THE MINDFUL CONDUIT: ORGANIZATIONAL STRUCTURE, CLIMATE AND INDIVIDUAL CHARACTERISTICS RELATED TO STRESS, COMMUNICATION AND DECISION PROCESSES

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To Marion, Jennifer, and John

In memory and appreciation of Dr. Wayne Bodensteiner
Teacher, scholar, friend and servant to his country

THE MINDFUL CONDUIT: ORGANIZATIONAL STRUCTURE, CLIMATE AND INDIVIDUAL CHARACTERISTICS RELATED TO STRESS, COMMUNICATION AND DECISION PROCESSES

by

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ABSTRACT

THE MINDFUL CONDUIT: ORGANIZATIONAL STRUCTURE, CLIMATE AND INDIVIDUAL CHARACTERISTICS RELATED TO STRESS, COMMUNICATION AND DECISION PROCESSES

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Harnessing the power of improved information access is a popular organizational objective. Organizations process information to reduce uncertainty and make effective decisions. Organizational systems use the mechanics of information distribution and the human cognitive functions of symbol recognition, thinking, and memory in decision making. Personal "information overload," however, is a growing concern as more access technologies compete for individual attention. Popular literature suggests that overload leads to increased work stress, poor efficiency and lower productivity.

The conundrum for decision agents is how to select useful information for judgment from the constant data flood without becoming overwhelmed. Using Holland's (1970) ideas for organizational transceiver, this study associates variables of organizational structure, climate, time management and perceived role stress with measures of individual decision process captured with an electronic process tracing system. Organizational systems theories, at the macro-level, and behavioral decision theories, at the micro-level, are used to model decision automaticity associated with organizational and individual influences in learned routine and representation of role stress.

This study compares individual decision processes using a controlled decision stimulus. The managerial population selected is routinely subjected to high information loads in a highly uncertain work environment: telecommunications product managers. Variations in decision process are compared with varying reports of role stress. Two groups of students in statistics and computer science engineering are used to validate the cue complexity manipulation. In all, three groups of decision makers and two levels of cue complexity are used for a total N=132. All groups are introduced to the task via a Web-based interactive process-tracing program. Each subject, independently searches at will for information and chooses a product development project case judged most likely to succeed. Survey data collected from managers provides information on work climate, organizational structure, time management and work stress.

The findings suggest that certain organizational structure and climate factors are related to perceived role stress. The manager's representation of type and degree of stress was found significantly associated with three of four decision process measures. Managers who reported higher stress at work tended to process the decision task cues differently than their less stressed cohorts.

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CHAPTER 1

INTRODUCTION

1.1 General Introduction

Electronic data covers the landscape of managerial life. Data throughput and the number of data transfer modes have increased at a relentless pace since electronic communications began more than a century ago. The simple bit stream of Morse code has grown into global rivers of digital signal, shot through glass, air and metal by the trillions.

Multiple data avenues now compete with each other for human attention at any time of day, every day. In a recent popular management press article, McCune (1998) laments:

> A study released by Pitney Bowes, Inc., of Stamford, Conn., in May showed that the average businessperson in the United States, Canada and the United Kingdom sends or receives 190 messages a day.
>
> We now have more ways of contacting each other and exchanging information. But as we find new ways to communicate—voice mail, fax, e-mail, Internet chat—we don't jettison our old methods. In fact, we use them more. Combine that with the information-gathering potential of the Internet, and you've got 60 percent of an office worker's time spent on processing information.

From the data user's point of view, a key problem is no longer getting access to data, but how to use attention successfully to interpret what one gets (Simon, 1973). The mind's capacity to comprehend and remember has not kept pace with data access technology.

Despite the widespread rush to incorporate the newest and fastest technology, research evidence suggests that more real knowledge is not necessarily created with it (Williams and Clark, 1990). As organizations expand their information access capacity, disruptive and annoying work environments grow in presence, as popular business press reports with increasing alarm (Gibbs, 1998; McCune, 1998). "Information overload" is becoming a widely discussed issue as it relates to work-related stress, efficiency, and perceived work quality. McCune refers to "information fatigue syndrome" as a psychological condition brought about by chronic information overload at work. The symptoms include:

> • *A shortened attention span*...They just can't concentrate on one thing for too long without having to move on...*this makes it hard to be reflective.*
> • *A reactive mode.* It's very easy to merely react to external stimuli—in this case, e-mail, voice mail, fax and other demands for your attention. But if you only respond, then you can't be proactive, can you? You're putting out fires, not spotting new ones.
> • *Analysis paralysis.* Ironically, *having more background on an issue can make it more difficult to reach a decision.* Either you're paralyzed by the sheer amount of data you've collected or worried that the answer lies beyond the next Web site or report. You just can't stop gathering information. And even if you pull the plug on your research, the process of examining every nuance makes decision making a monumental task...*Such analysis paralysis can lead to snap judgments.* Instead of dealing with all the data you've collected, you make a decision based on your gut.
> • *Stress and more stress.* Two thirds of businesspeople surveyed by Reuters said not only that coping with too much information had stressed them out, but that *the stress had damaged their personal relationships, increased tension with colleagues at work and lessened their job satisfaction*...researchers found that the farther up the ladder you are, the more overwhelmed you are.
> • *Diminishing quality. The overall quality of work declines* as people struggle to respond to every information demand that's placed on them. This cumulative problem results from all the other side effects. After all, how effective can a person be if he's constantly interrupted...? (McCune 1998, 11, italics added).

Organizations gather, process, and store information to reduce business uncertainty and risk (Duncan, 1972; Knight, 1921; March and Simon, 1958; Thompson, 1967). Organizations are complex systems with complex tasks (Boulding, 1956.) Information coordinates and integrates task performance of organizational subsystems and human contributors (Galbraith, 1973). Decades of research and capital investment have been devoted to business information systems design and development, resulting in a massive system of data access and storage. When viewed at the level of *organizational* decision making and performance, information overload is not simply a personal nuisance. Overload lowers productivity, devalues information, and wastes organizational resources. At its worst, information overload undermines decision making by causing coordination and integration failure.

Though popular press writers suggest fixing the overload problem with information filters, intranet restrictions, and data warehousing (Gibbs, 1998), scientific research has not confirmed the benefits of such practices. Management researchers have warned against the dangers of "inertia" and maladaptive "learning" that comes with cumbersome, inflexible, and untimely information stored as external memory (Grandori, 1984; Hedberg, 1981). Furthermore, those suggestions do not reflect the organizational need, well documented in research, for tailoring information access to differentiate and integrate task-specific roles and functions (Daft and Huber, 1987; Galbraith, 1973; Lawrence and Lorsch, 1967).

As described above, information fatigue syndrome is consistent with features cited in empirical studies of decision making under stressful conditions (Montgomery, 1989; Payne, Bettman and Johnson, 1993; Ranyard, Crozier and Svenson, 1997; Svenson and Maule, 1993). However, organizational characteristics are not compared nor measured in most experiments of decision making under stress; instead, contextual factors are highly controlled. In comparing stress behavior from experimental research with real-world management tasks, organizational complexity is absent. Like the popular press solutions, putting experimental laboratory evidence to work for improving organizational decision making is not fail-safe.

The empirical relationship between overload stress and organizational performance is probably most closely approximated in terms of task complexity and communication variety, as well as personal emotional valence.

The mechanical system for information distribution is conjoined with human cognitive functions in the organization's information processing system (Galbraith, 1974; Simon, 1976; Tushman and Nadler, 1978). Together, mind and machine provide the functions of symbol recognition, thinking and memory (Newell and Simon, 1972; Simon, 1973). Certain organizational functions and roles coincide to perform critical information processing tasks and integration. For example, information is a primary raw material and product in the professional communication behavior of research, product development and boundary roles (Holland, 1970; Leifer, 1975, Lysonski, Singer and Wilemon, 1988). Individuals occupying gatekeeping, liaison or other "special communicator" functions provide unique services to the organization as transceivers and interpreters of complex environmental information (Holland, 1970; Roberts and Fusfeld, 1981).

Their effectiveness as thinkers and doers is partly determined by formal organizational structures, such as lines of delegated authority (Lysonski, Levas and Lavenka, 1995), degree of participation and control in organizational decision making (John and Martin, 1984), and formalized procedures defining their communication behavior (Jablin, 1987). Informal factors such as social networks, perceived status, supportive work environments and personal behavior patterns also influence their cognitive performance (Holland, 1970; Pelz and Andrews, 1976). The quality of their interpretations is critically important, not only to the individual managers performing their assigned tasks, but also to others relying on them for achieving broader organizational goals (Daft and Weick, 1984). The overloaded individual transceiver performing organizational tasks will affect *organizational* performance by failing to effectively map the true complexity of the organization's environment with the communicated representation passed on to others in the organization's interpretive system.

The study reported in this dissertation attempts to explore the relationships between organizational structure, climate, and perceived stress in comparison with several measures of decision process and outcome. Three groups of decision makers and two levels of an experimental decision task are used for the study. To validate the decision instrument, a sample of product managers from the telecommunications industry and two samples of students are compared. The first group represents cognitive ability trained and conditioned by "overload" in the presence of organizational complexity and learning, while the latter group represents "naïve" or inexperienced cognitive ability suitable for entering similar employment. Native cognitive ability and educational formation are assumed approximately equal across the three groups.

Student and manager groups are introduced to a field decision experiment via a Web-based interactive decision-process tracing program. The decision experiment requires each subject, acting independently, to search for information, evaluate alternatives and select one top performing product development effort from a set of projects in a simulated task. At the same time, the management sample is asked to provide survey input about their work history, education, structural environment, their perceptions of stress, time management, work overload, decision making satisfaction, and relative success of the organizational product they manage. The student sample provides minimal survey data about current educational status and employment.

Behavioral decision research suggests that attention and information are deployed in one of several different decision process sequences, depending on the source, level, and/or duration of stress (Payne et al. 1988). For the management sample, cognitive representations of behavior and environment, as given in survey responses, are theorized to imply varying degrees of underlying learned routines in behavior and thinking. This research study explores the associations between reported structure, behavior and certain decision process outcomes as they are unobtrusively monitored. Prior research and theory, as reviewed in chapters 2 and 3, suggest that many associations are likely to be significant between reported perceptions and actual decision behavior. This study examines patterns of association that have not been previously linked using a simulated task.

1.2 Statement of the Problem

The problem addressed in this dissertation is embodied in the following conundrum: the chronic *business* condition of uncertainty about environment, outcomes and actions (a knowledge deficiency), and the simultaneously chronic *decision* condition of data flood (an attention deficiency). In applying information technology to organizational decision processes, management faces a paradox. As more information is gathered, stored and transmitted to reduce business uncertainty, the attention stress on individual decision agents increases. Theories of attention, at the level of the individual human processor, indicate that stress can undermine decision-making quality through sub-optimal cue processing behaviors (Easterbrook, 1959; Eysenck, 1993). However, theories of organizational uncertainty assume that information arriving in each information avenue may have some business value that should be assessed (Huber, 1991; March and Simon, 1958; Thompson, 1967; Tushman and Nadler, 1978). If each information parcel has potential to reduce the firm's uncertainty or business risk, then it should be used for *organizational* decision making and integrating complex sets of responsive actions (Duncan, 1972; Milliken, 1987).

What happens to decision-making processes when the deficit between attention and demand becomes a *chronic learned* decision condition for its managers? This study seeks to uncover the relationships among factors of structure, communications access, perception and personality that attend chronic decision stress in a sample of telecommunications industry managers judged likely to experience the complexity/uncertainty/overload dilemma (Kahn, Wolfe, Quinn, Snoek and Rosenthal, 1964). Their responses are compared with a group with similar cognitive faculties but without chronic, learned exposure to organizational structure and its communication complexity.

The organizational literatures on perceived environmental uncertainty (PEU), structural contingency and strategic control suggest that differing degrees of organizational structure, constraining information variety and load, may result in different modes of organizational response (Galbraith, 1974; Huber, O'Connell and Cummings, 1975; Schreyogg and Steinmann, 1987; Yasai-Ardekani, 1986). Theories of organizational structure prescribe various means to achieve "fit" between the environment and the organization. Those theories suggest that solutions to the problem of environmental information overload can be designed through deliberate selection of formal systems attributes, such as degrees of task and role differentiation, integration, communication formalization, and centralization in decision making authority (Ford, Armandi and Heaton, 1988; Gerloff, 1985; Wofford, Gerloff and Cummins, 1977). Essentially, the complexity of the organizational systems and tasks must match the complexity of the environment occupied. Therefore, personal, cognitive decision stress and resulting coping behaviors exhibited in decision making may be influenced by organizational design factors as well as psychological ones. When the complexity of the design is not matched with the information complexity of the environment, the individual copes with that complexity personally as "overload" and a source of personal stress.

1.3 Overview of Remaining Chapters

The first chapter discusses the background and relevance of the dissertation topic to current management practice. The purpose of the study, statement of the problem and important theoretical bases are highlighted in chapter 1.

Chapters 2 and 3 provide literature reviews for defending the hypothetical model. Chapter 2 covers relevant theories of information processing as they apply to organizational level constructs. A historical sequence of theories shows how the focus on the individual subordinate has shifted from physical to cognitive contributor. Chapter 3 overviews several sources of theory and empirical research on individual cognitive behavior and adaptation under information stress.

In chapter 4, constructs and their relationships are defined specifically as research hypotheses to answer the research questions posed in earlier chapters. Hypothetical statements are linked with prior research findings discussed in chapters 2 and 3.

Chapter 5 describes the three subject populations for the study, the methodology used to collect and analyze data, the levels of the experimental conditions, and caveats pertaining to data collection and interpretation for this particular sample of subjects. Chapter 6 reports the findings of data collection statistical analysis as they relate to the specific research hypotheses. An overall summary, conclusions, and directions for further research are presented in chapter 7. Appendices following chapter 7 include research statistics and graphs related to significant findings.

CHAPTER 2

LITERATURE REVIEW: PERSPECTIVES ON ORGANIZATIONS

2.1 Literature Review Synopsis

The purpose of the literature review is to introduce theories used to design the study and to interpret the data collected. This research explores the relationship between variables of organizational structure, the perceptions of an organizational information user, in a transceiver role, and the type of decision making process used in applying information. The key assumptions affecting the variable relationships are that: (1) both individual and organization are confronted with problems of information overload and uncertainty from the environment; (2) both are attempting to adapt or adjust in some manner, though not necessarily productively, and not necessarily in concert; (3) organizational structure constrains and channels the information user's behavior and controls access to data, and (4) the individual provides the critical cognitive functions for perception and interpretation of data, thus controlling data meaning. The general research conjecture is that organizational responses, in the form of structure, and individual responses, in the form of interpretation and type of decision process used, are both systematically related to each other as forms of coping with attention stresses.

Several sources of literature speak to this issue. Theories of formal organization and its structure explain information activities and their coordination at several different levels of analysis. Some organization theories explain information use at the level of the whole organization (i.e., the macro-organizational view), whereas other theories use information concepts at the level of individual roles, perceptions, language, and their interconnections (i.e., the micro-organizational view). These bodies of literature are reviewed in chapter 2.

In addition to theories of organization, theories of individual problem solving, decision making, and communications behavior under both normal and stressful conditions address information use. Much of that literature comes from behavioral decision making and experimental psychology, using evidence from individual subjects in controlled information contexts. That literature is reviewed in chapter 3.

This research explores the relationships among organizational structure attributes, individual perceptions, and individual decision process to see if and how experience in different formal organizational systems is related to decision routines. Decision routines are assumed in this research to operate in specific temporal sequences of patterned activity, captured in a simulated decision environment.

Individual intellectual ability and learning is regarded as a source of organizational competitive advantage and "core competence" (Lei, Hitt and Bettis, 1996). Therefore, knowing how organizational systems affect individual thinking, as well as how individual thinking affects organizational information use and performance, should be interesting to managers concerned with core competence development (Crossan, Lane and White, 1998). Organizational systems that erode unique, value-added capabilities of its decision making force create "externalities": intangible cost burdens dismissed in the assessed system value (Simon, 1973). Individual behavior, beliefs and perceptions are important study factors insofar as individuals engage in information activity on the organization's behalf (Cyert and March, 1963; March and Simon, 1958), and represent intellectual advantage to the organization (Nahapiet and Ghoshal, 1998).

2.2 Models of Organization

Human organizations have been modeled and explained from a variety of perspectives. The purpose of the review at hand is to explain how theoretical views of organization have contributed to a general understanding of information purpose, flows and constraints within organizational contexts. Some theories of formal organization are more centrally concerned with the problem of "information" than others (e.g., Galbraith, 1973, 1974; 1977; 1993; Tushman and Nadler, 1978), though most, if not all theories rely on the construct of information as a coordinating or integrating tool.

Morgan (1997) provides one of the most recent, comprehensive treatments of organization theories. Morgan's array of dominant "images" for organization include: machines, living organisms, learning brains, shared cultures, political conflicts, psychic prisons, continuous change processes, and finally, instruments of domination and control by an elite class. As Morgan explains, each successive theory has tried to improve on the explanations of its predecessors in portraying how organizations function. However, Morgan does not discuss how the use of information systems within each of these images is differentiated from one to another. This review relates organizational theories as they account for information in organizations: its purposes, uses, and tradeoffs as a managerially controlled resource. A subset of Morgan's recent collection of organizational images has been chosen for comparison and contrast, supported with source literature citations. The basis for choice is how directly information use and distribution is explicitly cited as a factor in each of the selected models.

In viewing the array of organization theories as a sequence of models in history, one finds a distinctive pattern of change in how human beings are thought to contribute to organizational work. In early theories of management, human beings contributed mostly to productivity by their physical presence: their strength, motor skill, endurance, and task training. A valuable employee developed a well-honed ability to perform a task by having it seem "second nature" to him or her—a rapid, precise, productive action exercised habitually (Taylor, 1947). The array of human motor and perceptual skills were orchestrated through the organization's managerial staff pursuing the goals of the entire enterprise.

Gradually, however, that idea of human productive value has been supplanted by the need for perception and judgment competence using complex cognitive stimuli in fast-paced, social situations (Eisenhardt, 1989). Organizational success has become increasingly a matter of mind: intellectual capacity, framed representations, cultural identities, ethical values, language referents, symbolic and ritualistic participation, and imagery (Dussauge, Hart, and Ramanantsoa, 1996; Lei et al. 1996; Smircich and Calás, 1987; Weick and Roberts, 1996). The increasing reference to the human resource function as a tool of competitive strategy and organizational knowledge indicates how important individual human cognitive resources are to organizational performance (Nahapiet and Ghoshal, 1998).

2.3 The Purpose of Organization

In all theories of organization, the general model assumes that "being organized" in some sort of systematic, collective fashion is better than simply having the aggregated resources of individuals working separately (Ford et al. 1988; Simons, 1995). Each organization theory presents its own assumptions about human beings, their capacity and willingness to work for the collective purpose, the kind of bonds that coordinate and differentiate their tasks and behaviors, and the basis (or lack of it) for managerial control over the collective outcomes. The latter issue, organizational control, is specifically linked to the use and design of information systems in most theories. Theories contrast as to what is being controlled, how control is achieved, and how such control might affect those being controlled (Ouchi, 1980; Simons, 1995). Later models describe how controls themselves are controlled as processes of organizational evolution take over (Greiner, 1972). The predominant paradigms for information control in organizations are variations of systems theory and cybernetics (Wiener, 1948).

2.4 Control in Organizations

In a recent comprehensive review of the literature, however, Morgan (1997) suggests that organizational control is only one face of a Janus-faced process of organizational transformation and paradox resolution. As management tries to control its workforce, it must destroy outdated mental models, erode nonproductive cultural barriers, and break into the "psychic prisons" of its workers. Morgan's "images" of organizational control are inconsistent with the simple "error correction and detection" concepts of earlier organizational models. In concluding, Morgan advises against using any single control theory as the best explanatory model, saying:

> As we move into the twenty-first century we find ourselves living through a period of unprecedented change with major implications for the whole field of organization and management. Theories that were once viewed as providing sound foundations are becoming obsolete...Needless to say, the situation is often overwhelming. Managers at all levels are invited to embrace new paradigms, develop new competencies, integrate left- and right-brain thinking...The intense theoretical and practical innovation is part of the transition and, given the fluid, self-organizing nature of a world dominated by electronic media, is likely to remain so...Managers at all levels must gain comfort in dealing with the insights and implications of diverse perspectives...despite its roots in mechanistic thinking, organization is really a creative process of imaginization (Morgan 1997, 375-376).

Morgan's multi-faceted review simply reflects the historical sequence of a diverse literature and the theoretical variations of control processes at work in organizations. As the value of the individual worker has shifted from physical presence to motivated, mental activity, a parallel shift has occurred in ideas of control. In early theories of scientific management, control was implemented through feedback: physical pace, output or attendance. In more recent theories, such as organizational culture and learning development, control is expressed in terms of feedforward measures: shared professional values, ethical standards, ideation and language fluencies, and educational prestige (Crossan et al. 1998; Smircich and Calás, 1987). Physical response measurement appears easier to verify scientifically and socially than cognitive change measurement. Indeed, some modern theorists recommend using surrogate measures for internal, self-control such as demographics, professional codes of ethics, specialized group affiliations, and the threat of extreme sanction by one's peers or "clansmen" (Dussauge et al. 1996, Hambrick and Mason, 1984; Ouchi, 1980, Smircich and Calás, 1987; Zajac and Westphal, 1996). However, imputing a process of control from such surrogate measures has been criticized. Little scientific evidence supports the use of those surrogates for representing underlying cognitive process (Walters, 1996).

