized group structure lead to the lowest task satisfaction score for noncomplex members. There were no significant differences for cognitively complex groups when analyzing the three-way interaction between group cognitive complexity, task complexity, and group structure.

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CHAPTER I

INTRODUCTION

Research in cognition has concentrated on three areas: (1) cognitive structures; (2) cognitive processes; and (3) cognitive styles (Schneider & Angelmar, 1993). Cognitive structures are the representations of knowledge such as categories, construct systems, causal systems, scripts, and schemata. These structures contain and organize information. Cognitive processes refer to how knowledge is selected, organized, transformed, stored, and utilized, while cognitive style refers to the differences in the cognitive structures and processes across units of analysis (Streufert & Swezey, 1986). Each of these areas will be described in the following paragraphs.

One stream of research on cognitive structures was derived from categorization theory in psychology (Mervis & Rosch, 1981; Rosch, 1975, 1978; Rosch & Mervis, 1975). Rosch's object categorization model explains how individuals reduce the complexity of incoming information by forming categories of similar attributes. In essence, categorization theory assumes that individuals use hierarchical relationships, e.g. abstract to concrete, to

form more complex cognitive structures such as scripts and schemata (Porac, Thomas, & Baden-Fuller, 1989).

Categorization theory has helped to explain the formation of leadership perceptions (Phillips & Lord, 1982). A category label is formed by comparing a person to a leadership prototype. Then, the person only needs to think of the category label to make judgements of likely behaviors and traits of this leader (Phillips & Lord, 1982). Categorization also has been explored by testing how managers sort events into categories of strategic issues (Dutton & Jackson, 1987; Dutton, Walton, and Abrahamson, 1989) and problems (Cowan, 1986). This process of categorization may be used by managers to sort events, objects, etc. into similar attributes to reduce the complexity of the situation (Dutton & Jackson, 1987). Finally, recent theory has suggested that experts and novices may categorize problems differently (Day & Lord, 1992). These differences may be attributable to the degree of complexity of a person's knowledge structure.

Schemata can be described as data structures in memory that represent knowledge about concepts (Alba & Hasher, 1983). A type of schema known as scripts describes data structures that occur as a sequence of events (Abelson, 1981). Scripts develop from recurrent past experiences

leading to a strong familiarity with tasks and situations (Abelson, 1981; Gioia & Poole, 1984; Lord & Kernan, 1987). For example, a person who wants to learn how to drive a car will go through a sequence of events that include opening the door, putting the key into the ignition, adjusting the mirrors, stepping on the brake, turning the key, putting the car into gear, and stepping on the accelerator pedal. Script processing has been studied in the context of understanding managerial decision making (Ashforth & Fried, 1988; Foti & Lord, 1987; Gioia & Poole, 1984; Lord & Kernan, 1987; Wofford & Goodwin, 1990). Like categorization, well-developed scripts allow individuals to deal more efficiently with the subtleties of complex tasks (Wofford, 1994).

Cognitive processes have been applied to many of the relationships in the study of organizational behavior. Examples of theoretical and practical applications for cognitive processes include the areas of attribution theory, leadership, decision making, and performance appraisal (Ford, 1985; Jolly, Reynolds, & Slocum, 1988; Lord & Maher, 1990; Pfeffer, 1981). In each of these areas, the study of cognitive processes may help to improve management and personnel practice by increasing the efficiency in decision-making, performance appraisals, and training and development programs (Lord & Maher, 1989). Moreover, cognitive

processes may be used by academicians as an explanation to managers of how to implement the various contingency approaches of leadership and job design (Wofford, 1994).

Cognitive styles have been used in previous studies to help explain the differences in cognitive structures or processes across different units of analysis. A major component of cognitive style is an individual's cognitive complexity. Cognitive complexity is defined as the degree to which a person within a particular domain utilizes multiple perspectives when perceiving and evaluating stimuli (Goodwin, 1991). These multiple perspectives can be referred to as dimensions that represent the grouping or ordering of stimuli (Streufert & Swezey, 1986). The ability to differentiate between various alternatives and on many dimensions will help individuals become better problem solvers and decision makers. This increased performance may be attributed to the type of strategies pursued by cognitively complex individuals and groups (Ginsberg 1989; 1990; Reger, 1987; Walton, 1986).

Statement of Problem

There are cognitive theorists who argue that only individuals think, and that the application of a cognitive approach to collective groups is unrealistic (Gioia & Sims, 1986). Other theorists have attributed group actions to a

collection of beliefs, assumptions, frames of references, and applied theories that individuals use to interpret their environment and anticipate events (Bartunek, 1984; Bettenhausen & Mernighan, 1985; Dunn & Ginsberg, 1986; Wacker, 1981). This current research takes a similar stance to the latter viewpoint and proposes an aggregated approach that is concerned with understanding the attribution of cognitive complexity to group decision making.

Exploring the role of cognitive complexity in groups requires an understanding of the concept at the individual level of analysis. It also requires an understanding of the relationship between an individual's cognitive complexity and a group's level of cognitive complexity. The practice of aggregating individual characteristics is similar to systems theory, which is based on the assumption that concepts such as purpose and feedback are applicable at many different levels (Miller & Friesen, 1978). Because groups are able to perform tasks, it can be assumed that they possess cognitive abilities and are able to acquire knowledge and process information similar to individuals (Campbell, 1974).

Groups have the potential for simultaneously increasing both the performance and the satisfaction of its members (Campion, Medsker, & Higgs, 1993; Gladstein, 1984; Hackman,

1987; Katzell & Guzzo, 1983). In this study, a group's performance and satisfaction are considered significant in their relationship to a group's cognitive complexity. Studying the effects of group cognitive complexity on performance and satisfaction may play a key role in avoiding the performance-satisfaction trade-off that is potentially inherent in work design. For example, enriching a group's task may increase their satisfaction but may decrease their productivity. In this study it is proposed that a reason for this trade-off may potentially be in the group's level of cognitive complexity. If cognitive complexity in groups is related to both the performance and the satisfaction of group members, it may be beneficial for managers to pay close attention to the cognitive complexity of their personnel.

It also is important to examine the interaction effect of the environment, the structure of the groups, and group cognitive complexity on performance and satisfaction. For example, a cognitively complex group may have higher performance and satisfaction on a complex task than on a simple task. Likewise, a cognitively complex group may have higher performance and satisfaction than cognitively simple groups in a decentralized structure than in a centralized structure. Much of the current research has begun to

suggest that experience and task complexity will have an effect on the cognitive processes of groups (Ashforth & Fried, 1988; Lord & Kernan, 1987; Louis & Sutton, 1991). Jacques (1990) has suggested that different levels of cognitive complexity may be needed depending on the function of the task at various hierarchical levels of an organization. McGrath (1984) reviewed group research and concluded that task type and group structure are of major importance in measuring satisfaction and task effectiveness.

In this paper, a comparison is made between a group's cognitive complexity and its task performance and task satisfaction. Potential interaction effects on task performance and satisfaction that are investigated include those between cognitive complexity and environmental complexity (i.e., task complexity), between cognitive complexity and group structure (centralized-decentralized), and between all three of these variables. Consequently, the goal of this research is to answer two general questions: (1) Should decision making groups consist of individuals who are either all cognitively complex or all cognitively simple in order to increase performance and satisfaction?, and (2) Does task complexity or group structure influence the relationship between group cognitive complexity and performance and satisfaction?

Theoretical Foundation

Complexity theory originated out of the area of cognition. Early theoretical approaches to complexity were concerned with identifying various ways individuals differentiate and integrate information. Differentiation refers to the ability of a person to separate two or more bipolar dimensions. Integration is the process of relating two or more dimensions (Streufert & Swezey, 1986). A cognitively complex person would employ differentiation and integration as part of his or her information processing (representing a multidimensional structure). A less complex person would respond to stimuli based on fewer dimensions (representing a unidimensional structure) (Streufert & Swezey, 1986).

Much of the development of complexity theory began in 1955 when Kelly proposed personal constructs as a guide for psychotherapy and client-therapist interaction. According to his view, a dimension (construct) emerges when individuals view two events or objects as similar and a third as dissimilar. Kelly (1955) developed The Role Construct Repertory (REP) Test, which measures an individual's degree of cognitive complexity. This research provided a basis for later cognitive theories. Similarly, Bieri (1961) and Bieri et al. (1966) were concerned with the

effect of an individual's cognitive complexity on the judgments he or she makes in response to environmental stimulation.

Zajonc (1960) advanced complexity theory by proposing categorization theory as an explanation for the degree of cognitive complexity in an individual. He viewed complexity as the extent to which a person could subdivide dimensions. This theory led to the subsequent formulations of Scott, Osgood and Peterson (1979). Scott was the first cognitive theorist to emphasize that cognitive complexity may be limited to specific cognitive domains. An individual may have various levels of cognitive complexity in different environments. Surprisingly, in these previous studies, there was no attempt by theorists to consider the effects of these environmental events.

In the late 1960's and early 1970's, researchers began considering the interaction effects of the task environment and its relation to cognitive complexity. The relationship between cognitive complexity and an environmental event became known as interactive complexity theory. Early interactive complexity theory proposed that effective cognition is a function of both a person's cognitive complexity and the environmental conditions (Driver and Streufert, 1966; Schroder, 1971; Schroder, Driver, and

Streufert, 1967; Streufert, 1970; Streufert and Driver, 1967). Examples of environmental conditions include information load, time pressure, and task complexity (Streufert & Swezey, 1986). According to interactive theory, people with different degrees of cognitive complexity reach various levels of cognitive performance when environmental conditions are optimal. In other words, individuals will perform best when their cognitive complexity is matched with the environmental conditions. This theory suggests that more complex persons will perform optimally at a higher level of information load, time pressure and task complexity.

In the late 1970's and early 1980's, complexity theory began to take a more extensive focus on decision making (Swezey, Streufert, Criswell, Unger, & Van Rijn, 1984). A revised relationship between environmental conditions and individual strategic decision-making performance was proposed. The results of these studies indicate that the relationship between decision-making performance and environmental complexity is curvilinear for both more and less complex persons; that is, there is an optimal level of environmental conditions for persons who are both more and less complex.

In the 1980's up to the present, researchers began to relate cognitive complexity to group performance (Brehmer, 1976; Schroder, Driver and Streufert, 1967). Their research has led to propositions for the effect of individual cognition on cognitive processes at the group level of analysis (Bartunek, 1984; Bettenhausen & Mernighan, 1985; Dunn & Ginsberg, 1986; Wacker, 1981). Consequently, researchers are now beginning a more serious investigation into the relationship between cognition and group performance (Ginsberg, 1990; Walsh, Henderson & Deighton, 1988; Walsh & Ungson, 1991). Questions such as, "how desirable is like-mindedness among group members?" "what should be the norms for encouraging or discouraging deviance?" or "what should be the norms for encouraging consensus vs. dialectical debate in group decision making?" have begun to surface in the literature.

Currently, researchers are operationalizing group cognitive complexity by using variables such as group coverage and consensus (Walsh et al., 1988). Group coverage refers to having at least one member of the group who is competent on each aspect of the information domain. Consequently, researchers have proposed that there may be a need for groups to have greater coverage when problems are ambiguous and uncertain. This would provide the group with

a chance to reflect on the maximum number of possible perspectives during their processing of information. Walsh et al. (1988) did not find support for this hypothesis. This finding may be attributable to the lack of manipulating potential interaction effects such as task complexity and group structure. Also, a stronger manipulation of the group's cognitive structure could have been made by prescreening their level of coverage and consensus. This manipulation would have created groups with higher variances of coverage and consensus profiles.

At the opposite end of the spectrum, researchers have proposed that groups may need greater consensus for easier and faster decision making (Ginsberg, 1990; Walsh et al., 1988; Walsh & Ungson, 1991). Higher consensus indicates that group members are relatively similar cognitively in the way they consider dimensions of the decision. Like group coverage, there have been inconclusive findings on this variable. These results indicate a need for researchers to study interactions between variables that may help to explain the relationship between group cognitive complexity and group outcomes.

Other research has shown that understanding a group's cognitive complexity may lead to more effective training and development of personnel (Stabell, 1978; Streufert & Swezey,

1986). Whether cognitive complexity is a decision-making style or a trait, training groups in differentiation and/or integration may have some success. Cognitive science topics having implications for cognitive complexity such as visual imagery, declarative knowledge (symbols, propositions, beliefs, schemata), episodic knowledge (scripts, serial memories), and procedural knowledge (knowing how to do things such as riding a bicycle) are currently being incorporated into training methods (Streufert & Swezey, 1986).

Cognitive complexity may be developed in a group of individuals by asking them questions about their goals and strategies. Asking groups to think about the long-term consequences of their decisions will enable them to better utilize all possible alternatives. Further, it may be possible to train across domains where previous complexity already exists. For example, if a group is very cognitively complex in its view of political candidates, this domain may be used to help facilitate multidimensionality of actions in other domains. Finally, instructions may be written for tasks that will allow an otherwise less complex group to respond in a way similar to a cognitively complex group (Streufert & Swezey, 1986).

Stabell (1978) investigated the relationship between the requirements necessary for training and applications of cognitive complexity. Stabell suggests that there is a positive relationship between the utilization of information in decision making and an individual's cognitive complexity. Moreover, he concludes that it is necessary to define task characteristics associated with performance that influence the information processing requirements of individuals. Therefore, training procedures may have to focus on specific aspects and requirements of information processing as a first step toward the development of cognitive complexity.

Given the difficulty of changing the individual to match the situation, it may be more cost effective to match a task to an individual and/or group with the cognitive complexity of its members. It would be unproductive to place a very low complexity group in a task for which complex information processing is the criterion for success. Matching job and personnel complexity clearly requires a measurement of both. Careful planning might enable an organization to provide the right task characteristics to the group's cognitive capacity. Also, if information processing capacity must match information processing requirements, then effective groups with complex tasks or those facing a changing environment should have a more

decentralized group structure than those facing routine tasks or stable environmental conditions.

Group cognitive complexity must either be developed and/or matched to meet the specifications of a task. Therefore, the structure of a group and/or its group members may have to be changed to meet the information characteristics of the task. For example, when a task is more complex, all else constant, there is greater uncertainty and more requirements for information. Thus, this type of task may best be performed by a group that has cognitively complex members with a decentralized group structure. On the other hand, under some conditions, overplanning can be just as detrimental as underplanning. Simple, straightforward decision making might be preferable to a well-considered strategic decision. A simple task may best be performed in a centralized group structure by individuals who function well in a unidimensional fashion if they perceive that the environment demands such action.

In summary, self-directed teams, executive teams, continuous improvement teams or groups of people with a common purpose sometimes are successful and sometimes fail. Often the construction and composition of the team are as much a problem as external factors. Identifying a fit between the members of a team or training members to be able

to adapt their cognitive complexity to the appropriate environment and group structure will save an organization time, money, and build confidence that a team approach can succeed. The interaction effects of group cognitive complexity, task complexity, and group structure on task performance and task satisfaction are presented as research questions in the following section.

Research Question

Although many studies on group performance have been conducted, little is known about why some groups are more productive than others (Hackman & Morris, 1975). It is proposed that one major reason for this confusion is the characteristics of the task environment as a determinant of group process and performance (Kabanoff & O'Brien, 1979).

One characteristic of the task environment is the type of task that is performed. For example, there may be a variation in group productivity depending on whether groups are performing intellectual or manipulative type tasks (Hewett, O'Brien, & Hornik, 1974; O'Brien & Ilgen, 1968). A second characteristic of the task environment is the amount of information given to groups to perform a task (Driver & Streufert, 1969). A group's performance on a task may be affected by both information load and time pressure (Hahn,

Lawson, & Lee, 1992). Finally, a variation in task complexity may have effects on cognitive and behavioral responses of task performers (Simonson & Weiser, 1976). Task complexity has been defined in terms of a person's psychological experience with the task, an interaction between the task and the person's characteristics, and as a function of objective task characteristics (Campbell, 1988). Thus, in order to fully understand the determinants of group productivity, various characteristics of the task environment must be analyzed (Bass & Leavitt, 1964; Hackman, 1969).

Another reason for the lack of consistency in results of group performance is the effect of a group's structure. There is evidence from several studies that the task environment has a significant influence on an emergent group structure, which in turn affects group productivity (Hackman & Jones, 1965; Lord, 1976). Therefore, an objective method for describing group structure would seem an important step to furthering knowledge of how task and structural variables influence group productivity (Kabanoff and O'Brien, 1979). Specific aspects of group structure include communication networks (centralized-decentralized), leadership style, and size (Bettenhausen, 1991).

Furthermore, to help explain why certain groups are successful while other are not, the group's composition must be examined (Gladstein, 1984; Guzzo & Shea, 1992; Hackman, 1987). One aspect of group composition is the group's level of cognitive complexity. This study poses that groups be investigated in terms of their makeup of cognitive complexity. The theory of cognitive complexity is just beginning to escalate into the group level of analysis. Results of studies on group cognitive complexity are still inconclusive (Driver & Streufert, 1969; Ginsberg, 1989, 1990; Walsh et al., 1988). This may be attributed to various methodological problems as well as the failure to test important variables such as task complexity and group structure. Therefore, based on the theoretical foundation of complexity theory and the current investigation into the group domain, the following research question is posed in this study:

How do group cognitive complexity, task complexity, and group structure combine to influence the group outcomes of task performance and satisfaction?

While current research on cognitive complexity has provided insight into how groups process information, it has overlooked the relationship among important related variables. For example, much of the past research has passed up the opportunity to look at the product(task

performance), social process (relationships), and personal reaction (task satisfaction) within the same experiment.

Another problem with much of the previous cognitive complexity research is the exclusive use of correlational designs in field settings. In the field setting, it is difficult to discern the true main effects of task dimensions on employee responses. Any given observed relationship could be in part spurious due to the covariation of such contextual factors as pay, supervision, working conditions, or task scope (Ganster, 1980). According to Schwab and Cummings (1976), many researchers have simply gathered data on task characteristics and employee responses by paper and pencil self-report instruments. Therefore, reported correlations may be due largely to common methods variance. Consequently, it is important to take the relationship between cognitive complexity and task performance and satisfaction into the laboratory where such artifacts can be controlled.

The preceding research question will be analyzed in a laboratory setting using a 2 X 2 factorial design blocked on the variable, cognitive complexity. The Repertory Grid will be used to measure the cognitive complexity of 240 student subjects. These subjects will be stratified into groups of three based on their cognitive complexity score on the

Repertory Grid (Kelly, 1955). Each group will be treated randomly with one of two levels of task complexity (complex or not complex). Moreover, the groups will have an imposed group structure that incorporates centralized or decentralized decision-making. The main effects of group cognitive complexity on task performance and task satisfaction will be analyzed. Also, the separate interaction effects of task complexity and group structure with group cognitive complexity on task performance and task satisfaction will be analyzed. Finally, the joint interaction effect of task complexity, group structure and group cognitive complexity on task performance and task satisfaction will be investigated. These relationships will be analyzed using ANOVA procedures.

Definitions of Terms

The following are definitions for terms that will be utilized throughout this study (Schneider & Angelmar, 1993; Streufert & Swezey, 1986).

1. Causal Systems:

Causal systems are established relationships of cause and effect obtained by trial and error or empirical testing.

2. Cognitive Complexity - Simplicity:

Cognitive complexity-simplicity represents the degree to which a potentially multidimensional cognitive space is differentiated and integrated.

3. Cognitive Content:

Content represents what persons think about a stimulus or what an institutionalized organizational response to a stimulus is, not how they think about it or respond to it.

4. Cognitive Dimension:

A dimension is a bipolar cognitive scale with two or more points of discrimination among stimuli.

5. Cognitive Processes:

Cognitive processes refer to how knowledge is selected, organized, transformed, stored and utilized.

6. Cognitive Structure:

Cognitive structure is a representation of knowledge that contains and organizes information. Cognitive structure represents the different or integrative use of dimensions in cognitive or conceptual space with regard to specific stimulus objects or configurations. While content is concerned with what individuals think about a stimulus or what response an organization

typically makes to it, structure is concerned with the processes underlying those thoughts or responses.

7. Cognitive Style:

Cognitive style refers to an enduring difference in cognitive structure or process measured by an individual's cognitive complexity or by surveys such as the Myers-Briggs Type Indicator (Myers-Briggs Inventory, 1962).

8. Discrimination:

Discrimination is the process of dividing (or the degree to which division has been accomplished) a cognitive bipolar dimension into subsections for the placement of stimuli that have relevance to the endpoints of that dimension. The minimum number of discriminations is two (the endpoints). The maximum number of discriminations on any dimension is limited only by the capacity of the individual or organization to meaningfully subdivide the dimension.

9. Differentiation:

Differentiation is the process of dividing cognitive or conceptual space (or the degree to which this division has been achieved relevant to specific stimulus configurations) into two or more bipolar dimensions, systems or subsystems.

10. Domains of Complexity:

Domains of complexity represent the subdivision of cognitive or conceptual space into specific areas for which the degree of differentiation/integration may differ widely.

11. Group Complexity-Simplicity:

Group complexity-simplicity represents the degree to which the conceptual space of a group is differentiated and integrated.

12. Integration:

Integration refers to the process of relating a stimulus configuration of two or more dimensions, systems, or subsystems.

13. Schema:

Schema refers to a cognitive structure used to organize and interpret information.

14. Script:

Scripts are a cognitive structure representing temporal relationships of actions in events.

15. Systems and Subsystems:

Systems and subsystems are applicable at macroscopic levels and imply components through which an organization (or task-oriented group) processes information.

Chapter Summary

The purpose of this chapter was to introduce the reader to both cognitive theory and complexity theory. First, an introduction was given on cognitive theory and its relation to decision making. Next, a theoretical foundation for complexity theory was reviewed, followed by the research questions proposed in this study. This study will address the direct relationship between group cognitive complexity and both task performance and satisfaction. In addition, the interaction effects on performance and satisfaction between group cognitive complexity, task complexity, and group structure will be examined.

Organization of Paper

Chapter II begins with a conceptual discussion of cognitive theory including cognitive structures and processes. This discussion is followed by an explanation of individual cognitive complexity and how it relates to group cognitive complexity. Group cognitive complexity is then defined as it applies to the current study both in terms of its content and operationalization.

The literature review defines the relationship between group cognitive complexity and task performance. Then, the

interaction effects of environmental complexity (information load, time pressure, and task complexity) and group structure are discussed. Finally, the effects of group cognitive complexity, environmental complexity and group structure on task satisfaction are reviewed.

Chapter III begins with a review of the methodology for the study. The sections in the methodology include the sample, design, and procedures of the experiment. Also, the measures of group cognitive complexity, task satisfaction, and task performance are introduced and the manipulations of task complexity and group structure are explained.

Chapter IV reports the results of the tests of the hypothesized relationships between group cognitive complexity and task performance and satisfaction. Tables within the chapter summarize the various ANOVAs for effects. Also, where appropriate, a post-hoc test between the experimental groups is displayed.

Chapter V begins by summarizing and interpreting the results of the study. The next section discusses the theoretical and practical implications of the contribution made by the results. The third section addresses the limitations of the study. Finally, the last section looks at possible directions for future studies concerning group cognitive complexity and task performance and satisfaction.

CHAPTER II

REVIEW OF LITERATURE

This review of the literature begins by examining cognitive theory as it pertains to two areas: (1) cognitive structure; and (2) cognitive processes. In order to clearly understand the meaning of cognitive complexity, it is important to discuss its relationship to the structures and processes of cognition. The review of cognitive theory is followed by a discussion on complexity theory. Complexity theory is then examined at both the individual and the group level. Group cognitive complexity is defined in terms of its content and the way in which it is operationalized. Next, the literature on group cognitive complexity is reviewed as it relates to information processing, task performance, and task satisfaction. Environmental complexity and group structure also is discussed in their relationships with these outcome variables. Finally, the interaction effects between group cognitive complexity, and group structure on task performance and satisfaction is addressed.

Cognitive Theory

Cognitive research on decision-making has focused on processes and structures of cognition rather than individuals and individual differences in cognition (Ginsberg, 1990; Schwenk, 1988). Cognitive structures emphasize how individuals and groups use developed schemata, knowledge structures, cognitive maps and negotiated belief structures (Dirsmith & Covalleski, 1983; Dunn & Ginsberg, 1986; Ginsberg, 1990; Porac et al., 1989; Schneider & Angelmar, 1993; Walsh, 1988; Walsh & Fahey, 1986; Walsh, Henderson, & Deighton, 1988). In contrast, cognitive processes refer to how individuals and groups search, select, and retain information including heuristics, inferences, and sense making (Bateman & Zeithaml, 1989; Duhaime & Schwenk, 1985).

Cognitive Structures

Research on cognitive structures in organizational literature began with categorization theory and its application to leadership (Lord, Foti & Phillips, 1982). Since then, categorization theory has been used in various strategic situations to assist in identifying relevant information (Cowan, 1988; Walsh et al., 1988). Specifically, categorization theory is useful in helping managers recognize problems (Cowan, 1986) and in explaining

how strategic issues are interpreted (Dutton & Jackson, 1987). Dutton and Jackson (1987) argue that classifying an issue as a threat or an opportunity affects the way managers process information. Further, as executives categorize a particular problem, it enables them to better understand the problem formulation process (Cowan, 1985,1986; Lyles 1981; Lyles & Schwenk, 1992; Pounds, 1969; Volkema, 1986).

Categorization theory also has been used to distinguish various differences between experts and novices such as what they perceive to be ideal characteristics of a leader (Baumgardner & Foti, 1988). Categorization theory may facilitate the utilization of other cognitive structures. These structures include schemata, scripts, knowledge structures, and negotiated belief structures. Each of these structures will be reviewed in the following discussion.

According to Lord and Maher (1989), an individual's long-term memory contains hierarchically organized sets of information called schemata. These schemata are used to analyze and evaluate the individual's environment leading to successful processing of information (Cantor & Mischel, 1977; Linville, 1982; Lyles & Schwenk, 1992; Walsh & Fahey, 1986).

A subset of schemata, called scripts, contains information about particular, frequently experienced events

(Schank & Abelson, 1977). Lord and Foti (1986) suggest that scripts help individuals put temporal meaning to events and represent causal relationships. Individuals are able to use scripts to carry out a sequence of actions in a given situation such as in an employment interview or a formal meeting (Abelson, 1976; Schank & Abelson, 1977).

Individuals with well-developed scripts are able to simultaneously attend to a number of activities. For example, a person would be able to hold a conversation on the phone while operating a computer (if the script for operating a computer is well-developed). Like a schema, a more elaborate, organized and generalized script develops as the individual gains experience with task and role-based behaviors (Lord & Foti, 1986).

According to Ashforth and Fried (1988), there are three problems that occur in decision making because of a reliance on scripts: blinkered perceptions, premature closure, and superstitious learning. Blinkered perceptions occur when scripts become ingrained and can no longer be adjusted to other situations. The problem of premature closure happens when managers reach conclusions and take action before all the information is processed. Finally, superstitious learning refers to managers incorrectly attributing causes of behaviors to prior events that are most salient.

Accordingly, it should be emphasized that the objective should not be to reduce the reliance on scripts but to increase the effectiveness of script processing (Ashforth & Fried, 1988). Scripts have a number of useful functions including the facilitation of sense making, the prediction and control of behavior, the organization of individuals' behaviors, the moderation of role conflict, and provisions for the basis of evaluating behaviors. Scripts also help to conserve cognitive capacity by enabling individuals to perform two activities simultaneously. Researchers can help individuals to achieve these benefits of scripts by investigating individual level characteristics such as work experience, training, a lack of job involvement, an intolerance for ambiguity, external locus of control, authoritarianism, low self esteem, and low cognitive complexity, all of which predict an over-reliance on behavioral scripts (Ashforth & Fried, 1988).

Researchers also may help groups prevent an over reliance on scripts. Variables at the group level that may lead to an over reliance on script processing include group longevity, task interdependence, frequency of interaction, group norms of conformity and predictability, and the level of group cognitive complexity (Ashforth & Fried, 1988). Finally, script processing can be researched at the

organizational level by testing whether there will be greater reliance on scripts for organizations that are large or have a mechanistic structure, a simple and stable task environment, a mass production technology, or a culture and climate that discourages innovativeness and risk-taking (Ashforth & Fried, 1988; Mintzberg, 1979).

The relationship between scripts, schemas and group cognitive complexity ultimately affects decision making. For example, it can be assumed that there is a correlation between cognitive complexity and the number of script tracks that are available to an individual or group (Goodwin, 1991; Wofford, 1994). Consequently, a complex group should be less likely to over rely on preexisting schemata and scripts that may bias its decisions. Thus, groups with higher levels of cognitive complexity should make more accurate decisions.

Another term closely related to scripts and schemata is known as a knowledge structure. Knowledge structures can develop at the individual level or through shared beliefs and goals that usually evolve through consensus among members in a group or in an organizational setting (Lyles & Schwenk, 1992). Knowledge structures can result from an interpretation of the environment, past organizational

events, and from the assumptions and beliefs of key decision makers.

One important characteristic of a knowledge structure is its complexity (Lyles & Schwenk, 1992). The complexity of an individual's knowledge structure refers to a person's ability to differentiate and integrate information. The more complex the knowledge structure, the easier it is to recognize and process a wide variety of information. In contrast, a simple knowledge structure may cause decision-makers to ignore many environmental signals because they are not recognized (Walsh & Fahey, 1986). Therefore, a person with more complex knowledge structures would be able to more successfully process a greater amount of information. Groups with cognitively complex individuals who have complex knowledge structures may make better decisions. In contrast, groups that have less cognitively complex individuals with less complex knowledge structures may make less accurate decisions.

In summary, group cognitive complexity, may enhance a group's sensing and switching capabilities (Louis & Sutton, 1991). Sensing and switching capabilities refer to a person's ability to recognize conditions in which she/he should rely on well-developed schemata and scripts as opposed to active thinking. It has been proposed that a

cognitively complex group is more likely to be sensitive to its environment, providing members with more useful information (Louis & Sutton, 1991). For example, cognitively complex groups are more likely to experience different beliefs leading to the encouragement of challenging views (dialectical inquiry) (Walsh et al., 1988). They also would be more likely to appoint a devil's advocate, or rotate members among various roles in the group. These decision-making methods should produce higher quality decisions especially under complex environmental conditions. Because group members may become aware of the beliefs and assumptions held by others in the group, groups that engage in such activities should experience fewer discrepancies in decision making. Therefore, these groups should have more skill at recognizing the limits of their schemata and at sensing the need to switch from a reliance on scripts and schemata to active thinking (Louis & Sutton, 1991). A summary of the research reviewed on cognitive structures is presented in Table 1. The authors and type of structure discussed in the respective articles are noted in the table.

TABLE 1
Summary of Literature on Cognitive Structures

Author(s)	Cognitive Structure
Baumgardner & Foti (1988)	Categorization Theory
Cowan (1985, 1986, 1988)	Categorization Theory
Dutton & Jackson (1987)	Categorization Theory
Lord, Foti & Phillips (1982)	Categorization Theory
Pounds (1969)	Categorization Theory
Volkema (1986)	Categorization Theory
Walsh et al., Henderson & Deighton (1988)	Cognitive Structures
Lyles (1981)	Knowledge Structures
Lyles & Schwenk (1992)	Knowledge Structures
Walsh & Fahey (1986)	Knowledge Structures
Cantor & Mischel (1977)	Schemata
Linville (1982)	Schemata
Lord & Maher (1989)	Schemata
Abelson (1976)	Scripts
Ashforth & Fried (1988)	Scripts
Goodwin (1991)	Scripts
Lord & Foti (1986)	Scripts
Louis & Sutton (1991)	Scripts & Schemata
Mintzberg (1979)	Scripts
Schank & Abelson (1977)	Scripts
Wofford (1994)	Scripts

Cognitive Processes

Though measuring cognitive processes is difficult (Lord & Carpenter, 1986), it is a necessary component of cognitive theory. Researchers are attempting to describe the ways individual thought processes interact to affect decision making. Examples of these cognitive processes include cognitive biases, heuristics, assumptions, analogies and metaphors. These processes are briefly discussed in the following paragraphs.

Research on cognitive biases is associated with the development of strategic assumptions used to comprehend complex problems. One example of cognitive biases is the development of groupthink (Janis and Mann, 1977). Heuristics are short-cut methods used by managers to simplify complex problems (Tversky & Kahneman, 1974). Various lists of managerial biases and heuristics can be found in the literature (Hogarth & Makridakis, 1981).

Another area of research under consideration is the use of assumptions in strategic decision-making. Strategic assumptions form the basis for scripts, schema, and knowledge structures that decision-makers use to represent complex strategic problems (Schwenk, 1988). According to Mason and Mitroff (1981), assumptions may be necessary for decision-making when complete information cannot be assessed

leading to conditions of extreme amounts of uncertainty. Similar assumptions, analogies and metaphors may be used as a means to apply scripts, schemata, and knowledge structures from other domains to new strategic problems. For example, the decision maker may draw an analogy between solutions to past problems and the current problem (Isenberg, 1983). Analogies and/or metaphors then may be shared among the group as guidelines on how a specific problem should be solved (Louis, 1980). It is reasonable to assume that a manager's past experiences at other work settings may be the best source of analogies and metaphors for group decision making (Huff, 1983).

According to the literature, cognitive processes, like cognitive structures, may differ in the extent to which they are automatic vs. controlled. These differences in cognitive processes may be a function of an individual's experiences as well as the complexity of the task (Ashforth & Fried, 1988; Lord & Kernan, 1987; Louis & Sutton, 1991). Additionally, differences in a manager's information processing capabilities may be a function of cognitive complexity (Schroder, 1971). A cognitively complex manager who is able to use cognitive processes at the right time and in the right place should have a team that excels.

In summary, cognitive processes help explain the various limitations on the information processing capacity of individuals and groups. Decision-making in groups may prove to be a fertile ground for observing these limitations and their consequences because of the potential for various failures in group processes (group think, biases, conformity, etc.). Additionally, group cognitive complexity is an important variable for study because of its potential relationship to these various cognitive processes. Groups with higher cognitive complexity will make better use of cognitive processes and ultimately have higher quality decisions. Thus, complexity theory is explained in greater detail in the following section. Table 2 contains a summary of the literature on cognitive processes.

Complexity Theory

Cognitive complexity is defined as the degree to which a person utilizes multiple perspectives when perceiving and evaluating stimuli within a particular domain (Goodwin, 1991). A less complex person would respond to a stimulus on the basis of few dimensions, while a cognitively complex individual would use many dimensions. A person who has the ability to differentiate between various alternatives and on many dimensions can be regarded as a major benefit in problem solving and decision making situations.

TABLE 2
Summary of Literature on Cognitive Processes

Author(s)	Cognitive Processes
Huff (1983)	Analogies & Metaphors
Isenberg (1983)	Analogies & Metaphors
Louis (1980)	Analogies & Metaphors
Ashforth & Fried (1988)	Cognitive Processes
Hogarth & Makridakis (1981)	Cognitive Biases & Heuristics
Janis & Mann (1977)	Cognitive Biases
Lord & Carpenter (1986)	Cognitive Processes
Lord & Kernan (1987)	Cognitive Processes
Louis & Sutton (1991)	Cognitive Processes
Schroder (1971)	Cognitive Processes
Tversky & Kahneman (1974)	Heuristics
Mason & Mitroff (1981)	Strategic Assumptions
Schwenk (1988)	Strategic Assumptions

Cognitive complexity is not concerned with what people think, rather it focuses on how people think (Streufert, Pogash, & Piasecki, 1988). Consequently, differences in complexity of conceptual structure are not related to differences in intelligence (Rosenkrantz, 1961; Schrest & Jackson, 1961). Correlations of complexity measures and measures of intelligence have generally been near zero (Streufert & Streufert, 1978).

Individual Cognitive Complexity

Many researchers argue that cognitively complex individuals out-perform cognitively simple individuals in complex tasks and environments (Streufert & Streufert, 1978; Streufert & Swezey, 1986). Thorne (1986) suggests that cognitively simple managers will have a tougher time adapting their management style to meet the demands of a complex task. Weick (1979) advises managers to "complicate" themselves and argues that it is difficult to overemphasize the importance of developing complexity in managers. Bartunek, Gordon, and Weathersby (1983) discuss theories of cognitive complexity and suggest specific methods for increasing managerial complexity. For example, repeated exposure to complex situations may allow individuals to have a better understanding of the various issues.

Previous research on cognitive complexity has resulted in various significant relationships. There is a positive link between cognitive complexity and an individual's success in choosing a suitable occupation (Haase, Reed, Winer, & Bodden, 1979), tolerance for ambiguity, propensity for leadership, and accuracy of prediction (Streufert, Streufert, & Castore, 1968). Individuals who have high levels of cognitive complexity are more likely to consider

the point of view of others (Triandis, 1977) and are less prejudiced (Gardiner, 1972). This may explain why complex individuals are more likely to make ethical decisions (Kohlberg, 1969) and are better at resolving conflict (Eiseman, 1978).

Managers with a higher level of cognitive complexity should be capable of attributing multiple causes to the behavior of superiors and subordinates (Green & Mitchell, 1979). This characteristic should result in more accurate appraisals and evaluations. Their ability to more accurately perceive others and the task environment should lead to managerial success. This ability results in improved communication (Tetlock, 1981) such as stronger persuasive strategies, active listening strategies, and better use of communication patterns (Hale, 1986; Sypher, Witt, & Sypher, 1986). It should be noted that persuasive abilities of cognitively complex individuals are not a function of verbal ability (Hale, 1980), but may be related to less apprehension to communicate (Neuliep & Hazleton, 1985) and more self-esteem and assertiveness (Raphael, Moss, & Rosser, 1979).

Another explanation for the success of complex managers was found by Streufert et al. (1968) who reported that simple managers are more task oriented while complex

managers are both task and consideration-oriented. Managers with greater cognitive complexity are more likely to empower employees (Merron, Fisher, & Torbert, 1987) and make better use of feedback (Nydegger, 1975). Consequently, complex managers tend to receive more favorable ratings from subordinates (Nydegger, 1975).

Overall, complexity theory holds that managers may be able to adapt their cognitive complexity to certain variations in environmental complexity. Similarly, groups may be able to use various degrees of cognitive complexity to match the demands of the task environment. Whether cognitive complexity is adaptable, trainable, or capable of being matched to the situation, it is an important variable for study (Bartunek et al., 1983). Table 3 summarizes the literature on individual cognitive complexity.

TABLE 3
Summary of Literature Individual Cognitive Complexity

Author(s)	Variables Correlated with Cognitive Complexity	
Neuliep & Hazleton (1985)	Apprehension to Communicate	—
Green & Mitchell (1979)	Attribution to Multiple Causes for Behavior	+
Merron, Fisher & Torbert (1987)	Collaborative Leadership	+
Tetlock (1981)	Communication	+
Nydeggar (1975)	Favorable Rating from Followers Use of Feedback Cues	+

Table 3 (continued)

Rosenkrantz (1961)	Intelligence	NR
Schrest & Jackson (1961)	Intelligence	NR
Gardiner (1972)	Less Prejudiced	+
Sypher, Witt, & Sypher (1986)	Listener Adaptive Strategies	+
Weick (1979)	Managerial Cognitive Complexity	NS
Kohlberg (1969)	Moral Judgments	+
Haase, Reed, Winer & Bodden (1979)	Occupational Choice	+
Hale (1986)	Persuasive Strategies	+
Eiseman (1978)	Resolve Conflict	+
Goodwin (1991)	Script Tracks	+
Raphael, Moss & Rosser (1979)	Self-Esteem	+
Triandis (1977)	Taking Perspective of Others	+
Streufert et al. (1988)	Task Performance	+
Streufert & Swezey (1986)	Task Performance	+
Streufert & Streufert (1978)	Task Performance	+
Thorne (1986)	Task Performance	+
Streufert, Streufert, & Castore (1968)	Tolerance of Ambiguity Assumption of Leadership Role Prediction Accuracy Task & Consideration Orientation	+
Bartunek, Gordon & Weathersby (1983)	Training in Cognitive Complexity	NS
Hale (1980)	Verbal Ability	-

+ = positive correlation
NR = no relationship

- = negative correlation
NS = non statistical

Group Cognitive Complexity

There are very few empirical studies that have organized groups according to the level of members' cognitive complexity. Those that have used this variable in their research have referred to the aggregation of cognitive complexity as integrative capacity (Driver & Streufert, 1969), as coverage and consensus (Ginsberg, 1990; Lyles & Schwenk, 1992; Walsh, et al., 1988), as sociocognitive complexity (Ginsberg, 1989), and group cognitive complexity (Stone, Sivitanides & Magro, 1994). Group cognitive complexity is simply the collectivity of each individual's cognitive complexity, and is defined as the total cognitive complexity of the members participating in a decision-making task (Stone et al., 1994). Group cognitive complexity is positively related to both the search and utilization of information (Stabell, 1978). It is also associated with a group's ability to handle novel situations and uncertainty (Ford & Baucus, 1987).

Research using decision-making groups indicates that many informational, short-term, and long-term memory limitations of individuals can be alleviated by having a group perform tasks (Lord & Foti, 1986). This improved cognitive capacity is a function of cognitive complexity. A higher level of successful information processing is a

linear function of the proportion of cognitively complex persons in a decision-making group. Even though groups can create additional information processing demands centered on communication, resolution of conflict, and social acceptance, such limitations can be overcome if people have shared cognitive structures for interpreting task and social requirements.

Given the previous research, it seems as though group cognitive complexity has potentially positive implications for group decision making. Groups that are more cognitively complex should have more well-developed processes and structures, and thus, be better equipped to make effective decisions. For the purposes of this study, the homogeneity of a group's cognitive structure and processes will be based on the measurement of cognitive complexity as explained below.

Measurement of group cognitive complexity. The key question in the study of a cognitive perspective at the group level of analysis is to what degree the total (collective) differs from the sum of the parts (or individuals) (Schneider & Angelmar, 1993). Aggregate measures of group cognitive complexity are sufficient if the purpose of the research is to determine how individual contributions combine to create emergent properties. In

this study, the group cognitive complexity construct is based on the complexity scores of the individuals comprising the group.

One method recommended to measure group cognitive complexity is the Repertory Grid technique (Dunn & Ginsberg, 1986; Ginsberg, 1990). The Repertory Grid, developed by Kelly in 1955 as a measure of individual cognitive complexity, is also particularly useful in operationalizing the concept of a group's frame of reference (Dunn & Ginsberg, 1986). Bieri (1961) operationalized cognitive complexity using the Repertory Grid by measuring the ability of a person to differentiate between various elements. A person utilizing a greater number of constructs to interpret others' behaviors is scored as more cognitively complex than those relying on only a few constructs. According to Ginsberg (1990), the Repertory Grid can be analyzed to assess the complexity level of groups by summing the cognitive complexity of the members of the team.

There are many ways to apply the Repertory Grid to measure a group's cognitive complexity. First, the construct scores can be summed and then averaged (Bougon, Weick & Binkhorst, 1977). Second, the highest individual scores can be averaged on each construct after being weighted by the amount an individual participates within the

group (Walsh et al., 1988). Finally, a sociocognitive network approach may be used to index cognitive structures (Dunn & Ginsberg, 1986). Here, grid interviews can be conducted to elicit constructs to approximate the number of cognitive similarities and differences between members of a group.

There also are various techniques that may be used to determine the similarity of groups on the basis of the groups' cognitive complexity. Walton (1986) suggests the use of linguistics analysis to identify profiles of common constructs used in groups. Walsh et al. (1988) used multidimensional scaling to identify the structure of each subject's schema. They suggested that a group has good coverage of an information domain if at least one group member achieves a high score on each of the schema's dimensions. Then, an aggregated score can be calculated by summing the means of the highest scores.

Measuring a group's cognitive complexity has several implications: (1) it allows researchers to examine a team's cognitive structure, (2) it allows researchers to examine ways in which shared cognitive structures affect the decision-making process, and (3) it allows researchers to make predictions regarding the influence of leaders on a group or team's cognitive structure (Ginsberg, 1990). See

Table 4 for a summary of the literature on group cognitive complexity.

TABLE 4
Summary of Literature on Group Cognitive Complexity

Author(s)	Aggregation Term
Ginsberg (1990)	Coverage and Consensus
Lyles & Schwenk (1992)	Coverage and Consensus
Walsh, Henderson, & Deighton, (1988)	Coverage and Consensus
Ford & Baucus (1987)	Group CC
Stone et al. (1994)	Group CC
Driver & Streufert (1969)	Integrative Complexity
Lord & Foti (1986)	Integrative Complexity
Stabell (1978)	Integrative Complexity
Bieri (1961)	Measurement of Group CC
Bougon (1977)	Measurement of Group CC
Dunn & Ginsberg (1986)	Measurement of Group CC
Ginsberg (1990)	Measurement of Group CC
Kelly (1955)	Measurement of Group CC
Schneider & Angelmar (1993)	Measurement of Group CC
Walsh et al. (1988)	Measurement of Group CC
Walton (1986)	Measurement of Group CC
Ginsberg (1989)	Sociocognitive Complexity

* CC = Cognitive Complexity

Relationships with Group Cognitive Complexity

Initially, the relationship between group cognitive complexity and task performance will be discussed. Then,

two variables proposed to interact with group cognitive complexity on task performance; environmental complexity (including information load, time pressure, and task complexity) and group structure, are reviewed. Finally, relationships between group cognitive complexity, task complexity, group structure, and task satisfaction are discussed.

Task Performance

There has been considerable research done on the relationship between individual cognitive complexity and task performance (e.g. Streufert, 1984; Streufert, Clardy, Driver, Karlins, Schroder, & Suedfeld, 1965; Streufert, Kliger, Castore, & Driver, 1967). Data from these studies indicate that cognitively complex managers are better planners, use more strategy in their decision making, and are better overall performers of decision-making tasks than simplistic managers.