Perhaps a more interesting issue arising from Morgan's novel model of "radical" control processes is why such fundamental change is necessary. Lei et al. (1996) suggest an answer: controlling cognitive competence in the form of learned interpretive routines requires breaking down the "normal" routine of "path-dependent" thinking. Individuals must undo their minds, so to speak, to alter the ways in which they screen and interpret information. Effective organizational control must play a part in that "undoing" process. Unlike motor or perceptual skill modification, revamping cognitive, evaluation and judgment skills is much more difficult. Because those skills are embedded in life-long accumulations of language referents, cultural standards, and idiosyncratic experience, changing those skills requires immense effort for both individual and organization.

In more recent organizational theory, the literature of organizational learning illustrates how institutionalized experience frequently crowds out the insightful contributions of intuition, even though that intuition is productive and sorely needed (Crossan et al. 1998). However, for the organization to accomplish "double-loop" learning, an internal competence must develop to sense when reliable routines still work, and when they must be discarded (Hedberg, 1981; Weick, 1979). External control mechanisms, such as direct cognitive intervention, may be construed as "radical" or even unethical (Nutt, 1999). What is not clear from the literature, however, is whether the "institutionalization" of mental routines occurs because of organizational structure constraints, shaping individual thought and communication, or whether it gets informally "entrenched" first at individual or task group levels and formalized later.

Why does that matter? Literature suggests that an organization must "unlearn" by divesting itself of older mental models and allowing new ones to develop freely (Crossan et al. 1998; Huber, 1991; Starbuck, 1983). However, if the organization has a highly formalized enculturation process, with a unique language or "referent" system, older mental models may be highly resistant to change. Individual thinkers with "new ideas" are forced out or opt out. Simply bringing in "new talent" may not change the thinking of the organization. The newcomers will absorb the old ways through socialization processes (Moreland and Levine, 1989), and remain subjected to the constraints of formal systems design and communication parameters (Galbraith, 1974).

2.5 Information Use and Control

Morgan suggests that older scientific/engineering views of organization are too rigid, outdated and of little value to current practitioners. He specifically cites "electronic media" as a force in keeping the business world "fluid." However, for research purposes, "images" do not lend themselves to scientific scrutiny. They cannot be represented with precision in a research community, and are not falsifiable. This study aims to provide a deeper scientific understanding of the difference between "rigidity" and "fluidity" in thinking, and how that distinction is driven by, and observed in, patterns of structure, perception and behavior.

This research will review a subset of Morgan's typology of images for comparisons and contrasts. The selected subset contains theories that have been elaborated and tested as scientific models. Information use is discussed in each successive theory: each model elaborates on the constructs of preceding theories in explaining information flows, significance and effects on organizational processes. Earlier models, such as those of scientific management, bureaucracy, contingency and information systems design, tended to interpret the "information systems" component of the organization as a variable of structure, or semi-permanent foundation of organizational process. Later models, such as organizational learning systems and cultures, appraise "information systems" for their symbolic meaning, relative source of value, and changeable quality. The power of symbolic "information" connects the shared representations of experience with unshared, internalized knowledge of the individual. The difference between older and more recent models is the degree of tacit or otherwise unique, internal cognitive involvement between the individual and the organizational referents.

Likewise, the problem of managerial control has also been reformulated along the way. In earlier work, information reflected a representation of behaviors and performance outcomes, to be used as corrective feedback by both management and workers (Child, 1984). Information was also used to connect and coordinate specialized tasks, diffused contributions, and dispersed operations to reduce uncertainty among interdependent systems (Gerloff, 1985; Thompson, 1967).

Later research, such as Simons' (1994) study of executive successions and a review of organizational learning by Crossan et al. (1998), indicate that organizational control is a feed-forward mechanism as well. Management may attempt to control information seeking, scanning and evaluation at the level of the individual subordinated mind. As these authors outline, management control contains an increasingly complex set of information routines, monitoring mechanisms, and exchange behaviors as the organization grows, matures, and institutionalizes the use of information. The most sophisticated of Simons' control "levers," interactive control, is used by managers to "involve themselves regularly and personally in the decision activities of subordinates...based on the strategic uncertainties they perceive...to activate search...focus attention...and force dialogue" (Simons 1995, 95-96). Another recent study by Nutt (1999) also suggests that managers may exercise considerable feed-forward control over both content and structure of decision making. Based on observation of 356 real managerial decision processes, Nutt (1999) concludes that managers can exercise tactics for controlling key cognitive and inferencing stages of establishing decision direction, identifying options, and implementing choices.

In sum, organizational researchers such as Morgan (1997) and Simons (1995) provide new insights into the role of information, control, and how organizations should be defined as unitary structures. Their observations of contemporary management practice invite theorists to update, expand and revise organizational constructs for use with current information environments. The fundamental reason for organizations to exist—to produce more work than a comparable set of independent actors—is still viable despite advances in information technology. The managerial "design" objective in dividing and integrating cognitive work, however, is not completely resolved with traditional theories of organization.

Like other resources shaped and directed by structure, time is an organizational resource in limited supply (McGrath and Kelly, 1986). The present author argues that time is structured at both the macro-level and the micro-level, and that perhaps it is the temporal structure of information processing, as well as the other aspects of organizational "structure" that guide attention (Simon, 1973). Bluedorn and Denhardt (1988) and McGrath and Kelly (1986) discuss *entrainment* as the process of synchronizing interdependent temporal structures. Entrainment adds another dimension to organizational structure that further channels and constrains information flows.

2.5.1 Classical Scientific Management

Classical management theories emphasized workflow and decision making efficiencies (Euske and Roberts, 1987). That efficiency was to be gained from appropriate division of tasks, central authority and control, and hierarchical arrangement of formal communications flows. Human workers were assumed to "lack intelligence, judgment, and motivation" and to avoid productive work whenever organizational mechanisms failed to control them from doing so (Ford et al. 1988, 9). Organizational management, using efficient formal structure, trained and monitored their human work force to accomplish manual tasks through specific, differentiated "best practice" routines (Taylor, 1947). Information management belonged strictly to the cadre of managers; "thinking" was divorced from "doing" under scientific management principles (Morgan, 1997). Individual workers were considered entirely substitutable; the human "part" required for the task was the only important substitution. Chief executives alone would have had access to the complete causal mapping of the organization and its enterprises. External forces on the organization were assumed as "givens" in classical models of machine efficiency.

In the mechanistic view of organization, information use and access was a highly differentiated, highly guarded activity. Information in its proper form represented a clear, precise definition of specific tasks, methods, performance standards, and monitoring measures, directed downward from top management to the workforce (Euske and Roberts, 1987). Information was to be codified as memoranda for unambiguous use by completely substitutable individuals, so that the ongoing purposes of the organization were maintainable apart from its individual members (Thompkins, 1987). In bureaucracy, where exceptions to routine tasks were encountered, information for problem-solving and decision-making functions flowed up the scalar chain of management until the proper authority established the solution. Solutions were articulated downward in the chain as required. In rare instances, lateral communications could be used if all parties agreed to its need (Euske and Roberts, 1987; Robbins, 1990). Oral face-to-face communication was preferred for handling exception information because it promoted speed and optimal morale (Thompkins, 1987).

The principal factors contributed by mechanistic theories include *hierarchy* (number of distinct management levels between the lowest ranked worker and the chief executive), *span of control* (number of individual persons reporting to a certain supervisor), and *specialization* (degree of uniqueness in role tasks, knowledge or skills, or, degree of diversity in organizational activity (Hage and Aiken, 1967). Control was exercised solely by the chief executive under the principle of *unity of command* and supported unambiguously by means of clear, non-redundant scalar chains (Euske and Roberts, 1987).

Later research linked constructs via systems theory logic. Some researchers explained hierarchy, span of control, and specialization as an outcome of differences in technical complexity (Gerloff, 1985; Woodward, 1965; Thompson, 1967), interdependence (Aiken and Hage, 1968), and organizational size (Blau and Schoenherr, 1971). In general, the scientific studies conducted on these variables suggest the following relationships:

- Increases in size (as total number of full-time plus a ratio of part-time employees) increase the degree of specialization, increase the number of hierarchical levels, or vertical span, and generate a greater ratio of administrative roles to non-administrative roles.

- The relationship between the increase in size and the increase in each of the other variables may be moderated by the initial size measured; large organizations continue to differentiate and grow taller, but at a slower rate than small organizations, given equal time periods.

- As size increases, authority becomes more decentralized and delegated.

- As organizational size increases, levels of stress of individual members increase (up to a level of 5000+ employees) (paraphrased from Ford et al. 1988, 360-365.)

Jablin (1987) has considered the scientific evidence of size, specialization, hierarchy or vertical span, and span of control for their relationships to communication behavior. (Jablin's review takes a retrospective account of mechanistic theories; the theories developed at the time did not necessarily describe information and communication details in the same terms). For span of control, Jablin reports that surprisingly little research has been conducted for its association with communication. Theoretically, narrower spans of control are associated with more two-way exchange between subordinate and superior, and thus promote greater communication potential between lower and higher levels in the scalar chain. However, the converse has also been argued: as greater hierarchy arises from smaller spans, there are more levels to penetrate with communication, and therefore less communication flows between levels at a greater distance from each other. However, the span of control appears unrelated to the choice of method (oral vs. written), perceptions of closeness of supervision, and perceptions of communications openness and trust. Jablin cautions that the research in this area has been primarily gathered through self-reports rather than behavioral activities. Later research on the relation between work unit design and the perception of empowerment (Spreitzer, 1996) argued, and found support for, the idea that a wider span of control allows less supervisory monitoring, thereby permitting more individual decision making discretion and feelings of responsibility over work tasks.

Jablin (1987) also found support for the theory that upper levels of the hierarchy tend to use more "rich" methods of communication than lower levels (Daft and Lengel, 1986). Upper levels tend to have greater communications volume. Also, they tend to use group conferences and meetings more than lower levels, particularly under highly uncertain conditions. However, the evidence in the stream is equivocal, and operational definitions of "hierarchy" are not consistent. Jablin also reported an overall "weak" support for the theoretical relation between organizational size and diminished communication quality, though he suggested size may not be as important as complexity in explaining why communication quality diminishes.

Mechanistic views of organization gave way to new interest in organizations as human social and biological systems. As machine models of organization were implemented in society, they were criticized heavily for their extreme social costs arising from disregard of many human needs and capabilities (Morgan, 1997; Perrow, 1972). The social problems that sprang up—disease, apathy, and fatigue—became more clearly defined and scientifically observable. Research such as the Hawthorne studies showed that management could gain better performance for the organization *overall* if outside social needs were "balanced" against the self-serving goals of the organization. Models of organization as a living organism or open system came into widespread use, borrowing paradigms from systems theory and cybernetics (Ashmos and Huber, 1987; Beer, 1972; Boulding, 1956).

2.5.2 Organizations as Open Systems

The principle ideas in open systems views of organization were fourfold: (1) the organization is a "whole" containing differentiated and interdependent subsystems (Ashmos and Huber, 1987; Boulding, 1956; Katz and Kahn, 1966; Lawrence and Lorsch, 1967); (2) organization is differentiated from its environmental context, and the boundary is identifiable (Katz and Kahn, 1966; Lawrence and Lorsch, 1967); (3) energy is exchanged between environment and organization, and that exchange process is not completely tractable (Child, 1984; Duncan, 1972; Emery and Trist, 1965; Lawrence and Lorsch, 1967; Perrow, 1967), and (4) different types of organizations relate to the environment successfully in different but equifinal ways. Each organizational type must find the proper congruent relationship or "fit" with its environment through structural alignment mechanisms (Burns and Stalker, 1961; Katz and Kahn, 1966; Miles and Snow, 1978; Miller and Friesen, 1984; Ulrich and Barney, 1984).

The open systems/contingency perspectives of organizations are well developed in the management literature, covering at least three decades of scholarship and experimental evidence. Other reviews of the literature and methods cover them extensively (Fry and Smith, 1987; Morgan, 1997; Robbins, 1990). For present research purposes, however, another exhaustive review is not needed here. The important contribution of open systems and contingency theories is that they provided a basis for information processing theories of organization, resource dependence models, and strategic choice. Unlike mechanistic models, open systems models explained organizations as both different from and partially controlled by their uncertain environmental relationships. Empirical studies of those relationships attempted to verify their structure, function, and effects on organizational design and performance. The logic of systems analysis was used to relate macro-organizational design variables such as centralization, complexity, formalization, technology, differentiation and integration, and organizational size to measures of environmental uncertainty and degree of change (Aiken and Hage, 1968; Burns and Stalker, 1961; Emery and Trist, 1965; Hall, Haas and Johnson, 1967; Lawrence and Lorsch, 1967; Perrow, 1967; Pugh, Hickson, Hinings and Turner, 1968; Thompson, 1967). For the current research question, the structure variables of complexity, formalization and centralization are important because they are theorized to have a direct relationship with information processes and decision making behavior. Also, these three variables account for a substantial amount of communication practice and behavior in empirical research (Jablin, 1987, 411).

2.5.2.1 Design Factors: Formalization

Formalization refers to the extent of job codification and rule-based behavior, or, the extent to which rules, standard procedures, authority structure and decision routines are expressly articulated and documented in written statements (Ford et al. 1988). Formalization also may include formal orientation and training for new members and in-service training for ongoing members (Hall, Haas, and Johnson, 1967). Ford et al (1988) discuss four mechanisms of formalization: performance control, action planning, behavior formalization, and process control. The standards expressed in formalized documentation may specify a general performance goal to be met, a specific activity to be used, a specific behavioral routine to follow under given conditions, or a set of standards with penalties and sanctions for non-standardized responses. Not all operational definitions of formalization include all mechanisms cited by Ford and colleagues (Jablin, 1987; Payne and Pugh, 1976). Moreover, the main body of literature cited as formalization research does not define how formalization is instituted and ratified, and what level of management initiates it.

The purpose of formalization is to regulate behavior, making it more consistent and uniform, and therefore more predictable. Formalization, also linked with standardization, promotes coordination and control (Robbins, 1990). Earlier empirical work tends to distinguish between formalized role specificity from standardized activity (Payne and Pugh, 1976). Formalization is a means of economizing effort in two ways: (1) it preserves managerial resources otherwise used for direct supervision and control, and (2) it provides for task performance with a lesser degree of judgment skill, formal education, or professional expertise, thereby allowing the organization to substitute less expensive labor for more expensive specialized labor (Robbins 1990, 96). However, in contexts requiring specialized professional skills, low formalization is usually present because the control and coordination of the specialists is internally driven through prior education and training. A highly formalized system is a redundant control mechanism in a professional work environment (Burns and Stalker, 1961; Robbins, 1990).

Jablin (1987) reports very little scientific evidence linking formalization with communication activity, though theoretically, that link is clear. Formalization provides for a reduction of ambiguity because it forces certain routinized communications; therefore, less interpersonal discussion and negotiation of meaning is necessary. Indeed, Jablin found general support in the research literature for a negative correlation between formalization and attendance at informal, oral, unscheduled communications.

2.5.2.2 Centralization and Complexity

Centralization refers to the degree to which formal authority has been delegated or distributed among intermediate and lower levels of management. A completely centralized organization maintains a tight rein on decision making authority, does not solicit participation from its lower managerial ranks, and does not place any emphasis on two-way communication about developing goals and strategies. Centralization may also be considered as the degree to which the unity of command has been loosened to include multiple actors and their cognitive complexity. Decentralization is preferred when the information processing demands on the central management core are too burdensome; thus, some information processing and decision making tasks are distributed to lower ranking managers and professionals (Robbins, 1990).

Early bureaucratic theories espoused high centralization because top management alone had both incentive and knowledge needed to produce high quality decisions (Ford et al. 1988, 160). Later human relations theorists argued that lower levels of management should participate in decision making when: (1) more information can be presented, thus providing a higher quality decision; (2) ambiguous situations and information can be clarified with more interpretations; (3) participation may produce better overall group acceptance and support, and (4) there is little reason to suspect significant conflict among group members (Vroom and Yetton, 1973; Ford et al. 1988). Delegation of decision responsibility entails having a willing, motivated, and able decision maker to take on delegated responsibilities; some decisions should be kept centrally controlled when expertise and motivation do not justify their delegation.

Centralization reflects a formal authority structure, not an informal social influence process, and derives from global top management philosophy and direction, rather than local appropriation of duties and authority through habitual practice (Ford et al. 1988). However, not all parts of the organization are similarly decentralized (Payne and Pugh, 1976). Areas in which professionalism and a high degree of training and education are required tend to have more discretion over work-related decisions, though may not have similar discretion over other decision-making issues, such as personnel hiring, pay and promotion of subordinates.

Centralization, as a structural property of organization, has been related to other structural properties as well as perceptions of structure and organizational climate (Falcione, Sussman and Herden, 1987; Hall, Haas, and Johnson, 1967; Payne and Pugh, 1976). Centralization is often operationalized as: (1) the locus of authority, or hierarchical level, at which a certain decision occurs (decision type often moderates this variable), and (2) the degree or extent to which individuals are allowed or perceive themselves to participate in making decisions (Jablin, 1987; Lysonski, Levas, and Lavenka, 1995). Organizational size and centralization appear to be negatively correlated (Blau and Schoenherr, 1971; Ford et al. 1988; Hickson, Pugh, and Pheysey, 1969).

However, the size-centralization relationship may be more usefully viewed as a relation between centralization and organizational complexity (i.e., the multiplicity of activities, the degree of specialization, the degree of hierarchy, and the degree of spatial dispersion) (Aiken and Hage, 1968; Hall et al. 1967). Centralization appears negatively correlated with complexity: as the organization becomes more complex, responsibilities and authority shift downward and outward in the hierarchy to compensate for: (1) increased information load at the center; (2) local specialized knowledge availability at the boundaries; (3) greater loss and distortion of information passing through more channels as complexity increases, and (4) the increased need for feedback and control by coordination.

Centralization also seems to relate negatively to formalization: as decision making authority becomes distributed, the managerial core maintains some control over decisions by means of standardizing the way in which they are carried out and communicated (Jablin, 1987). Payne and Pugh (1976) also provide evidence from several sample studies showing that formalization and centralization are negatively correlated. The evidence suggests that formalized procedures and standardized prescriptions are even more negatively correlated with centralized authority in the United States than in Great Britain (Payne and Pugh, 1976).

Jablin (1987) finds that centralization is negatively related to communication volume, as a general rule. Decentralized organizations tend to have more two-way upward, downward, and lateral communication exchange, and persuasion is more often used in decentralized (rather than centralized) organizations. New communication technologies may either encourage or inhibit centralized authority and decision making "depending on the nature of the organization's external environment" (Jablin, 1987, 410). Just as information technology has the potential to distribute information more widely and more quickly, providing the means to link information with a wider decision-making audience, that same technology also promotes more rapid and precise, centralized performance monitoring of distributed decisions. Both complexity and decentralization are directly related to measures of environmental uncertainty in much research. Lawrence and Lorsch

(1967) distinguished between complexity and their idea of differentiation/integration as they measured emotional and cognitive orientation of managers as well as role and task segmentation (Jablin, 1987). Lawrence and Lorsch (1967) found that differentiation was directly related to the uncertainty perceived as present in the task environment, and that not all organizations dealt with the same level of environmental uncertainty.

2.5.3 Open Systems and Uncertainty

Environmental uncertainty was a key independent construct in most open systems research because most early researchers assumed that uncertainty was not discretionary. Uncertainty has been operationalized as both an "objective" measure, made plausible by the research context, and as a subjective measure conveyed by respondents. Measures of "uncertainty" have been defined as: the degree to which states of the environment and their respective probability estimates are known (Conrath, 1967; Duncan, 1972), the degree to which required information for completing tasks is known (Duncan, 1972; Hrebiniak, 1978); the degree of environmental change (Emery and Trist, 1965; Lawrence and Lorsch, 1967), stability or predictability of environmental change (Duncan, 1972; Tung, 1979), degree of factor complexity (Duncan, 1972; Tung, 1979), degree of routineness, or conversely, frequency of exceptions (Duncan, 1972; Perrow, 1967) and degree of environmental complexity, dynamism and munificence (Dess and Beard, 1984). Perceived Environmental Uncertainty (PEU) is differentiated from general environmental uncertainty as referring to the subject's personal appraisal of the environment rather than the "objective" environment. Despite the measurement of subjective "uncertainty" as PEU, the processes linking individual thinking with choice behavior were not discussed as an important determinant of the organization/environment relationship in most early open systems models.

The open systems models of organization were criticized as too simplistic to represent the true complex, uncertain nature of human social, cognitive, and communication interaction in the aggregate (Ashmos and Huber, 1987; Yasai-Ardekani, 1986). Some writers also criticized ambiguous construct definition, lack of clear, testable relationships, and haphazard application of analytical methods in contingency research (Drazin and Van de Ven, 1985; Fry and Smith, 1986; Schoonhoven, 1981; Venkatraman and Grant, 1986). Others theorized that individuals had a great deal of control over organizational actions *from within* rather than as outside environmental components (Cyert and March, 1992; March and Simon, 1993; Simon, 1957). Moreover, the systems/contingency views did not fully explain why organizations changed, why some failed, and why others thrived while in the process of reform (Quinn and Cameron, 1983). Although open systems models did refer to "information" as a resource exchanged between organization and environment, neither the content nor the process characteristics were defined in detail initially (Ashmos and Huber, 1987).