Specifically, Tuckman (1966) found a strong positive correlation between innovative behavior and an individual's level of complexity. Tuckman's results indicated that when faced with a decisional problem, complex subjects searched for a greater variety of information and were less certain after they had made a decision (especially if immediate feedback was not available) than were simple subjects.

Because a group's collective mindset consists of an aggregation of each member's cognitive complexity, this relationship between cognitive complexity and task performance also may be applied to the group level of analysis.

One explanation for an increase in efficiency for high complexity groups is the manner in which they process information (Staw, 1981). Streufert, Suedfeld, and Driver (1965) were among the first researchers to investigate the relationship between group cognitive complexity and information processing. These authors suggest that groups with complex members are more likely to engage in innovative creative tactics in dealing with input. Thus, groups with higher levels of cognitive complexity are better able to compare alternatives on their strengths and weaknesses. This leads to an improvement in efficiency because then only the most viable alternatives are considered in the decision-making process. Further, groups with high levels of cognitive complexity will be able to consider alternatives simultaneously, reducing the escalation of commitment to any one option (Staw, 1981). This flexibility may provide the group with a fallback position. If one alternative fails, a cognitively complex group can quickly shift to a new one. Moreover, more complex groups interact faster and

demonstrate better cue utilization (Bieri, Atkins, Briar, Leaman, Miller, & Tripodi, 1966; Tripodi & Bieri, 1964) and overall faster decision speed (Hendrick, 1979). Also, it has been suggested that cognitive complexity in a group may speed issue identification, allowing executives to identify problems and opportunities sooner and to consider more alternatives (Dutton & Jackson, 1988). Eisenhardt's (1989) work on organizational decision making has identified two antecedents of decision speed: the number of simultaneous alternatives considered and the presence of experienced decision makers. Eisenhardt and others have found that the number of alternatives considered was positively associated with decision speed (Anderson, 1983; Eisenhardt, 1989; Schwenk, 1988).

A second explanation for the relationship between group cognitive complexity and task performance is the efficient use of conflict resolution techniques. Much of the research indicates that conflict slows the pace of decision making (Hickson, Butler, Cray, Mallory, & Wilson, 1986; Mintzberg, Raisinghani, & Theoret, 1976). Research related to the effective use of dissent techniques (Anderson, 1983; Schwenk, 1983; Stone et al., 1994) suggests that cognitively simple persons take approximately twice as long as complex persons to complete a problem-solving task. The most common

dissent techniques analyzed in research are the dialectical inquiry and devil's advocacy approaches to decision making (Chanin & Shapiro, 1984; Cosier, 1981; Cosier & Dalton, 1982; Schweiger, Sandberg, & Ragan, 1986; Schwenk, 1982; 1984; Schwenk & Cosier, 1980). In the dialectical inquiry technique, two opposing plans are presented. The proponents of each plan engage in a structured debate that ends with an acceptable agreement. In the devil's advocate approach, a plan of action is first presented and then a designated person criticizes the plan and its underlying assumptions. The plan is successively revised until an acceptable plan emerges.

Stone et al. (1994) used cognitive complexity as a moderating variable between formalized dissent and group performance. Dialectical inquiry and devil's advocacy methods were used by groups that were divided into high and low complexity levels based on their scores on the Sentence Completion Test (Streufert & Swezey, 1986). Groups that used the dialectical inquiry method were equally effective regardless of the complexity of their members. In contrast, groups with low complexity members did not perform as well with the devil's advocate condition. A potential explanation for these results was based on the assumption that the devil's advocacy approach demanded a higher

tolerance for ambiguity from the decision-makers (Schwenk, 1982). Because the devil's advocacy approach requires two distinct roles (exclusively attacking and exclusively defending), there is greater role conflict than in the dialectical inquiry method which requires the same role (attacking and defending). Thus, groups with complex member's should have a higher tolerance for ambiguity, a characteristic of cognitive complexity, and therefore, should perform better with the devil's advocacy approach (Larson & Rowland, 1974). Consistent with this assumption, Stone et al. (1994) indicated that devil's advocacy groups with low complexity members had less equal participation than the groups performing with the dialectic inquiry approach. Their results indicated that groups consisting of complex members make more efficient use of information than noncomplex groups. A low sample size, the potential for low interrater reliability between the judges who rated the group's quality of recommendations, and the failure to manipulate the task's complexity, however, may weaken the quality of the assumptions and recommendations from this study. Refer to Table 5 for a summary of the literature on the relationship between group cognitive complexity and task performance.

Table 5
Summary of Literature on the Relationship Between
Group Cognitive Complexity and Performance

Author(s)	Task Performance
Anderson (1983)	Conflict
Hickson et al. (1986)	Conflict
Mintzberg, Raisinghani & Theoret (1976)	Conflict
Bieri, Atkins, Briar, Leaman, Miller & Tripodi (1966)	Cue Utilization
Tripodi & Bieri (1964)	Cue Utilization
Anderson (1983)	Decision Speed
Eisenhardt (1989)	Decision Speed
Hendrick (1979)	Decision Speed
Schwenk (1988)	Decision Speed
Chanin & Shapiro (1984)	Dissent Techniques
Cosier & Dalton (1982)	Dissent Techniques
Cosier (1981)	Dissent Techniques
Larson & Rowland (1974)	Dissent Techniques
Schweiger, Sandberg & Ragan (1986)	Dissent Techniques
Schweiger et al. (1986)	Dissent Techniques
Schwenk (1982, 1983, 1984)	Dissent Techniques
Schwenk & Cosier (1980)	Dissent Techniques
Stone et al. (1994)	Dissent Techniques
Streufert & Swezey (1986)	Dissent Techniques
Staw (1981)	Escalation of Commitment
Streufert, Suedfeld, & Driver (1965)	Information Processing
Streufert (1984)	Information Processing
Streufert, Clardy, Driver, Karlins, Schroder, & Suedfeld (1965)	Information Processing

Table 5 (continued)

Streufert, Kliger, Castore, & Driver (1967)	Information Processing
Tuckman (1966)	Information Processing
<u>Dutton & Jackson (1988)</u>	<u>Issue Identification</u>

Environmental Complexity

Environmental complexity is defined as a variation in the environment that may either deprive or overload an individual with information (Streufert & Swezey, 1986). Environmental conditions that are considered part of environmental complexity include information load, time pressure, and task complexity. Environmental complexity may influence the relationship between cognitive complexity and task performance.

Early studies on the relationship between individual cognitive complexity and environmental complexity concluded that cognitively complex individuals would have different optimal levels of environmental complexity than cognitively simple individuals (Driver & Streufert, 1966; Schroder, 1971; Schroder et al., 1967; Streufert et al., 1965). This literature indicates that the importance of cognitive complexity increases with the complexity and the degree of uncertainty of the task environment. It assumes that more complex individuals would perform optimally at a higher

level of environmental complexity (Streufert, 1970). Theory developed by Streufert and Streufert (1978) suggests that the appropriate amount of both cognitive complexity and simplicity is related to the complexity of the environment. Even though it can be agreed that there is a common optimal level of environmental complexity for simple as well as complex members, there are considerable differences in both performance levels and styles at this optimal level.

Like individuals, both complex and noncomplex groups also may be affected in a curvilinear fashion when under various levels of environmental complexity. However, their resulting performance levels will be significantly different at these various levels. Less cognitively complex groups under inordinate amounts of environmental complexity will perform a task less effectively than complex groups. However, in situations where there is very little environmental complexity, complex groups may become bored and inattentive to the task. Consequently, noncomplex groups may perform better in environments that are less complex.

Time pressure and information load. According to Isenberg (1981), when subjects are making their choice decisions, time pressure will affect performance. Time pressure can be defined as the amount of time available for

processing information (Wright, 1974). There are two important findings on the effects of time pressure on decision-making accuracy. First, an increase in time pressure causes arousal that can be detrimental to group performance at a certain point (Lanzetta, 1955; Pepinsky, Pepinsky & Pavlik, 1960). Second, time pressure may make it more difficult for group members to coordinate their activities and, therefore, maximize group performance (Isenberg, 1981).

Several researchers have studied the interaction of time pressure and cognitive complexity on various outcomes. In these studies, time pressure interacted with cognitive complexity to affect such dependent variables as the amount of communication, sociometric ratings, self-report scales, and objective measures of task performance (Isenberg, 1981; Lanzetta, 1955; Pepinsky et al., 1960; Schutz, 1955). In each of these studies, there were several indications that the increase in time pressure increased activation levels. Activation level is known to have a curvilinear effect on an individual's performance (Lanzetta, 1955; Pepinsky et al., 1960). Thus, suboptimal activation levels would be detrimental to task performance, especially for noncomplex individuals because of their inability control their arousal.

Many researchers have examined the effects of cognitive complexity and information load on the utilization of information (e.g. Bieri et al., 1966; Schroder et al., 1967; Tripodi & Bieri, 1964). Information load is generally thought of as the amount of data to be processed per unit of time. Researchers have operationalized information load by either increasing the number of decision alternatives or by increasing the total amount of information in the immediate environment to distract the participants (Driver and Streufert, 1969). Consequently, information overload is the sheer number of activities one must cope with at a single point in time.

Driver and Streufert (1969) discussed information load as a possible suggestion for why complex groups do better on tasks requiring complex behavior, whereas less complex groups do better on tasks requiring simpler behavior. These authors proposed that both individuals and groups respond in a curvilinear fashion to three components of information load: (1) the complexity of information, (2) the noxity or unpleasantness of information, and (3) the eucity or pleasantness of information. These three components contribute to the complexity of the environment and jointly affect the information processing of groups. A decision-making group has an optimal level of input load where it may

achieve maximum complexity of information processing. At similar input loads, some groups are expected to show more complex information-processing than other groups. Similarly, Rotton, Olszewski, Charleton, and Soler (1978) report that information overload such as loud noise or loud speech can limit a subject's ability to tolerate frustration as well as his/her ability to differentiate between the roles of participants in a group.

Other research by Streufert, Streufert, and Denson (1983) indicates that in high load conditions, the overall performance scores, risk taking, and accuracy scores of cognitively complex persons were higher than those of less complex persons. Swezey, Streufert et al. (1984) found that groups composed of cognitively simple subjects had high levels of information search under low load conditions and low levels of information search under high load conditions. Complex groups maintained a stable level of information search in both high and low load conditions. Moreover, it was found that complex members were more likely to engage in innovative, creative tactics in dealing with input. Therefore, when a task involves high levels of information load and demands a complex search, then complex groups should be at an advantage. If the task involves very low

levels of information load and demands simpler search methods, then there may be an advantage for simpler groups.

Task Complexity. Literature manipulating the complexity of tasks in a group setting has considered many different typologies to operationalize task complexity. Wood (1986) categorizes a task as complex with regard to three aspects: (1) component complexity (number of acts and information cues involved); (2) coordinative complexity (type and number of relationships among acts and cues); and (3) dynamic complexity (changes in acts and cues and the relationships among them). Campbell (1988) classifies task complexity based on the subjective, psychological experience of the task doer (e.g., task variety, task identity), the abilities of the task doer (person-task interaction), and purely in terms of objective task characteristics. Objective task characteristics have been identified by Schroder et al. (1967) as: (1) the number of dimensions of information requiring attention (information load); (2) the number of alternatives associated with each dimension (information diversity); and (3) the rate of information change (the degree of uncertainty involved). Complexity increases as each of these dimensions increases.

Just as there are many typologies for task complexity, there are also various definitions. March and Simon (1958)

defined task complexity in terms of the abilities of the individual taking part in the task. They believe that tasks are more or less complex relative to the capabilities of the individual who performs the task. Therefore, task complexity includes the factors of an individual's short-term memory, span of attention, and computational efficiency. Steinmann (1976) equates task complexity with the amount of information involved in a task, the internal consistency of this information, and the variability and diversity of the information itself. Payne (1976) and Olshavsky (1979) defined complexity as a function of both the number of alternatives facing the decision maker and the number of attributes with which each alternative was compared. Finally, Schroder et al. (1967) define a complex task as one in which high cognitive demands are placed on the task doer. An increase in the number of possible ways to arrive at a desired outcome increases information load, and thus increases complexity. A common thread in each of these definitions relates to an individual's cognitive capacity to complete an assigned task. In this paper, task complexity is defined as the degree to which a task provides a variety of stimulations to the task performer. This definition may be operationalized in terms of number of distinguishable and dissimilar alternatives present and the

degree to which the task is unique to the participants (Berlyne, 1960; Scott & Erskine, 1980).

Research has supported an interaction effect of cognitive complexity and task complexity on various outcomes. It is suggested that cognitively complex individuals experience a task differently than do cognitively simple individuals (e.g., Schroder & Suedfeld, 1971; Streufert & Streufert, 1978; Wood, 1986). Complex individuals are able to tolerate ambiguity, resolve conflicts, use feedback cues, and make use of better strategies than noncomplex individuals. Consequently, DeLuca and Stumpf (1981) and Schroder et.al, (1967) suggest that certain task and decision style combinations will be more effective in terms of performance than others when forming problem-solving groups.

Popper and Gluskinos (1991) describe the qualitative differences in decision making existing at the various hierarchical levels in terms of time-span, task complexity, and mental capabilities required. They divide the nature of decision-making tasks into four distinct levels of complexity. Levels 1 and 2 require the decision maker to make direct judgments, while levels 3 and 4 require the ability to pursue simultaneously parallel tasks. Cognitive complexity required at levels 3 and 4 may be a liability at

lower levels where direct judgment and quick action are needed. Those individuals performing tasks in level 1 have to make quick judgments concerning tangibles and do not have the luxury of procrastinating in lengthy data collection. Intolerance for ambiguity is an asset in such a position. If a manager of high-level cognitive complexity is in this position, his/her tendency for lengthy diagnostic accumulation may cause inexcusable delays and damage.

In summary, as task complexity increases from low to superoptimal, task performance will move from suboptimal through optimal to suboptimal again (Schroder et al., 1967). When the information processing demands of the task exceed the capacity of the task-doer, performance will diminish. Therefore, groups that are matched with the appropriate task environment will perform better than those groups that are mismatched. Research also suggests that managers who are more complex are able to make fast decisions by accelerating their cognitive processing. This can be done by using efficient problem-solving strategies that maximize information and analysis within time constraints (Hayes, 1981; Payne, Bettman & Johnson, 1988). Likewise, groups that are able to make fast decisions are more likely to have complex members with well-developed schemata and scripts that create a smooth decision-making process. More research

needs to be done to investigate whether complex groups will make faster decisions at all levels of task complexity and within all variations of group structures. A summary of the research presented in this section is indicated in Table 6.

TABLE 6
Summary of Literature on the Relationships Between Group
Cognitive Complexity, Environmental Complexity, Group Structure
and Individual and Group Performance

Author(s)	Effect
Duncan (1973)	Communication Patterns X GS
Galbraith (1969)	Communication Patterns X GS
Hage, Aiken & Marrett (1971)	Communication Patterns X GS
Mears (1974)	Communication Patterns X GS
Pennings (1975)	Communication Patterns X GS
Shaw (1964)	Communication Patterns X GS
Snawdowsky (1972)	Communication Patterns X GS
Thomson & Tuden (1959)	Communication Patterns X GS
Tushman & Nadler (1978)	Communication Patterns X GS
Van de Ven, Delbecq, & Koenig (1976)	Communication Patterns X GS
Driver & Streufert (1966)	EC X CC
Duncan (1973)	EC X GS X CC
Galbraith (1969)	EC X GS X CC
Galbraith (1977)	EC X GS X CC
Hage & Aiken (1969)	EC X GS X CC
Katz (1993)	EC X GS X CC
March & Simon (1958)	EC X GS X CC
Pennings (1975)	EC X GS X CC

Table 6 (continued)

Schroder (1971)	EC X CC
Schroder, Driver & Streufert (1967)	EC X CC
Snawdowsky (1972)	EC X GS X CC
Streufert & Swezey (1986)	EC X CC
Streufert & Driver (1971)	EC X CC
Streufert (1970)	EC X CC
Streufert, Suedfeld & Driver (1965)	EC X CC
Streufert & Streufert (1978)	EC X CC
Thompson (1967)	EC X GS X CC
Van de Ven, Delbecq & Koenig (1976)	EC X GS X CC
Van de Ven & Delbecq (1974)	EC X GS X CC
Von Cranach, Ochsenein & Valach (1986)	EC X GS X CC
Bieri, Atkins, Briar, Leaman, Miller & Tripodi (1966)	Information Load X CC
Driver & Streufert (1969)	Information Load X CC
Rotton, Olszewski, Charleton & Soler (1978)	Information Load X CC
Schroder et al. (1967)	Information Load X CC
Streufert et al. (1985)	Information Load X CC
Swezey, Streufert, Criswell, Unger & Van Rijn (1984)	Information Load X CC
Tripodi & Bieri (1964)	Information Load X CC
Arnett (1978)	Leadership X CC
Fiedler (1967, 1978)	Leadership
Hill (1969)	Leadership X CC
Larson & Rowland (1974)	Leadership X CC

Table 6 (continued)

Merron et al. (1987)	Leadership X CC
Mitchell (1972)	Leadership X CC
Schneier (1978)	Leadership X CC
Stogdill (1962)	Leadership
Streufert & Swezey (1986)	Leadership X EC
Streufert, Streufert, & Castore (1968)	Leadership X CC
Weiss & Adler (1981)	Leadership X CC
Streufert & Swezey (1986)	Organizational Structure X CC
Berlyne (1960)	Task Complexity
Campbell (1988)	Task Complexity
DeLuca & Stumpf (1981)	Task Complexity X CC
Hayes (1981)	Task Complexity
Levi & Tetlock (1980)	Task Complexity X CC
March & Simon (1958)	Task Complexity
Olshavsky (1979)	Task Complexity
Payne et al. (1988)	Task Complexity
Payne (1976)	Task Complexity X CC
Popper & Gluskinos (1991)	Task Complexity X CC
Schroder, Driver & Streufert (1967)	Task Complexity X CC
Schroder & Suedfeld (1971)	Task Complexity X CC
Scott & Erskine (1980)	Task Complexity
Steinmann (1976)	Task Complexity
Streufert & Streufert (1978)	Task Complexity X CC
Wood (1986)	Task Complexity X CC

Table 6 (continued)

Hahn, Lawson & Lee (1992)	Time Pressure X Information Load
Isenberg (1981)	Time Pressure X CC
Lanzetta (1955)	Time Pressure X CC
Pepinsky et al. (1960)	Time Pressure X CC
Schutz (1955)	Time Pressure X CC
Wright (1974)	Time Pressure
Yukl et al. (1976)	Time Pressure

- * CC = Cognitive Complexity
- * GS = Group Structure
- * EC = Environmental Complexity

Group Structure

Work groups have structures that explain and predict a large portion of group performance. Structural variables include formal leadership, roles, norms, group status, group size, communication network, and composition of the group. The literature reviewed here relates to the communication network structure in a group. The terms centralized and decentralized will be used to refer to the amount of participation given equally to all group members. In a centralized group, the communication pattern will tend to flow to the central position (formal leadership), while in the decentralized structure the communication pattern will flow in all directions and to all members of the group (Shaw, 1964).

Researchers suggest that a group's communication network is affected by its structure, with a subsequent impact on performance (Mears, 1974). Individuals in highly decentralized communication networks are given more opportunity for feedback and error correction and are able to synthesize different points of view (Tushman & Nadler, 1978). Moreover, highly decentralized networks tend to be associated with less formality, less attention to rules and regulations, and greater peer involvement in decision making (Hage, Aiken, & Marrett, 1971; Snadowsky, 1972). Therefore, groups with decentralized communication networks should be less sensitive to high levels of environmental complexity and should be better able to deal with work-related uncertainty than are centralized communication networks (Duncan, 1973; Hage, Aiken, Marrett, 1971; Shaw, 1964; Van de Ven, Delbecq, Koenig, 1976). On the other hand, decentralized structures consume more time, effort, energy, and are less open to managerial control (Shaw, 1964; Thomson & Tuden, 1959). Consequently, a group's structure is an imperative variable for the study of work group effectiveness.

Although there has been no research on the interaction between group cognitive complexity and group structure and its effect on group performance, there has been research on the relationship between the leader's cognitive complexity and group performance (e.g., Mitchell, 1972). In addition,

there is research suggesting that leadership style and environmental conditions interact to influence the subordinate's performance (e.g., Streufert & Swezey, 1986). Because the leader's role is, in part, an aspect of the group's structure, and the group structure is an environmental condition that may interact with the group's cognitive complexity level, it is logical to assume there may be a combined influence on task performance. In order to better understand this potential relationship, studies investigating the relationship between the group leader's cognitive complexity and task performance are discussed below.

Streufert et al. (1968) used Stogdill's (1962) ten leadership scales to examine cognitive complexity in leaders. The results indicated that complex leaders were more willing to work with unknown factors, more empathetic, and predicted group success better. Complex leaders also were more considerate of their coworkers. Simple leaders were more concerned with initiation of structure and scored higher on production emphasis.

The relationship between leadership style and cognitive complexity has been studied using the Least Preferred Coworker (LPC scale) as a measure of cognitive complexity. The LPC scale was developed by Fiedler and his associates (1967). They have reported a relationship between the interaction of leadership style and situational

favorableness on subordinate performance (Fiedler, 1986). Situational favorableness refers to the degree to which the situation enables leaders to exert influence over their groups (Fiedler, 1967). It is proposed that task-oriented leaders (low LPC) do well in favorable or unfavorable situations, while relationship-oriented leaders (high LPC) are more effective in intermediate situations.

Mitchell (1972) has suggested that task-oriented leaders are less cognitively complex than relationship oriented leaders. Hill (1969) reasoned that high LPC leaders might be more cognitively complex than low LPC leaders because they are able to differentiate between the interpersonal and the task dimensions of their least preferred co-workers. Low LPC leaders, on the other hand, are not. In Mitchell's (1972) research, groups were organized with a leader and two members working on four different types of tasks. The results suggested that the complexity of the leader (as measured by the LPC scale, i.e., relationship-oriented leaders) was positively related to task performance. Also, both the leaders and members perceived the high complexity leaders as having greater variation in the group atmosphere (laughing, joking, and enjoyment). Complex leaders have a more developed schema system that may result in higher activation levels than necessary with simple tasks. With high activation levels during the performance of a simple task, cognitive capacity

may not be used effectively, because it is not required to successfully accomplish a task. This could lead to mindless behavior rather than focused behavior toward the accomplishment of a task.

Larson and Rowland (1974) did not find results to support the hypothesis that LPC score is related to measures of cognitive complexity-simplicity. Instead, the authors attribute differences in LPC score to differences in the underlying needs of high and low LPC leaders for structure rather than to their level of cognitive complexity. That is, high LPC leaders are relationship oriented because they have a need for affiliation and low LPC leaders are task oriented because they have a need for order. Similarly, other studies have not supported the relationship between LPC and cognitive complexity (Arnett, 1978; Schneier, 1978; Weiss & Adler, 1981). Consequently, research that examines the relationship between leader's cognitive complexity and group performance should be interpreted with caution if the LPC scale is the measure used to assess cognitive complexity.