2.5.4 Organizations as Information Systems

Models of the organization as information processing and decision making systems focused more attention on the information exchange process specifically. Some discussed the internal dynamics of information exchange from the perspective of the individual and his or her perceptions, motivations and tastes (e.g., Duncan, 1972; March and Simon, 1993). Others maintained a macro-systems information design perspective, in keeping with earlier work in organization/ environment relations (e.g., Galbraith, 1973). Simon (1957), March and Simon (1993) and Cyert and March (1992) provided an analysis for how individual decision and evaluation behavior affected organizational choices and outcomes.

Mechanistic and early macro-organizational systems theories assumed a rational, uniform standard for judgment and action on behalf of the optimum organizational goal.

Unlike earlier theorists, March, Simon and colleagues argued that individual members within organizations are only "boundedly rational," not like-minded nor similarly motivated to seek organizational goals. The result of bounded rationality is that bargaining and heuristic processing provide a "satisficed" organizational outcome: a relative optimum given multiple individual constraint sets. March and Simon's work demonstrated an internal, uncertain environment within organizations that systems level factors could not completely control nor dismiss. Individuals themselves presented uncertainty. Individual attitude, perception, limitation and political behavior became important managerial and organizational control issues, aside from structure and form alone.

Galbraith (1973, 1974) and Tushman and Nadler (1978) discussed information design issues at the macro-organizational level. According to Galbraith (1974), management has two sets of choices for handling environmental uncertainty: (1) reduce the need for information processing by reducing the degree of internal interdependence, and (2) increase the organization's capacity to process information. With the first option, management is reducing exposure to uncertainty by buffering and redundancy (Thompson, 1967); with the second, uncertainty is absorbed more efficiently, through matching environmental variety with organizational response variety (Ashby, 1956). Structural mechanisms for hierarchical and lateral coordination, integration of specialist, interdependent roles, and internal feedback systems form the bases of management control over its environment (Tushman and Nadler, 1978).

The decision factors in design include: task complexity, degree of task interdependence, and amount of environmental uncertainty to be processed (Tushman and Nadler, 1978). Boundary spanning roles also provided means to monitor and control environmental information (Galbraith, 1974; Aldrich and Herker, 1977). In the design model of organizations as information processing systems, communication processes formed the basic "glue" unifying and coordinating specialist activities. The architecture of that communication system, both as a social grouping mechanism and as a technically controlled rate of flow, became a critical factor in the successful maintenance of organizational control and integration (Euske and Roberts, 1987). Galbraith's suggested methods of integration are summarized later in the chapter.

In a modified systems model, Huber and McDaniel (1986) recommended viewing the organization as predominantly a decision-making unit, with information design strategies aimed at better decision outcomes. Huber and McDaniel cited growing environmental complexity and turbulence as reasons for preferring a decision paradigm, valuing timeliness and decision effectiveness over information throughput and ease-of-use.

In summary, the open systems model of a clearly defined, organized system with a unitary purpose had been challenged by later information processing theories of organization. The relevant "environment" to be managed lay both within and outside the boundaries of the organization. On the one hand, individuals within organizations created internal uncertainties because their behavior was not always consistent with norms of economic rationality. One key problem for management became how to assess the cognitive limits on "rationality" and how to view their effects on decision making and organizational outcomes. On the other hand, the environment produced unpredictable surprises and changing information for macrostructure to absorb. A second key problem was to engineer organizational boundaries and information flows so that real, relevant changes might be noticed and acted upon with coordinated behaviors. Finally, understanding how to control both internal and external environments, and how to distinguish change between them, suggested that organizational control was a multifaceted concept (Ouchi, 1977, 1980).

2.5.5 Theoretical Divergence: Control

Theories of organization based on information and design have diverged since early congruence and contingency models appeared. The issue of how to control organizational outcomes successfully has developed through several different approaches. One theoretical viewpoint has investigated the *content* of environmental information and its relationship to performance outcomes, i.e., how selected strategy, the purposeful choice of structure, and performance results align successfully (Chandler, 1962; Child, 1984; Dess and Beard, 1984; Keats and Hitt, 1988; Miles and Snow, 1978; Miller, 1987; Peters and Waterman, 1982; Porter, 1980, 1985; Rumelt, 1974). The information content problem relates to how the organization defines its uncertain environment, selects plans of action, and measures its relative performance.

A second tack has examined how the *sources* of information are used to enact organizational outcomes through domain definition, use of power, and cooptation. That line of research has used paradigms of social control, political conflict, resource dependency, and interlocking elite relations to explain the organization's relationship with its environment (Barney, 1991; Pettigrew, 1992; Pfeffer and Salancik, 1978; Useem, 1984.) The source problem for the organization is gaining privileged access to and/or control over environmental information processes and sources, thereby reducing environmental uncertainties and risks. In the extreme, information source control is theorized to divide the members of an organization into those that have control over those that have none, instituting domination of one class by another (Morgan, 1997).

Neither the strategic content nor the political source of organization/ environment linkages concerns us here, and so the theoretical views of organization focused on those issues will be dropped from further analysis in this review. They are mentioned because they represent important factors in the design of organizational information systems apart from those factors emphasized in this research. However, they do not provide a basis for hypotheses in this study. More central to this research are questions about how organizational information use is affected by information systems *processes*: communication techniques, communication structure, and decision making architecture.

2.5.6 Uncertainty Control in Organizations

The first of those three factors, *communication techniques*, examines the design relationship between organization, human communication behavior, and information distribution techniques. In earlier management literature on information systems design, this approach borrows its logic from the first of four different communication paradigms as given by Krone, Jablin and Putnam (1987): (1) *mechanistic*, with focus on the transmission process, or channeling of communication quantity; (2) *psychological*, focusing on individual attitudes and perceptions that affect message meaning and filtering; (3) *interpretive-symbolic*, centering on the process through which shared meaning and action are derived from patterns of communication exchange, and (4) *systems-interaction*, focusing on patterned sequential behavior of communications exchange among individuals.

2.5.6.1 Organizational Communications Transmission

The *mechanistic* model of communication takes its logic from the information theory paradigm from mathematical theories of communication fidelity and cybernetic control (Daft and Lengel, 1986; Shannon and Weaver, 1949; Weiner, 1948). The principal research concern is to understand how communication in organizations—as a process linking sender, receiver, message channel, coding scheme, and temporal frame—is linked to perception of meaning and performance outcomes (Daft and Huber, 1987; Fulk and Boyd, 1991; Wofford, Gerloff and Cummins, 1977, 36). Besides the contingencies presented by its environment, organizations are subject to the uncertainties evoked by message variety, ambiguity, equivocality, and message timing failures.

At the micro-organizational level, the communications technique problem has been interpreted in terms of selecting communications media and procedures with the appropriate "richness" level (Bodensteiner, 1970; Daft and Lengel, 1986; Daft, Lengel and Trevino, 1987). Various types of communication techniques have been investigated for their perceived "richness" quality and use by managers (Carlson and Zmud, 1999; Daft et al. 1987; Trevino et al. 1990). Methods with "higher richness" have been found to be more effective in communicating more complex meaning per unit of time. Holland (1970) found that research and development engineers considered by peers to have higher "information potential" as colleagues used richer communication channels for outside communications. Information potential was defined as the relative quantity, quality, and accessibility of information available from a source (Holland, 1970, 73).

However, message content, perceived familiarity and method availability also influence the choice of media for conveying meaning (Carlson and Zmud, 1999; Huseman and Miles, 1988). According to channel expansion theory, a medium can be perceived as increasingly "rich" as the level of experience with messaging partners and the media technology increases (Carlson and Zmud, 1999).

2.5.6.2 Structure and Decision Architecture

At the macro level, the *communications structure* and *decision architecture* are key components of information design. According to Krone et al. (1987), those aspects of communication within a macrostructure are studied using the fourth of their four paradigms: the *systems-interaction* perspective. The key issues in this form of research are timing and pattern of information exchange. In traditional organizational theory literature, the systems-interaction approach is referred to as the information systems processing model of organizations (Galbraith, 1974; Tushman and Nadler, 1978). Information systems design answers how well the frequency and routineness of communication matches the degree of task uncertainty present in the work unit. Some of the structural variables of organizations, such as formalization, centralization, and complexity have already been discussed for their relation to communications behavior, especially, in terms of volume and routing. The theories discussed below provided more detailed accounts explanations of the structure and communications relationships.

2.5.6.3 Galbraith's Design Factors

According to Galbraith (1974) and Hrebiniak (1980), organizational structure influences information absorption rate and capacity. That rate can be improved through faster vertical throughput and creation of lateral relations. Galbraith (1973, 31) suggests four dimensions, or levers, for designing the vertical information system: (1) fixed or periodic versus continuous decision processing; (2) local versus global information access scope; (3) degree of formality in collection and reporting procedures, and (4) type of decision mechanism: man, machine, group, or some combination of those.

For creating lateral relations, Galbraith's recommendations are: (1) provide direct (as in face-to-face or "rich") management contact between problem-sharers; (2) establish permanent liaison roles between departments; (3) create temporary task forces; (4) create the integrating role to manage multiple lateral relations; (5) establish a linking-managerial role, and (6) at the highest level of required integration, use a matrix reporting structure (Galbraith, 1973, 48).

The vertical information structure adjusts the speed of throughput from top to bottom. In routine, stable environments, speed is improved with formalization, use of formal routines and standard operating procedures, and local machine processing routines. The lateral relations structure, in contrast, adjusts the localized task unit's ability to adjust to task uncertainty, i.e., lateral relations promote greater, and more localized absorption and decoding of environmental information (Galbraith, 1994).

2.5.6.4 Formalization and Communications

Related to the technical issues in communication is the distinction between forms of communication acknowledged as formal and informal means (Holland, 1970; Pelz and Andrews, 1966; Wofford et al. 1977). Formal communications procedures are instruments of managerial oversight and control of routine activities (Child, 1984; Eisenhardt, 1985; Ford et al. 1988; Hage and Aiken, 1967, Pugh et al. 1968). Formalization is instituted at the level of the macro unit. The communication methods and procedures for transferring routine and exception information are part of the larger structural component measured as *formalization.*

The degree of formalization and the availability or distribution of communications technique need not be directly associated theoretically. Hage and Aiken (1967) and Pugh et al. (1968) suggest that the extent of rule codification, specificity, and recordkeeping is directly associated with formalization; thus, greater amounts of formalization would be associated with greater amounts of "formal" communications processing. However, the choice of media, the frequency of its use, or the perceived social acceptability of communication avenues does not have to be constrained by formal organizational rules, except where the rules make technical procedure part of the expressed policy statement.

Galbraith, on the other hand, argues that both formal and informal means of communication are "...necessary as well as inevitable, but their use can be substantially improved by designing them into the formal organization" (Galbraith, 1973, 47). Galbraith says that informal formation of social task groups, or cliques, should not be discouraged from arising "spontaneously" because they serve a useful information processing purpose not always handled through formal channels. Therefore, Galbraith's arguments suggest to this researcher that the organizational tendency to *sponsor* informal clique formation and spontaneous information exchange is in fact a part of its formalized structure, rather than outside of it. The difference between the truly "formal" processes and the informal ones might be the perception of "having too go around the back door to get things done" (Galbraith, 1973, 47). A more relaxed communication atmosphere, as suggested in Burns and Stalker's idea of organicness, follows Galbraith's conception of formally sponsoring the informal application of communications techniques and social behaviors (Burns and Stalker, 1961).

2.5.6.5 Structuration Theory

Later on in theory development, structuration theory created an explanation for how emergent social communication processes, often informal, become acceptable non-formal "standards" for social communication activity that eventually become entrenched into formal organizational systems (Fulk and Boyd, 1991; Monge and Eisenberg, 1987; Poole and McPhee, 1983). Jablin (1987) relates structuration theory and the emergence and dissolution of formalized structure:

> Structuration's major argument is that every action bears a dual relation to structure: It both produces and reproduces structure and the related social system...In essence, a structuration approach to the study of formalization moves us beyond measuring how written practices affect the frequency of various forms of oral communication and leads us to consider how communication processes function in the creation, interpretation, legitimation, and transformation of organizational formalization (Jablin, 1987, 406).

Structuration theory stands in contrast to the traditional view of formalization, in which the central core of management relinquishes part of its direct control by substituting standards and rules for behavior and performance. Whereas formalization appears to have a purposive, planned origin in its original definitions, structuration theory suggests that standard procedure and rules take root from the "ground up". Moreover, formalization would seem to have an indeterminate lifetime as an influence on behavior and communication routines, whereas structuration theory would argue that rules and procedures are constantly undergoing tests of utility and confirmation.

2.5.6.6 Summary: Information Processing Design

To summarize briefly, the information processing and decision making views of organization elaborated on prior open systems and contingency views. In particular, these views addressed the impact of both the individual and the internal network structure supporting individual and group relations in more detail. The generalized notion of "uncertainty" impinging on abstract organismic boundaries became more clearly defined in terms of micro-level and meso-level behaviors. With that increased detail, the "uncertainty" associated with both ambiguous communication processes and individual perception became more clearly a matter of concern. The organizational structure constructs taking on more clear definition from those models are *formalization* and *integration* of activity within the organizational boundaries. Organizational control over environment and its own internal behaviors must be achieved through a purposeful matching of internal information structure with environmental demands, using those two levers (in combination with others: span of control, hierarchy, centralization, specialization, interdependent grouping, and size). Structuration theory suggested further that communications processes in organizations were not unilaterally created; rather, they tended to reinforce or diminish the formal routines in place by virtue of their continued use. Communication structure, therefore, had hierarchical, lateral, and temporal aspects.

For some organizational researchers, however, the explanation from the information processing model was still lacking. The model did not provide a theory of differences in how meaning was assigned to information, nor did it permit the relative valuation of experience as a governor on meaning and value assignment. The two remaining organizational "images" to be addressed in this review give some clarification to these remaining issues. They are the image of an organization as a culture or group of cultures, and the organization as a learning entity.

2.6 Organizations as Cultures and Climates

As information and transportation infrastructures continued to grow worldwide and gain better reliability through technical improvement, commerce and market competition became more international in scope for many large organizations. Scholars became aware of the increasing need to study the impact of different cultural norms, language barriers, and symbolic or ritualistic practices on commercial activity and the production of useful social interaction (Smircich and Calás, 1987). Their focus shifted from examining organizations as sets of exogenous characteristics, filled by people, to sets of shared beliefs or ways of seeing, transmitted through symbolic activity (Falcione et al. 1987). Similarly, climate research shifted from trying to explain organizational behavior as an outcome of structure to comparing perceptions grounded within a measured contextual configuration (Falcione et al. 1987; Tagiuri and Litwin, 1968). Culture researchers studied perceptions as representations of internally consistent causal relationships, referents, and evaluative schemes (Smircich and Calás, 1987).

2.6.1 Organization Culture: Five Themes

Smircich and Calás (1987) discuss five different themes or approaches to organizational culture research. The first and second themes, comparative management and corporate culture, treat culture as an exogenous variable of the organization—a trait or aspect it possesses. Comparative management research studies differences in existing national or religious cultures and how organizations adapt to either ethnocentric or polycentric contexts, attitudes and practices. Corporate culture research, on the other hand, focuses on how organizations develop and sustain cultural ideology and distinctive practices from within (e.g., Peters and Waterman, 1982). While the former theme describes cultural differences and their impact on organizational behavior, the latter theme takes a more normative view. Simons (1995) model of strategic control levers supports Smircich and Calás. His first control lever, belief systems, are "value-laden and inspirational" and "must be broad enough to allow all organizational participants to commit to organizational values and purpose on their own terms" (Simons, 1995, 38). They are too "vague," Simons contends, to be measurable for performance purposes; rather, they represent an ideal value to be sought. Simons says that belief systems of organization management are evident in documents such as credos, mission statements, and statements of purpose.

In the last three themes of culture research, according to Smircich and Calás (1987), an organization is treated in research studies as an entity created out of cultural dynamics, such as a metaphor for sensemaking, organizing collective action or sharing a system of meanings (Weick, 1979). In the third theme, the "organization" is identified by its members as a cognitive system of language referents for interpreting shared experience (a knowledge structure) or creating a collective understanding for coordinating group behavior. The fourth theme of culture involves patterns of symbolic discourse involving rites, ceremonies, and symbolic attempts to celebrate, confirm identity, reinstate freedoms or transcend a punishing reality, much like the role of liturgical performance in religious ceremonies. In the fifth theme, Smircich and Calás refer to culture as "a reflection of the mind's unconscious operations" or psychodynamic "deep structure" in which organizations are created and recreated in the unconscious mental activities and belief systems of the individual member through symbolic practices, rituals, and myths. The authors argue that all five themes are not necessarily compatible with each other in their explanation of organizational behavior. Unlike the typical positivist measurement approaches used for studying prior organizational models, the "organization as culture" model is pursued using anthropological methods such as ethnography, participant observation, cause-mapping, and other field-based methods.

2.6.2 Culture in Schema Theory

Harris (1996) argues that organizational culture should be studied at the level of the individual making sense of organizational experience. The "culture" evident is the common sensemaking activities across individuals in the same organizational domain. The idea that individual perceptions reflect agreement of their organizational context or environment is also studied as "organizational climate" (Payne and Pugh, 1976).

Schema theory is the most recent paradigm of choice among scholars who study the mechanics of social cognition (Harris, 1996). Schemas are:

> dynamic, cognitive knowledge structures regarding specific concepts, entities, and events used by individuals to encode and represent incoming information efficiently...(they) are typically...derived from one's experiences about how the world operates...(and)...guide perception, memory, and inference...(Harris, 1996, 286).

Schemas act as maps or procedural guides for interpreting raw experiential data; they connect past, present, and future representations of experience and the search for information to take subsequent actions. One of the important functions of the schema, especially as it pertains to the current research question, is how schemas simplify and speed up the process of perceiving environmental information. Stimuli from the environment are "matched" in the head of the perceiver with the set of schema representations for the "map(s)" of the encountered situation. Missing data may be filled in on the basis of the schema; erroneous attributions of cause and effect may take place in the process (Harris, 1996, 287). As experience with certain data configurations generate successive use of the schema, the schema becomes more ingrained as routine cognitive processing for that set of stimuli. At the level of group or social context, shared schemas are reinforced through use of shared language referents, behaviors, and symbolic gestures, making their embedded nature even harder to undo. The reality of situations, therefore, becomes socially constructed from negotiated meanings and reinforced behaviors interpreted through common schemas (Bateson, 1972; Berger and Luckmann, 1966).

Schemas seem similar in concept to the perceptions measured as organizational climate. Climate is captured in perceptions of autonomy, reward, consideration, warmth, and support experienced on the job as they relate to perceived dimensions of organizational structure. An example of perceived structure is participative decision-making atmosphere (Payne and Pugh, 1976, 1140). The relationship among climate variables, however, is determined by the design of the research investigator, while the study of schemas presupposes that the subject has a specific causal relation and evaluation scheme already operating directly to affect action.

2.6.3 Summary: Organization Culture

From both the perspectives of Harris (1996) and Smircich and Calás (1987), one finds organizational culture to be a reinforcing cycle of meaning generation through both social and private interpretation of symbols. The important underlying idea is that raw experience, either social or individual, is made sensible through a collection (and process of generation) of codes or representations. Through the vehicle of language, gestures, symbols, graphics, and props, meanings between people are connected and made actionable collectively (Cook and Yanow, 1996).

Disagreement remains, however, on whether or not the process of creating shared meaning and value can be manipulated at the social level indefinitely. From Simons's (1995) view, the answer would be in the affirmative: management can manipulate socially shared forms of communication very well to achieve strategic goals. From Smircich and Calás's (1987) and perhaps Harris's (1996) arguments, however, the attempt to control cultural mechanisms would not last if the symbols no longer "made sense" to those being controlled. When a meaning–experience mismatch goes on for an extended period, other meanings may become attached and even gain group ratification.

Unlike the information processing view of organizations, the culture view advocates a research interpretation of localized information value. Information does not have a uniform meaning to everyone. Therefore, the task design and information channeling procedures do not completely determine how information will be interpreted. Besides, the structure of the information system is very much determined by the evolution of private interpretation and local use, whether management wills it or not (Morgan, 1997; Smircich and Stubbart, 1985).

To summarize the cultural view of organization, culture is both exogenous to and entrenched in organizational activity. Organizations are placed in a variety of nationalistic settings or are subject to the value judgments of various belief systems embodied in their members and stakeholders. Managers may attempt to understand and describe the differences in individual perception resulting from cultural differences. Managers may also try to unify or control those perceptions by deliberately manipulating "internal' symbols, statements, and documents, stories, ritualistic participation, and ceremonies. Representations, in the form of information and symbolic transmission activity, are the chief tools for creating, sustaining, melding, observing and understanding the social processes of cognition and interpretation (Cook and Yanow, 1996). Organizational control, culturally speaking, may come about through a variety of vehicles: cultural similarity or like ethical standards, use of similar language referents and schemas, selection and enculturation processes of newcomers, and ritualistic enactments or stories of legitimate (and illegitimate) behavior.

Unlike earlier organization models, however, the individual's cognitive processes and attributions for self and others have taken on a key role in the explanation of organizational being. Organizational control is no longer accomplished via external incentive systems, punishments, information access and structural mechanisms of decision making centrality, formalization, integration and grouping. In the cultural view, organizational sanctions can now be administered through the more personal threat of exclusion, social repudiation, and value irrelevance.

Models of organizational culture fall short of explaining organizational knowledge and how organizations increase their productivity using similar inputs and technology. Cultural models do not concede that organizations have a real productive purpose to be achieved or lost. That productive purpose or "performance gap" gives information and symbol use a particular teleological meaning, rather than a culturally assigned meaning (Duncan and Weiss, 1979). A more recent model of organizations as learning systems provides a theoretical backdrop for understanding information use as a vehicle for the development and transfer of knowledge, i.e., useful meaning sustainable over multiple instances, multiple generations of users, and multiple locations.

2.7 Organizations as Learning Systems

Organizational learning theories explain the knowledge transfer process within an organization as a complex system of cognitive participants with both shared and unique knowledge bases, all of which form a store of referents, cause maps, and evaluation strategies for environmental data. "Participants" in the learning system may include human beings, calculating and storage machines, archival records, symbols and objects, and the systems that interconnect them in time and space. The knowledge store serves some, past, present, or future organizational ends, though the ends may not be discovered through a synoptic planning process (Argote, 1999). Like culture, learning systems may assign multiple valences and meanings to individual symbols, depending on their use in the order of organizational activity, and depending on who is using them.

2.7.1 Organizational Learning: Consensus

Measures of organizational learning exhibit a wide array of definitions for the construct. Fiol (1996) measured learning as a dynamic group-level process of converting opinion diversity to varying degrees of consensus in a new product team. Fiol used a content analysis of a communication logbook to code instances of argument, support and disagreement. In her study, Fiol did not measure the final outcome of the new product nor its performance results on behalf of the sponsoring firm.

2.7.2 Learning as Information Processing

Huber (1991) declares that an organization has learned if "through its processing of information, its range of its potential behaviors is changed (Huber, 1991, 89). Huber's review of the literature divides learning constructs into four themes: (1) knowledge acquisition; (2) information distribution; (3) information interpretation, and (4) organizational memory. Knowledge can be acquired through inheritance, or incorporating knowledge through its individual members' experiences and skills. Knowledge can also be gained through deliberate experimentation, action research, and growing experimenting subunits such as research and development teams. Repeated experience, vicarious experience, partnering and surprise events may also result in learning.

Information distribution is accomplished through scanning, focused search, and performance monitoring or feedback channels. Information interpretation is influenced by cognitive maps (schema) and framing effects, media richness and information load. Also, unlearning can affect learning by either decreasing or altering the range of behaviors applied to the information interpretation. Finally, organizational memory can enhance the information processing of individuals by extending their private memories, allowing for information exchange, and precluding substantial loss when individuals take their memories with them upon leaving. Huber's review suggests structural characteristics that may change with "learning" changes, rather than suggest "organizational learning" measures specifically.

2.7.3 Organizational Memory

Walsh and Ungson's (1991) concepts of organizational memory differentiate between "anthropomorphizing" individual memory and learning and those activities truly associated with group-level information retention. Walsh and Ungson assume that organizations are information processing systems capable of sensing, processing, and retaining information about the environment. Further, they assume that organizations are interpretive systems for assigning meanings, and these interpretations are generated from collected experience stored in memory. Finally, they argue that organization memory is both an individual and organization level construct because the retention mechanisms for organizational knowledge are in both organizational and individual repositories. Organizational memory is kept in five "bins": individual members, cultural symbols and language, transformation technology, role structure, and physical layout or settings.

Huber (1991), Daft and Huber (1987), and Argote (1999) would agree with Walsh and Ungson (1991) that organizational learning consists of both individual member learning and collectively stored information and routines. Besides the points listed above, organizational learning serves the function of transferring knowledge from geographically dispersed units, temporally dispersed units, successive generations of information users, and from external to internal sources. Argote (1999) defines organizational learning in terms of production efficiencies increased over repeated performance episodes, such as product life cycles. In Argote's view, learning is evident in production increases over time.

2.7.4 Organizational Routines

Not all theorists agree that organizational learning contains individual learning as a component part. Unlike Walsh and Ungson (1991), Levitt and March (1988) and Cohen

(1996) contend that organizational learning should be construed as independent of individual retention. Simulation evidence obtained by Carley (1996) show just how much personnel turnover can affect organizational retention of knowledge. To account for the loss of learning through turnover, organizational learning should be measured as a *shared* knowledge system. Cohen (1996), citing the ideas of Nelson and Winter (1982), suggests that organizational learning is best captured in the form of explicit or noticeable routines.

Cohen and Bacdayan (1996) define organizational learning as explicit development of routine, interlocking, reciprocal behaviors, or procedural memory. Cohen and Bacdayan (1996) claim that:

> routines arise in repetitive situations where the recurring cost of careful deliberation can become a heavy burden; they store organizational experience in a form that allows the organization to rapidly transfer that experience to new situations. (Cohen and Bacdayan 1996, 405).

Procedural memory is different from declarative memory, according to psychology theorists, in that procedural memory stores knowledge of habit or skill, while declarative memory stores facts, truth propositions, and events (Singley and Anderson, 1989).

By use of an experimental simulation with a card game, Cohen and Bacdayan (1996) were able to show that the group memory for routines is procedural rather than declarative, using four findings to support their conclusion: (1) increasing reliability of playing moves; (2) increasing speed to make a move; (3) repeated action sequences of joint behavior, and (4) suboptimality (i.e., the group collectively made a suboptimal processing mistake on the basis of encoded procedural memory). The important point of the research is that memory retained as procedure is very durable and not easily expressed, making it difficult to isolate and change using language referents. Moreover, it is a collective construct apart from individual memory.

2.7.5 Adaptive Connectionism

Weick (1996) and Hutchins (1996) also consider organizational learning to be a group construct, questioning whether such a thing as "group cognition" exists. For Hutchins (1996), who observed a ship crew's response to an emergency equipment failure, organizational learning is a process of adaptation through non-reflective task redistribution at the local level. Hutchins contrasts the adaptation response to what might be considered "global" awareness to redesign. As one member of the unit realizes that he or she is missing the target response, he or she offloads some of the information processing demands locally through other interdependent actors, thereby adjusting system-wide actions.

In a simulation of an air attack, Chapman, Kennedy, Newell, and Biel (1959) noted, like Hutchins (1996) that group members adjusted their actions and responses to each other without a global "design" worked out in advance. Over several episodes of attack and response, simulation crews were able to show evidence of group-level adaptive learning, despite increases in task load. Chapman et al. (1959) report:

> This learning showed itself in procedural short cuts, reassignment of functions, and increased motor skill to do the job faster and more accurately...the most obvious thing crews learned was to distinguish between information useful for task accomplishment and that which was not. Crews focused their attention on important classes of tracks at the expense of unimportant classes (Chapman et al. 1959, 264.)

Interestingly, however, the evidence of crews' learning was not reflected in their discussions among themselves and the researchers as a language representation, or what might be called "stored knowledge" or agreement by other organizational learning theorists (e.g., Duncan and Weiss, 1979; Fiol, 1996; Huber, 1991; Walsh and Ungson, 1991). Like Hutchins' crew, the crews from the Chapman et al experiments adapted to changing tasks via tacit understanding and reciprocal action adjusting, consistent with the distinctions made by Cohen and Bacdayan (1996) and Cook and Yanow (1996):

> We believe that the "debriefings" following each session, where the operating results were reviewed, were crucial to the learning that led to improved performance. But we have been unable to relate the content of these discussions directly to crew development. Procedures were frequently changed without any sign that an operating problem had been recognized or a solution proposed. As a matter of fact, procedural changes sometimes moved in one direction while discussions went in another (Chapman et al. 1959, 264).

The two foregoing descriptions of organizational learning depict what Weick and Roberts (1996) refer to as a "connectionist" explanation of group adjustment and adaptation. Weick and Roberts (1996, 333) claim that connectionist theories of organization provide "the insight that complex patterns can be encoded by patterns of activation and inhibition among simple units, if those units are richly connected." Organizations are social forms of a neural network, processing distributed task information. The network must have "overlapping knowledge (that) allows for redundant representation," "behavioral dependencies," and "the substrate of distributed processing" (Weick and Roberts, 1996, 333).

2.7.7 Heedful Interrelating

Weick and Roberts argue that the connectionist model of organizational learning is not adequate to explain emotion and motivation. In place of the connectionist model, they support the model of "collective mind" in which members act as if they are a group "with more or less care" (Weick and Roberts, 1996, 334). "Mind", in their view, "is a dispositional term that denotes a propensity to act in a certain manner or style" and "is actualized in patterns of behavior" (Weick and Roberts, 1996, 335). Collective mind is synonymous with a degree of "heedful interrelating" that combines "contributing, representing, and subordinating actions that form a distinct pattern external to any given individual" (Weick and Roberts, 1996, 339).

Weick and Roberts conclude their article by relating the idea of collective mind with heedful interrelating to other organizational theories. Increased collective heed, in combination with greater task-related interdependence and flexibility in task sequencing, permits organizations to act as high-reliability, rather than high efficiency, systems. They explain:

> A smart system does the right thing regardless of its structure and regardless of whether the environment is stable or turbulent. We suspect that organic systems, because of their capacity to reconfigure themselves temporarily into more mechanistic structures, have more fully developed minds than do mechanistic systems (Weick and Roberts, 1996, 353).

2.7.8 Holism and Deutero-Learning

Morgan (1997), taking principal ideas from Bateson (1972), Ashby (1956), Weick (1979) and Argyris and Schon (1978), likens learning organizations to holograms in their design. An organization capable of learning must be able to: (1) anticipate environmental change through detection of variation signals; (2) develop an internal ability to question and change its own rules and routines, and (3) allow strategic direction and structural design to emerge, rather than be imposed from the outside. The principles of a holographic organizational design include: (1) build the whole organization (purposes, visions, cultural values) into the parts (members' thinking, team structures); (2) build redundancy in structure and function among parts; (3) match the requisite variety of the environment with the complexity of organizational control mechanisms; (4) define or specify formal routines as little as possible, leaving behaviors free to vary with changing situations, and (5) acquire the skill of learning how to learn, or deutero-learning (Bateson, 1972).

In deutero-learning, the organization moves beyond the simple error detection and correction routines involved in feedback. The patterning or routine formation, evolved through repeated experience with the environmental stimulus, is "undone" or "unlearned" in deutero-learning; the learning organization is able to sense that its routines are no longer sufficient to respond to the environment. The cognitive process of a deutero-learner is self-aware, able to behold and recreate its own methods of structuring. In so doing, the deutero-learning process segments past from present in attention and memory.

2.7.8 Organizational Learning Summary

Despite its limited scope, the review of organizational learning literature indicates how broadly writers construe this topic. A learning organization is different from other organizational types because it has the capacity to repeat specific behaviors over instances and generations in time. A learning organization has a performance impetus, though the specific performance goal may not be discussed globally and planned in advance. A learning organization shows evidence of improvement, either in meeting its performance objective, in economizing in the use of resources, or in performing activities in less time (Argote, 1999). Finally, a learning organization has a system of shared symbols, languages, behavioral protocols, referent objects, interrelating and interdependent procedures, or other methods of establishing coordination among a complex set of tasks performed by multiple actors. Although no writer wishes to attach the anthropomorphic "group cognition" on the construct, each has carefully argued why organizational learning is neither equal to nor contained in the sum of individual cognitions in the set. However, thinking and cognitive processing, as well as tacit knowledge in the forms of increased skill proficiency, shared coding schemes, and local "transactive memory" are all fundamental activities of organizational learning.

Organizational learning constructs are not as well developed and internally consistent as those of other organization theories. Cohen and Sproull (1996) preface their volume of collected works on organizational learning by naming three dimensions on which organizational learning theories diverge.The first dimension is whether organizational learning is best described as a *storehouse of facts* and propositions, or a *set of routines* or accepted procedures for action (Nelson and Winter, 1982). The second dimension asks whether organization learning is stored in the *minds* of its individual members or is resident in the *relations* among those individuals. Third, there is debate about whether organizational learning reinforces existing action or stimulates behavioral change. None of Cohen and Sproull's dimensions, however, captures the idea of process: how organizational learning is sustained or transformed over time.

The deutero-learning concept introduced to management literature through the works of Argyris and Weick describes the learning process and the conditions for it to take place. In contrast to the theorizing of Cohen and colleagues, who refer to organizational learning as the creation of routines, Argyris and Weick would argue that routines are created, disrupted and re-negotiated at will in a learning organization. The cognitive process that involves all aspects of deutero-learning is self-aware, able to segment past from present in attention and memory. For a deutero-learner, the context of time is not a "given" to be taken for granted. Time is segmented and re-segmented into relevant periods for specific purposes. Weick and Roberts (1996) suggest this idea in their comment:

> A smart system does the right thing regardless of its structure and regardless of whether the environment is stable or turbulent. We suspect that organic systems, *because of their capacity to reconfigure themselves temporarily* into more mechanistic structures, have more fully developed minds than do mechanistic systems (Weick and Roberts, 1996, 353, italics added).

The important assumptions made by Weick and Roberts are that the "smart system" or learning organization is capable of *knowing when* to reconfigure itself in the stream of activities it performs, and that its parts are coordinated to act with "collective mind."

2.8 Discussion: Control Concepts

In this chapter, several major streams of organization theory literature have been reviewed, examining organizations and their participants in the context of information use and design. At the beginning of the review, the present author asserted that the sequence of theories has placed increasing emphasis on the individual thinking actor as a source of control over organizational outcomes. In parallel with that increased emphasis on the individual mind is the increasing acknowledgment of tacit organizational knowledge, i.e., sources of organizational knowledge and thinking that are not open to scientific measurement and comparison directly at the level of organizational attributes. Those sources are "tucked away" in the heads of individuals. Either the individual cannot (some knowledge is unconsciously perceived) or will not (some knowledge is not permitted for organizational disclosure) allow public discourse about that tacit knowledge.

Direct measurement of organizational knowledge would allow a better research vantage point for assessing knowledge change via information processing and absorption activity. However, knowledge measurement cannot be direct and unambiguously evaluated at the organizational level of analysis, given the theories presented here. This researcher is left trying to do with less direct methods of assessment. Some surrogate measures for knowledge, supposed to relate to processes of thinking, have already been mentioned earlier in the review. Those might include: organizational tenure, academic education sources, professional association membership, cultural identities, national origin, age, and relevant group affiliations. From the arguments of cultural, climate, and learning theories of organization, those demographic, cultural and educational variables may indicate intellectual development, expertise, professional codified practices, and level of general knowledge. However, as Walters (1996) points out, those variables are merely substitutions for the thinking processes that determine information processing and use. The assumed high correlation between the surrogate measure and the cognition process is not established empirically in the literature.

Resorting to macro-organizational factors of formalization, centralization, complexity, integrating mechanisms, and communication technology does not work either. Those factors do not satisfactorily account for systematic influences of learning, individual perception biases, group socialization processes, and idiosyncratic local norms and "bounds" on uniformity or otherwise "rational" behavior. As some argue with confidence, organizational structure is not the only systematic source of control over its members' mental activity.

All organization theories reviewed suggest, however, that the "whole" organization cannot exist independently of its "parts," even if those "parts" are substitutable in time and space. Information use and absorption activities of the "parts," and in particular, the individual actor, thinker and information user, is the primary resource for attending, sensing, and interpreting environmental uncertainty on behalf of the organization, however varied individual perception differences and knowledge competences might be (James, Joyce, and Slocum, 1988).

Researchers cannot "hardwire" their minds into the minds of their subjects to discover what is in them. A researcher can only "know" what goes on in the thinking processes of subjects through an imperfect, temporally dependent communication process, using a variety of language forms (Pylyshyn, 1983). Communication processes, however, involve substantial information losses because transmission fidelity is not perfect (Shannon and Weaver, 1949).

Taking that underlying principle as a starting assumption, the present author argues that the level of the individual, rather than either the levels of the group or the organization, is the best level of analysis for measuring differences in information load and use, though not all the factors related to information processing are controlled at the individual unit of analysis (Carver and Scheier, 1982; Payne and Pugh, 1976). Even though this research is supposed to tell something about organizational information processing, this author assumes that *control effects* are best measured at the level of the individual, as an initiating point of organizational thought and action, despite the evidence that *control causes* are not necessarily instituted solely at the unit of the individual.

Others have argued elsewhere that the individual need not be the only unit of theory for certain organizational properties related to thought and language because inter-subjective meanings can be measured with relatively high reliability (Glick, 1985, 1988). This author would counter-argue, however, that if intersubjective meanings and symbols persist apart from organizational members as individuals, then they do so as a part of the "learned routines" and "memory" accruing over repeated use and exposure in multiple organizational generations. As this research is not intended to be longitudinal, no evidence to support a claim of independent, organizational knowledge or meanings will be provided apart from the subjects who provide responses. Therefore, the research is designed under the assumption that the only relevant unit of analysis for the observation of information control effect is the individual subject reporting.

In reviewing the literatures of organization structure, information processing design, communications, and organizational learning, a fundamental tension between the need to resolve uncertainty and the resources of available time underlies their theoretical points. Greater structure, use of general procedure, and "higher resolution" task definitions promote communication and response speed, while greater redundancy, procedural variability, and overlapping task definitions promote response scope. Response speed comes from *routinized* processing (use of procedural memory, formalized and standardized responses); response scope increases as variety in information inputs and associations increases (in use of declarative memory and non-standardized responses).

Despite the fact that advances in information technology afford more data accessibility, the organization's efficiency problem of how to allocate limited time and attention across information resources and absorption tasks is still open to question. The information design school of Galbraith, Huber, Tushman and colleagues contributes answers at the level of organization, assuming that individuals behave and think in more or less uniform ways (though these "ways" need not be equivalent to March and Simon's perfect economic rationality). Variables of organizational structure may influence, if not direct, the use of time by specifying formally what data is attended and what is not. However, in the absence of uniform thought and behavioral constraint, the organizational problem of time and attention allocation may be solved heuristically at the individual or small task group level as a coping response to overload conditions. Besides individual heuristic coping and formal organizational procedure, local task group "routines-in-use" may influence time and attention direction (e.g., Cohen and Bacdayan, 1996).

At the individual level, theorists suggest that some control is willfully imposed in individual choice and evaluation, motivation, and bargaining (Cyert and March, 1963). Also, some control is not consciously manipulated, but may be related to cognitive capacities of attention, memory, and input capacity (Carver and Scheier, 1982; Eysenck, 1982; Kahneman, 1973). Selectivity and focus of attention has been empirically studied in connection with variation in states of arousal, different forms of decision stress, and variations in information cue processing (Easterbrook, 1959). In cognitive models of attention and central processing in the brain, information processing tasks are controlled in a hierarchical structure governing the level of focus and application of effort. The relation of attention, arousal, and effort expenditure on information processing will be discussed in more detail in chapter 3, particularly in relation to stress and coping.

At the small task group level, researchers have suggested that control is also exerted in the form of *local* symbolic representations, theories-in-use, emergent group structures, information system architecture, and locally generated behavioral routines (Argyris and Schon, 1978; Cohen, 1996; Huseman and Miles, 1988; Galbraith, 1974; Smircich and

Calás, 1987). For example, supportive supervisory climate, level of group familiarity, level of trust, relative isolation, redundant communication procedures and channels, use of "rich" communication methods, and span of control may each contribute to the ways in which symbolic exchange activity becomes ratified and embedded in group process routines, socialization and affiliation (Levine, 1989). In turn, information controls stimulated by group process and maintained through social behavior may also affect self-attention, social comparison, and self-categorization in relation to the group (Carver and Scheier, 1982; Festinger, 1954; Turner and Oakes, 1989).

Still other forms of control are exerted system-wide through standard procedure, articulated management beliefs, training and continuing education, information and decision system architecture, formal authority delegation and decentralization, role structures, and performance monitoring systems (Duncan and Weiss, 1979; Fayol, 1949; Galbraith, 1973, 1974; Simons, 1995; Tushman and Nadler, 1978). Macro control systems may have self-transformation capacities to reorganize on a temporary basis, responding to extreme situations or task demands (Burns and Stalker, 1961; Chapman et al. 1959; Hutchins, 1996; Weick and Roberts, 1996), or they may also institutionalize behavioral responses into rigid, path-dependent sequences (Crossan et al. 1998; Hedberg, 1981; Lei et al. 1996; Starbuck, 1983).

Researchers have not investigated how these various forces of information processing control are related to the allocation of individual attention and resulting decision making processes. Attention allocation, information load, and states of arousal are all important factors in how decision making cues are processed (Eysenck, 1982, 1993). Routinized decision making using procedures make efficient use of individual, group, and organizational attention and time. However, routines can be maladaptive decision responses, undermining their utility as efficiency controls.

The idea of control at the organizational level is generally associated with the organizational processes of information and communication (Jablin, 1987; Culnan and Markus, 1987). Information is also regarded as a means for the organization to control the uncertainty presented by its environment (Duncan, 1972; Tushman and Nadler, 1978). Control at the individual level is associated with the allocation of attention, effort and cue processing; communication processes affect those individual factors also. As the individual subordinated mind processes communicated information about organizational uncertainty, there are many types of information control acting on that process. These control functions may not be linear-additive, but hierarchical and systematically interdependent. Each source of control acts on the structure, temporal frame, and cognitive interpretation of symbolic transmission conducted in sequences of time.

One potential linking variable among all forms of hierarchical control operating on the individual thinker is *time*: how much time the individual has available for attention, how that time is distributed across tasks, and how time is structured and synchronized by global and local efforts to integrate those tasks with interdependent others (McGrath and Kelly, 1986; Sproull, 1984).

2.9 Organizational Structure and Time

Organizational structure constructs, as they are now explained, permit a very limited view of an organization as a temporal unit of analysis, on the one hand, or an orchestration of multiple temporally dependent activities, on the other. Much of the literature supports the argument that organization structure is created for a non-specified lengthy duration. That duration is frequently discussed as if: (1) it lasts longer than the average tenure of any single individual member and (2) structure is determined by market forces primarily out of organizational control.