Based on this information about leaders, an aspect of group structure, one can make other propositions about similar relationships between cognitive complexity and group structure. For example, cognitively complex group members tend to have more collaborative leadership (Merron et al., 1987) and should thrive in this type of structure

(decentralized). Therefore, performance should increase when a group's cognitive complexity is matched with its group structure. In other words, groups with high cognitive complexity should perform better with a complex group structure (decentralized). Likewise, groups with low cognitive complexity should perform better with a simple group structure (centralized). Furthermore, Streufert and Swezey (1986) proposed that a match between organizational structure and information processing is needed in organizations. These authors reported that cognitive complexity functions in organizations at three levels: (1) the level of organizational structure, (2) the level of interaction among organizational personnel (task groups, committees, etc.), and (3) the cognitive level of individuals within the organization. Optimal organizational functioning is most likely to occur when the organizational structure (including information-flow characteristics) is matched with the cognitive complexity of organizational personnel. This match can be achieved through selection and/or training of personnel and/or through adaptive changes in organizational characteristics (Streufert & Swezey, 1986).

In other research, the joint effect of group structure and task complexity has been investigated for its influence on task performance. Shaw (1964) concluded that groups with

communication networks that were very centralized (e.g., wheels) performed simple tasks faster; while more decentralized groups (e.g., circles) had superior performance on complex tasks. To help understand the interaction between task complexity and group structure, Shaw (1964) introduced the terms independence and saturation. Independence is defined as the freedom of action with which a person may function in the group. Independence is greater in the decentralized than in the centralized group, regardless of the kind of task. Saturation is defined as the work load that tends to increase to a position (many times the leader) either by virtue of the number of channels reporting to it, or by virtue of the information processing requirements of the task at hand. Therefore, a person who is a designated leader of a highly centralized group may tend to become overloaded more easily when the group faces a complex task. Saturation should be less likely to occur in the centralized than in the decentralized group with simple tasks, but be more likely in the centralized group with complex tasks. Consequently, the cognitive complexity of the leader in a centralized group may be an important factor related to saturation. Cognitively complex groups may be able to prevent saturation from occurring on a complex task by

sharing the information load more effectively among its members.

Von Cranach, Ochsenbein, and Valach (1986) outlined a theory that refers to small groups as living systems. These authors point out that groups have the ability to generate energy, direct behavior through internal information, and exchange energy and information with their environment. They propose that the matching of tasks and group structure is what enables a group to complete a given task. These two structures together lead to information processing at two levels. The first level resides at the individual level where individual cognition operates. Individual cognition then forms the basis for group information processing (communication). In group communication, individual ideas are discussed, elaborated, changed and enhanced, and then fed back into individual cognitions. Information processing with the appropriate match between group cognitive complexity and group structure will lead to individual actions and group cooperation, which should result in effective task performance and satisfaction.

The type of interdependence required within a group also has implications for the joint effects of group cognitive complexity, task complexity, and group structure on group outcomes (March & Simon, 1958; Thompson, 1967).

Results have indicated that a group performing a task that requires very little interdependence has little need for information from, or collaboration with, others. Moreover, as the type of interdependence becomes more complex (pooled, sequential, or reciprocal), coordination and mutual problem-solving demands increase (Galbraith, 1977; March & Simon, 1958). There is substantial literature to support this uncertainty-based approach to group task characteristics (Hage & Aiken, 1969; Snadowsky, 1972; Van de Ven & Delbecq, 1974; Van de Ven et al., 1976). Conversely, the less uncertainty faced by a group, the less its cognitive complexity requirements; therefore, the group structure does not need to be as complex (Duncan, 1973; Galbraith, 1969; Pennings, 1975). If a group's structure must match the information processing requirement (group cognitive complexity), then groups faced with complex tasks or changing environments should have more decentralized structures than those facing routine tasks or stable environmental conditions.

In summary, work group effectiveness is largely dependent on how well group structure fits its information processing capacity (Streufert & Swezey, 1986) and its task environment (Katz, 1993). To better understand this fit, it is important to study the relationship between group

structure (centralized-decentralized), group cognitive complexity, and environmental complexity (i.e. task complexity). Table 6 summarizes the research presented in this section.

Task Satisfaction

Considerable research suggests that individuals prefer stimulus environments of greater complexity (Day, 1966; 1967; 1968; Jones, 1964; Minton, 1963). Other research suggests that some people prefer calm settings, whereas others actively seek to increase their arousal by selecting novel or complex settings (Zuckerman, Schultz & Hopkins, 1967). Clearly, the various causes of task satisfaction that have been identified in previous research are not consistent across studies. Furthermore, a number of individual or group level variables have been identified as well as environmental variables in the list of causes. Research describing the need for a person-environment fit suggests the importance of considering both types of variables on task satisfaction. Because group behavior is the focus of this study, task satisfaction will be discussed as the potential result of the joint influence of group cognitive complexity and task complexity, an aspect of environmental complexity.

Group cognitive complexity. Group cognitive complexity can be related to task satisfaction by examining conflict theory. Cognitive conflict can be defined as the degree of disagreement over the interpretation of alternatives and dimensions of a decision-making task (Cosier & Rose, 1977). Research indicates that task satisfaction may be related to the conflict level of groups (Mason & Mitroff, 1981; Priem & Price, 1991; Schweiger & Sandberg, 1989; Stager, 1967). To enhance task satisfaction group's must reach the optimal level of conflict. The optimal level of conflict, however, may depend on the group's cognitive complexity. Thus, the relationship between group cognitive complexity and conflict should be addressed.

There are many problem-solving techniques that have been utilized to increase the conflict level of groups. Conflict in groups can be useful in eliminating process loss phenomena such as groupthink (Janis, 1972). Both dialectical inquiry and devil's advocacy are techniques used to facilitate the adoption of the best solution and to optimize the level of cognitive conflict during group discussion (Mason & Mitroff, 1981; Priem & Price, 1991; Schweiger & Sandberg, 1989). These techniques are known to have inherent levels of complexity and ambiguity (Stone et al., 1994). Dialectical inquiry has issue or "substantive"

complexity and devils advocacy has role or "procedural" complexity. Because cognitively complex groups may be more tolerant of ambiguity, they may be able to make better use of such conflict resolution techniques as devil's advocacy (Larson & Rowland, 1974; Schwenk, 1984) and, consequently, may be more likely to reach the optimal level of conflict. At this optimal level of conflict, groups should reach consensus and have complete coverage of the topic; thus, they are more likely to be satisfied with their final decision. Consequently, groups that are cognitively complex may be satisfied with their tasks if they use conflict-based approaches to decision-making, while less complex groups will be more satisfied when conflict is not introduced into the decision-making process.

Task Complexity. Another explanation for satisfaction with tasks is related to the complexity level of the task. Variations in task complexity have effects on affective, cognitive, physiological, and behavioral responses of task performers (Simonson & Weiser, 1976). Activation theory describes the basis for these effects (Fisk & Maddi, 1961; Gardner, 1986; Gardner & Cummings, 1988; Huber, 1985; Scott, 1966, 1967). Activation levels are predicted to be curvilinearly related to three major outcomes of task performance: (1) task performance level, (2) task

satisfaction level, and (3) frequency of stimulation-modifying behaviors. Extremes in activation level affect the processing of task-based information. For example, if group members at high activation levels causing information processing not related to the task, will be less likely to make optimal use of their information processing capacity. On the contrary, moderate activation levels are associated with optimal use of short-term memory and sustained information transfer within memory (Humphreys & Revelle, 1984), as well as maximum use of rehearsal and storage of task information (Eysenck, 1985). The optimal use of information processing is expected to lead to greater satisfaction with the task; whereas, suboptimal usage of processing capacity may become detrimental for task satisfaction.

Because exposure to more complex stimulus environments leads to higher levels of activation (Baker & Franken, 1967; Berlyne, 1960; Berlyne & Borsa, 1968; Berlyne & McDonnell, 1965; Berlyne, Craw, Salapatek, & Lewis, 1963; Berlyne & Peckham, 1966; De Charms, 1968; Fiske & Maddi, 1961; Scott, 1966;), a complex group working on a complex task may obtain the optimal level of activation. However, if the task is too simple, members of a complex group may become bored, which could decrease their activation to suboptimal levels.

Likewise, a cognitively simple group will have optimal activation for a simple task, but may become very frustrated when it must handle a complex task. The complex task would lead to higher activation levels and ultimately, less task satisfaction.

In summary, a group's activation level may not facilitate an effective decision-making response if the information stimulus and response capabilities are not matched. That is, a unidimensional information stimulation presented to a cognitively complex group may result in a multidimensional response that is inappropriate, or not required. In contrast, a multidimensional information stimulus presented to a cognitively simple group may place demands on the group that they are not equipped to handle. When there is a mismatch in the task's complexity and group's cognitive complexity, dissatisfaction with the task is likely to follow.

Group Structure. Research indicates that group structure is related to the morale as well as the productivity of the group (e.g., Cartwright & Zander, 1960). Satisfaction in groups may be a function of the group structure rather than whether the optimal solution was presented. For example, Whetten and Bettenhausen (1987) found that faculty satisfaction was higher when the

departmental governance structure fit faculty attitudes, the task structure, and resource dependencies. Other studies have shown that group members may become dissatisfied because group and individual goals are in conflict. This conflict in goals may be a direct result of the group's structure. If a group's structure does not allow members to communicate and accumulate information, it will create a communications dilemma. (Brightman & Verhoeven, 1986).

Member satisfaction also may be related to the member's position in the group. Shaw (1964) concluded that member satisfaction was higher in more centralized positions, but overall satisfaction was higher in decentralized positions (Shaw, 1964). Cummings, Huber, and Arendt (1974) found decentralized groups to have a higher degree of consensus and member satisfaction than centralized groups. Decentralized groups, however, may suffer from poor coordination of information (which may be true under complex tasks); thus, there is a poorer quality of products and lower levels of satisfaction (Borsig & Frey, 1979).

Other studies have found that centralized groups report more satisfaction with the decision-making process than decentralized groups (deCharms & Bridgeman, 1961; Harshberger, 1971). These researchers take the position that satisfaction is linked to the quality of the group

performance and not simply based on the equality of inputs or power relations. To the extent that a centralized group structure facilitates discussion and enhances the likelihood of a superior decision, subjects may feel more satisfied.

In summary, a group's cognitive complexity may need to match the structure of the group. Specifically, a cognitively complex group may require a decentralized structure in order to reach the optimal level of conflict, activation, and communication pattern. In contrast, a cognitively simple group with a decentralized structure may suffer from poor coordination of information and ultimately extreme conflict and activation levels. When there is a mismatch in the group's structure and the group's cognitive complexity, dissatisfaction with the task is likely to follow. Table 7 summarizes the research on the relationship between group cognitive complexity, task complexity, group structure, and task satisfaction.

TABLE 7
Summary of Literature on the Relationships Between Group
Cognitive Complexity, Task Complexity, Group Structure, and
Task Satisfaction

Author(s)	Effect
Borsig & Frey (1979)	Group Structure
Brightman & Verhoeven (1986)	Group Structure
Cartwright & Zander (1960)	Group Structure
Cosier & Rose (1977)	Group Conflict X CC

Table 7 (continued)

Cummings, Huber & Arendt (1974)	Group Structure
deCharms & Bridgeman (1961)	Group Structure
Harshberger (1971)	Group Structure
Janis (1972)	Group Conflict
Larson & Rowland (1974)	Group Conflict X CC
Mason & Mitroff (1981)	Group Conflict X CC
Priem & Price (1991)	Group Conflict X CC
Schwenk (1984)	Group Conflict X CC
Schwiger & Sandberg (1989)	Group Conflict X CC
Shaw (1964)	Group Structure
Whetten & Bettenhausen (1987)	Group Structure
Baker & Franken (1967)	Task Complexity
Berlyne (1960)	Task Complexity
Berlyne & Peckham (1966)	Task Complexity
Berlyne & McDonnell (1965)	Task Complexity
Berlyne, Crow, Salapatek Lewis (1963)	Task Complexity
Berlyne & Borsa (1968)	Task Complexity
Day (1966, 1967, 1968)	Task Complexity
deCharms (1968)	Task Complexity
Eysenck (1985)	Task Complexity
Fisk & Maddi, (1961)	Task Complexity
Gardner (1986)	Task Complexity
Gardner & Cummings (1988)	Task Complexity
Huber (1985)	Task Complexity
Humphreys & Revelle (1984)	Task Complexity
Jones (1964)	Task Complexity

Table 7 (continued)

Miller, Jackson, Mueller & Scherschling (1987)	Task Complexity
Minton (1963)	Task Complexity
Scott (1966, 1967)	Task Complexity
Simonson & Weiser (1976)	Task Complexity
Stager (1967)	Task Complexity X CC
Zuckerman, Schultz & Hopkins (1967)	Task Complexity

* CC = Cognitive Complexity

Group Cognitive Complexity Model and Hypotheses

Based on the review of the literature, the research model shown in Figure 1 is proposed for the current study. This model illustrates the relationships of group cognitive complexity, environmental complexity, and group structure with task performance and task satisfaction. All relationships presented in the model will be tested in the proposed study except that task complexity will be the only aspect of environmental complexity examined.

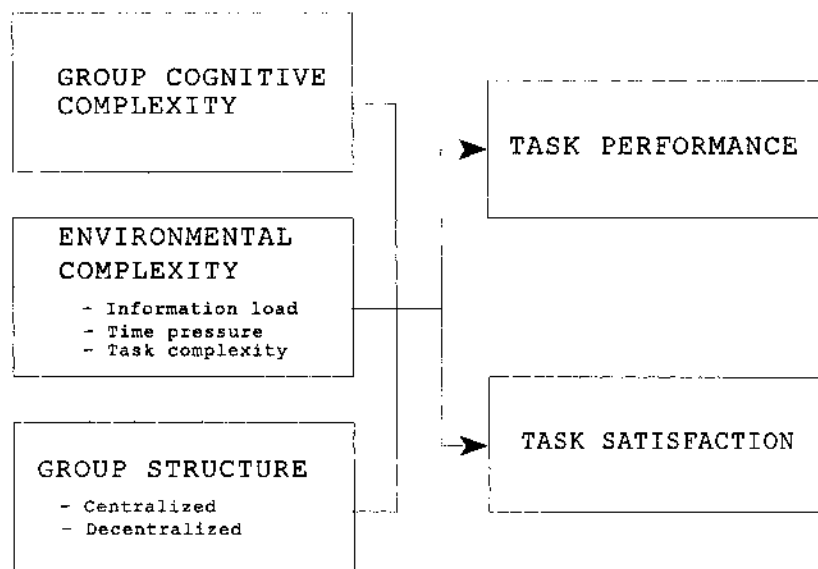
The following nine hypotheses will be tested in the current study:

H1: There will be a positive relationship between group cognitive complexity and task performance.

Many researchers have indicated that complex groups perform better than noncomplex groups (Karlins & Lamm, 1967; Schroder et al., 1967; Stager, 1967). Specifically, these

researchers studied the effects of groups with high cognitive complexity and information processing, searching, integration, and tracking. Mitchell (1972) found that leaders with high cognitive complexity performed better on tasks than leaders with low cognitive complexity. More recently, Stone et al. (1994) found a positive relationship between the cognitive complexity of individual group members and group performance in an ambiguous, ill-structured task. These results were consistent with Hendrick (1979), who found more successful group performance when members were cognitively complex as compared to cognitively simple.

FIGURE 1
MODEL OF GROUP COGNITIVE COMPLEXITY



H2: Groups with cognitively simple members will perform better with a simple task than groups with cognitively complex members, whereas groups with cognitively complex members will perform better with a complex task than groups with cognitively simple members.
Although earlier research generally supports a positive

relationship between group cognitive complexity and task performance (Streufert & Streufert, 1978; Streufert & Swezey, 1986), other research suggests the need to match group cognitive complexity and task complexity to obtain optimal performance (Schroder et al., 1967; Schroder & Suedfeld, 1971; Streufert & Streufert, 1978; DeLuca & Stumpf, 1981; Wood, 1986).

H3: Groups with cognitively simple members will perform better with a centralized group structure than groups with cognitively complex members, whereas groups with cognitively complex members will perform better with a decentralized group structure than groups with cognitively simple members.

Whether cognitive complexity is an asset or a liability depends on the overall structure of the group (Streufert & Streufert, 1978). Because cognitively complex group members are better communicators, have a high need for collaborative leadership and make better use of feedback cues (Merron et al., 1987; Nydegger, 1975; Streufert et al, 1968), groups composed of cognitively complex individuals should perform better in a decentralized group structure than cognitively simple groups. Other research also suggests that a match between group structure and group cognitive complexity is

necessary for successful group performance (e.g., Mitchell, 1972).

H4: Groups with a simple task will perform better with a centralized group structure than groups with a complex task, whereas groups with a complex task will perform better with a decentralized group structure than groups with a simple task.

The joint effect of group structure and task complexity has been investigated for its influence on task performance. People working on difficult tasks perform better when the group allows feedback while doing the task. Thus, groups perform complex tasks more effectively when they use decentralized communication and decision-making structures. Groups performing simple tasks can use a centralized structure more effectively (Shaw, 1964). Furthermore, Von Cranach et al. (1986) propose that the matching of tasks and group structure is what enables a group to complete a given task.

H5: There will be a three-way interaction effect between group cognitive complexity, task complexity, and group structure on task performance. Groups with cognitively simple (complex) members performing a simple (complex) task in a centralized (decentralized) group will have higher task performance than when there is a mismatch between group cognitive complexity, task complexity, and group structure.

There is evidence from several studies that the task environment has a significant influence on an emergent group structure, which in turn affects group productivity (Hackman & Jones, 1965; Lord, 1976). For example, groups with

decentralized communication networks should be less sensitive to high levels of environmental complexity and should be better able to deal with work-related uncertainty than groups with centralized communication networks (Duncan, 1973; Hage, Aiken, Marrett, 1971; Shaw, 1964; Van de Ven, Delbecq, Koenig, 1976). Additionally, groups that have higher complexity levels may handle chaos and ambiguity more effectively than groups with lower levels of cognitive complexity. Therefore, the decentralized structure may be more appropriate for cognitively complex groups performing a complex task. Further, cognitively complex groups may be able to perform more effectively on a complex task because of their enhanced ability to share the information load among group members. Consequently, the interaction between the task complexity, the group's structure, and cognitive complexity should influence effective performance.

H6: Groups with cognitively simple members will be more satisfied with a simple task than groups with cognitively complex members, whereas groups with cognitively complex members will be more satisfied with a complex task than groups with cognitively simple members.

Considerable research suggests that individuals prefer stimulus environments of greater complexity (Day, 1966; 1967; 1968; Jones, 1964; Minton, 1963). However, there have been mixed results as to why certain groups are more satisfied with complex tasks than others. It has been

suggested that cognitively complex groups should be better able to handle a complex task and experience more task satisfaction than noncomplex individuals because of their ability to cope with the conflict connected to the complexity of the task (Mason & Mitroff, 1981; Priem & Price, 1991; Schweiger & Sandberg, 1989). In addition, activation theory may provide a basis for understanding differences in the task satisfaction of groups with varying levels of cognitive complexity (Fisk & Maddi, 1961; Gardner, 1986; Gardner & Cummings, 1988; Huber, 1985; Scott, 1966, 1967). Exposure to more complex stimulus environments leads to higher levels of activation (Baker & Franken, 1967; Berlyne, 1960; Berlyne & Borsa, 1968; Berlyne, et al., 1963; Berlyne & McDonnell, 1965; Berlyne & Peckham, 1966; deCharms, 1968; Fiske & Maddi, 1961; Scott, 1966). This activation level can become beneficial or detrimental for group task satisfaction depending upon the specific level. For example, a complex group working on a complex task may obtain the optimal level of activation. If the task is too simple, however, members of a cognitively complex group may become bored, which could decrease their activation to suboptimal levels. Likewise, a cognitively simple group will have the appropriate activation level for a simple task, but may become very frustrated when they must handle a

complex task. This would result in higher activation levels and ultimately, less task satisfaction.

H7: Groups with cognitively simple members will be more satisfied with a centralized group structure than groups with cognitively complex members, whereas groups with cognitively complex members will be more satisfied with a decentralized group structure than groups with cognitively simple members.

Research indicates that group structure is related to the morale and, thus, the satisfaction, of the group. There has been, however, inconsistent results as to whether a centralized or decentralized group structure leads to increased task satisfaction. Various researchers have related degrees of consensus and member satisfaction to having a decentralized group structure (deCharms & Bridgeman, 1961; Harshberger, 1971). Other studies have found that centralized group structures lead to more satisfied group members (Cummings et al., 1974; deCharms & Bridgeman, 1961; Harshberger, 1971).

To try to uncover potential reasons for these inconsistent results, individual characteristics such as cognitive complexity may need to be measured for its effect on group structure. For example, a group's cognitive complexity may need to match the structure of the group. Specifically, a cognitively complex group may require a decentralized structure in order to reach the optimal level of conflict, activation, and communication pattern. In

contrast, a cognitively simple group with a decentralized structure may suffer from poor coordination of information and ultimately extreme conflict and activation levels. When there is a mismatch in the group's structure and the group's cognitive complexity, dissatisfaction with the task is likely to follow.

H8: Groups with a simple task will be more satisfied with a centralized group structure than groups with a complex task, whereas groups with a complex task will be more satisfied with a decentralized group structure than groups with a simple task.

A basis assertion is that individuals receive greater satisfaction from groups that contain active participation and high input procedures (Greenberg & Folger, 1983; Miller & Monge, 1986). Similarly, Cummings et al. (1974) found decentralized groups to have a higher degree of consensus and member satisfaction than centralized groups. These researchers take the position, that if the environment demands complex information processing, group members will be more satisfied with a decentralized structure.

Other studies have found that centralized groups report more satisfaction with the decision-making process than decentralized groups (deCharms & Bridgeman, 1961; Harshberger, 1971). These researchers take the position that satisfaction is linked to the quality of the group performance and not simply based on the equality of inputs

or power relations. Thus, with a simple task, a centralized group structure may facilitates enough discussion and enhances superior decisions that will increase group member satisfaction.

H9: There will be a three way interaction effect between group cognitive complexity, task complexity, and group structure on task performance. Groups with cognitively simple (complex) members performing a simple (complex) task in a centralized (decentralized) group will have higher task satisfaction than when there is a mismatch between group cognitive complexity, task complexity, and group structure.

According to Shaw (1964), a group has the potential to become more saturated in a centralized group with a complex task. This saturation may lead to increased stress and a state of activation. This activation level has been found to be curvilinearly related to task satisfaction (Fisk & Maddi, 1961; Gardner, 1986; Gardner & Cummings, 1988; Huber, 1985; Scott, 1966, 1967). The optimal amount of activation in a group may be influenced by the group's cognitive complexity level. For example, a complex group working on a complex task in a decentralized group structure will likely obtain the optimal level of activation. However, if the task is too simple or the structure is centralized, members of a complex group may become bored, which could decrease their activation to suboptimal levels. Likewise, a cognitively simple group will have the appropriate activation level for a simple task within a centralized

group structure, but may become very frustrated when they must handle a complex task in a decentralized group structure. This would result in higher activation levels and ultimately, less task satisfaction.

CHAPTER SUMMARY

Chapter II began with a discussion of cognitive theory. Cognitive theory includes both the processes and structures that an individual or group uses for information search and utilization. Cognitive processes include biases, heuristics, assumptions, analogies, and metaphors, while cognitive structures include categories, scripts, schemata, and knowledge structures. Groups that are more cognitively complex should have more well-developed processes and structures. The concern is whether complex individuals and groups are able to switch cognitive gears to meet the demands of both complex and simple environments.

The next section began with a discussion of cognitive complexity. Cognitive complexity was defined at both the individual and the group level. It is important to understand the relationship between these two levels of analysis. Individual cognitive complexity has been correlated with variables such as a tolerance for ambiguity, leadership, prejudice, perception of others, etc. Likewise, group complexity has been correlated with use of information

and better decision making at various levels of task complexity. In addition, the measurement of group cognitive complexity was discussed.

Next, there was a discussion of a number of variables in their relationships with group cognitive complexity (i.e., performance; environmental complexity, including time pressure, information load, and task complexity; and group structure. Both bivariate and multivariate relationships between these variables were identified in previous research. In the next section of the chapter, the relationships between group cognitive complexity, task complexity, group structure, and task satisfaction were discussed.

Finally, a research model was presented. The relationships to be tested in this study were identified and hypotheses were presented. The following chapter will describe the methods to be used for analyzing proposed relationships.

CHAPTER III

METHOD

This chapter contains information about the sample, experimental design, and the experimental task. This information is followed by a definition of each of the measures and manipulations used in the study.

Sample

To conduct this experiment, a sample of business students at a mid-size Southwestern University participated for course credit. To determine the appropriate sample size, Cohen's (1988) sample size table was used. The effect size (ES; the difference between the means of the experimental groups), Type I errors (α), Type II errors (β) and the power of a statistical test ($1-\beta$) were defined. Cohen (1965) defines a small ES as .25, a medium ES as .5, and a large ES as 1.00. The power analysis indicated that the sample size per condition should be 80 groups in order to obtain a medium ES, with a two-tailed α of .05, and power of .70. After eliminating certain groups either because of contamination or inappropriate (blank) responses, 76 triads remained for a total of 228 subjects.

Design

Based on the theoretical framework, problem, hypotheses, treatments, measures, setting, cost, feasibility and time, a 2X2 factorial design with two levels of task complexity (complex; noncomplex) and two levels of group structure (centralized; decentralized) blocked on group cognitive complexity (high vs. low) was used.

The factorial design appears as follows (Pedhazur & Schmelkin, 1991):

GCC₁ TC₁ GS₁ O₁

GCC₁ TC₁ GS₂ O₂

GCC₁ TC₂ GS₁ O₃

GCC₁ TC₂ GS₂ O₄

GCC₂ TC₁ GS₁ O₅

GCC₂ TC₁ GS₂ O₆

GCC₂ TC₂ GS₁ O₇

GCC₂ TC₂ GS₂ O₈

GCC, TC and GS represent the factors of group cognitive complexity, task complexity, and group structure, respectively. The subscripts refer to categories within each factor: GCC₁ = high group cognitive complexity and GCC₂ = low group cognitive complexity; TC₁ = high task complexity and TC₂ = low task complexity, and GS₁ = centralized group structure and GS₂ = decentralized group structure. The

letter, O, signifies measures of the dependent variables: task performance and task satisfaction. For example, O_1 represents the mean satisfaction and performance scores for subjects who were given the treatment combination GCC_1 , TC_1 , and GS_1 .

Experimental Task

The problem-solving task used was Johnson and Johnson's (1994) Winter Survival Exercise (Appendix A). It is a single trial, decision-making task that is conducted without information feedback or time pressure. The Winter Survival Exercise has been identified as a task that is similar to the types of problems faced by managers (Bottger & Yetton, 1987).

In the Winter Survival Exercise, subjects were given a scenario in which an airplane they were traveling had crashed in a remote area of upper Minnesota during the winter. There is an implied decision in this task used by participants as they evaluate the alternatives. This implied decision is whether to stay at the crash site, or try to walk to a community known to be 20 miles away. Those subjects who choose to base their decisions on trying to walk from the campsite are considered low performers because this decision would ensure instant death from the sub-zero temperatures (Johnson & Johnson, 1994).

Participants were supplied with a list of items that may be beneficial to their survival. They were asked to independently rank order the survival items in terms of their importance to survival. Items may be used in combination with other items or may have more than one function for survival. Following the individual ratings, the members of the group were instructed to collectively rank each of the survival items as well as write out explanations for the use of each item in their struggles for survival.

The Winter Survival Exercise was selected because it represents an opportunity to manipulate both task complexity and group structure. First, task complexity can be easily manipulated by varying the number of items the groups are given to rank order in terms of their importance for survival. This manipulation is consistent with Woods' (1986) definition of task complexity. Second, group structure also can be easily manipulated as either centralized or decentralized based on the instructions given to the groups by the experimenter. In addition, the dependent variable measures for task performance and task satisfaction can be obtained easily from well-established measures of both variables.

Independent Variable Measures and Manipulations

The independent variable measured in this study was group cognitive complexity. The manipulations included task complexity (complex - noncomplex) and group structure (centralized - decentralized). Each of these measures and manipulations are explained in detail in the following sections.

Group Cognitive Complexity

Initially, the subjects were placed into groups using group cognitive complexity as a blocking variable. Before participation in the experiment, each subject responded to a modified version of the Repertory Grid test (Bieri, 1955; Appendix B). The version of the Repertory Grid used in this study was an $m \times n$ matrix of elements and constructs in which respondents classified and evaluated each of ten roles on 8-point scales for ten researcher-provided bipolar adjectives (Goodwin, 1991). Researchers with extensive experience using the grid have found that 8-15 elements for each construct provide a useful basis for the elicitation of a reasonable grid (Pope & Keen, 1981).

There are four basic steps in administering the Repertory Grid (Dunn, Kearns, & Cahill, 1984; Dunn & Ginsberg, 1986; Pope & Keen, 1981; Wacker, 1981). The first

step includes selecting a set of roles that constitute the stimuli to which participants are asked to respond along with the adjective scales used to rate each role. In the second step, subjects are asked to rate each of the role holders on the ten adjective scales using an 8-point Likert scale. The rankings are analyzed by counting the number of times that the same ranking was obtained on different adjective scales used to describe a single role holder. The total score is determined by summing these scores across all roles.

Groups with different cognitive complexity profiles were created prior to the experiment. Prior to developing groups, the individual cognitive complexity scores were identified as high or low by determining whether they were above or below the median (48) of all individual cognitive complexity scores. Those above the median score were classified as noncomplex (high scores equal low cognitive complexity) and those below the median were classified as complex. Complex groups were created by placing individuals with low cognitive complexity scores in groups, and noncomplex groups were created by placing individuals with high cognitive complexity scores into groups. The complexity score of each of the group members was averaged to develop a group-level measure of cognitive complexity

(Walsh, et al., 1988). The minimum group complexity score was 39 and the maximum group complexity score was 60.

Task Complexity

Task complexity was manipulated according to the number of survival items available for subjects' consideration on the Winter Survival Exercise. In the low task complexity manipulation, eight survival items were randomly provided by the experimenter. These items included: ball of steel wool, newspapers, cigarette lighter, 45-caliber pistol, chocolate bars, shirt and pants, and a hand ax. In the high task complexity manipulation, 15 survival items were randomly provided by the experimenter. These 15 items included: ball of steel wool, newspapers, compass, hand ax, cigarette lighter, 45 caliber pistol, sectional air map, canvas, shirt and pants, shortening, whiskey, chocolate bars, knife, ski poles, and gauze (Appendix A).

Group Structure

Two types of group structure were manipulated by instructions from the experimenter. The instructions given to the groups with the decentralized group structure (without a leader) were as follows (Johnson & Johnson, 1994):

*This is an exercise in group decision making.
Your group is to employ the method of group*

consensus in reaching its decision. This means that the ranking for each of the fifteen (eight for simplified version) survival items must be agreed upon by all group members before it becomes a part of the group decision. Consensus is difficult to reach. Therefore, not every ranking will meet with everyone's complete approval. Try, as a group, to make each ranking one with which all group members can at least partially agree.

Members in these groups were seated in strategic positions so that communication could flow in all directions.

The instructions for the group with a centralized group structure (i.e., the group had a specified group leader) were as follows (Johnson & Johnson, 1994):

Your group is to discuss what the rankings of the survival items should be. At the end of the decision-making process, the group's leader will hand in the group's best ranking of the items. The role of the group members is to provide as much help as the leader wants in trying to determine how the items should be ranked. The leader in this group is responsible for making the final decision.

These groups were seated so that the leader was 10-12 feet away from the two other members. The centralized structure was further imposed on these groups by instructing the leader that he or she may only speak with one member at a time. The other two members were approximately 10 feet apart and were not allowed to communicate with each other, nor could they hear the other's conversation with the leader.

This was emphasized by a physical cardboard barrier was placed between the two members facing the leader of the group.

Dependent Measures

This section explains how each of the dependent variables are measured. Two dependent measures of task performance were derived from an initial score labeled "group output score." One of these two subsequent measures was the average individual performance score; the other was the most accurate member score. Finally, task satisfaction was measured using two distinct, scaled instruments.

Task Performance

Using the Winter Survival Exercise, group decision-making performance can be analyzed in three contexts. First, the performance of one group's decision can be compared with an expert's score (Bottger & Yetton, 1987; Hall & Watson, 1970; Miner, 1984; Nemiroff & King, 1975). This is referred to as the "group output score." Second, group performance can be measured by the extent to which the group's solution improves the average of the individual members' solution (Bottger & Yetton, 1987; Hall & Watson, 1970; Nemiroff & King, 1975), referred to as "average individual performance score." Third, the group's solutions

can be compared to the solution of the best member in the group (Burleson, Levine, & Samter, 1984; Hill, 1982; Libby, Trotman & Zimmer, 1987; Yetton & Bottger, 1982), referred to as "best member score." The last two performance measures reflect process loss within the group.

Group Output Score. For each group, an output score was obtained. A group's output score was determined in the Winter Survival Exercise as the sum of the absolute differences between the ranks assigned by the group members for each item and those advocated by three wilderness experts. The three wilderness experts are M. Wanvig (U.S. Army survival training instructor), R. Johnson (environmental education expert), and C. Rulstrum (author of New Ways of the Wilderness) (Johnson & Johnson, 1994). A small absolute difference between the experts' rank and the participants' ranks indicates a highly effective decision. A large absolute difference between the expert rank and the participants' ranks indicates a less effective decision. For example, if the participants ranked an item as 8, and the correct (expert) answer was 13, the net difference was 5. The plus and minus signs were disregarded when the scores were totaled. Then, in order to compare groups, the scores were standardized for both the simple and the complex task in order to standardize the score between task

complexity conditions. Deviation scores were obtained by converting the raw data to ratio data by dividing the group output score by the maximum possible error. So the complex task which contained 15 survival items was divided by 112 and the simple task which contained 8 survival items was divided by 32.

The group output score (the absolute value of the group's decision minus the expert's decision) also was used in the calculation of other performance measures. The group's output score was compared to 1) the average individual performance, and 2) to the most accurate member of the group as identified by the researcher.

Average Individual Performance Score. The first measure of task performance indicating process loss was a comparison of the group output score to the average member score. As explained above, deviation scores were used to compare performance between task complexity conditions. The average member score was assessed by totaling all of the member's individual scores for each group and dividing by the number of members. Difference scores were then generated by taking the final group output score and subtracting the average individual score. This difference score provided an index of group improvement over the average individual performance score. If the group's

performance is higher than the average individual performance score, the difference score should result in a negative number. The greater the negative number, the more improvement the groups had in their decisions.

Most Accurate Member Score. The second measure of task performance indicating process loss was comparison of the group output score to the most accurate member as determined by taking the best individual member's score. Like the group output score and the average individual performance score, the most accurate member score was obtained from the transformed data (deviation scores). Difference scores were then generated by taking the final group output score and subtracting the best individual score. This difference provided an index of group improvement over the best individual performance score. Like the average individual performance score, the smaller the positive number or the greater the negative number, the more improvement the groups had in their decisions.

Task Satisfaction

There were two different satisfaction scales employed in an attempt to reduce the effects of common methods variance or mono-method bias (Cook & Campbell, 1976). The first satisfaction measure was a four-item, Likert-type

scale with a 7-point response format (e.g., 1 = Not Satisfying at all; 7 = Very Satisfying; Appendix C). This scale was developed by Weiss & Nowicki (1981) and has obtained a reliability coefficient of .85 in a previous study. A group satisfaction score was calculated by averaging the three individual satisfaction scores. The second satisfaction measure was a 20-item, semantic differential scale developed by Stone (1977) (Appendix D). The coefficient alpha was .97 for this scale in a previous study (Gardner, 1986). Items 1, 5, 8, 10, 11, 13, 16, 17, 19, and 20 constituted the task satisfaction scale. The remaining items were distractors and were not used in the analyses. A group satisfaction score was calculated by averaging the three individual satisfaction scores.

Procedure

In phase I of the study, the Role Construct Repertory Test (Bieri, 1955; Kelly, 1955; Vannoy, 1965) was used to measure the cognitive complexity of each subject. Once the cognitive complexity scores were obtained from the subjects, they were placed into stratified groups based on their complexity scores.

In phase II, the task complexity and group structure treatments were randomly assigned to the groups. This resulted in eight experimental groups. When the subjects

reported to the laboratory in groups of three, they were given a packet of materials containing four copies (one for each individual and one for the group) of the Winter Survival Exercise, a score sheet, and procedural instructions. The participants were instructed first to complete the decision form individually so that the results indicated their own decisions.

The instructions explained that the group task was the same as the individual task and that the group goal was to come up with one best solution that was as close as possible to the solution of the winter survival experts. Furthermore, to facilitate individual and group motivation, groups were told that they would find out how their group solutions compared with the experts' and their peers' solutions. The task was reviewed with the participants emphasizing that their survival depended upon the quality of their decision.

The groups without a leader were instructed to communicate with one another and determine the rankings of the survival items by group consensus. Specific instructions were given to the groups to eliminate conflict-reducing procedures such as majority voting, tossing a coin, averaging, or bargaining. These instructions were as follows (Johnson & Johnson, 1994):

1. Avoid arguing blindly for your own opinions. Present your position as clearly and logically as possible, but listen to other members' reactions and consider them carefully before you press your point.
2. Avoid changing your mind just to reach an agreement and avoid conflict. Support only solutions with which you are able to agree to at least some degree. Yield only to positions that have objective and logically sound foundations.
3. Avoid conflict-reducing procedures such as majority voting, tossing a coin, averaging or bargaining.
4. Seek out differences of opinion. They are natural and expected. Try to involve everyone in the decision process. Disagreements can improve the group's decision because a wide range of information and opinions improves the chances of the group to hit upon more adequate solutions.
5. Do not assume that someone must win and someone must lose when discussion reaches a stalemate. Instead, look for the next most acceptable alternative for all members.
6. Discuss underlying assumptions, listen carefully to one another, and encourage the participation of all members, especially important factors in reaching decisions by consensus.

In contrast, the groups with a leader were simply given the instructions that set up the centralized group structure as described in the section on manipulations (Johnson & Johnson, 1994).

After the task, the participants responded to questionnaires assessing their perception of the task's complexity and the group's structure as manipulation checks. The perceived task stimulation scale developed by Gardner

(1982; 1986) measures the perceived task complexity (Appendix E). This 20-item scale results in an overall complexity/stimulation score (based on perceptions of intensity, complexity, meaningfulness, novelty, and variety of stimulation). This measure also provides a score for freedom to initiate stimulation-modifying behaviors (activation level). Items 1, 7 and 13 are perceived intensity questions. Items 2, 8, and 17 are perceived complexity questions. Items 3, 9, and 14 are perceived meaningfulness questions. Items 4, 10, and 15 are perceived novelty questions. Items 5, 11, and 18 are perceived variety questions.

Intensity, complexity, meaningfulness, novelty, and variety items were summed to create a total perceived task stimulation score. Those groups performing a complex task should have a higher task stimulation score. In addition, each group member was asked whether they perceived the task as complex or simple. Their responses were reported on a five-point Likert scale (1=Simple; 5=Complex).

Subjects were asked to identify on a 7-point Likert scale what type of structure (1=centralized; 7=decentralized) they thought they had in their group (Appendix F). In addition, a modified version of Hemphill's index of group dimensions was used to measure three

characteristics of the groups (control, participation, and flexibility). Fifteen items were answered on a 5-point scale. These fifteen items were summed to obtain a measure of group structure. Items for Hemphill's index were suggested from a free-response type questionnaire administered to 500 individuals; five judges then put the items into dimensional categories (Hemphill, 1956). The split-half reliabilities for the instrument range from .59 to .87. The dimension scores describing the characteristics of two quite different groups vary accordingly, while those describing the characteristics of two similar groups are quite similar making the validity of this instrument very good (Miller, 1991).

Finally, group members were asked whether they understood the instructions as they were debriefed on the significance and relevance of the study. The subjects were given the correct ranking and rationale for each item. An explanation was given of how the rankings were scored so that each person had an idea of how they scored.

Chapter Summary

Chapter III presented a discussion of the experimental methodology used to test the hypothesized relationships. The chapter began with a review of the sample and the design of the research. A student sample was used in a laboratory

setting using a 2 X 2 factorial design blocked on group cognitive complexity. Following the discussion of the experimental design, a summary of the experimental task was presented. The purposes and procedures of the Winter Survival Exercise were explained in detail.

Next, each of the manipulations and measures used in the experiment were described. The manipulations included task complexity and group structure, while the measures included group cognitive complexity (the blocking variable), and task performance and task satisfaction (the dependent variables).

Finally, a detailed discussion of the procedure used was presented. This experiment was conducted in two phases. In phase I, a measure of cognitive complexity was obtained from the student sample. In phase II, the subjects were placed into stratified groups based on their scores for cognitive complexity. Each group was randomly assigned to one level of task complexity (complex, not complex) and one level of group structure (centralized, decentralized). The groups were then asked to respond to questionnaires to obtain dependent variable measures and to determine the effectiveness of the task complexity and group structure manipulations. Once the subjects responded to the

questionnaires, they were debriefed and any questions were answered.

CHAPTER IV.

RESULTS

This chapter reports the results of the hypotheses tested in the study. Descriptive statistics, correlations among study variables for the total sample, and internal consistency reliabilities for all measures of single constructs are presented in Table 8. In the first section, results from the manipulation checks for task complexity and group structure are described. The second section reviews the hypotheses tested via ANOVA procedures. Within the second section, various tables are used to explain the results of the manipulation checks and the hypotheses. Means, standard deviations, and sample size by condition for each dependent variable follow closely in Table 11.

Manipulation Checks

T-tests were used to check for the strength of the manipulation of task complexity and group structure. To identify whether subjects perceived a difference in the two types of tasks (simple and complex), subjects were asked to indicate their perception of task complexity. A 5-point Likert scale was used to assess the subjects' perceived task

complexity. The aggregate mean score on this question for each condition of task complexity is reported in Table 9. There was a significant difference ($t(74) = -2.34$; $p < .01$) in the expected direction between those subjects who were administered a simple task versus those who completed a complex task.

Table 8
Descriptive Statistics, Correlations,
and Internal Consistency Reliabilities

Var	Mean	S.D.	GCC	GWS	ACWS	AVWS	TSM	TSS	GEN
GCC	47.38	4.67	<u>.73</u>						
GWS	.57	.15	0.20	<u>.41</u>					
ACWS	.04	.14	0.19	0.65	-				
AVWS	-.06	.12	0.17	0.79	0.85	-			
TSM	46.87	4.96	-0.07	0.05	-0.14	-0.09	<u>.86</u>		
TSS	20.55	2.66	-0.16	-0.08	-0.08	-0.09	0.79	<u>.83</u>	
GEN	.47	.50	-.11	.14	.03	.11	-.05	.06	-

* Internal consistency reliabilities are presented on the diagonal.

Correlations $> .15$ are significant at $p < .10$

Correlations $> .19$ are significant at $p < .05$

GCC = Group Cognitive Complexity

GWS = Group Winter Survival Score

ACWS = Most Accurate Winter Survival Score

AVWS = Average Winter Survival Score

TSM = Task Satisfaction Measure

TSS = Task Satisfaction Scale

GEN = Gender

A second questionnaire was distributed to subjects assessing the perceived task stimulation, another indication of task complexity. This 15-item questionnaire is composed of five factors (complexity, variety, intensity, meaning, and novelty). These five factors were aggregated into one factor (task stimulation), which yielded an alpha of .67. This does not quite meet Nunnally's (1978) criterion of .70, although it is acceptable in a laboratory environment.

Table 9 Task Complexity					
Variable	Simple Task Mean (SD)	Complex Task Mean (SD)	t-Value	df	1-tail Sig.
Task Complexity	2.91 (1.0)	3.43 (.92)	-2.34	74	.01
Task Stimulation	59.48 (11.06)	65.51 (11.30)	-2.33	74	.01

As indicated in Table 9, there is a significant difference in the subjects' perception of task stimulation ($t(74) = -2.33$; $p < .01$). Subjects who performed the simple task had lower task stimulation levels than those who performed the complex task. These two manipulation checks suggest that subjects who were given the simple task were less apt to perceive the task as novel, intense, complex, and meaningful.

T-tests were used to check for the strength of the manipulation of the group's structure (see Table 10). To

identify whether subjects perceived a difference in the two types of groups (centralized and decentralized), two separate questions using a 5-point Likert scale were asked of respondents. These two questions were added together to form one dimension of group structure (Autocratic-Democratic), and yielded a Cronbach's alpha of .67. There was a significant difference in the mean scores on this dimension ($t(74) = -2.47$; $p < .01$). Members who were in decentralized groups (no-leader) perceived to a higher degree that more than one member was in control of their group and that they had a more democratic environment than did members in centralized groups (leader) (See Table 10).

Table 10 Group Structure					
Variable	Centralized Structure Mean (SD)	Decentralized Structure Mean (SD)	t-Value	df	1-tail Sig.
Autocratic - Democratic	7.16 (1.76)	8.20 (1.81)	-2.47	74	.01
Group Structure	47.84 (4.77)	51.83 (4.91)	-3.61	74	.001
Stratification	13.38 (4.42)	10.61 (3.76)	2.92	74	.001

Two other questionnaires were used to measure group structure. The first questionnaire included three factors (control, flexibility, and participation). Cronbach's alpha for this 10-item questionnaire was .60. There was a significant difference in respondents' perceptions of their

group structure ($t(74) = -3.61$; $p < .001$). Groups with no leader (decentralized groups) perceived themselves as having greater flexibility and participation, yet having less control. Their total scores (reported in Table 10), however, suggest the manipulation was perceived as intended. The final questionnaire measures the perceived level of stratification in the group. This 5-item questionnaire yielded an alpha of .76. Like the previous test for manipulation of group structure, there was a significant difference in the perceived stratification level of the two group structures. Subjects who were in centralized groups perceived their structure to be more stratified than those groups with a decentralized structure ($t(74) = 2.92$, $p < .001$). These three manipulation checks suggest that subjects who were in a centralized group (with a leader) were more apt to perceive that they had a defined structure (centralized structure) than decentralized groups.