Organizational duration is often expressed in terms of its structural development and institutionalized routines (Crossan et al. 1998; Starbuck, 1983). The information design approach to structure assumes that structural variation promotes certain information efficiencies over others, and the choice of structure should be consistent with performance goals, grouping of tasks, and level of environmental uncertainty and unpredictability.

Variation in organizational structure does not, on the face of it, provide substantially more temporal resources for attention: structure decisions modify the direction and assimilation of attention. This assumption is basic to the research hypotheses given in chapter 4. There are two ways for the organization to increase its store of attention: it can buy more (i.e., hire more cognitive processers, both human and machine), thereby increasing its size and attending capacity. In addition, those already providing attention can provide more attention incrementally through: (1) spending more time on organizational cognitive tasks; (2) refocusing their attention on more appropriate information, and (3) increasing their processing speed.

Increasing organizational size, however, usually creates increasing complexity as well, so that more attention must be devoted internally to the processes of coordination (Graicunas, 1933; Urwick, 1974). Also, increasing size increases risk exposure and the internal uncertainty associated with more boundedly rational agents (Simon, 1976). The net effect of hiring more attention may not necessarily produce more uncertainty absorption at the organizational level. The current managerial trend in organizational size appears to limit size as much as possible, to hold down costs, prices and risk exposure. Downsizing, outsourcing, widespread use of temporary labor, and increasing emphasis on efficiency suggests that growing larger is not a popular management goal.

On the other hand, as more and more information load is placed on the individual agent-processor, that person may resort to attention-rationing, in turn affecting cue processing and the symbolic transmission of those cognitions to others who are interdependent for work accomplishment. When the net effects of those rationing routines and interdependencies are considered, the organization as a whole may not be getting enough information to respond correctly or in time. Moreover, the additional stresses placed on the individual may backfire: competent minds will seek less stressful conditions through other work avenues, resulting in turnover and a loss of organizational knowledge.

Attention has been related to the human's "central processor" in the brain (Eysenck, 1982). The capacity of that central processor appears to be limited in several distinct ways, according to research evidence. Substituting the variable of time for the variable of attention, insight into the tradeoffs between sources of information control, organizational characteristics, and the personal expenditure of attention may become evident. What appears to be missing from variables of structure is the deliberate or assumed segmentation of time as a method of directing attention (Bluedorn and Denhardt, 1988). The concept of *entrainment* is especially useful for illustrating that interdependent work relationships are structured on the basis of time and attention as well as on the basis of environmental uncertainty (McGrath and Kelly, 1986).

Management chooses many of its organization's temporal horizons strategically, for example: product releases, obsolescence timing, use of temporary or outsourced labor, and changes to capital structure. Keeping product development cycle times to a minimum, choosing the timing and sequencing of product introductions, and parallel product development are all issues related to formal temporal structuring and competitive positioning (Dussuage et al. 1996; Schilling and Hill, 1998). Likewise, the information activities supported both inside and outside the firm's boundaries may be purposefully designed to parallel these types of cyclic and aperiodic behavior. Exhortations to "unlearn" outdated schemas and codified strategies indicate that certain information activities have only a temporary value to the organization (Hedberg, 1981). The "unlearning" prescription indicates that management should exercise some form of control and measurement over deciding when structures, processes, and information activities are no longer useful. These considerations invite academic researchers to further investigate organizational structure, and the attention controlled within that structure, as time-dependent.

To account for the increasing impact of information technology, variables of organizational structure, as organizational responses to uncertainty, must be somehow referenced with respect to the use of time either as individually perceived time or organizationally shared time. Time allocation, as a surrogate for directed attention, is a significant resource constraint on productivity and information processing (March, 1978; Simon, 1973; Sproull, 1984). One basis for understanding the impact of organizational structures on individual cognitive processes lies in how temporal structure in decision making routines, as sequence, duration, horizon, and incrementing strategies, is associated with the degree of formalized temporal "structures" given by the organization as social routine. The literature of decision-making under time pressure and stress is useful for hypothesizing how individuals attend and screen information, based on perception of uncertainty in relation to temporal constraints.

2.10 Research Definitions

A definition of *organization* for this research is similar to traditional definitions (Child, 1984; Ford et al. 1988; Robbins, 1990). Organizations are defined as whole entities: (1) with a specific production or service purpose; (2) providing resources to external parties while importing external resources to achieve that purpose; (3) having more than one actor/agent with interdependent and intercommunicating relationships among themselves, and (4) exerting productive effort collectively for super-additive gain. Organizations are not identified as only names or electronic presences. In addition, organizations in this sample are not single individuals doing business as organizations, with complex external ties, contracts, funding mechanisms, and outsourced production facilities. Organizations are defined around a collective representation of purpose and identity, with social communication behavior and physical systems supporting that behavior. Organizations defined for this research must have a clearly identifiable reciprocal support relationship with their individual members, defined by work in exchange for remuneration.

Individual members of an included organization are "identified" as members based on the following criteria: (1) they identify themselves as members of the named organization; (2) they report to a superior also identifying himself or herself as a member of the named organization; (3) they are remunerated by the named organization on a regular (rather than episodic) basis; and (5) they are charged with responsibilities of information interpretation and decision making on behalf of the named organization(s). Geographic co-location with other organizational members is not required.

2.11 Chapter Summary

This chapter has briefly reviewed several organization theories and their accounts of information and control functions within the organization. Sequential theories have changed their views of human worth and function as organizational contributors; in turn, theorists have also suggested changes in how organizational control over individual contributions is manifested. This review has highlighted several sources of control over individual contributions in the forms of attentiveness and cognitive processes. Individuals may be controlled at the macro-organizational level by means of formal communications and monitoring, standard role relationships, explicit rule-based behavioral routines, and explicit authority structures. Individuals may be controlled more informally at the level of the task group or local work context through specific superior/subordinate role definitions and communications (span of control), information technology access, group affiliations, and informal socialization processes. Finally, individual thinking and cognitive processing may be controlled by individual perception and attention factors related to chronic or episodic task situations, such as processing load, level of arousal, levels of distraction and noise, level of focus, and amount of time spent on work tasks.

What is not clear from the literature review, however, is which of these three levels of control is most important as a determinant in how information search, load, and use are perceived and carried out in decision process sequences. Also, there is no suggestion in the literature that the type of control may relate to specific perceptions of information and time stress as well as uncertainty.

The next chapter considers the empirical evidence that relates individual psychological factors of information processing and decision processing to different loads and use conditions. In particular, information processing is viewed as a form of coping with uncertainty under various types of stressful conditions. Whereas the organizational information processing theory of design views uncertainty and stress as a macro-structural problem, adjusted through communications and roles at the interpersonal level, theory of stress and individual coping suggests that adjustments to uncertainty may arise in intra-personal processes of attention, cue utilization, and perceptual filtering. Because either of these methods of uncertainty alleviation can control information processing and the formation of processing "routines", they are assumed systematically related to each other in this research. The hypotheses for relationships are discussed in chapter 4.

As this research is motivated to understand how both macro-organizational and intra-personal processes control information load and use in an information transceiver function in particular, use of product managers as subjects is defended in chapter 5 in connection with sample characteristics. As a boundary-spanning, technical specialist in an information transceiver function, product managers perceive, attend to, and interpret data highly relevant to the organization's interpretation of its uncertainty and competitive position (Liefer, 1975; Zirger and Maidique, 1990). Product managers are motivated by *both* organizational goals and personal needs to relieve the uncertainty and stress associated with their work tasks. Theories of organizational structure and design have explained the relationship between goals, uncertainty, and task control; next, the personal experience of uncertainty and stress is discussed with theories of personal adjustment and coping.

CHAPTER 3

LITERATURE REVIEW: PSYCHOLOGICAL FACTORS IN INFORMATION PROCESSING

3.1 Introduction

Chapter 2 briefly covered the literature of organizational structure and design as influences on information flows and use. This chapter focuses on aspects of information use from the perspective of the individual user rather than the organization or social collective, with the caveat that the individual is acting on behalf of an organization as a subordinate. Herbert Simon's seminal work, *Administrative Behavior*, describes factors and interrelationships between individual and organization as decision-making actors (Simon, 1976). Simon's discussion of organizational decision making behavior, and particularly, the factors of bounded rationality, docility, memory, habit, and attention, are used as organizing points for the research review.

3.2 Herbert Simon's "Bounded Rationality"

At the beginning of his book, Simon distinguishes between deciding what is to be done versus "the actual doing." He notes: "a general theory of administration must include principles of organization that will insure correct decision-making, just as it must include principles that will insure effective action" (Simon, 1976, 1). Decisions include choice leading to action, as a special process apart from the "doing" of administrative work. The act of choice necessarily involves a process of selecting some actions over others in a purposive, goal-oriented way. Administrative decisions involve fact and value judgments, are group activities requiring coordination, and are subject to multiple forces of individual and social influence.

However, Simon continues, administrative decisions do not coincide with economic models of optimal, "rational" decision or choice, in that: (1) complete knowledge of future outcomes and relationships is never available; (2) imagination of future events requires imputing value, and some future preferences cannot be estimated, and (3) the mind cannot bring all possible choice options in view at once, so one's options are limited by what one can bring to mind. The human decision maker can only make "rational" decisions, therefore, under those constraints.

Human beings are capable of choice, in Simon's view, because they are docile (i.e., "teachable"), have memory capacity, and are able to direct their attention selectively (Simon, 1976, 84). Docility implies the human ability to learn causal relations and abstract consequences through experience and inference processes. Memory provides a vehicle for storing information about experience and inference so that it can be applied to future experience and causal interpretations. When one's attention gets focused on stimuli in a way that does not produce a response out of "habit," then rational choice is possible. Choice takes place with prior *hesitation* to take in information, compare, weigh evidence, and choose selectively. Alternately, habit does not require conscious choice; in fact, habit preserves energy by not demanding as much focused *attention* and *time out* to link information with appropriate response. Habitual responding happens automatically (Eysenck, 1993).

The organizational counterpart of individual human memory is contained in communications and symbolized, recorded information, such as documents and pictorial representations. Similarly, the organizational counterpart of habit is routine or procedure, generally preserved and shared collectively in some recorded form.

The essence of the decision making problem is to decide how to attend selectively, to know which stimuli require automatic or habitual response, and which require "hesitation" and deeper analytic thought. Having more information, in the form of symbols, does not indicate which symbols are more relevant than others, nor does it tell how to parse the entire set into manageable proportions (Simon, 1968). More information does not necessarily come with more rules for applying and prioritizing (March and Simon, 1993).

At the organizational level, distributing scarce attention resources across problems and opportunities from the environment involves (1) minimizing interdependence of decision components, and (2) knowing the time deadlines associated with different kinds of decisions. Simon adds:

> The richness of the informational environment and the scarcity of attention have many consequences for organizational design...First, the difficulty of coping with the information-rich environment is compounded by the fact that most information relevant to top-level and long-run organizational decisions typically originates *outside the organization, and hence in forms and quantities that are beyond its control*. This means that the organization must have an "interface" for ingesting such information selectively and for translating it into formats that are compatible with its internal information flows and systems.
>
> Second, if attention in the scarce resource, then it becomes particularly important to distinguish between problems for decision that come with deadlines attached (real-time decisions), and problems that have relatively flexible deadlines...(Simon, 1976, 294-295, italics added).

3.3 Alternative Models of Decision Making

Simon provides a relatively simple system of factors for describing the administrative decision process and the means by which individual and organization are related in that process. Simon's model of "boundedly rational" organizational decision behavior is one of the most often cited in the literature of decision making; however, it is not the only one used to describe organizational decision processes. Table 1 outlines differences in eleven theoretical decision process models with sources listed. Simon's model of attention, time deadline (temporal structure), value judgment, use of memory/learning schemes, and interdependent influences are used to compare the decision processes described.

Table 1—*Continued.* Comparison of Decision Making Models Using Simon's Factors

total image comparisons/ option screening (Beach, 1993)	attention and successive comparison is dependent on initial personal appraisal of worth	highly sensitive to personal perception and use of time and time structures	extremely dependent on multi-criteria, subjective value function, tacit understanding	highly dependent on past experience (weighed in relation to feelings, morals, beliefs)	all decision components are highly dependent on prior subjective assessment of value and belief, anchored in prior emotional valence
logical, incremental disclosure of goals and commitments (Quinn, 1977)	incremental goals provide ambiguous anchors for directing attention by savvy managers	decision outcomes are temporary and therefore less rigid	dependent on value judgments but not in a fully observable way	outcomes may or may not benefit from learning and experience	components are interdependent in producing outcomes but not in fixed patterns; decision system is flexible yet purposive
group adaptation to threat (Meyer, 1982)	highly dependent on existing espoused ideologies, not on attention quantity necessarily	not dependent; ideology, slack resources, structure are counter-forces to external "deadlines"	highly dependent on collective sense-making and language referents for explaining "threat"	memory and learning are used to restructure future decisions and reinterpret past experiences	all decision variables are highly dependent on common ideology in place at time of "incident"
cybernetic control process (Argyris and Schon, 1978; Grandori, 1984; Weick, 1979)	highly dependent on attention focus and availability to scan attention quantity is critical	highly dependent on temporal framing of incoming stimuli as pattern requiring responsive action	"exception" value controls scanning and response loop; emotion and morality have no influence	in Type I systems, memory and learning are not possible; in Type II systems, memory and learning determine response	attention, deadlines, and value "triggers" are heavily dependent on pattern recognition from prior learning
random association of factors Cohen, March and Olsen, 1972; Grandori, 1984)	mix of factors is highly dependent on attention availability and motivation	decision outcomes are wholly time-dependent; associations are temporally determined	association of value with decision criteria and outcomes may be transient	not important to outcome; learning not possible over time	interdependence is determined by transience and temporal co-location

Table 1. Comparison of Decision Making Models Using Simon's Factors

Type of Decision Process	*Attention Resource-Dependence*	*Time Deadline-Dependence*	*Subjective Value-Dependence*	*Memory/ Learning Dependence*	*Component Interdependence*
economic/ "perfect" rationality Simon, 1976)	infinite attention required	infinite time/ infinitesimal deadline assumed	Either not applicable or perfectly "just"	not needed	Interdependence not defined
constrained optimal solution, bounded rationality (Simon, 1976; March and Simon, 1993)	highly dependent on attention quantity and capacity	highly dependent but controllable through deadline recognition and manipulation	highly dependent but values are calculable and negotiable, not necessarily completely tacit	highly dependent for successful, efficient responding over multiple instances	attention, deadlines, values, and memory are all highly interdependent in producing decision outcomes
muddling through, limited successive comparisons (Lindblom, 1959)	dependent on attention but does not dictate outcome	outcomes are subject to continuous reanalysis; temporary solutions	highly dependent on value judgment and forceful persuasion	mildly dependent on past experience and retention, but successive decisions may not depend on prior causal logic	interdependence of value judgment with attention/deadline structure is critical for outcome
power struggle among players (Allison, 1971)	"like-minded" collective attention is absent; attention is parochial and directed for gain	deadlines manipulated as part of power play to force attentiveness	highly dependent on value as an instrument of power and internal dominance	not important to future outcomes as causal knowledge; dominant factions control future	attention/value components are highly interdependent with exercise of current power

Table 1 illustrates that other models of decision making processes emphasize certain resource factors in Simon's model over others. Those models are explained more generally as: (1) traditional economic or analytic decision procedures (Ansoff, 1965); (2) political outcomes of power struggles (Allison, 1971; Cyert and March, 1963); (3) successive limited comparisons of goals, means, ends, and values (Lindblom, 1959), (4) comparisons of global images for options and consequences (Beach, 1993; Beach and Mitchell, 1978); (5) an outcropping of the most dominant decision maker's psychological makeup (Miller, Kets de Vries, and Toulouse, 1982); (6) a purposefully incremental disclosure of goals and commitments (Quinn, 1977); (7) a group adaptation to unforeseen conditions (Meyer, 1982); (8) an error sensing/correcting procedure (Grandori, 1984), and (9) a random pairing of choice opportunities, participants, problems, and solutions by their co-location in time (Cohen, March and Olsen, 1972; Grandori, 1984).

The descriptive decision models compared in table 1 are grounded in field observations of practicing management, though the observed fields of practice have varied. Some authors, such as Allison (1971) and Lindblom (1959), describe decision making in public policy arenas, whereas others, such as Meyer (1982) describe decisions in for-profit institutions. In most cases, the authors listed in Table 1 describe decision making processes in relatively "large" organizations rather than small or entrepreneurial firms. However, each model takes into account the effects of selective attention, time and temporal frames, evaluation, and memory for past experience in some way. Not all models, however, agree on how much control management can exercise in manipulating decision outcomes through these variables (Hunt, 1988). Hunt (1988) illustrates how the rubric of "decision making" does not have to imply any sort of deliberate choice process; in fact, the activities of decision making may be as much metaphorical as substantive.

3.4 Decision Making: Potential and Limitation

Unlike some of the models compared in table 1, Simon's description of decision making allows the potential for *design*. In Simon's view, the decision factors of attention, time, memory and value are controllable, or at least partially tractable, within the larger context of organizational information systems design. Like Galbraith's macro-information systems design model (Galbraith, 1973, 1974, 1993), information use and decision making activity are purposive, with potential to shape future states and uncertainty. Managers have opportunities and motivations to become better decision makers as individuals while also creating environments for better decision processes to occur at the organizational level (March and Simon, 1993). In summary, the regulators of information design are:

(1) *attention*–how much is available and how it is to be directed;

(2) *time structure*–how deadlines are noticed, selected and manipulated as decision triggers;

(3) *value judgment*–how personal, individual value is aligned with organizational purposes;

(4) *memory and learning*–how cause/effect relationships are stimulated, maintained and extinguished for use in inference and efficient patterned responding to stimuli;

(5) *communication*–how symbolic exchange and transformation methods provide a mechanism for social/organizational coordination and control of attention, time, value, and memory.

The design presumption is that organizational management can and will align organization and information structures with environmental demands and internal technological imperatives (Burns and Stalker, 1961; Galbraith, 1974; March and Simon, 1993; Thompson, 1967).

However, the information structure actually implemented in an organization may not meet the design criteria required. There may be lags in time between the need for structural change and the recognition that change is necessary (Greiner, 1972; Miller and Friesen, 1984). Furthermore, the causal link between elements of "environment" and corresponding elements of "structure" may be ambiguous (Amburgey and Dacin, 1985). Management may not be willing to make investments in additional attention and cognitive resources due to the risks of organizational inertia (Lei et al.. 1996).

Taking Simon's individual-in-organization decision making model as a basic framework for design, what happens when the implemented design fails, or, when design is left to chance? How do the factors of attention, time structure, memory/learning, value and communication play a role if organizational systems design is not suitable for its decision making requirements, particularly at the individual level?

The answer proposed by oiganizational contingency research suggests that, eventually, organizational performance will suffer. In the absence of the organization's "global" effort and attention, poor environmental alignment will probably lead to organizational decline and even death (Cameron and Whetten, 1983). However, that prediction does not address the issue of what happens to the *individual* subordinated thinker/actor during the maladaptive period. The individual(s) involved may or may not be aware of a design problem, and similarly, may or may not share their awareness through communicated means. For example, strong group norms for conformity may keep one from "speaking out" (Festinger, 1954). Strong behavioral sanctions or punishments might also be administered for acting in discord with organizational mandates (French and Raven, 1968). The culture of the organization may not permit a valid representation of self-righteous disagreement with other shared values (Harris, 1996). Finally, the beleaguered individual(s) may simply "get used to it" and fail to recognize the personal intrusion (Eysenck, 1983), or even unconsciously suppress the evidence of the problem (Aldwin and

Brustrom, 1997). Research on role stress indicates that stressed individuals tend to withdraw and avoid contacts with others "sending" the stress (Kahn et al. 1964). Communication frequency sometimes exacerbates, rather than alleviates, the stressful relationship (Kaufmann and Beehr, 1989).

3.5 Organizational Design and Subordinate Stress

Where organizational information design is maladaptive, individual and group decision processes adapt as best they can, though not necessarily in ways that benefit the decision outcomes of the organization. In the context of the research question presented here, information processing and decision making is a work task delegated to individual roles. Organizational uncertainty creates cognitive work for those roles. Where the organization does not adapt adequately to uncertainty, its individual subordinate/ decision maker must adjust through the experience of *stress*. Stress may occur when the organization does not provide adequate division of work, clear lines of authority, adequate guidelines for carrying out tasks, or because it prevents the production of tasks through structural constraint (Kahn et al. 1964). Though Kahn et al. do not expressly mention cognitive production tasks, this research assumes that their model includes cognitive as well as other types of delegated tasks.

3.51 Definitions of Stress

According to Bronner (1982, 1), *stress* is "a condition to which individuals and groups are exposed when they recognize that their freedom of action is limited" and "can be designated as any imbalance that prevails on the biological-physical, psychic-cognitive, or the social-interactive level of the human system." Selye (1983, 2) defines stress as "a nonspecific response of the body to any demand." Wheaton provides a more detailed definition of social sources of stress:

> To provide a starting point for discussion, I define (social) stressors as threats, demands, or structural constraints that, by the very fact of their occurrence or

> existence, call into question the operating integrity of the organism...potential stressors must be capable of challenging the integrity of the organism if they occur in their more extreme form.
>
> A stressor must also, by virtue of the threat it poses, represent a "problematic" that requires resolution and cannot be allowed to exist indefinitely without damage...
>
> Finally, I want to make explicit that a stressor must be identity-relevant. This means that the pressure exerted by the stressor in part derives its power from the fact that it has the potential to threaten or alter current identities...a stressor need not be exclusively defined by consciousness of its existence. Awareness of the damage potential of a stressor is not a necessary condition of that stressor having negative consequences (Wheaton, 1997, 46-47, original italics).