Analysis

The analysis of the data was designed to answer whether there were differences in the measures of task performance and task satisfaction across groups with varying levels of group cognitive complexity (GCC), task complexity (TC), and group structure (GS). The means, standard deviations, and cell sizes per condition are reported in Table 11.

Correlation analysis was used to assess the relationship between group cognitive complexity and task performance. ANOVA was used to assess the interaction effects of group cognitive complexity, task complexity, and group structure on performance and satisfaction. Task performance was measured by the group output score (comparison to the expert's winter survival score), comparison to the most accurate individual winter survival score, and the comparison to the average individual winter survival score. Again, the group output score was a deviation score that is obtained by dividing the raw data by the greatest possible error. This is done in order to make equal comparisons between the two degrees of difficulty in the Winter Survival Task (8-items vs. 15-items). The most accurate individual score and the average individual scores are simply derived by comparing the group output score to the most accurate member's score in the group and to the average score of the three group members. Furthermore, task satisfaction was measured by a task satisfaction scale and a task satisfaction measure.

Meas.	Table 11 Means, Standard Deviations and Sample Sizes by Condition							
	High Cognitive Complexity				Low Cognitive Complexity			
	High TC		Low TC		High TC		Low TC	
	Cen.	Dec.	Cen.	Dec.	Cen.	Dec.	Cen.	Dec.
Group Output Score	.55 (.13) n=13	.58 (.09) n=11	.54 (.17) n=10	.41 (.07) n=9	.68 (.15) n=9	.66 (.07) n=9	.60 (.23) n=7	.51 (.13) n=7
Compare to Most Accur.	.02 (.09) n=13	.03 (.08) n=11	.09 (.10) n=10	.00 (.16) n=9	.07 (.14) n=9	.04 (.07) n=9	.18 (.28) n=7	.00 (.14) n=7
Compare to Average	-.09 (.12) n=13	-.07 (.06) n=11	-.05 (.11) n=10	-.12 (.09) n=9	-.01 (.13) n=9	-.04 (.09) n=9	.02 (.18) n=7	-.12 (.16) n=7
Satis. Scale	20.8 (2.2) n=13	20.6 (2.5) n=11	21.1 (1.7) n=10	20.0 (3.6) n=9	19.4 (2.3) n=9	23.3 (1.9) n=9	20.1 (2.5) n=7	18.5 (2.9) n=7
Satis. Measure	46.6 (4.9) n=13	47.9 (5.2) n=11	46.3 (5.4) n=10	45.7 (6.0) n=9	45.5 (5.2) n=9	52.1 (1.6) n=9	45.5 (3.5) n=7	44.8 (3.2) n=7

- * Meas. = Measure
- * Cen. = Centralized group structure
- * Dec. = Decentralized group structure
- * TC = Task complexity
- * Group Output Score = Group winter survival score compared to wilderness expert's score
- * Compare to Most Accur. = Group output score compared to the most accurate individual member's score
- * Compare to Average = Group output score compared to the average individual score
- * Satis. Scale = Satisfaction scale
- * Satis. Measure = Satisfaction measure

Hypothesis One

Hypothesis one proposed that there will be a positive relationship between group cognitive complexity and task performance. Specifically, groups that were cognitively complex were expected to outperform groups that were noncomplex. As shown in Table 9, significant correlations exist for the relationship of group cognitive complexity (GCC) on task performance as measured by the group's output score (GWS; $r=.20$; $p < .05$), and the comparison to the most accurate individual score (ACWS; $r=.19$; $p < .05$). The relationship between GCC and GWS suggests that the lower the group cognitive complexity score (an indication of high cognitively complexity) the lower the group winter survival score (indicating the ranks were close to the expert's rankings). The relationship between GCC and ACWS suggests that groups containing cognitively complex members were significantly more likely to outperform the most accurate individual in the group than were groups with low cognitive complexity. The correlation between GCC and the comparison to the average individual score (AVWS) approached significance ($r=.17$; $p < .10$) and was in the direction of the hypothesis. Based on these results, hypothesis one was generally supported.

Hypothesis Two

Hypothesis two proposed that group cognitive complexity and task complexity should interact to affect task performance. Specifically, groups that were cognitively complex were expected to perform best on a complex task, whereas, groups that were not as cognitively complex were expected to perform best on a simple task. Group cognitive complexity (GCC) and task complexity (TC), however, did not jointly affect the group output score ($F(1,72)=.13$, $p<.72$), the most accurate individual score ($F(1,72)=.01$, $p<.91$), or the comparison to the average individual score ($F(1,72)=.07$, $p<.80$; See Table 12). Based on these results, hypothesis two was not supported.

Hypothesis Three

Hypothesis three proposed that group cognitive complexity (GCC) should interact with group structure (GS) to affect task performance. Specifically, cognitively complex groups were expected to perform best in a decentralized structure, whereas, less cognitively complex groups were expected to perform best with a centralized structure. Group cognitive complexity and group structure did not jointly affect the group output score on the Winter Survival Task ($F(1,72)=.02$, $p<.90$), the most accurate

individual score ($F(1)=.63$, $p<.43$), or the comparison to the average individual score ($F(1)=1.2$, $p<.27$; See Table 12).

Table 12
ANOVA Results

Group Output Score	df	F	p
GCC	1	8.82	.00
TC	1	10.08	.00
GS	1	2.98	.09
GCC*TC	1	.13	.72
GCC*GS	1	.02	.90
TC*GS	1	3.37	.07
GCC*TC*GS	1	.58	.45
Model	7	3.71	.00
Comparison to Most Accurate Individual Score	df	F	p
GCC	1	1.82	.18
TC	1	1.27	.27
GS	1	5.92	.02
GCC*TC	1	.02	.91
GCC*GS	1	.63	.43
TC*GS	1	2.81	.10
GCC*TC*GS	1	.42	.52
Model	7	1.58	.16
Comparison to Average Individual Score	df	F	p
GCC	1	2.57	.11
TC	1	.27	.61
GS	1	4.47	.04
GCC*TC	1	.07	.80
GCC*GS	1	1.24	.27
TC*GS	1	3.16	.08
GCC*TC*GS	1	.15	.70
Model	7	1.49	.18

Hypothesis Four

Hypothesis 4 proposed a joint effect of task complexity and group structure on task performance. Specifically, groups performing a complex task were expected to perform best with a decentralized structure; whereas, groups performing a simple task were expected to perform best in a centralized structure. As shown in Table 12, there was a tendency to support hypothesis four when analyzing the group output score ($F(1,72)=3.37$; $p<.07$), the comparison to the most accurate member's score ($F(1,72)=2.81$; $p<.10$), and the comparison to the average members score ($F(1,72)=1.2$; $p<.08$). Although the means were in the predicted direction, it must be concluded that support for hypothesis four was not obtained.

Hypothesis Five

Hypothesis 5 analyzed the three-way effect of group cognitive complexity (GCC), task complexity (TC) and group structure (GS) on task performance. Specifically, groups that were cognitively complex were expected to perform best on a complex task in a decentralized structure, whereas, noncomplex groups were expected to perform best on a simple task in a centralized structure. As shown in Table 12, group cognitive complexity, task complexity and group structure did not jointly affect the group output score on

the Winter Survival Task ($F(1,72)=.58$; $p<.45$), the most accurate individual score ($F(1,72)=.42$; $p<.52$), or the comparison to the average individual score ($F(1,72)=.15$; $p<.70$). Based on these results, hypothesis five was not supported.

Hypothesis Six

Hypothesis six proposed that group cognitive complexity (GCC) and task complexity (TC) would interact to affect task satisfaction. Specifically, cognitively complex groups were expected to be most satisfied with a complex task, whereas, less cognitively complex groups were expected to be most satisfied with a simple task. No support was obtained for hypothesis six using the task satisfaction scale ($F(1,72)=2.4$; $p<.12$), or the task satisfaction measure ($F(1,72)=1.2$; $p<.28$; See Table 13).

Hypothesis Seven

Hypothesis seven proposed a joint effect of group cognitive complexity (GCC) and group structure (GS) on task satisfaction. Specifically, cognitively complex groups should be most satisfied with a decentralized structure; whereas, less cognitively complex groups should be most satisfied with a centralized structure. As shown in Table 13, no support for hypothesis seven was obtained on the task

satisfaction scale ($F(1,72) = 2.5$; $p < .12$) or the task satisfaction measure ($F(1,72) = 1.35$; $p < .25$).

Table 13 ANOVA Table			
Task Satisfaction Scale	df	F	p
GCC	1	.26	.62
TC	1	3.28	.07
GS	1	.18	.67
GCC*TC	1	2.43	.12
GCC*GS	1	2.53	.12
TC*GS	1	7.51	.01
GCC*TC*GS	1	4.01	.05
Model	7	2.71	.02
Task Satisfaction Measure	df	F	p
GCC	1	.13	.72
TC	1	4.93	.03
GS	1	2.20	.14
GCC*TC	1	1.17	.28
GCC*GS	1	1.35	.25
TC*GS	1	4.33	.04
GCC*TC*GS	1	1.47	.23
Model	7	2.15	.05

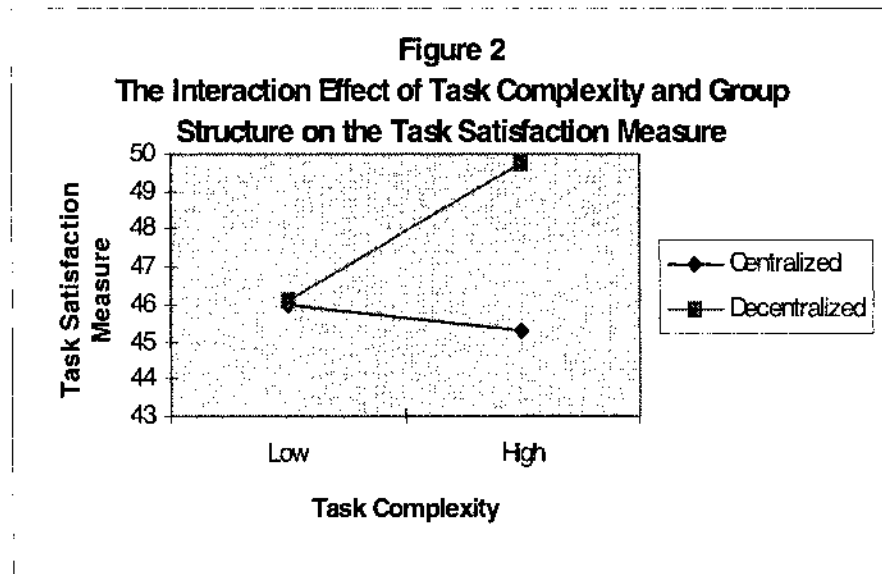
Hypothesis Eight

Hypothesis 8 analyzed the joint effects of task complexity (TC) and group structure (GS) on task satisfaction. Specifically, groups performing a complex task were expected to be most satisfied with a decentralized structure; whereas, groups performing a simple task were

expected to be most satisfied with a centralized structure. As shown in Table 13, a statistically significant interaction between task complexity and task structure was obtained using scores on the satisfaction scale ($F(1,72)=7.5$; $p<.01$) and the task satisfaction measure ($F(1,72)=4.3$; $p<.04$).

Because task complexity had a significant main effect on the task satisfaction measure, differences in task complexity at both levels of group structure were examined in an analysis of simple effects (See Table 14). This analysis provides partial support for the hypothesis. There was a significant difference in scores on the task satisfaction measure between high and low levels of task complexity when the group structure was decentralized [$F(1,75) = 7.98$, $p < .01$], but not when the group structure was centralized [$F(1,75) = .01$, $p < .92$]. In the decentralized condition, groups with a complex task were significantly more satisfied than groups with a less complex task. The interaction between task complexity and group structure is depicted in Figure 2.

There were no significant main effects of task complexity or group structure on the task satisfaction scale. The main effect of task complexity; however, approached significance (See Table 14). Consequently, for

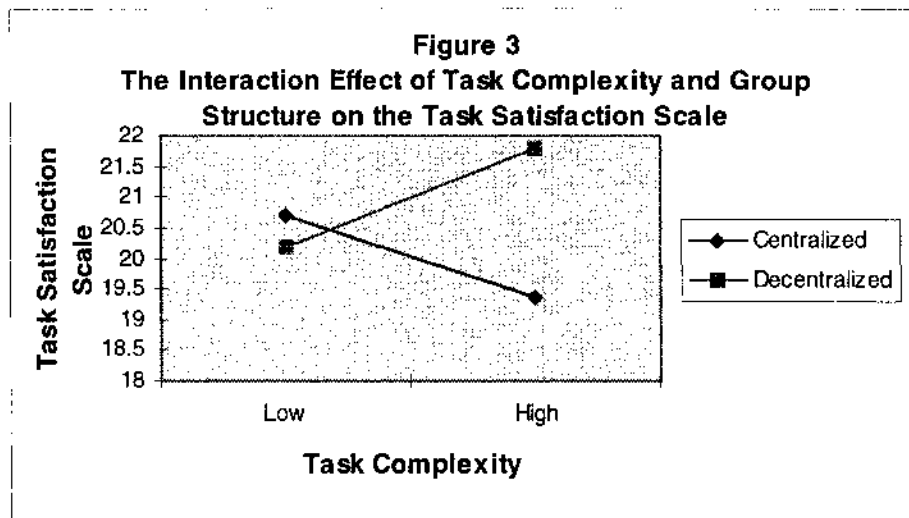


the purposes of comparison with results on the task satisfaction measure, differences in task complexity at both levels of group structure were examined in a simple effects analysis. The results were the same as those using the task satisfaction measure.

There was a significant difference in scores on the task satisfaction scale between high and low levels of task complexity when the structure was decentralized [$F(1,75) = 7.82, p < .01$], but not when the structure was centralized [$F(1,75) = .41, p < .53$] (See Table 14). In the decentralized condition, groups with a complex task were significantly more satisfied than groups with a less complex task. The interaction between task complexity and group

structure and its effect on the task satisfaction scale is depicted in Figure 3.

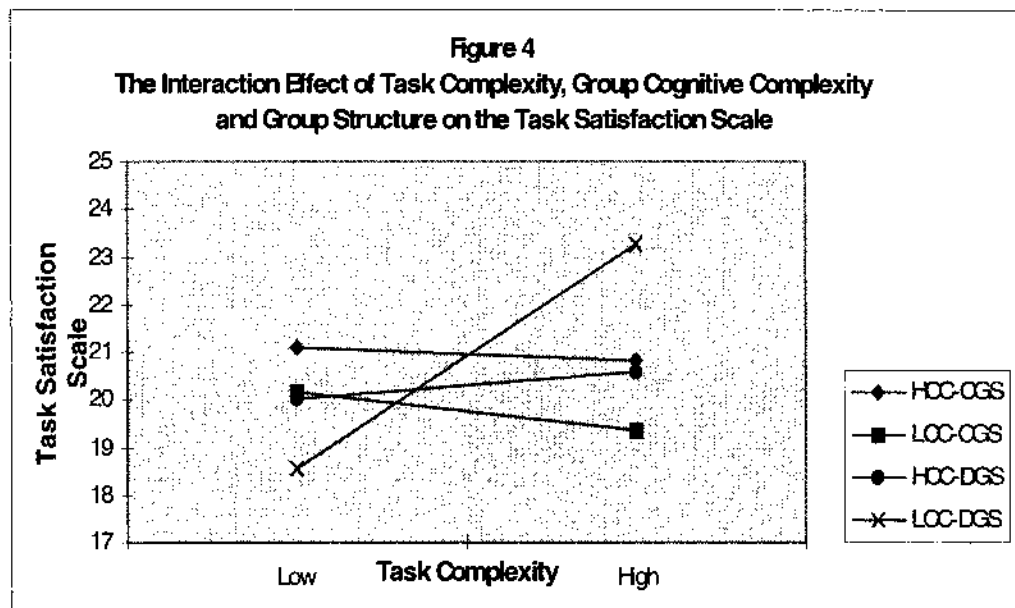
Table 14 Simple Effects Analysis for Hypotheses 8 and 9			
Task Satisfaction Measure (Group Structure X Task Complexity)	df	F	p
Group Structure	1	1.86	.18
Task Complexity	1	4.47	.04
Task Complexity within Centralized Structure	1	.01	.92
Task Complexity within Decentralized Structure	1	7.98	.01
Task Satisfaction Scale (Group Structure X Task Complexity)	df	F	p
Group Structure	1	.05	.82
Task Complexity	1	2.50	.12
Task Complexity within Centralized Structure	1	.41	.53
Task Complexity within Decentralized Structure	1	7.82	.01
Task Satisfaction Scale (Cognitive Complexity X Group Structure X Task Complexity)	df	F	p
Task Complexity	1	3.28	.07
Group Structure	1	.18	.67
Task Complexity within Group Structure	1	7.51	.01
Group CC within Simple Task within Centralized Structure	1	.62	.44
Group CC within Simple Task within Decentralized Structure	1	1.32	.26
Group CC within Complex Task within Centralized Structure	1	2.00	.16
Group CC within Complex Task within Decentralized Structure	1	5.85	.02



Hypothesis Nine

Hypothesis nine analyzed the three-way effect of group cognitive complexity (GCC), task complexity (TC) and group structure (GS) on task satisfaction. Specifically, groups that are cognitively complex were expected to be most satisfied with a complex task in a decentralized structure, whereas, groups that were less cognitively complex were expected to be most satisfied with a simple task in a centralized structure. As shown in Table 13, group cognitive complexity, task complexity and group structure did jointly affect the group's level of task satisfaction as measured by the task satisfaction scale ($F(1,72) = 4.0$; $p < .05$), but not by the task satisfaction measure ($F(1,72) = 1.5$; $p < .23$).

An analysis of simple effects examined differences in scores on the task satisfaction scale between groups with high and low cognitive complexity across the different conditions in the task complexity-by-group structure interaction. Results indicate that the only difference in satisfaction between groups with high and low cognitive complexity was when the task was complex and the structure was decentralized [$F(1,68) = 5.85, p < .02$] (See Table 14). There was no significance in any of the other three-way combinations between group cognitive complexity, task complexity, and group structure. Figure 4 graphically depicts the significant relationship. When the task was complex and the group had a decentralized structure, groups with low cognitive complexity had higher task satisfaction than groups with high cognitive complexity. This suggests that noncomplex groups were more affected than complex groups by a mismatch between task complexity and group structure (simple task-decentralized structure or complex task-centralized structure). That is, when a complex task was performed in a decentralized structure, groups with low cognitive complexity significantly were more satisfied than when a less complex task was performed in a decentralized structure. Surprisingly, there was no significance



involving any of the cognitively complex groups. Results of this analysis did not support hypothesis nine.

Chapter Summary

The present chapter reported the results for the tests of hypothesized relationships between group cognitive complexity, task complexity, group structure, group performance and satisfaction. Results for hypothesis one indicated that groups consisting of cognitively complex members outperformed groups consisting of noncomplex members. No support was obtained for the hypothesized two-way interaction between group cognitive complexity and either task complexity or group structure, but support was obtained for the interaction between task complexity and

group structure on both task satisfaction measures. The highest satisfaction levels occurred with an appropriate match between task complexity and group structure. In addition, the three-way interaction effect on the task satisfaction scale between group structure, task complexity, and group cognitive complexity was significant. The means, however, were not in the predicted direction. For cognitively simple groups, a complex task with a decentralized structure lead to high task satisfaction; whereas, a less complex task with a decentralized group structure lead to low task satisfaction. There were no significant differences for cognitively complex groups on either dependent variable when analyzing the three-way interaction between group cognitive complexity, task complexity, and group structure.

In the final chapter, the results will be discussed and summarized. The strengths and limitations of this study will be presented and the implications for future research will be examined in light of previous findings.

CHAPTER V

DISCUSSION

This chapter begins by interpreting the results of the study. Within this section, each hypothesis is restated and explanations for the finding is provided. The second section outlines both the theoretical and practical implications of this research. Within the second section, the various contributions made by these results are explained in both theoretical and practical terms. The third section addresses the possible limitations in this research project. Finally, potential directions for future research concerning group cognitive complexity are discussed.

Summary of Results

Hypothesis one. Hypothesis one predicted that groups containing cognitively complex members will have higher task effectiveness than group's containing noncomplex members. Similar to previous studies (Karlins & Lamm, 1967; Schroder et al., 1967; Streufert & Streufert, 1978; Streufert & Swezey, 1986), the present study suggests that groups composed of members with high cognitive complexity perform

better than groups with low cognitive complexity. In addition, cognitively complex groups had less process loss in their group decision making. To measure process loss, comparison scores were obtained from the group output score. First, the group output score was compared to the average individual score. Then, the group output score was compared to the most accurate individual score. There was a significant difference between cognitively complex and cognitively simple groups on both of these comparisons. These findings are consistent with Steiner (1972) who states that process loss will be maximal when groups contain low-ability members and minimal when every group member is capable of meeting task requirements. Comparison of the three performance measures (group output score, comparison to average individual, and comparison to most accurate individual) taken from groups suggests that complex group output scores were higher than the average individual performance score and nearly exceeded the most accurate individual's score in the group. These results are equivalent to those found in studies by Bottger & Yetton (1987), and Libby et al. (1987).

Hypothesis two. The second hypothesis stated that group cognitive complexity would interact with task complexity to predict task performance. Even though results

of group cognitive complexity are still inconclusive (Driver & Streufert, 1969; Walsh et al., 1988; Ginsberg, 1989, 1990), most research has proposed that complex groups should perform best in a complex environment (e.g. Thorne, 1986).

Hypothesis two was proposed based on interactive theory developed by Streufert and Streufert (1978). These researchers described a model relating environmental complexity and cognitive complexity to performance. In their model, it is proposed that both cognitively complex and simple individuals will have an optimal level of environmental complexity; however, even when both complex and simple individuals are at their optimal levels, the cognitively complex individuals should outperform the noncomplex individuals. Streufert and Streufert suggest that their model should hold for both individuals and groups. This study does not support research indicating that cognitively complex groups can deal with a greater number of stimuli (i.e. in a complex task) than less cognitively complex groups. There were no differences found in performance between cognitively simple and cognitively complex groups when the task was simple or complex. The operationalization of task complexity may provide a potential explanation for the lack of support. First, the manipulation of task complexity varies slightly from

previous research. Researchers who have advanced interactive theory, increased the level of task complexity by increasing the number of decision alternatives or by increasing the total amount of information in the immediate environment to distract the participants (Driver & Streufert, 1969). The manipulation in this study did not allow for increasing levels of task complexity; rather, the task was represented as either simple or complex. Thus, respondents at each task complexity level did not experience any type of information change, and had constant levels of uncertainty. As a result, cognitively simple groups involved in this experiment may have had an easier time adapting to the complexity level of the Winter Survival Task. Consequently, the complex version of the Winter Survival task may have not actually been at the optimal level for cognitively complex groups, which would have lead to the greatest significant differences between the two levels of group cognitive complexity.