Wheaton continues his explanation with more graphic image of the "insidious process" of chronic stress with a historical scenario of a collapsed bridge:

> In 1984, the middle span of a bridge over a river on I-95 between New York and Boston collapsed near midnight, extinguishing the lights along the highway for miles leading up a bridge. Without the usual light, cars hurtled off the last intact span into the black waters below...The sensational coverage that followed this event in the media centered on the possible cause of the collapse. The first questions asked had to do with precipitating events...All searched for an event that could have precipitated the collapse. It seemed to me that this was misguided...
>
> ...Observable, discrete events have an attractive quality as causes: They explain why the outcome happened when it did. It is more difficult to point to an insidious process and suggest that perhaps the wear-and-tear simply reached a threshold, a threshold of structural integrity.
>
> This is in fact what happened to the bridge. There was no "life event" that triggered the collapse: The weather was normal, the traffic was normal, there had been no sudden trauma...But long-term rusting, unmonitored by inspectors...had finally reached the point where the current structure could survive no more...
>
> ...The bridge...does not feel its rust. And the rust is not a static problem; it grows in scope and virulence, but imperceptibly...(Wheaton, 1997, 43-44).

Wheaton's collapsed bridge has a human parallel in organizations. Individual problem solvers and decision makers, acting as organizational agents, encounter forms of stress in information processing. If the organization's systems have not been designed with appropriate division of work, coordination, redundancy and operational deadlines, the individuals involved must adjust or exit to avoid the noxious effects of their environmental stressors (Kahn et al. 1964). For some, the behavioral pressure to adapt may not be severe enough to produce radical personal adjustments to "extreme" threats, as suggested by Wheaton (1997). However, a lack of personal changes in behavior and communication may not signal that stress is being prevented from taking its toll as a chronic personal challenge to "integrity" and balance. Research evidence on role stress suggests that higher stressful relations at work are often associated with lower communications frequency where conflict is present, reflecting conflict avoidance as a means to cope (Kahn et al. 1964).

Findings from studies of attention, decision making, and judgment under stressful conditions of cue overload, time pressure, time urgency, and task complexity are indicators of what individuals will do when forced to adjust their behavior to sub-optimal organizational conditions. Each of those factors is considered in light of empirical research in subsequent sections of this chapter. Before turning to them, a fundamental assumption of the research must be defended: the individual's cognitive and behavioral adaptation to stress will *mediate* the relationship between organizational structure/ design and organizational action/ performance outcomes (Lazarus, 1998).

3.6 Symbol and Rule in Representations

The mediation assumption holds that *individual* cognitive and communication effort is key to experiencing uncertainty of the organizational environment. Decisions, actions and shared perceptions at the organizational level are outcomes of personal, individual thinking. The transformation process connecting organizational information *inputs* (scanning, filtering, ordering and triggering) with organizational decision/action *outputs* (responding, saying, learning, and recording) is rooted fundamentally in the individual subordinated mind. Collective interpretation, action and coordinated responses are made possible through *communication acts* using symbolic representation and rule-based exchange (Eysenck, 1993; March and Simon, 1993; Pylyshyn, 1983). Pylyshyn refers to the "representational metapostulate" as a philosophical assumption about how knowledge and intelligence is created, maintained, and shared. Pylyshyn explains:

> Although, as we have seen, there are a number of theoretical and methodological characteristics that pervade a variety of approaches to understanding intelligence and human cognition, there is one overriding theme that more than any other appears to me to characterize the field of cognitive science. There are a number of ways of expressing this theme-for example, as the attempt to view intelligent behavior as consisting of processing information or to view intelligence as the outcome of rule-governed activity. But these characterizations express the same underlying idea: Computation, information processing, and rule-governed behavior all depend on the existence of physically instantiated *codes* or symbols that refer to or represent things and properties outside the behaving system. In all these instances, the behavior of the systems in question (be they minds, computers, or social systems) is explained, not in terms of intrinsic properties of the system itself, but in terms of rules and processes that operate on *representations of extrinsic things*. Cognition, in other words, is explained in terms of regularities in semantically interpreted symbolic representations, just as the behavior of a computer evaluating a mathematical function is explained in terms of its having representations of mathematical expressions (such as numerals) and the mathematical properties of the numbers these expressions represent. This is also analogous to explaining economic activity by referring, not to the categories of natural science (say, speaking of the physico-chemical properties of money and goods), but to the conventional meaning or symbolic value of these objects (e.g., that they are taken to represent such abstractions as legal tender or buying power). Although in both economics and cognitive science, the meaning-bearing objects (or the instantiations of the symbols) are physical, it is only by referring to their symbolic character that we can explain observed regularities in the resulting behavior (Pylyshyn, 1983, 70, original italics).

Pylyshyn's idea is that human communication takes place using symbolic representations and the logical rules that organize them. When we communicate what we think, we must use *referents* for the world and its orderliness to make sense to self and others. Though we might know the world in a "raw" and direct way, in some sense, we cannot fully communicate that direct perception because we must symbolize and order our experience in a way that has some meaning to others. Putting direct experience into a symbolic representational form changes its character and significance, and may also enhance or inhibit its storage and recall in memory functions (Eysenck, 1993; Zakay, 1993). For example, we cannot communicate the complete experience of "getting burned" by a hot object because we cannot package the full emotional and physical sensation into a limited, temporally dependent system of referent words, art, music, and so on.

3.6.1 Cognitive Mediation: Representations

In a similar fashion, the raw, cognitive mechanics of "deciding" may not be equivalent to what people can communicate about their "decision making." An individual may refer to "paying attention", recognizing "deadlines" as important or useful, engaging "memory" or learning from the "past," and placing relative "value" on certain outcomes over others, but may still not demonstrate a correspondence between what is said and what is acted out. Some theorists suggest that this difference may stem from how decision makers relate to themselves and their own experience in the processes of self-reference, self-attribution, and self-regulation (Carver and Scheier, 1981). Other research evidence indicates that the cognitive activities of thought and language are not equivalent, and not necessarily mutually co-determining (Eysenck, 1993). Still other psychologists suggest that our accounts of future time and past time experiences are not equivalent in either their measurement or their valence (Block, 1993; Zakay, 1993). The literature of behavioral decision adaptation to stress-producing contexts illustrates how differently people respond in cue sensing, processing and filtering tasks as the level of "stressors" are manipulated. Psychologists explain the variation as a change in the character of representation created in the presence of one level of "stressor" versus another (Kahneman, 1973; Yates, 1990). However, changes in representation and valence in choice situations is not always obvious to the individual perceiver, as shown in evidence for prospect theory (Kahneman, 1982), framing effects (Plous, 1993), and escalation of commitment (Staw, 1981).

The important connection between the system of collective referents, in language, and the range of socially constructed, collective responses *is made actionable first at the locus of the individual mind.* Lazarus (1998) refers to this epistemological assumption as *cognitive mediation.* Just as the *transaction* between mind and environment generates an abstract, *relational meaning* (Lazarus, 1998, xviii-xix), the adaptations of reference in response to personal, individual stress will change the potential actionable routines, learning, and social record at the collective, organizational level as well.

Moreover, those adaptations in personal referents and connecting logic may or may not be successfully communicated as a socially shared representation of experience (Kahn et al. 1964). The Chapman et al. (1959) experiments using decision crews in simulated air defense disasters illustrate how group adaptations to change may occur and yet not be *referenced* in collective communication exchange. Similarly, the organizational responses referred to as "connectionist learning" and "heedful interrelating" (Hutchins, 1996; Weick and Roberts, 1996) suggest that some sort of shift in the reference and rule structure governing personal responding in sync with interdependent others has occurred. Perhaps the important adaptation that researchers noticed is not really an "organizational" response at all, though it appears like a collective effort. Rather, the adaptations to threat are multiple, contemporaneous, and individually spontaneous. They occur as the individual, personal experience of stress changes each personal representation and logic for action (e.g., Lazarus' notion of *relational meaning*) through an intersubjective, yet partly non-verbal, communication process (Lazarus, 1998, 360).

The potential for stressful adaptation and its effect on organizational decision making is not mentioned in Simon's description of organizational decision factors, though it appears to apply to the "organizational learning" episodes described by Hutchins (1996), Weick and Roberts (1996), and Chapman et al. (1959). For Simon, what makes organizational rationality "bounded" is limited knowledge of the future, limited understanding of personal preferences in the future, and limited awareness of potential decision scenarios. However, the model appears to treat the individuals involved as more-or-less identical in their degree of cognitive dynamism, at least insofar as that dynamism might affect communication and collective outcomes. Simon does not discuss the "boundedness" that arises from having to reduce the richness of personal experience, tastes, and multiple referent "rule" values (i.e., cultural values, religious mores, prior schemas-in-use) into a communicated, relational, logically coherent referent set. So, in addition to the three sources of limitation Simon mentions, a further constraint on rationality may be due to the fact that the human mind has to *represent* the process of thinking and deciding as a communication act; in so doing, there is a certain amount of alteration in richness, time-dependency, and effort required in the cognitive process of representation. The emotional adjustment that takes place either consciously or unconsciously as an adaptive, personal, stress-relieving response (Lazarus, 1998) is part of that cognitive process as well, though this aspect is not frequently emphasized in descriptive theories of organizational decisions. One exception is Beach's (1990) model of decision "images" with required emotive "threshold acceptability".

The following sections of this chapter outline a brief summarization of research on stress and its effects on information processing. In particular, attention stress, time pressure and time urgency, information load, and certain heuristics are viewed to affect decision processes and coping responses in systematic ways. At the conclusion of the chapter, the net effects of stress and personal adaptation to stress are summarized in relation to decision processes.

3.7 Models of Stress, Adaptation, and Coping

The earliest work on stress concentrated on understanding biological and physical responses in illness, pain, threat, harmful exposure, and other negative life events, such as accidents and war (Lazarus, 1998; Selye, 1983). Selye tried to explain the syndrome of "just being sick" as a generalized physical response to toxic or noxious external agents, which he called *stressors*. The intrusion or effect of the stressor on the body created *strain* in the individual experiencing a stressful episode, producing a pattern of physico-chemical responses in the glands, tissues, and vascular systems. Selye's research, conducted primarily in medical domains, led him to propose the GAS (generalized adaptation syndrome) model of stress response. The model indicates three stages of responding:

> (1) *Alarm Reaction*: The organism's reaction when it is suddenly exposed to diverse stimuli to which it is not adapted....a general call to arms of the body's defensive forces. The reaction has two phases: (a) *Shock phase*: the initial and immediate reaction to the noxious agent...; and (b) *Countershock phase*: a rebound reaction marked by the mobilization of defensive phase...
> (2) *Stage of Resistance*: The organism's full adaptation to the stressor and the consequent improvement or disappearance of the symptoms. The manifestations of this second phase are quite different from—in many instances, the exact opposite of—those which characterize the alarm reaction...Curiously, after still more exposure to the noxious agent, the acquired adaptation is lost again...
> (3) *Stage of Exhaustion*: Since adaptability is finite, exhaustion inexorably follows if the stressor is sufficiently severe and prolonged. Symptoms reappear, and if stress continues unabated, death ensures. (Adapted from Selye, 1983, 4-5, italics from the original author).

Selye says that the potential for adaptability, or adaptive energy, is observed to be finite, and is not related to caloric energy. Even when adaptation has taken place, Selye argues, there is a long-term cost involved. "Just as any inanimate machine gradually wears out, so does the human machine sooner or later become the victim of constant 'wear and tear'" (Selye, 1983, 5). The presence of stress has been linked to both direct and indirect pathogens, producing illness and disease, by creating a disruption in the homeostatic healthy state. In particular, stress has been linked to cancer and cardiac malfunction, as well as other progressive diseases (Eysenck, 1983). According to Selye, individuals have been observed to vary in their stress tolerance, reactive responding, and endurance over time, though the mechanisms for these differences are not understood. Also, stress research has shown that there are differences in reactions and outcomes for those involved with overstress (e.g., work overload), understress (e.g., lack of self-realization, restriction in choice, boredom), eustress (positive stress, such as excitement or joy) and distress (negative stress, such as anger or pain).

3.7.1 Types of Stressors

A more recent distinction has separated the problems of episodic versus chronic stress (Eysenck, 1983; Wheaton, 1997) and the responses of coping with those two stress forms (Aldwin and Brustrom; 1997; Lazarus, 1998). Episodic stress has recognizable points of demarcation of beginning and resolution, and is shorter in duration, whereas chronic stress may have no clear resolution for an indefinite period. For example, a particular event, such as loss of a job, getting a divorce, a family death, or accident may trigger an episode of stress. A chronically stressful situation might entail a more persistent stressor, such as constant poverty, prolonged or terminal illness, disability or handicap. Also cited as chronic stressors are structural constraints on behavior, such as role ambiguity and role conflict (Aldwin and Brustrom, 1997; Kahn, et al. 1964; Pearlin, 1989; Rizzo, House, and Lirtzman, 1970).

Although early stress research focused primarily on biological, chemical and physical responses to external, material noxious agents (e.g., drugs, shock, food deprivation, etc)., more recent work has examined the psychological and emotional processes disclosed in communications of stressful experiences. The experience of stress has been linked in research to the terms: "trauma," "daily hassles," "life difficulties," and "role strains" (Ivancevich and Matteson, 1980; McGrath, 1976; Wheaton, 1997). In this type of research, the subject provides self-report data rather than measures of physical response. From this research, it is clear that individual psychological stress experiences frequently involve social situations and intersubjective communication. However, research evidence does not provide consistent answers about whether social communication is a stress-producing or stress-relieving activity (Kahn et al. 1964; Kaufmann and Beehr, 1989). Wheaton (1997) defines social stressors as "threats, demands, or structural constraints" that have the potential to cause "identity-relevant" changes in the individual. Aldwin and Brustrom (1997, 83) argue that "nearly all chronic stress takes place in an interpersonal context" because "significant others" must be involved somehow involved in either chronic stress-producing situations or their management.

3.7.2 Chronic Stress at Work

Chronic stress has also been related to work situations (Hepburn, Laughlin, and Barling, 1997). Hepburn et al. (1997) differentiate between workplace stressors that appear to be typical throughout employment and subordination situations, and those that have become more endemic in recent times. They cite six different stressors likely to affect health and well being: work scheduling, role stress (ambiguity, conflict, overload), career security, interpersonal relationships, job content (autonomy, meaningfulness, variety, definition, and feedback) and personal autonomy over work. In greater detail, these six work stressors are explained below.

Work scheduling creates potential stress through pacing, performance output demands, reconciling work and family time demands, and personal needs for rest and renewal. Work schedule stress appears highly related to the concept of *entrainment* between pace, mesh, tempo and rhythm for the individual and the social contexts he or she occupies (McGrath and Kelly, 1986). The finite resource of time must be divided efficiently into chunks, rates and deadlines for intertwining the various responsibilities and opportunities to be met.

Research on job stress indicates that concerns with time pressure and meeting deadlines are the main stress-causing agents at work (Puffer and Brakefield, 1989). In their survey of museum store managers, Puffer and Brakefield found that tasks presenting recurrent time management problems were associated with higher task stressfulness, higher sense of incompetence, higher job anxiety, and higher use of avoidance behavior to cope with the stressor. They also found that time-stressing tasks were negatively associated with cognitive "pep talk" to do the task despite its difficulties.

The individual's temporal resources may be controlled by the individual or may be dictated by external sources. Bond and Feather (1988), using a survey instrument to measure time structure in college students, found that perception of more time structure was positively related to greater sense of purpose, increased self-esteem, lower depression, better health, lower psychological distress, greater optimism, and more goal-striving behavior. Mudrack (1997) performed a factor analysis of a 46-item scale for time management behavior created by Macan, Shahani, Dipboye and Phillips (1990), showing that the theme of "perceived control" in the use of time was the most well-defined of the four subscale factors obtained. Mudrack's sample included 1,023 responses from working adults. The relation between perceived autonomy in structuring one's time and perceived stress has not been reported elsewhere.

Role stress is created when job responsibility is not well defined (role ambiguity), when there are conflicting demands and expectations from superiors or performance objectives (role conflict), and when job demands are too numerous, complex, or difficult for the individual (role overload). Role stress may be exacerbated with high levels of communication and/or functional dependence between the role sender and the role receiver (Kahn et al. 1964). Kahn and colleagues summarize the relationship between role stress, functional dependence and communication:

> Role relations of functional dependence and power bind the person into his role in ways satisfying when he is relatively free of conflict. But these role relations prohibit the use of avoidance responses which might protect him from the emotional strains of intense conflict. As a result the person whose role set is characterized by many members who depend highly on his performance or who have at their command the resources with which to influence him, exhibits a high intensity of inner conflict, low satisfaction with the job, a high degree of futility, and a kind of psychological withdrawal reflected in a weakening of affective interpersonal bonds.
>
> The suggestion that the avoidance coping strategies—withdrawal, rejection, and evasion—may protect the person from the emotional consequences of conflict is supported when one considers the mediating effects of frequency of communication with role senders. When communication rates are high, all these

> signs of strain are present in response to high conflict; when the focal person communicates less frequently with his senders, conflicting pressures from them led to less severe inner conflicts and dissatisfactions.
>
> The flaw in avoidance responses, however is that low communication is associated with high probability of conflict. Withdrawal as a mechanism may generate more intensely the very conditions one tries to avoid. The short-range success of avoidance tends to be coupled with a long-range failure (Kahn et al. 1964, 221-222).

Individual reactions to organizational stress vary depending on several psychological and personality factors, according to Kahn and colleagues. Some people are able to tolerate different levels and types of stress better than others. Kahn et al. compared reported stress with measures of neuroticism, extroversion-introversion, flexibility-rigidity, and achievement-security orientations. They found that personality characteristics mediate the relationship of stress and reactions to stress. For example, the experience of conflict is greater for introverts, emotionally sensitive people, and strongly achievement-oriented people. Flexibility or high achievement orientation tend to stimulate conflict pressure from role senders.

In sum, Kahn et al. (1964) suggest that the major organizational determinants of role conflict and ambiguity are threefold: (1) the necessity for "crossing organizational boundaries"; (2) the need to "produce innovative solutions to nonroutine problems", and (3) the need "for being responsible for the work of others" (Kahn et al. 1964, 381).

Rizzo et al. (1970) conducted a factor analysis of a 30-item instrument for measuring role conflict and role ambiguity. Their factor analysis results produced two distinct factors, as hypothesized. They also correlated the factors with several other variables of job satisfaction, perceived leadership, organizational factors, anxiety, demographics, and turnover. The authors report "significant" correlations between many of their variables (45 in all) and each of the two role stressors using two different survey samples (total N < 300). Because of the analytical method used, their entire list of conclusions has been modified for this review. The present author assumes a higher "rejection" threshold for significance for interpretation of the findings. Assuming a more restrictive level of significance, using correlations of at least ($r = .35$) and internal reliability of at least .6 on each measure (for each of the two subject samples), the significant relationships between variables of satisfaction, leadership, and organizational factors with role stress factors are summarized as follows:

> (1) Role ambiguity is negatively related to job satisfaction variables of perceived job autonomy, intrinsic job satisfaction, perceived personal recognition, and social pleasantness.
> (2) Role ambiguity is negatively related to leadership variable of teamwork facilitation.
> (3) Role ambiguity is negatively related to organizational variables of formalization, goal consensus, clear goals, and perceived work flow coordination.
> (4) Role conflict is negatively related to teamwork facilitation and upward influence of ideas on leadershi (Rizzo et al. 1970, 158).

Career security stress involves the degree of uncertainty about one's potential working longevity and/or career progress. Kaufmann and Beehr (1989) found that future ambiguity about one's job was a source of considerable source of work-related stress for police officers.

Interpersonal relationships at work can both create and relieve stress by threatening personal identity, integrity, standards, acceptance, and supervisory sponsorship. These relationships can take the form of conflict, emotional support (e.g., showing care and empathy, or alternately, buttressing negative emotions) or instrumental support (e.g., absorbing unfinished tasks, providing assistance or instruction). House (1981) considered emotional support to be more important to stress relief than instrumental support, though Kaufmann and Beehr's (1989) study indicated that the reverse was more evident in their sample. They also noted that internal sources of support (supervisors and coworkers) were more important in relieving stress than external sources.

Job content stress may result when one is not allowed the freedom to carry out work in a way deemed appropriate or necessary, not seeing one's contribution as meaningful or distinct, and not having appropriate levels of feedback about performance. Finally, stress can also ensue from not having adequate authority and autonomy in one's work and decision making when appropriate.

Current sources of workplace stress cited by Hepburn and colleagues include a heightened general level of environmental uncertainty and change, rapid advances in technology, especially in information technology, redistribution of markets and competition on a global scale, and the looming threat of unemployment, layoffs and temporary employment conditions. Whether these conditions will abate over time was not known predicted by these authors.

Episodes of stress are also clearly associated with work tasks and temporary work demands, such as decision making under immediate, threatening conditions, e.g., events of extreme conflict, social effacement, and physical harm or criminal activity. The studies by Hutchins, Weick and Roberts, and Chapman et al. are examples. Temporary conditions of extreme time pressure, time urgency, task overload, and differing situational conditions (e.g., deciding between two losing alternatives versus deciding between two gaining alternatives) may also generate variations in stress reaction and response (Yates, 1990). Experimental research that manipulates contextual variables such as time pressure, decision frames, information load, distraction and conflict generate more temporary stress reactions and are therefore more "episodic" in nature and may reflect different kinds of adaptation responses than those purposefully used in chronically stressful contexts.

3.8 Types of Coping Behavior

According to research findings, individuals deal with stressful situations in a variety of ways. Some methods are conscious, purposive, and planned while others are automatic and not obvious to the person responding. Because the present research does not address physical sources and responses to stress, those issues will not be covered any further. Some of the strains at work may be physical in nature, such as eye strain in using computers and video monitors, hearing strain from loud or constant noise, or muscle strain from repetitive movements. However, those types of strain are not the subject of the research, even though the stressors that provoke them may be related to "information processing" tasks. The primary interest here is to understand how information processing and decision making, as cognitive activities, are causes of stress, and to explore current models of coping and adjustment that might explain individual thinking and behavior in dealing with them as stressful situations. In particular, the stressors that affect the individual cognitive mediation process of representation and reference, and thus social communication, coordination, and control, are the influencing factors in this study.

Aldwin and Brustrom (1997, 76-77), in their review of coping literature, differentiate between three types of coping behavior models. The first of these, the psychodynamic models of coping, explain coping as an unconscious defense mechanism for "regulating negative affect, primarily anxiety." Some forms of defensive coping are pathological, such as neuroses and distortions of reality, while others, such as forms of suppression, are viewed as instrumental in providing relief from intolerable strain. The shared element in such models is the assumption that coping processes are not consciously or purposively initiated. Research indicates, however, that suppression of stress in work environments may indeed be a conscious process of avoidance and denial (Kahn et al. 1964). One form of suppression is to reduce the flow of communication stress senders. This form of suppression provides a buffer from continued conflict between individuals, but will prove ineffective for maintaining organizational functions of coordination and integration (Galbraith, 1993).

A second body of coping research holds that individuals have particular individual styles of coping, based on personal attributes, abilities, and personality. In this vein, coping is done consciously and purposefully. Generally, the model assumes that there are two basic approaches to coping: either people seek information about the situation or their potential responses (approach coping), or they avoid the situation (avoidance coping). Research shows that the effects of approach versus avoidance coping may depend on the type and longevity of the stressful situation encountered. For example, for short-term stresses, approach coping is usually beneficial, while avoidance coping is usually more stress-enhancing. Alternatively, in chronic or long-term stressful situations, avoidance may have some benefit over trying to deal with the stress directly. Coping type research has also been linked to personality type (Type A versus Type B), though some have viewed such a simple dichotomous typology as too limiting and not sufficiently explanatory (Hepburn et al. 1997). Coping type models have been criticized for their inability to explain or predict variations in coping methods taken by a single individual (Lazarus, 1998). However, as Kahn et al. (1964) point out, individual coping type may be limited by role constraints, degree of autonomy, and communication, but not by personal preference.

The third body of coping literature argues that coping is really a process involving a negotiated and changing pattern between the stressor and the stressed individual. People do not always deal with stress in the same way, just as stressors differ in type, severity, and duration. Stressors may involve threat, harm/loss or challenge, not all of which have negative consequences (Lazarus, 1998). The individual under stress makes a subjective appraisal of the situation, in a transactive connection between perception, representation, motivation and changing environmental conditions (Segovis, 1990). In other words, persons make situations meaningful according to a context, and not all stressful situations are interpreted to "mean" the same thing across time and instances, even for a single person.

The theory that coping responses do change over time has empirical support. However, Aldwin and Brustrom (1997) criticize coping process research because of its data collection and instrumentation methods, suggesting that some of the findings in support of process may be spurious effects from the instrumentation. They argue that the findings may not be reliable across stressful instances, and that individuals may develop consistent coping response patterns over time. Segovis (1990) suggests that the nature of the sampled populations may also skew the generalizability of the findings: most coping research examines threat, combat, accident, natural disaster, death, and everyday life experience. Despite the fact that most adults spend the majority of their waking time at work, few studies have examined coping in work settings (Segovis, 1990, 9). Lazarus (1998) also calls for longitudinal research designs that will study whether individual processes for coping are indeed stable across time.

Two coping patterns have become accepted as predominant in research on coping as a process of adaptation (Billings and Moos, 1982, 1984; Folkman and Lazarus, 1984). The first, called *problem-focused coping*, indicates that the efforts of the stressed individual are centered on trying to change the external environment creating the stressor. For example, deliberate action such as information search, or attempts to further clarify the nature of the problem might be viewed as maintaining a focus on the environmental stressor. *Emotion-focused coping*, on the other hand, is a type of coping in which the individual attempts to deal with his or her own internal emotions or meanings for dealing with the stressful problem. In this case, the person may attempt to control display of feelings, discharge negative emotions through behaviors such as smoking, sleeping more, overeating, etc., or trying to convince oneself that "things will get better." The difference between problem-focused and emotion-focused coping appears to be related to the degree of control the individual has over the stressful situation (Hepburn et al. 1997). However, it is not clear from the research which strategy is most effective as a stress reliever. Some evidence suggests that when emotion-focused coping is used to combat organizational stresses, greater feelings of depersonalization result for the individual.

In a study of small business owners (N = 102) recovering from a disastrous hurricane, Anderson, Hellreigel and Slocum (1977) found that Class 1 coping strategies aimed at resolving the problem through action were strongly positively associated with organizational effectiveness as measured by sales revenue and profitability. Similarly, they found that Class II coping using threat, emotionalism, and hostility or aggression were negatively associated with effectiveness. The personalities of the owners, measured as the internal-external locus of control (Rotter, 1966), explained the most variability in stress reactions and coping behaviors. Anderson and colleagues found that managers who view themselves as having personal control over their own life (Rotter's "internal" personality) are also significantly more likely to use problem-solving, action oriented coping strategies aimed at managing the external problem (Class I), and also perceived less stress in the situation. In constrast, those perceiving a high degree of stress were more likely to use emotional (Class II) coping. Unlike most employee work roles, however, the sample of managers in the study had a large amount of control and autonomy in facing the stressor as chief executive and general manager. Two organizational characteristics, organizational size (as number of employees) and past performance, were also significantly associated with the outcome measures of organizational effectiveness. The organizational variables' relationship to effectiveness suggests that the individual executives' stress and coping behaviors alone do not account for a significant portion of the outcome produced by the stressful situation. Organizational structure and previous success (or learned routines as a system) may be partially responsible for successful adaptation to the stressful environment, *despite* the perceived control and autonomy of the chief executive.

Beyond the two individual coping processes studied extensively by Lazarus and colleagues, other recent study has illustrated the use of social coping strategies, especially in situations of chronic stress (O'Brien and DeLongis, 1997). Stressful family or work situations involving interdependency and cooperation may have *interpersonal* sources of stress for the individuals participating. While some problems might involve situational ambiguity, prolonged illness or other stressor, the majority of stressful interpersonal relationships contain conflict. Several styles of interpersonal coping have emerged.

Confrontational coping, using anger and coercion, is directed at forcing the other person causing stress to change their behavior. Confrontational strategies are not observed to work well, instead provoking greater tension in the relationship and emotional distancing. Also, the stressed individual may experience even more unresolved stress as an angry person. The net effect of confrontational coping is not positive as a stress reliever. Relationship-focused coping, on the other hand, is directed at maintaining and regulating social ties through two modes: empathic responding and compromise. Empathic coping preserves emotional relatedness and maintains strong affective bonds. Empathic coping is strongly associated with both verbal and non-verbal communication and attempts to relate to the other person's subjective views and experiences. Other manifestations of relationship-focused coping are attempts to constructively solve problems through interpersonal discussion and cooperative thinking (such as in "brainstorming"), and to conceal internal worries from the other person in an effort to buffer them from the stressful agent (O'Brien and DeLongis, 1997). Research in this area, however is complex and difficult. Standard measures are largely unavailable, and longitudinal research studies are scarce. The authors do not provide any evidence from organizational work contexts, though clearly the evidence provided by Kahn and colleagues is relevant as a study of chronic work stress.

Hepburn et al. (1997), in their account of work-related chronic stress, report that the majority of organizational programs to relieve stress for its individual employees usually provide intervention only after the employee is suffering visibly from strain (tertiary approaches). Strain responses such as alcoholism, drug abuse, and family violence are targeted for assistance and education. White-collar employees are occasionally offered education in recognizing stress responses, regulating their own responses through self-help programs, and understanding health and social consequences of stress. Primary prevention of organizational stress, however, is very limited. Organizational managements appear to prefer to deal with stress by teaching its affected members to cope better rather than remove the cause of the stress at its source, even though limited research has shown that failure to remove the cause can have tragic consequences for employees individually. Puffer and Brakefield (1989) show that the individual worker can also use individual discretion in coping with stress by avoiding the task, putting it off, or convincing themselves that it is not worth doing. This form of coping undermines organizational outcomes in subtle and delayed ways.

3.9 Summary: Coping and Research Designs

In summary, the coping literature in psychology suggests that individuals may use several methods for relieving stress, whether experienced temporarily as an episode or experienced indefinitely as a chronic state. Earlier literature tends to focus on the psychosis of stress and the lack of communication and self-awareness that accompanies those largely unhealthy coping reactions. More recent literature and empirical research has been directed at explaining coping as a conscious, purposeful effort to deal with stress, whether the coping effort was typical of an individual or a dynamic process of engagement between the person and the situation. In the latter research stream, the key assumption is that individuals can communicate, i.e., *represent* their cognition about the stressor and their responses in a valid and reliable way. Much of the data from that stream has been supplied through self-report instruments collected in field settings, where the experience of the stress was real, direct, and not subject to experimental manipulation, unlike many earlier stress experiments involving animals (Selye, 1983). Like other types of field investigation, however, empirical studies of coping are subject to multiple confounds, potential problems with reliability and generalizability, and potential for researcher-induced effects in data collection and communication methods.

3.10 Stress and Behavioral Decision Research

In contrast to the coping literature, which takes the "whole person" into account as an emotional, thinking, and expressive individual, the experimental literature of decision making under stressful conditions provides a more fragmented, fine-grained, and controlled approach to the study of dealing with types of information and decision stress. Before turning to briefly review findings in this area, several distinctive differences between the field studies of coping and the experimental manipulation of behavior are noteworthy.

First, whereas the "stressor" in many coping studies is usually *real* in terms of severity, duration, and effect, the "stressors" provided in behavioral decision experiments are carefully controlled in their severity, duration and effect. Control is required for ethical reasons as well as measurement precision. Because the context of "experimental time" is so much different than the experience of stress in "real time", only episodic stress data can be reasonably compared with behavioral decision experiments, and even that comparison is dubious. McGrath and Kelly (1986) discuss the impact of real versus experimental time on the ability to provoke and capture causal relations of interest. Because there is usually some lag in time between the causal agent (stressor) and the effect (experience of strain and/or action to cope), it is doubtful that some findings in experimental contexts are ecologically valid in real, stressful experiences. In general, the behavioral experiments examine adjustments that come in *a short period of time*, appear behaviorally automatic, and occur at the level of cue perception (i.e., which may result in provoking "habit" or schematic programming), while field study of stress and coping examine adjustments that often require *time to think through* and plan consciously for stress abatement. Cognitive researchers are convinced that these two ways of cognitive processing are not equivalent because they use different memory stores, trigger different categories of representation, and may also be linked to varying levels of motivation (Eysenck, 1993).

Second, much of the coping evidence is provided via intersubjective communication processes between subject(s) and researcher(s), rather than mere observation of subject behavior. The symbolic exchange and representation of emotional and behavioral data are provided in a field-based format, allowing the subject to read, write or hear with some motivation to understand and consent. Even though behavioral decision experiments occur with expressed participation "consent" as a matter of ethics, there is a certain amount of deception usually involved in producing the behavioral variations of interest. That deception implies that the subject is not fully aware of, and therefore not fully consenting to, the manipulation of his or her behavior in a way that is mutually understood. Simply, there is a kind of misrepresentation going on in the experimental procedure. Even though this misrepresentation will not necessarily provoke serious negative consequences for the subject, nonetheless, it may reduce the clarity of what is actually being communicated and measured as a responsive behavior. Also, that misrepresentation may mask how the subject's motivation or arousal level might affect his/her response. The burden of interpretation must then fall on the experiment's designer in lieu of the subject's direct and purposive assignment of accurate "relational meaning" of the stressful event (Lazarus, 1998).

Because behavioral decision experiments manipulate both the perception of time in relation to measured response, as well as the assignment of "meaning", the emotional and intra-psychic significance of the controlled "stressor" is probably spurious at best. The reaction of the subject to a controlled cause of stress may have little or no emotional validity, even if it does provoke an emotive response. Therefore, the findings from experimental manipulation of perception, attention, time duration, and framing context are interesting for what they say about quantitative, automatic and perceptual aspects of stressors and responses, but they may yield very little about relational meaning and conscious, purposive attempts to deal with real stressful environments and the experience of uncertainty as a real-life threat.

In effect, experiments producing information and decision stress ignore much of the contributions of emotion and social communications relations in both causing stress and relieving it. As authors reviewing the coping literature suggest, emotional appraisal and social relationships are the *sine qua non* of many forms of stress, especially chronic stress. Moreover, inter-subjective exchanges in communication and support provide, not merely the ***representation*** of conflict or relief from chronic stress, but the ***actual mechanism*** of prolonging the ability to sustain adaptive responding. The result is that experimental evidence of decision making under stress does not explain nor predict conditions for chronic decision stress and its resolution in organizational experience.

Lack of significant research attention to chronic stressors in work organizations has important implications for information systems and organizational decision system design. The model of bounded rationality uses experimental evidence of heuristics, biases, politics, and simulated games to provide the foundation for its support (e.g., Cyert and March, 1992). Those arguments have carried through decades of research on decision system design, and jibe consistently with Galbraith (1973) and Tushman and Nadler's (1978) macro-design criteria while inserting some level of individual control into system dynamics. However, because both experimental and simulation evidence largely ignore the influence of emotion and personal appraisal, the systemic bases for organizational information design as a source of chronic stress may have been under-appreciated, other than as a source of role constraint (Kahn et al. 1964), personal goal conflict (March and Simon, 1993) or physical wear-and-tear, such as eye strain.

In particular, there appears to be little research on how different forms of formal organizational structure, communications systems structure and resulting decision processes are associated with individuals' self-appraisals and social support. The literature of organizational climate comes closest to covering these issues, though it stops short of delving into decision process design specifically. Coping literature argues that the dynamic processes of communication are not merely a source of task-related information, programming, and coordination (e.g., Cohen and Bacdayan, 1996; March and Simon, 1993). They also provide a means of achieving intersubjective emotional balance, interpersonal support, nurturing and growth (as suggested in some communications research reviewed by Jablin, 1987). Research on climate captures part of those ideas as environmental "warmth", "supportiveness" and "openness" (Jones and James, 1979; Payne and Pugh, 1976).

Information design criteria in macro-level organizational models do not appear to include such design factors as emotional and information valence/appraisal in communications methods. Their omission suggests that the individual working in the organization must somehow find a satisfactory personal balance between self and the demands of work using whatever means are available. However, as Kahn et al. (1964) and Hepburn et al. (1997) point out, the individual is not always successful in finding that healthy, *sustainable* balance, especially if left to work out the problem in the absence of relevant social contact. Eventually, as chronic wear-and-tear combine with a lack of personal control over information and emotive access, the organizational agent's decision making quality and personal problem-solving integrity are eroded. The individual may get into a stressful information-handling "rut," with no way to express "being in a rut" in an organizationally accepted way. In the process of learning the "rut", the individual may have coped with the macro-level stressor, but may have no way to talk about how that coping took place. Over time, the "rut" between organizational stressor and personal coping response becomes an ingrained, learned behavior and a potential source of organizational decision failure. The failure happens because the individual has "learned" to suppress or ignore certain signals as a form of self-preserving coping response. Unfortunately, both individual and organization lose the opportunity to meet the environmental challenge in the most effective way.

As Hunt (1988) has suggested, decision making processes provide more than a content-oriented organizational solution to the challenge of the uncertain environment. The social activity of participating in decision making, as a form of interpersonal communication and mutual empathic exchange, may also encourage the personal, individual attitude, drive and behavior to "hang in there" during uncertain times and threats. Thus, what may appear to be group-level adjustment is more appropriately explained as a combined effort in personal adjustment. The field investigations of "organizational learning" suggest that group adaptation to threat can be explained in more than one way. In the first espoused explanation, the group shares *information content* in the forms of shared cause maps and redundancy. In an alternative explanation based on a group coping model, an empathic coping pattern develops as an intersubjective, bilateral exchange of relational meaning, emotional appraisals, and social support cues. Prior "organizational learning" incidents have been explained as *episodes* of group behavior. Unfortunately, there are no reports of such "heedful interrelating" or "connectionist responding" occurring over extended periods of threat or stress, so research has not shown how group communications and outcomes would unfold in such chronic conditions. The difference between episodic and chronic conditions would help to flesh out the distinction between content-specific and emotional coping responses at the group level.

These observations notwithstanding, behavioral decision literature is highlighted next in this review. Experimental evidence suggests that individuals exhibit systematic regularities in perceiving and responding to certain types of stressful decision conditions. Several summary reviews of specific literatures focusing on attention, time pressure, time urgency and time stress highlight research findings for a large number of individual studies. The constructs used in these studies are noteworthy because of their suggested importance to organizational models of decision making behavior and information processing design (Simon, 1976).

3.10.1 Attention, Arousal, and Cue Processing

According to Eysenck (1993), attention is used to selectively process information inputs. He quotes William James's (1890) definition of attention: "Everybody knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought" (Eysenck, 1993, 42). Several sources of literature review give a thumbnail sketch of relevant distinctions and models (Carver and Scheier, 1981; Eysenck, 1982; 1993; Kahneman, 1973; Hockey, 1984; Warm, 1984).

Research on attention, as a part of cognition, attempts to explain how attention is focused on one stimulus rather than something else, how attention is divided among multiple competing cues, and how attention is sustained for prolonged periods of time (vigilance). Early studies of attention used auditory tasks, requiring subjects to discern or attend by hearing. Later research emphasized visual tasks using words, symbols and color representations. In addition, attention has been studied in relation to practice with the task or stimulus. Research on task practice is directed toward understanding how attention functions in learning and automatic information processing. Finally, attention has been studied as absent-mindedness, perceptual failures, and action slips. Except for the latter research stream, experimental manipulation and controlled measurement of inputs and outputs have characterized most attention research.

Although there are debates and multiple theories for understanding how attention works and how it is directed, a few recurring themes are worthy of note. First, attention is finite. The individual's capacity for attention is affected by interference, state of general arousal, degree of expended effort, history of practice or learning on task, and the degree of similarity in competing cue stimuli. People cannot attend to multiple sources of information at one time without great effort or familiarity with the competing tasks. Noise, ambient temperature, drowsiness, emotional state, cue presentation, and performance feedback, and motivation are all factors in how attention is directed. Interference cues split attention, causing poorer performance. Feedback motivates effort to attend, thus causing better or stable performance. Practice with a task promotes development of cue recognition strategies, and thereby relieves some of the attention requirement to monitor and continue task performance because performance is carried out "automatically".

Some combinations of stimuli appear to cancel each other out, producing conflict of attention. For example, vigilance tasks, which require prolonged monitoring, are associated with gradually declining over extended time, though the reasons for the performance "decrement" are not clear (i.e., people lose the ability to discriminate cues effectively, or do not communicate cues being noticed).

Theorists have tried to characterize the mechanism for attention finiteness. Early views (Broadbent, 1958) proposed that attention used a cue filter, allowing only a subset of cues to be noticed. Later theorists suggested that attention had a finite amount of capacity. The capacity to attend varied on the level of general state of arousal or purposeful intent directed at the stimulus (Easterbrook, 1959; Kahneman, 1973). More recent theories proposed that attention has a two-level function including search/perception and channel control (Hockey, 1984) and that energy expended between the two levels is cognitively varied and traded as needed by the situation, within a maximum limit.