A second explanation for the lack of support for this hypothesis may relate to the amount of task variability between the simple and the complex task. The Winter Survival Task was used for both the simple and complex version. This allowed for a test of the effects of task complexity without changing the nature of the task.

Manipulation checks indicated that groups perceived a significant variation in the complexity of the Winter Survival Task. This perceived variation, however, does not rule out the possibility that both versions (8-item and 15-item) of the Winter Survival Task could be complex. Because the Winter Survival Task has been reported in previous research as having similar characteristics of a complex managerial decision, changing the number of items from 15 to eight may not have simplified this task; it may have instead changed the task from complex to moderately complex. Thus, low task complexity may not have been obtained, resulting in an inability to examine performance in cognitively simple groups working on a simple task.

A third explanation for the failure to obtain a difference in task performance may be related to the components of environmental complexity. Researchers of interactive complexity have used task complexity, time pressure, and information load to represent environmental complexity. Like previous research, this study used only task complexity to create an environment of uncertainty. Perhaps task complexity by itself does not sufficiently represent environmental complexity. The other components of environmental complexity addressed in previous research -

time pressure and information load - may be needed to create variations in environmental complexity.

Hypothesis three. The third hypothesis predicted that there would be an interaction effect between group cognitive complexity and group structure (centralized-decentralized) on task performance. Previous research has proposed that participation (e.g., a decentralized structure) should have a modest, but positive, effect on task performance as group members are cognitively complex (e.g., Merron et al., 1987). Results indicated, however, no significant variation in task performance between cognitively simple and cognitively complex groups within either a centralized or a decentralized group structure. One explanation for the lack of significance may be related to the short amount of time spent by group members within the particular structure. Group members may not have experienced the various process factors in their group as they would if they were in a group for a longer length of time. Process factors such as conformity, group think, and high levels of conflict may take many months to develop in groups. Thus, over a longer period of time, groups with higher cognitive complexity levels in a decentralized structure may become more proficient than their cognitively simple groups at effectively handling these process loss factors.

Additionally, cognitively simple groups may become more suited to a centralized structure once an emergent structure develops more distinct characteristics.

A second explanation for the lack of support for hypothesis three may be related to the requirements placed on the leaders in groups with a centralized structure. These leaders were appointed, and responsible for making the final decision. Any communication between the leaders and their group members was private (i.e., the other member could not hear the conversation). The leader's cognitive complexity level may have been more significant to the group's performance than the other two members of the group. Even though the leaders' cognitive complexity levels were similar to the rest of the group, one individual may become overloaded with information more quickly than the total group. The leader may have experienced a saturation of information; whereas, the group may not have felt this overburden. Consequently, the leader's cognitive complexity may be a better indicator of group performance in a centralized structure than the group's cognitive complexity.

Hypothesis four. Hypothesis four predicted that an interaction between task complexity and group structure would affect task performance. Past research has shown that decentralized group structures (as compared to centralized)

have more of an effect on satisfaction than on task performance (Locke & Schweiger, 1979). Performance within a group with a decentralized group structure, however, should be greater with a complex task than with a simple task; though there has not been as much objective data to support this proposition. The results of this study did not indicate an interaction effect between task complexity and group structure on task performance. The possible explanations given previously for the manipulations of task complexity and group structure may have influenced the results of task performance.

Hypothesis five. Hypothesis five predicted that task complexity, group structure, and group cognitive complexity would interact to affect task performance. Like the two-way interaction, this hypothesis was not supported. As indicated by previous researchers (Fiedler, 1967, 1986), it is possible that the task and group structure variables actually reduced the importance of member cognitive complexity and its effect on group performance. In group research, task type and group structure tend to overwhelm individual differences in satisfaction and task effectiveness (McGrath, 1984). Thus, in future research, the experimenter may need to obtain more of a variation in the group cognitive complexity scores. This could be done

by only using the extreme upper and lower group cognitive complexity scores. Consequently, the number of groups tested would have to increase to maintain the appropriate statistical power.

Hypotheses six. The effects of group cognitive complexity, task complexity, and group structure on task satisfaction also were analyzed in this study. Previous research has discovered a relationship between the level of group conflict and task satisfaction. The optimal level of conflict for groups to have the highest levels of satisfaction will depend on the group's cognitive complexity. Because cognitively complex groups should be able to handle greater amounts of conflict, it was proposed that they would be most satisfied with a complex task. In addition, because a decentralized structure is more likely to have characteristics of high conflict levels, cognitively complex groups should thrive in this type of structure.

Hypothesis six specifically predicted that the interaction between group cognitive complexity and task complexity would affect task satisfaction. No support was obtained for this hypothesized relationship. As mentioned previously, the complex version of the Winter Survival Task may not have provided cognitively complex groups with the optimal level of conflict and ultimately group members may

not have experienced the optimal level of activation. The same could be said about cognitively simple groups working on less complex tasks. If the match between group cognitive complexity and task complexity was not obtained, the predicted relationship would not have been detected.

Hypothesis seven. This hypothesis predicted an interaction effect of group cognitive complexity and group structure on task satisfaction. Research has had mixed results on the effect of group structure on task satisfaction (e.g., Harshberger, 1971).

To try to uncover potential reasons for these inconsistent results, cognitive complexity was measured for its effect on group structure. It was proposed that a group's cognitive complexity may need to match the structure of the group. Specifically, a cognitively complex group may require a decentralized structure in order to reach the optimal level of conflict, activation, and communication pattern. In contrast, a cognitively simple group with a decentralized structure may suffer from poor coordination of information and ultimately extreme conflict and activation levels. When there is a mismatch in the group's structure and the group's cognitive complexity, dissatisfaction with the task is likely to follow.

The analysis did not support this hypothesis. Those groups with a centralized group structure may have experienced high task satisfaction at the leadership position, whereas, overall group satisfaction may have been quite low. Because the imposed group structure may not have given group members the time to develop any rapport with their leader, their satisfaction level may not have been affected. Moreover, since the leader is the central communicator, their satisfaction with the level of participation may be greater than other members in the group. For these reasons, cognitively simple groups may not be as satisfied with a centralized structure as was predicted by the hypothesis. In addition, it may be assumed that the lower performance of cognitively simple groups lead to overall lower task satisfaction scores regardless of the type of group structure.

Hypothesis eight. Hypothesis eight predicted that the interaction between task complexity and group structure would affect task satisfaction. As in previous research (Campbell & Gingrich, 1986), this study indicated that an increase in information exchange fostered by participation (decentralized structure) lead to greater satisfaction when the task was complex than when the structure was centralized; thus, supporting the hypothesis. Because a

free-flow of information allowed decentralized groups to handle the high level of conflict inherent in a complex task, the satisfaction levels were highest when groups performed a complex task in a decentralized structure.

Hypothesis nine. Analysis of hypothesis nine produced a significant three-way interaction effect of group cognitive complexity, task complexity, and group structure on satisfaction. It was predicted that a match between group cognitive complexity, task complexity and group structure would lead to the highest levels of task satisfaction. For example, a cognitively complex group performing a complex task should be most satisfied with a decentralized structure, whereas a cognitively simple group performing a simple task should be most satisfied with a centralized structure. Results indicated that regardless of the cognitive complexity of groups, all groups preferred a complex task with a decentralized structure. A three-way significant interaction was obtained, but not as predicted. Specifically, groups composed of cognitively simple members were significantly more satisfied with a complex task and a decentralized structure than were cognitively simple groups in a less complex task with a decentralized structure. No other differences between conditions were significant.

This result may be explained by the needs of cognitively simple groups (Suedfeld & Streufert, 1966). It is possible that cognitively simple groups may not be able to adapt to situations where there is not enough information and participation given to solve a problem. There is inherent complexity in the Winter Survival task in that each of the items can be used in conjunction with the other items for survival purposes. It is possible that the task with fewer items may have caused cognitively simple groups difficulty in performing with suboptimal information. Furthermore, the centralized structure of their groups did not provide a lot of additional input from the other group members. Stated differently, when a cognitively simple group received a complex Winter Survival Task in a decentralized structure, they had more items to choose from as well as more participation from others, making their decisions less stressful. On the contrary, the cognitively complex groups may be better able to adapt to making decisions with suboptimal information and limited in participation from group members (centralized structure).

A second explanation for the significant three-way interaction may lie in the definition of a cognitively complex group. It has been stated that complex groups possess greater flexibility than simple groups (Barron,

1953). Likewise, complex groups have been shown to have more tolerance of various group structures and levels of task complexity and thus, will have less variation in their task satisfaction scores. On the contrary, cognitively simple groups will not be as tolerant to ambiguity, and, therefore, will not be satisfied with a mismatch between group structure and task complexity. Thus, cognitively simple groups had significantly higher satisfaction levels with a complex task and a decentralized group structure (match), but not with a less complex task with a decentralized group structure (mismatch).

In summary, significant results were reported for cognitively simple groups. Cognitively simple groups had the highest levels of satisfaction when performing a complex task in a decentralized structure. Further research should help to uncover the explanation for these results and help to answer the following questions. Do cognitively simple groups actually prefer a complex task in a decentralized group structure? Or, is it their cognitive structure that does not allow them to adapt to the other combinations?

Theoretical Contributions

Cognitive research on decision-making has focused on cognitive processes and structures rather than on individual or group differences in cognition (Ginsberg, 1990; Schwenk,

1988). This research advances complexity theory by studying the relationship between group cognitive complexity and task performance and satisfaction in a laboratory setting. This research is one of the first studies to prescreen the subjects' cognitive complexity and create groups with different profiles of cognitive complexity. Additionally, it is one of the first to manipulate group cognitive complexity, task complexity and group structure to investigate these effects on task performance and satisfaction. Because previous theory has defined work group effectiveness in terms of both productivity and employee satisfaction (Gladstein, 1984; Hackman, 1987, Sundstrom et al., 1990), this study may be more methodologically sound than those measuring either productivity or satisfaction but not both. Furthermore, previous research has been correlational leading to problems of self-reports. The experimental design used in this research removes this problem and enables the assessment of cause-effect relationships to a degree.

Results obtained advance research in the relationship between group cognitive complexity and task performance. Groups containing cognitively complex individuals outperformed noncomplex groups without regard to the complexity of the task or the structure of the group. One

explanation for the poor performance of the cognitively simple groups may be their over-reliance on cognitive scripts. Cognitively simple groups are more apt to "go on automatic" and cognitively detach themselves from their work (Ashforth & Fried, 1988), and if these automatic scripts are inappropriate, performance will be detrimental.

Furthermore, automatic script processing will inhibit creativity and innovation, and work is carried out using routine procedures rather than a problem-solving approach. Thus, noncomplex groups may be more likely to reach a decision by majority rule. Even though results did not support the interaction of task complexity and group structure with group cognitive complexity, the effects of these variables on a group's performance may become more apparent with a larger sample of groups. Consequently, various levels of task complexity and group structure need further investigation as possible explanations for the poor performance of noncomplex groups.

This study also advances research on group cognitive complexity and its relationship to task satisfaction. Results indicate that task complexity and group structure interacted with cognitive complexity to affect task satisfaction. The relationship between group cognitive complexity and task satisfaction can be explained through

activation theory. A person's activation level is related directly to the intensity, variation, uncertainty, and meaningfulness of the stimulus (Scott, 1966). Furthermore, activation theory predicts that individuals subject to monotonous tasks are apt to actively seek distractions from their work such as kibitzing, gossiping, flirting, and daydreaming (Gardner, 1986). Groups, like individuals, should seek to maintain a constant level of arousal. In this study, groups with the highest level of task satisfaction performed a complex task in a decentralized group structure. Results also suggested that groups with low cognitive complexity preferred a complex task with a decentralized structure. This may indicate that groups that were not cognitively complex were more sensitive to a mismatch in task complexity and group structure. Consequently, one may not be able to assume that noncomplex groups prefer a centralized group structures or simple tasks. Perhaps what they really prefer is congruence between environmental conditions. Cognitively complex individuals may not be affected by incongruent environmental conditions because of their tolerance for ambiguity. Further research needs to be done in this area to better explain the effect of these variables on task satisfaction.

Practical Implications

An important issue related to the increasing use of groups in organizations is how to structure groups to maximize performance and satisfaction (Druckman & Bjork, 1991). This research suggests a number of implications for the improved use of groups in the work organization.

First, a group's composition (cognitive complexity) may explain when certain groups are more productive than others. Attempts to upgrade the performance and satisfaction of groups may require a focus on training groups to adapt their complexity levels to the dynamics and complexities of the task as well as the structure of the group (Hall & Watson, 1970; Van den Ven & Delbecq, 1974). The first step in such training may be to assess team members' cognitive complexity. This assessment may be useful for screening prospective team leaders and for determining whether existing leaders would benefit from complexity training (Bartunek et al., 1983). The next step may require training in the use of decision-making procedures such as dialectical inquiry, devil's advocacy, nominal group technique, and brainstorming. By improving group members' skills in critical evaluation, they may increase their cognitive complexity; thus, they would be equipped to

successfully perform across a wider range of task complexity levels.

Second, the structure of a group (centralized vs. decentralized) may suggest why certain groups are more productive than others. From this study, it can be stressed that participation (a decentralized group structure) should not be viewed as the preferred management approach for all situations. A decentralized group structure may work best when employees have the relevant cognitive complexity or the task is a relatively complex one. Furthermore, managers must be very aware of how a mismatch between group structure and task complexity is perceived by team members. A mismatch (e.g., complex task with a centralized group structure) may have detrimental effects on task satisfaction for group's with low levels of cognitive complexity.

Third, the complexity of the task will likely influence a group's effectiveness. Previous research has indicated that complex tasks can create additional information-processing demands (Lord & Maher, 1990). One purpose of this study was to determine if high levels of group cognitive complexity would help alleviate some of the processing demands placed on individuals in a complex task. The results suggested that to improve group satisfaction, managers may need to create challenging tasks in decentralized group structures

for all groups regardless of their complexity levels. This could be done by setting challenging goals even for simple tasks, enriching the task design to make it more challenging, or by introducing methods to increase levels of individual participation.

Limitations

Although this research provided some advantages over previous studies, there are several limitations. First, the issue of external validity needs to be addressed. In assessing external validity, the subject population is a crucial factor. This laboratory study uses novices to perform a task that was developed for the training of groups in the consequences of process loss in decision making. Because group cognitive complexity may exist in all groups and the concern is with the effect of any type of task, a generalization of this study can be made from the laboratory to the field. Furthermore, laboratories have provided valid research results in decision-making studies utilizing individual cognitive capabilities (Schweiger & Sandberg, 1989; Walsh et al., 1988).

A second limitation may be with the measurement at the group level of analysis. Aggregation of individual data to the group level of analysis has been a controversial issue. Previous literature has suggested that the effect of such

aggregation depends on the purpose of the study (Schneider & Angelmar, 1993). Because this study investigated the shared views of the group, aggregation is appropriate. The aggregate measure of group cognitive complexity is sufficient when used to determine how individual contributions combine to create emergent group properties. Furthermore, aggregation of satisfaction and performance data is common in research, even though the practice is not without criticism (Roberts, Hulin, & Rousseau, 1978). Finally, many authors have suggested that the meaning of these variables does not change from the individual to the group perspective (Van de Ven & Ferry, 1980).

A third limitation found in this study is a potential problem with method bias in that group structure was manipulated in one way. Another possible way to manipulate group structure is to vary such factors as expertise, aggressiveness, power and status of one or more group members. These factors would change the hierarchy of groups from democratic to autocratic. Experimenters could allow a group structure to emerge without forcing a particular structure on the group. Although "real" groups may not spontaneously adopt the structures manipulated in this study, they were recognized by subjects as intended.

A fourth limitation relates to the existing knowledge structures of the groups, which may have played a part in the accuracy of the decision in the Winter Survival Task. The life experiences, as well as the experience with this type of task, may have biased the results. According to Campbell (1988), a person's familiarity with the task, his or her short-term memory, span of attention, and time constraints can moderate the relationship between objective and experienced complexity of a task. That is, a cognitively complex person may not have perceived the complex version of the Winter Survival task to be complex as a cognitively simple person. If this occurred, then the tasks were not necessarily equivalent leading to difficulty in interpretation of the results.

Future Research

The first requirement for future research is to establish the construct validity of group cognitive structure. This would include developing a model of the antecedents of a group's cognitive structure. For example, various task characteristics and the importance of a task could be investigated for their effect on group cognitive structures (Klimoski and Mohammed, 1994). In addition, the extent to which individual's internalize the group's goals as their own may affect differences in a group's cognitive

structure. Finally, more research on the affects of personality characteristics (i.e., cognitive complexity) on group cognitive structure needs to be considered.

A second area that needs significantly more research is the relationship between group cognitive complexity and group strategies. Effective group performance by cognitively complex groups may be attributed to the type of strategy pursued by these groups (Ginsberg, 1989;1990). Strategies used by groups also may be affected by the complexity of the task and the structure of the group. Yetton and Bottger (1982) noted that team effectiveness in performing the NASA Moon problem was enhanced by the use of a best-member strategy (the adoption of the decision of the most knowledgeable member). Yet, this type of strategy may not be best for all levels of cognitive complexity, task complexity, or group structure. For example, with a complex decision-making task, a group may be more effective by having many different perspectives from group members to arrive at complete coverage of the problem. Complete coverage and competent strategic analysis of a problem may be best obtained by groups containing all cognitively complex individuals. Experimenters should investigate the various group strategies used and their relationship between the cognitive complexity of group members and group

performance for both simple and complex tasks in centralized and decentralized structures (Hendrick, 1979; Stone, et al., 1994).

A third area of research that warrants further investigation is the relationship between cognitive complexity and group leadership. Specifically, the influence of a dominant group member or group leader on the group's performance may be the result of his/her level of cognitive complexity. Previous research has indicated that leaders with high cognitive complexity scores tend to have better performance and more variable behavior than leaders with low cognitive complexity scores (Mitchell, 1972). High complexity scores could have been detrimental to the group's score, however, depending on the type of task or structure of the group. A person's ability to make fine differentiations might lead to irrelevant behavior on the part of the leader in a particular situation.

There also is a need to continue research on the relationship between group cognition and performance. This research could expand on the argument of coverage/consensus proposed by Walsh et al. (1988). They suggested that it might be advisable to have greater coverage when problems are complex to reflect a maximum number of possible perspectives. Greater consensus, however, might be

advisable for easier and faster implementation of decisions (Walsh & Ungson, 1991; Ginsberg, 1990). Walsh and colleagues concluded that an understanding of a group's coverage and consensus may be related to group decision performance. Other team performance indicators such as willingness to take risk, confidence levels, and trust could be measured as consequences of group cognition.

Finally, a pretest and posttest measurement could be used to assess the effects of training on the development of group cognitive complexity. Training in perceptions of multiple causes of events or in the ability to make productive use of dissent techniques would potentially change the level of individual or group cognitive complexity (Bartunek, Gorden, & Weathersby, 1983).

In closing, this experiment should be replicated, and extended into other settings where subjects (such as CEOs) may have had the opportunity to develop their levels of cognitive complexity. In addition, a larger sample size may be required to improve the statistical power of the analysis. Other group level measures of task satisfaction (consensus rating) and performance should be examined, and other task should be examined for the opportunity to perhaps improve the task complexity manipulation.

Chapter Summary

The purpose of this study was to expand on the research in the area of group cognitive complexity. Specifically, a model was proposed and hypotheses developed that investigated the relationship between group cognitive complexity, task complexity, group structure, and task performance and satisfaction.

Two of the nine hypothesized relationships in the study were supported. The first hypothesis that was supported was that groups with cognitively complex members outperformed noncomplex groups on the Winter Survival Task. The second hypothesis that was supported indicated that groups were most satisfied with a complex task and a decentralized group structure. Finally, this research found that cognitively simple groups differed significantly in their satisfaction with the task between conditions of a complex task in a decentralized group structure and complex task in a centralized structure, or with a simple task in any structure.

The first section of this paper provided a summary and explanation of the results. Each hypothesis was briefly summarized and possible reasons for the results were listed. In the second section, practical implications of this study were presented. Then, in the third section of this chapter

theoretical implications were given. This was followed by a discussion of the various limitations and suggestions for further research.

APPENDIX A
WINTER SURVIVAL TASK

Purpose

The purpose of this exercise is to compare the effectiveness of four different methods of making decisions. Three of the methods do not utilize group discussion; the fourth one does. The methods compared are (1) decision by averaging members' opinions, (2) decision by expert member, (3) decision by most competent member as perceived by the group, and (4) group consensus. The exercise takes approximately 1 hour. The materials need are as follows:

- A description of the situation and individual decision forms.
- A group summary sheet for group's decisions.
- Instructions.
- A summary table (for experimenter's use only).

Procedure

The coordinator for the exercise should use the following procedure.

1. State that the objectives of the exercise are to demonstrate the advantages and disadvantages of group decision making, and to explore factors that influence and affect group decision making. Set the stage by pointing out that group decision making is one of the most significant aspects of group functioning; that most consequential decisions are made by groups rather than individuals; that though many decisions are routine, others are extremely crucial; and that participants in this exercise are now in a situation where the decisions they make as a group may determine whether or not they survive.
2. Have individuals read the "Winter Survival Situation," and rank the items in order of importance.
3. Pass out the score sheet. Have the individuals transfer their rankings to the score sheet.
4. Have the groups reach a consensus on the rank of items according to their importance.
5. Read the survival experts' ranking and have the experimenter post the experts' rankings to the individual score sheets.

Expert Rankings

- 1 _ Cigarette lighter (without fluid)
 - 2 _ Ball of steel wool
 - 3 _ Extra shirt and pants for each survivor
 - 4 _ Can of shortening
 - 5 _ Twenty-by-twenty-foot piece of heavy-duty canvas
 - 6 _ Hand ax
 - 7 _ Family-size chocolate bar (one per person)
 - 8 _ Newspapers (one per person)
 - 9 _ Loaded .45-caliber pistol
 - 10 _ Knife
 - 11 _ Compress kit (with 28-ft., 2-in gauze)
 - 12 _ Two ski poles
 - 13 _ Quart of 100-proof whiskey
 - 14 _ Sectional air map made of plastic
 - 15 _ Compass
6. The experimenter will calculate the group accuracy score by taking the difference between the group ranking and expert ranking. Post the absolute value in the group accuracy column. Add the totals to get the differences.
 7. To arrive at an average member's score, total all members' scores for each group and divide by the number of members
 8. Enter the scores of the most accurate group members.

9. Enter the scores of the most competent member as perceived by the group.

Item Explanations

1. Cigarette Lighter (Without Fluid):

- ▶ Gravest danger facing the group is exposure to the cold.
- ▶ Greatest need is for a source of warmth.
 - building a fire the first order of business
- ▶ Second greatest need is for signaling devices.
 - fire will provide smoke for daytime signaling
 - fire will provide firelight for nighttime signaling

Without matches something is needed to produce sparks to start a fire. Even without fluid the cigarette lighter can be used to produce sparks.

2. Ball of Steel Wool:

- ▶ Steel wool is the best, substance with which to catch a spark and support a flame

To make a fire, the survivors need a means of catching the sparks made by the cigarette lighter.

3. Extra Shirt and Pants for Each Survivor:

- ▶ Clothes: the most versatile item in a situation like this. Clothes can be used for:

adding warmth to the body, shelter, signaling, bedding, bandages, string when unraveled, tinder to make fires, and maps can be drawn on them.

- ▶ The versatility of clothes and the need for fires, signaling devices, and warmth make these items third in importance.

4. Can of Shortening: This item has many uses

- ▶ a mirror like signaling device can be made from the lid. (the lid can be shined with the steel wool)

If the survivors had no other means of signaling than this, they would still have a better than 80 percent chance of being rescued within the first twenty-four hours.

- ▶ shortening can be rubbed on exposed areas of the body for protection from the cold.
- ▶ In desperation it could be eaten in small amounts..
- ▶ When melted into an oil the shortening is helpful in starting fires.
- ▶ When soaked into a piece of cloth, melted shortening will produce an effective candlewick. The can is useful for melting snow to produce drinking water.
- ▶ The can is also useful as a cup.

5. Twenty-by-Twenty-Foot Piece of Heavy-Duty Canvas:

- ▶ The canvas can be part of a shelter, protecting the survivors from the wind and possible snow.
- ▶ Rigged as a wind screen, it could hold heat.

The cold makes some form of shelter necessary.

- ▶ Its squareness, contrasting with the surrounding terrain, might also be spotted in an air search, and this makes it an important signaling device.

6. Hand ax:

- ▶ useful in obtaining wood to maintain the fire
- ▶ useful for clearing a sheltered campsite, cutting boughs for ground insulation, and constructing a frame for the shelter.

7. Family-Size Chocolate Bars (One Per Person):

- ▶ Chocolate will supply the energy to sustain them for some time.

Because it contains mostly carbohydrates, it supplies energy without making digestive demands upon the body.

8. Newspapers (One Per Person):

- ▶ useful for starting a fire
- ▶ is an insulator: when rolled up and placed under the clothes around a person's legs and arms, it provides dead-air space for extra protection from the cold.

- ▶ survivors can use the paper for recreation by reading it, memorizing it.
- ▶ roll newspaper into a cone and yell through it as a signaling device.
- ▶ spread it around an area to help signal a rescue party.

9. Loaded .45-Caliber Pistol:

- ▶ a sound-signaling device.

There have been numerous cases of survivors going undetected because they were too weak to make a loud enough noise to attract attention.

10. Knife. A knife is a versatile tool, but it is not too important in the winter setting. It could be used for cutting rope into desired lengths, making shavings from pieces of wood for tinder and many other uses could be thought up.

11. Compress kit (with gauze). The best use of this item is to wrap the gauze around exposed areas of the body for insulation. Feet and hands are probably the most vulnerable to frostbite, and the gauze can be used to keep them warm. The gauze can be used as a candlewick when dipped into melted shortening. It would also make effective tinder.

The small supply of gauze is the reason this item is ranked so low.

12. Ski poles. Although they are not very important, the poles are useful as a flag pole or staff for signaling. They can be used to stabilize a person walking through the snow to collect wood, and to test the thickness of the ice on a lake shore or stream. Probably their most useful function would be as supports for a shelter or by the fire as a heat reflector.
13. Quart of 85-proof whiskey. The only useful function of the whiskey is to aid in fire building or as fuel. A torch could be made from a piece of clothing soaked in the whiskey and attached to an upright ski pole. The danger of the whiskey is that someone might try to drink it when it is cold. Whiskey takes on the temperature it is exposed to, and a drink of it at minus thirty degrees would freeze a person's esophagus and stomach and do considerable damage to the mouth. Drinking it warm will cause dehydration. The bottle, kept warm, would be useful for storing drinking water.
14. Sectional air map made of plastic. This item is dangerous because it will encourage individuals to

attempt to walk to the nearest town -- thereby condemning them to almost certain death.

15. Compass. Because the compass may also encourage some survivors to try to walk to the nearest town, it too is a dangerous item. The only redeeming feature of the compass is the possible use of its glass top as a reflector of sunlight to signal search planes, but it is the least effective of the potential signaling devices available. That it might tempt survivors to walk away from the crash site makes it the least desirable of the fifteen items.

Winter Survival Correct Answer Rationale

Mid-January is the coldest time of the year in Minnesota and Manitoba. The first problem the survivors face, therefore, is to preserve their body heat and protect themselves against its loss. This problem can be met by building a fire, minimizing movement and exertion, using as much insulation as possible, and constructing a shelter.

The participants have just crash-landed. Many individuals tend to overlook the enormous shock reaction this has upon the human body, and the death of the pilot and copilot increases the shock. Decision making under such conditions is extremely difficult. Such a situation requires a strong emphasis upon the use of reasoning, not only for making decisions, but also for reducing the fear and panic every survivor would naturally feel. Shock is manifested in feelings of helplessness, loneliness, and hopelessness as well as in fear. These feelings have brought about more fatalities than perhaps any other cause in survival situations. Through the use of reasoning, hope for survival and the will to live can be generated. Certainly the state of shock means that the movement of the survivors should be at a minimum and that an attempt to calm them should be made.

Before taking off, a pilot always has to file a flight plan. The flight plan contains the vital information regarding the flight, such as the course, speed, estimated time of arrival, type of aircraft, and number of persons on board. Search-and-rescue operations would begin shortly after the failure of the plane to appear at its destination at its estimated time of arrival.

The twenty miles to the nearest known town is a long walk even under ideal conditions, particularly if one is not used to walking such distances. Under the circumstances of being in shock, being dressed in city clothes, and having deep snow in the woods and a variety of water barriers to cross, to attempt to walk out would mean almost certain death from freezing and exhaustion. At temperatures of minus twenty-five to minus forty degrees, the loss of body heat through exertion is a very serious matter.

Once the survivors have found ways in which to keep warm, their immediate problem is to attract the attention of search planes and search parties. Thus, all of the items the group has salvaged must be assessed for their value in signaling the group's whereabouts.

WINTER SURVIVAL EXERCISE

Name _____ ID# _____

You have just crash-landed in the woods of Northern Minnesota and Southern Manitoba. It is 11:32 A.M. in mid-January. The light plane in which you were traveling crashed on a lake. The pilot and copilot were killed. Shortly after the crash, the plane sank completely into the lake with the pilot's and copilot's bodies inside. None of you are seriously injured and you are all dry.

The crash came suddenly, before the pilot had time to radio for help or inform anyone of your position. Since your pilot was trying to avoid a storm, you know the plane was considerably off course. The pilot announced shortly before the crash that you were twenty miles northwest of a small town that is the nearest known habitation.

You are in a wilderness area made up of thick woods broken by many lakes and streams. The snow depth varies from above the ankles in windswept areas to knee deep where it has drifted. The last weather report indicated that the temperature would reach minus twenty-five degrees Fahrenheit in the daytime and minus forty at night. There are plenty of dead wood and twigs in the immediate area. You are dressed in winter clothing appropriate for city wear--suits, pantsuits, street shoes, and overcoats.

You may assume that the number of passengers is the same as the number of persons in your group and that the group has agreed to stick together.

While escaping from the plane, several members of your group salvaged twelve items. Your task is to rank these items according to their importance to your survival, starting with 1 for the most important item and ending with 15 for less complex conditions) for the least important one.

Simple Version

Rank the following items according to their importance to your survival (1 is the most important and 8 is the least important)

- _____ Loaded .45-caliber pistol
- _____ Sectional air map made of plastic
- _____ Extra shirt and pants for each survivor
- _____ Can of shortening
- _____ Family-size chocolate bar (one per person)
- _____ Knife
- _____ Two ski poles
- _____ Compress kit (with 28-ft., 2-in. gauze)

Complex Version

Rank the following items according to their importance to your survival (1 is the most important and 15 is the least important)

- _____ Ball of steel wool
- _____ Newspapers (one per person)
- _____ Compass
- _____ Hand ax
- _____ Cigarette lighter (without fluid)
- _____ Loaded .45-caliber pistol
- _____ Sectional air map made of plastic
- _____ Twenty-by-twenty-foot piece of heavy-duty canvas
- _____ Extra shirt and pants for each survivor
- _____ Can of shortening
- _____ Quart of 100-proof whiskey
- _____ Family-size chocolate bar (one per person)
- _____ Knife
- _____ Two ski poles
- _____ Compress kit (with 28-ft., 2-in. gauze)

APPENDIX B

ROLE CONSTRUCT REPERTORY GRID TEST

Instructions:

1. At the top of each of the following ten pages is a description of a person. In the blank provided on each page, write the name of the person who matches the description. If you cannot remember the name, but do remember the person, simply make a check mark or some other note of identification. If you cannot remember the person, substitute the name of a person whom the description suggests to you. Do not repeat names. If a description appears to call for a duplicate name, substitute the name of another person whom the second description suggests to you.
2. On each page is a list of 10 adjective scales that can be used to describe each person. Rate each person on each of the ten adjective scales. Do so by checking the appropriate space along the scale provided. Continue this process until all 10 people have been rated on all 10 adjective scales.

1. Write your mother's first name here or the person who
has played the part of a mother in your life.

Pessimistic	____ ____ ____ ____ ____ ____ ____ ____	Optimistic
Sociable	____ ____ ____ ____ ____ ____ ____ ____	Unsociable
Wise	____ ____ ____ ____ ____ ____ ____ ____	Foolish
Humorous	____ ____ ____ ____ ____ ____ ____ ____	Serious
Insensitive	____ ____ ____ ____ ____ ____ ____ ____	Sensitive
Shy	____ ____ ____ ____ ____ ____ ____ ____	Outgoing
Warm	____ ____ ____ ____ ____ ____ ____ ____	Cold
Impulsive	____ ____ ____ ____ ____ ____ ____ ____	Deliberate
Dull	____ ____ ____ ____ ____ ____ ____ ____	Exciting
Argumentative	____ ____ ____ ____ ____ ____ ____ ____	Passive

2. Write your father's first name here or the person who
has played the part of a father in your life.

Pessimistic	____ ____ ____ ____ ____ ____ ____ ____	Optimistic
Sociable	____ ____ ____ ____ ____ ____ ____ ____	Unsociable
Wise	____ ____ ____ ____ ____ ____ ____ ____	Foolish
Humorous	____ ____ ____ ____ ____ ____ ____ ____	Serious
Insensitive	____ ____ ____ ____ ____ ____ ____ ____	Sensitive
Shy	____ ____ ____ ____ ____ ____ ____ ____	Outgoing
Warm	____ ____ ____ ____ ____ ____ ____ ____	Cold
Impulsive	____ ____ ____ ____ ____ ____ ____ ____	Deliberate
Dull	____ ____ ____ ____ ____ ____ ____ ____	Exciting
Argumentative	____ ____ ____ ____ ____ ____ ____ ____	Passive

3. Write the name of your sister who is nearest your own age. If you have no sister, write the name of the person who is most like one.

Pessimistic	____ ____ ____ ____ ____ ____ ____ ____	Optimistic
Sociable	____ ____ ____ ____ ____ ____ ____ ____	Unsociable
Wise	____ ____ ____ ____ ____ ____ ____ ____	Foolish
Humorous	____ ____ ____ ____ ____ ____ ____ ____	Serious
Insensitive	____ ____ ____ ____ ____ ____ ____ ____	Sensitive
Shy	____ ____ ____ ____ ____ ____ ____ ____	Outgoing
Warm	____ ____ ____ ____ ____ ____ ____ ____	Cold
Impulsive	____ ____ ____ ____ ____ ____ ____ ____	Deliberate
Dull	____ ____ ____ ____ ____ ____ ____ ____	Exciting
Argumentative	____ ____ ____ ____ ____ ____ ____ ____	Passive

4. Write the name of your brother who is nearest your own age. If you have no brother, write the name of the person who is most like one.

Pessimistic	____ ____ ____ ____ ____ ____ ____ ____	Optimistic
Sociable	____ ____ ____ ____ ____ ____ ____ ____	Unsociable
Wise	____ ____ ____ ____ ____ ____ ____ ____	Foolish
Humorous	____ ____ ____ ____ ____ ____ ____ ____	Serious
Insensitive	____ ____ ____ ____ ____ ____ ____ ____	Sensitive
Shy	____ ____ ____ ____ ____ ____ ____ ____	Outgoing
Warm	____ ____ ____ ____ ____ ____ ____ ____	Cold
Impulsive	____ ____ ____ ____ ____ ____ ____ ____	Deliberate
Dull	____ ____ ____ ____ ____ ____ ____ ____	Exciting
Argumentative	____ ____ ____ ____ ____ ____ ____ ____	Passive

5. Write the name of a teacher you liked or the teacher of
a subject you liked.

Pessimistic	____ ____ ____ ____ ____ ____ ____ ____	Optimistic
Sociable	____ ____ ____ ____ ____ ____ ____ ____	Unsociable
Wise	____ ____ ____ ____ ____ ____ ____ ____	Foolish
Humorous	____ ____ ____ ____ ____ ____ ____ ____	Serious
Insensitive	____ ____ ____ ____ ____ ____ ____ ____	Sensitive
Shy	____ ____ ____ ____ ____ ____ ____ ____	Outgoing
Warm	____ ____ ____ ____ ____ ____ ____ ____	Cold
Impulsive	____ ____ ____ ____ ____ ____ ____ ____	Deliberate
Dull	____ ____ ____ ____ ____ ____ ____ ____	Exciting
Argumentative	____ ____ ____ ____ ____ ____ ____ ____	Passive

6. Write the name of a teacher you disliked or the teacher
of a subject you disliked.

Pessimistic	____ ____ ____ ____ ____ ____ ____ ____	Optimistic
Sociable	____ ____ ____ ____ ____ ____ ____ ____	Unsociable
Wise	____ ____ ____ ____ ____ ____ ____ ____	Foolish
Humorous	____ ____ ____ ____ ____ ____ ____ ____	Serious
Insensitive	____ ____ ____ ____ ____ ____ ____ ____	Sensitive
Shy	____ ____ ____ ____ ____ ____ ____ ____	Outgoing
Warm	____ ____ ____ ____ ____ ____ ____ ____	Cold
Impulsive	____ ____ ____ ____ ____ ____ ____ ____	Deliberate
Dull	____ ____ ____ ____ ____ ____ ____ ____	Exciting
Argumentative	____ ____ ____ ____ ____ ____ ____ ____	Passive

7. Write the name of an employer, supervisor, or officer
under whom you served during a period of great stress.

Pessimistic	____ ____ ____ ____ ____ ____ ____ ____	Optimistic
Sociable	____ ____ ____ ____ ____ ____ ____ ____	Unsociable
Wise	____ ____ ____ ____ ____ ____ ____ ____	Foolish
Humorous	____ ____ ____ ____ ____ ____ ____ ____	Serious
Insensitive	____ ____ ____ ____ ____ ____ ____ ____	Sensitive
Shy	____ ____ ____ ____ ____ ____ ____ ____	Outgoing
Warm	____ ____ ____ ____ ____ ____ ____ ____	Cold
Impulsive	____ ____ ____ ____ ____ ____ ____ ____	Deliberate
Dull	____ ____ ____ ____ ____ ____ ____ ____	Exciting
Argumentative	____ ____ ____ ____ ____ ____ ____ ____	Passive

8. Write the name of your wife (husband) or, if you are not married, your closest present girl (boy) friend.

Pessimistic	____ ____ ____ ____ ____ ____ ____ ____	Optimistic
Sociable	____ ____ ____ ____ ____ ____ ____ ____	Unsociable
Wise	____ ____ ____ ____ ____ ____ ____ ____	Foolish
Humorous	____ ____ ____ ____ ____ ____ ____ ____	Serious
Insensitive	____ ____ ____ ____ ____ ____ ____ ____	Sensitive
Shy	____ ____ ____ ____ ____ ____ ____ ____	Outgoing
Warm	____ ____ ____ ____ ____ ____ ____ ____	Cold
Impulsive	____ ____ ____ ____ ____ ____ ____ ____	Deliberate
Dull	____ ____ ____ ____ ____ ____ ____ ____	Exciting
Argumentative	____ ____ ____ ____ ____ ____ ____ ____	Passive

9. Write the name of the person whom you have met within the past six months whom you would most like to know better.

Pessimistic	____ ____ ____ ____ ____ ____ ____ ____	Optimistic
Sociable	____ ____ ____ ____ ____ ____ ____ ____	Unsociable
Wise	____ ____ ____ ____ ____ ____ ____ ____	Foolish
Humorous	____ ____ ____ ____ ____ ____ ____ ____	Serious
Insensitive	____ ____ ____ ____ ____ ____ ____ ____	Sensitive
Shy	____ ____ ____ ____ ____ ____ ____ ____	Outgoing
Warm	____ ____ ____ ____ ____ ____ ____ ____	Cold
Impulsive	____ ____ ____ ____ ____ ____ ____ ____	Deliberate
Dull	____ ____ ____ ____ ____ ____ ____ ____	Exciting
Argumentative	____ ____ ____ ____ ____ ____ ____ ____	Passive

10. Write the name of the most successful person whom
you know personally.

Pessimistic	____ ____ ____ ____ ____ ____ ____ ____	Optimistic
Sociable	____ ____ ____ ____ ____ ____ ____ ____	Unsociable
Wise	____ ____ ____ ____ ____ ____ ____ ____	Foolish
Humorous	____ ____ ____ ____ ____ ____ ____ ____	Serious
Insensitive	____ ____ ____ ____ ____ ____ ____ ____	Sensitive
Shy	____ ____ ____ ____ ____ ____ ____ ____	Outgoing
Warm	____ ____ ____ ____ ____ ____ ____ ____	Cold
Impulsive	____ ____ ____ ____ ____ ____ ____ ____	Deliberate
Dull	____ ____ ____ ____ ____ ____ ____ ____	Exciting
Argumentative	____ ____ ____ ____ ____ ____ ____ ____	Passive

APPENDIX C
TASK SATISFACTION SCALE

1. How satisfying was the Winter Survival Task?

1	2	3	4	5	6	7
Not Satisfying At All						Very Satisfying

2. How interesting was the Winter Survival Task?

1	2	3	4	5	6	7
Not Interesting At All					Very Interesting	

3. How enjoyable was the Winter Survival Task?

1	2	3	4	5	6	7
Not Enjoyable At All						Very Enjoyable

4. How bored were you during the Winter Survival Task?

1	2	3	4	5	6	7
Not Bored At All						Very Bored

APPENDIX D
TASK SATISFACTION MEASURE

APPENDIX E

PERCEIVED TASK STIMULATION SCALE

This section requires you to describe the task you performed in terms of the responses you made, the thought required, and the degree to which the task was stimulating. There are also some questions about the degree of control you had over the task.

Some of the questions are difficult to answer. People are not used to describing tasks in terms of the degree to which they are stimulating or not. Nevertheless, please try to answer the questions as best as you can. If you have any problems, please ask the experimenter for help. Also, please indicate your answers by circling the appropriate number on each scale.

1. How much effort was required to perform this task?
 1-----2-----3-----4-----5-----6-----7
 Very much Some Very little
 effort effort effort
2. How complex were the required responses in performing this task?
 1-----2-----3-----4-----5-----6-----7
 Very simple Somewhat Very complex
 complex
3. How similar were the thought processes required for this task to thought processes you needed for other jobs that you have now or had in the past?
 1-----2-----3-----4-----5-----6-----7
 Very similar Some Not similar
 similarity at all
4. How frequently were there times when you did not feel stimulated at all by the task?
 1-----2-----3-----4-----5-----6-----7
 Seldom Often Continuously

12. To what extent must your vision be focused on the task materials in performing this task?

1-----2-----3-----4-----5-----6-----7
 Rarely Sometimes Constantly
 focused focused

13. How intense was the stimulation inherent in this task?

1-----2-----3-----4-----5-----6-----7
 Not intense Somewhat Very
 at all intense intense

14. How much did the stimulation from this task remind you of other jobs you have now or have had in the past?

1-----2-----3-----4-----5-----6-----7
 Not at Somewhat Very much
 all

15. How frequently did you have to think about what you were doing?

1-----2-----3-----4-----5-----6-----7
 Continuously Often Seldom

16. Did you feel free to vary or change the rate at which you performed this task?

1-----2-----3-----4-----5-----6-----7
 Not free Somewhat Very free
 at all free

17. How complex was the stimulation inherent in performing this task?

1-----2-----3-----4-----5-----6-----7
 Very simple Somewhat complex Very complex

18. To what extent did you make a variety of responses in performing this task?

1-----2-----3-----4-----5-----6-----7
 Very much Some Very little
 variety variety variety

19. Did you feel like you could prevent yourself from becoming understimulated (bored, drowsy) while performing this task?

1-----2-----3-----4-----5-----6-----7
Very much Somewhat Not at all

20. Did you feel like you could prevent yourself from becoming overstimulated (excited, overwhelmed) while performing this task?

1-----2-----3-----4-----5-----6-----7
Very much Somewhat Not at all

APPENDIX F

GROUP STRUCTURE MANIPULATION CHECK

Record your answer to each of the items on the answer sheet for the group you are describing. In considering each item go through the following steps

1. Read each item carefully
2. Think about how well the item tells something about your group
3. Find the number on the answer sheet that corresponds with the number of the item you are considering

The questions that follow make it possible to describe objectively certain characteristics of social groups. The items describe characteristics of groups; they do not judge whether the characteristics are desirable or undesirable. Therefore, in no way are the questions to be considered a test either of the group's effectiveness or of the effectiveness of the person answering the questions. We simply want an objective description of what your group is like.

1. The group had well understood, but unwritten rules,
concerning member conduct.

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

2. Members were afraid to express their real opinions.

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

3. Members of the group worked under close supervision

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

4. Only certain kinds of ideas could be expressed freely
within the group.

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

5. A member had to think twice before speaking in the
group's meeting.

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

6. The opinions of all members were considered as equal.

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

7. The group was controlled by the actions of a few member

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

8. Every member of the group enjoyed the same group
privileges

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

9. Certain members of the group had more influence on the
group than others

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

10. Each member of the group had as much power as any
other member

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

11. There was a high degree of participation on the part of members

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

12. Work of the group was left to those who were considered most capable for the job.

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

13. Members were interested in the group but not all of them want to participate

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

14. The work of the group was well divided among members

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

15. Every member of the group did not have a job to do.

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

16. The group was very informal

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

17. A list of rules and regulations were given to each member

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

18. The group was organized along semimilitary lines

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

19. The group had rules to guide its activities

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

20. There was a recognized right and wrong way of going about group activities.

_____	_____	_____	_____	_____
Definitely True	Sometimes True	Undecided	Mostly False	Definitely False

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