The most enduring hypothesized relationship in attention and decision making research is the Yerkes-Dodson Law (Hockey, 1984; Kahneman, 1973; Yates, 1990; Yerkes and Dodson, 1908). This model indicates that task performance (and decision making quality) is an inverted U-shaped function of the degree of arousal in the subject. Figure 2 depicts the relationship graphically. In plain words, the law postulates that performance

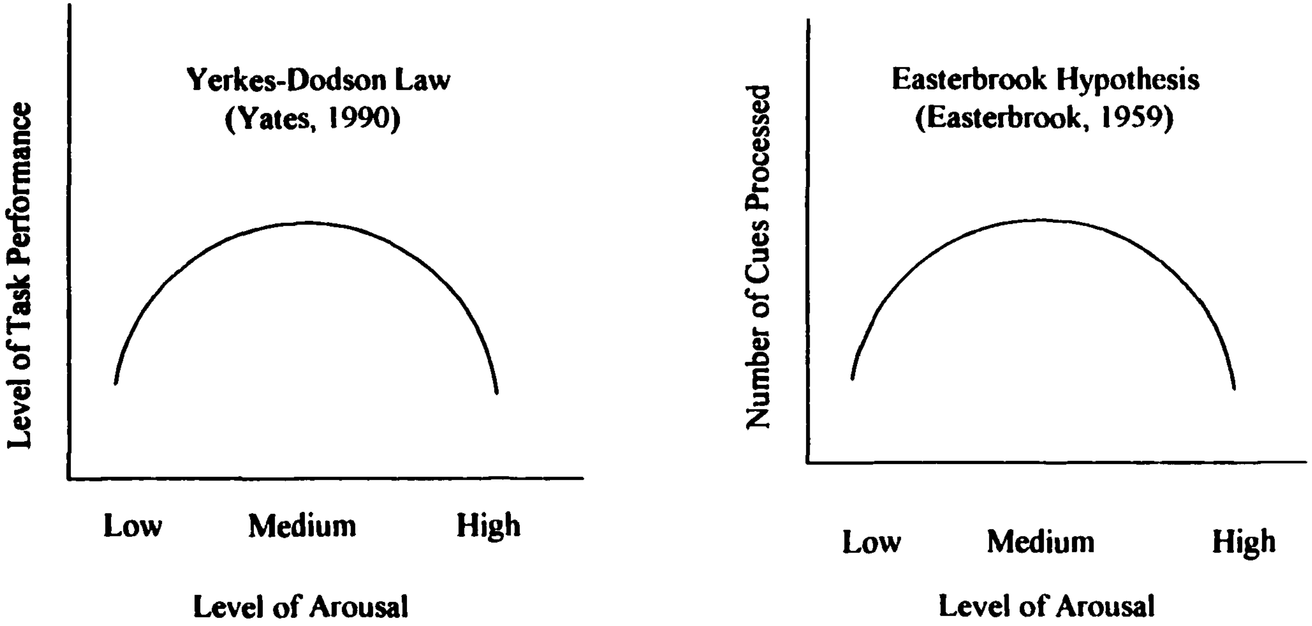


Figure 1. The Relation Between Arousal, Cue Processing and Task Performance.

reaches an optimal level at moderate levels of arousal (some writers refer to "arousal" interchangeably with "stress"), and that at both low and high levels of arousal, performance is relatively low. Eysenck (1982) criticizes the Yerkes-Dodson law for contrary evidence in much research, though he also admits that much empirical work supports it.

The Easterbrook hypothesis (Easterbrook, 1959; Hockey, 1984) also uses an inverted U-shape curve to explain the relationship of arousal to the number of cues processed. Graphically, this relationship is also depicted in figure 2. As greater effort or arousal is present, the number of cues processed in the task reaches a maximum for moderate levels of arousal. At levels of greatest arousal, the number of cues processed actually decreases, because the subject is attending more closely and carefully to that limited set. Performance levels decrease because the attention given to the cues is overly selective, thus, not enough information is sampled to get a relevant representation of the task situation. Task judgment is impaired and, in the end, a performance decrease occurs. The hypothesis for a narrowing of cue attention has received considerable general support in empirical research (Hockey, 1984; Wright, 1974; Yates, 1990). However, it does not explain the relationship of attention to task difficulty and motivation. Researchers found that telling subjects to "pay more attention" or giving them feedback about their performance stimulated more effort to attend, thereby increasing their perceptual accuracy, to a limiting point.

In a different vein of attention research, Sproull (1984) studied managerial attention specifically by collecting field observations of practicing managers in public sector organizations. Unlike the contrived performance situations described in psychological research on attention, Sproull measured attention as directed activity per increment of time. Sproull also did not note multitasking or competing use of attention, claiming instead that managers had noticeable "interrupt rules" for shifting their singular thread of attention between different types of solitary or communicative activity. In effect, Sproull assumed that individual attention could be applied to a single cue source, and that the change in cue sources must occur in serial order, rather than in parallel. However, she did question, in the end, how managers processed so many forms and sources of disparate information in so short a time period, most often without coming to any decision resolution. She concluded that perhaps managers did indeed resort to multitask processing, though she had not uncovered the central processing mechanism for ordering and prioritizing selected cue flows.

Some interesting findings emerged from Sproull's research. She reflected that 80% of the average subject's workday was spent in "talking to people" (Sproull, 1984, 15). The length of the conversations, however, was relatively short unless group meetings were involved. Solitary periods were terminated voluntarily by originating oral communication. She noted that brief oral communication dominated the use of attention and was the most important source of information. Decision-relevant information was most noticed when it was associated with decision deadlines and particular trusted individuals. However, Sproull also noted that managers exchanged a great deal of decision-irrelevant information in the course of their work schedule.

3.10.2 Time Pressure and Time Urgency

In keeping with the general proposition that human attention capacity is limited, behavioral decision studies have investigated the effects of time pressure, time urgency, and time constraint on the perception of time stress, decision making processes, information use, and performance outcomes. Both individual and group levels of analysis have been used, though individual-level research only will be cited here.

Operational definitions of "time pressure" and other temporal constraint concepts are varied. The literature offers some explanations about why certain definitions are distinct from others, either in theory or in interpretation of findings. "Time pressure" has been typically operationalized as an exogenous condition of the decision context or experimental scenario. For example, subjects are asked to make a judgment or a choice under different experimental conditions of temporal "clock-time" duration, where the "pressured" condition is some fraction of the original allotment. Often the shortened duration is not made explicit to the subject through the use of a shorter "deadline" for responding, although sometimes the subject is simply told to respond "more quickly" (Maule and Hockey, 1993). Researchers have observed that simply shortening the time interval for performance (experimentally) does not produce the same effect as having the experimenter *communicate* that the time interval or deadline has been shortened (Zakay, 1993). The experience of time duration and time passage in relation to decision processes appear to be quite malleable through communication and framing effects, sometimes leading to preference reversals (Svenson and Benson, 1993).

Time urgency, on the other hand, is a construct that captures an internal cognitive state of the subject, and need not be associated necessarily with actual manipulation of time deadlines or horizons. Time urgency is best captured in the idea of "being in a hurry" or feeling "rushed" or "having too many things to do at the same time." Urgency has been studied extensively in connection with the Type A behavior pattern, the perceptions and physical responses to stress, and certain medical conditions such as cardiac arrest (Lundberg, 1993; Rastegary and Landy, 1993).

Time stress, a third conception of temporal constraint, is contrasted with either exogenous "time pressure" and endogenous "time urgency" as a more severe condition of shortened time, bringing about a stress-strain response and coping (Zakay, 1993). In time stress, the individual is keenly aware of "being pressed for time" in such a way that the attention paid to the passage of time may: (1) distract from the needed attention to process decision-relevant information, thus causing either a performance decrement (for lack of adequate cue processing, as in the Easterbrook hypothesis), or (2) cause the individual to seek an alternate approach or strategy to all cue processing (e.g., decision rule-shifting).

In a review of research on time pressured judgment and decision making, Edland and Svenson (1993) assert that most research in the area has not been linked specifically to any one or group of theoretical beginnings. Rather, time pressure manipulations are simply an "add-on" manipulation used in relation to other manipulations of interest. Hypotheses have been based on three different theoretical themes: (1) time pressure makes it necessary to use minimal cognitive effort to achieve a solution, as a cost-versus-payoff evaluation (Payne, Bettman, and Johnson, 1988); (2) time pressure reduces cue processing through a filtering process in response to information overload, and (3) time pressure causes greater arousal, which in turn affects cue processing and performance (Easterbrook, 1959; Kahneman, 1973). All three of these assumptions can be traced back to the general theory of a limited attention capacity presented earlier.

According to Johnson, Payne and Bettman (1993), decision makers adapt to time constraints in three distinctive ways or phases: (1) under low to moderate time pressure, they use the same cues and decision strategy for processing relevant information, but they do it an accelerated pace; (2) under moderate time pressure, they become more selective in filtering out important cues from non-important cues, so that they focus more closely on fewer bits of information, and (3) under high time pressure, or time stress, they change their decision strategy altogether, using different decision rules for accepting the preferred alternative.

The decision outcomes produced under the third condition are noteworthy because they show discontinuous shifts in behavior. Under low and moderate time pressure, *compensatory* decision rules are usually used. Compensatory rules involve cognitively weighing a complex system of tradeoff functions for each alternative, in which "positive values" in one function can be offset by "negative values" in another function. For example, choosing a car based on features, price, quality, or manufacturer uses a compensatory process if the decision maker is able to forfeit certain preferred features for a lower price paid and/or a different reliability rating. A noncompensatory strategy, on the other hand, is one in which those tradeoffs are not considered possible or relevant. The car purchaser, using a noncompensatory decision process, would insist that certain features be included, price or reliability notwithstanding. The noncompensatory process has also been referred to as an *attribute-based* decision strategy because the presence or absence of a particular attribute is used as the sole decision rule.

Edland and Svenson (1993) sum up research findings on time pressure research with the following general observations:

> (1) Under time pressure, most studies report an increased selectivity of input of information. Some researchers have suggested increased use of many pieces of information but in a more shallow way under time pressure.
> (2) More important attributes are given more importance or weight during time pressure than in situations with no time pressure.
> (3) The accuracy of human judgments decreases under time pressure.
> (4) Under severe time pressure, the use of noncompensatory decision rules becomes more frequent than compensatory rules requiring value tradeoffs.
> (5) Time pressure leads to a tendency of locking in on a strategy and to decrease competence of finding alternative strategies in problem solving.
> (6) Some evidence indicates that decision makers increasingly tend to avoid negative consequences under time pressure. However, other evidence indicates no such tendency or increased use of positive evidence. These seemingly conflicting results should be integrated in a common framework in which the importance of attributes, the goals of the decision maker, the importance of the decision problem, and other task characteristics are used to predict changes under time pressure.
> (7) There are conflicting results as to whether time pressure leads to more or less risk taking.
> (8) Payoff and motivation can attenuate the effects of time pressure.

The experimental operational definitions of time and time pressure, discussed above, do not account for the numerous studies indicating a marked variability in the way individuals perceive time. In the time pressure research reviewed above, the time parameter is defined and manipulated by the researcher. Other psychologists who study the differences in time perception would argue that the external manipulation of time has little bearing on how individuals represent the temporal constraint internally as a cognitive prompt for behavior (Cottle, 1976; Pouthas, 1992; Zakay, 1989, 1993). The relevant measure of time constraint or time pressure is how the subject internalizes that sense of duration or sequence (Fraisse, 1984). Also, the experience of time pressure or level of stress may be different depending on whether the time is in the future (using prospective sensing) or in the past (using retrospective sensing) (Zakay, 1993).

Three different models for sensing time passage and duration have emerged in the literature. Prospective sensing models of time perception rely on the paradigm of attention's finite capacity, positing that the mind uses some sort of "temporal counter" to keep track of time passing, once the representation of "temporal constraint" has been logged as an important cue to be tracked. The fact that attention has a finite capacity also implies that attending to one's "time counter" is a distraction from the task-relevant cues. The implication is that the subject judges time duration to be relatively shorter during sequences of very complex tasks (as in "time just flew by") because fewer cues were noticed (attention was split between the task cues and the time-counter). In a second approach to explaining time sense, a theory of retrospective time sensing maintains that time is experienced as a "storage space" for processed stimuli. As a very complex task takes up more "memory space", the individual attributes greater passage of time to completing it, in a retrospective account (Ornstein, 1969; Zakay, 1989).

Besides these two explanations, a third theory posits that duration judgment is based on the representation and experience of event change. Events are stored in memory through encoded schemes, and their logical "temporal" markers or contextual definitions are stored with them. Future event-experiences are coded in relation to prior memory schemes, and the inter-event duration is marked and judged according to enduring memories of past events in relation to present ones (Poynter, 1989). Research appears to support the position that people experience the time-between-event duration of the past as much different than the duration of time between events in the present and future.

Furthermore, people usually overestimate the length of short time periods and underestimate the length of long time periods.

Despite the fact that individuals exhibit great variation in their accounts of time passage, time duration, time stress, and the decisions and outcomes produced, human beings show the ability to become sensitive to the temporal rhythms and pacing of others and their environment from a very early age (Pouthas, 1992). Time awareness is observed as a keen sense of when action is appropriate or necessary, when to repeat certain motor responses as a sequence, and when to communicate in an interactive pattern constructively with other people (e.g., without talking over others). At a more macro-level, social constructions of time as schedules and deadlines are often the product of social *entrainment*, in which individuals have become aware of their surrounding rhythms and tempos for work accomplishment in connection with others (Bluedorn and Denhardt, 1988; McGrath and Kelly, 1986). Even though people try to synchronize their behavior, there are often conflicts between the roles they occupy and the interdependent temporal systems that must mesh together (Kahn et al. 1964). For example, a product manager may experience direct *conflicts* in trying to schedule a product team meeting involving several departments. This type of conflict creates tension and stress about the use of time, though it is not the same type of stressful condition brought about by shortening a decision deadline, necessarily. McGrath and Kelly (1986) suggest that perhaps one solution to that type of conflict problem is to shift the organization's focus from *process* (i.e., setting deadlines for work accomplishment, heavily scheduled behaviors) to *outcomes* (i.e., making individuals accountable for results), while allowing the individual workers to fully control the synchronization of their role-based activities, both inside and outside the work environment. McGrath and Kelly also suggest shifting the scheduling of tasks and outcome production from the organization level to the small task group level, thereby making it easier to synchronize and monitor fewer behavioral activities at once.

3.11 Chapter Summary

This chapter has reviewed a portion of relevant research regarding individual information use and decision making behavior, particularly as experienced under stressful conditions. The beginning caveat was that the "stressed" individual thinks and behaves as an organizational agent, serving organizational purposes more or less accurately. Being a part of a formal organization, the individual is required to interact with interdependent others physically and emotionally through processes of communication. When the organization is not designed, i.e., does not provide adequate attention and time resources, the individual within the organization experiences stress. The worker must adjust his/her behavior, the offending environment, or cope with the stress subjectively through adjustment of emotions (Lazarus and Folkman, 1984) or social relationships and expectations (O'Brien and DeLongis, 1997).

The organizational theories presented in chapter 2 allude to the presence of emotional and personal meanings in communications activities as socio-cultural outcomes (e.g., Harris, 1996; Jablin, 1987), but do not discuss how those meanings may be dynamic under stressful situations. The purpose of this chapter has been to embellish models of macro-organizational information systems by including the dynamic systems of cognition and emotion underlying interpersonal communication processes. Simon's model of bounded rationality was taken as a reference point for organizing several research streams relating to the dynamics of personal representation. The themes from Simon's model—attention, time deadlines, value, and memory—have been investigated using psychological theories and research evidence as applied to information processing and decision making.

Several sources of literature speak to the "input side" of the meaning assignment process, while others speak to the "output side" of the action/response process. Theories of attention and time constraint suggest that human beings are ultimately finite in their ability to attend to, process, and recall stimuli/response patterns. Early theories of attention claimed a passive, stimulus-filtering process for handling cue overload. However, research has shown that attention requires effortful responding, is affected by motivating communication and feedback, and can be divided among multiple tasks only with difficulty. Furthermore, sustained attention almost invariably involves a performance decrement over longer periods of time. Learning a task over repeated exposure, however, appears to lessen the amount of attention needed to perform it accurately—responses become automatic, so long as the need for them continues.

In a management context, attention has been observed as time passing in a single, undivided source of cognitive effort (Sproull, 1984). Managers do not appear to split their attention; rather, they allow themselves to be interrupted, or they interrupt themselves when alone for long periods. Their interruptions tend to involve interpersonal, oral communications.

Performing information processing and decision making tasks under time constraint changes how attention is applied to the stimuli, how responses develop, and how those responses are explained afterward. Research has shown that mild time constraints induce more acceleration in cue processing (reflecting an awareness and execution of increased effortful attending). Moderate time constraints induce greater information filtering or shallower content absorption (reflecting an even greater level of attending as a highly focused, effortful absorption of limited cues). Finally, high time constraint, or time stress, appears to cause a dramatic shift in the mechanism of attention as an adaptive response to cue overload. The subject reduces the complexity of the cue-processing task by pre-empting the choice rule. In place of a compensatory evaluation process, involving complex tradeoff functions, the individual simplifies the choice problem by singling out the most salient attribute to process. However, while this simplifying process may produce a decision outcome in the allotted time, it does not always produce the optimal choice, nor does it correspond to greater personal satisfaction with the choice made. Attribute-wise processing also coincides with Easterbrook's hypothesis that cue processing becomes *too* selective, causing suboptimal choice. Also, there is some evidence that the attribute processed under time stress is usually of a "negative" valence, i.e., the decision maker is trying to avoid losing rather than bet on potential gains (Wright, 1974). In an organizational context, a choice based on personal risk aversion rather than organizational gain-seeking is not necessarily the best one to make in the interest of the collective strategy. Nevertheless, it might appear as the "only real alternative" when presented to the stressed decision agent acting alone. The presence of work conflicts and strained social relations at work will probably intensify the negative organizational consequences because the stressed individual is not likely to communicate frequently or openly about the problems. Over repeated exposure to the stressful context, the individual may develop a negative sense of self-esteem, feelings of hostility, anger, depression, and lack of competence in performing work tasks. Whether collective organizational structure is a cause, an enhancer, or a neutralizing factor affecting work stress and coping has not been shown.

Taking behavioral decision research findings alongside research on stress and adaptation provides some interesting parallels. Selye's model of stress suggests that an organism responds to stressors in three phases: (1) shock reaction, with a bolstering of energy to respond to challenge and re-establish homeostatic balance; (2) sustained, increased application of energy to cope and maintain homeostasis, and finally (3) succumbing to threat or noxious agent when energy stores run out, or, when the balance between energy expenditure and replenishment is lost. This process compares to Easterbrook's (1959) hypothesis of effortful cue processing: (1) greater effort is expended to focus attention as the task difficulty and/or the time constraint increases until; (2) a match between effort to attend and task demand occurs, or (3) the relationship between effort and accurate cue processing breaks down, causing performance to deteriorate.

Interestingly, in both coping and behavioral decision research streams, *communication*, in the form of instructions, feedback, discussion, appraisal, or expressions of empathy, tends to: (1) motivate greater effort and (2) provide a value anchor for continuing information processing and/or stress absorption. This effect for communication is mentioned specifically in both experimental and field-based results. This outcome suggests that human intersubjective communication adds some relevant boost to cue processing and cognitive evaluation that task-relevant cues alone do not provide. Chronic stress research implies that intersubjective communication provides a means to *represent* an emotional valence that may not be represented at all in the absence of human presence. For example, the experimenter's observation of the subject's behavior is not a communication act if the subject is not aware of the "presence" of the researcher (Zajonc, 1965). Coping with chronically stressful situations appears to be better when there are other people aware and involved.

3.12 Review Summary

The purpose of the previous two chapters was to review the literature of organizational structure and psychology as theoretical bases for understanding stress and its relation to decision making processes in work organizations. The assumption for linking the two groups of theories was that organizations and the individual agents within them face environmental uncertainty and change. Information provides a means to reduce uncertainty, yet it also poses a significant challenge or even threat if it cannot be absorbed (or neglected) for productive ends.

Further assuming that information absorption is at root an organizational problem, to be addressed through effective systems design, the question remains as to what happens to the individual agent when the design is inadequate or is left to chance. The suggested answer is that the individual experiences a stressful situation. Using Simon's model of decision making behavior in connection with psychological research findings, one finds that the individual may experience cue or information overload (too much to process), time pressure or feelings of time urgency (too little time to accomplish the tasks), and a potential consequent shift in information valence (what was considered important under "good-design" conditions is not salient or relevant under "stressful" conditions). For example, what might be an attitude of "I'll do it (or not do it) because it serves my organization's best interests" can become "I'll do it (or not) to avoid the consequences of threatening myself." The change in action rule does not represent a failure of personal intention or a lack of personal alignment with organizational goals, because, in the end, no one's interest is served if the individual can no longer function effectively in the assigned tasks. The individual may have reached the stress point cited by Wheaton (1997) when organizational choices no longer seem relevant, but instead threaten more person-centered "identity-relevant" concerns.

Chronic stress research suggests, however, that social communication, or lack of it, provides a potential mechanism for reconciling the impasse between serving organizational identity and one's own self-interest. Intersubjective communication allows expressions of support, empathy, and feedback for gaining other perspectives in temporal orientation, emotion, and problem valence. Alternately, interpersonal communication can enhance already negative feelings and appraisals. Such cues may be just as organizationally relevant as any other source of "objective" information. They stimulate greater amounts of effort and motivation to "try harder" in giving one's attention to organizational demands. Psychological research has shown that greater effort and motivation are associated with greater levels of attention, greater accuracy in cue recognition and processing, and higher levels of task performance.

When the individual is not motivated to "try harder" to cope with the stressful environment, the organization may provide its own (defeating) escape mechanism for reducing attention demands: *routine*. Highly formalized, scheduled procedures and communications routines may be used as substitutes for expertise and problem-solving ability (Rudolph and Welker, 1998). In stable environments, use of routine response patterns deploys attention and time most effectively. Also, routines offer a valuable social and contextual anchor for coordinating multiple activities in time and space (McGrath and Kelly, 1986). In unpredictable and turbulent environments, however, routine responding provides equally unpredictable and potentially threatening results (Dutton, 1990).

In the absence of a compelling motive to do otherwise, the individual may resort to using routines for "what worked in the past" as a learned response. Organizations may even foster routine responding by documenting prior experiences in written records, policies, procedural maps, project standards, timetables or other socially shared forms of organizational communication (Walsh and Ungson, 1991). The existence and social ratification of routines gives the individual the justification needed to claim that his/her routinized actions were accurate, even if they prove later to be ineffective (Starbuck, 1983). The use of routine can also be defended as socially valuable because it is public "knowledge." It is perceived as instrumental to the collective purpose because it has received either formal or tacit collective acceptance (Cohen and Bacdayan, 1996). Therefore, the individual may feel compelled to use "procedure" even if the individual's personal appraisal of the threatening environment causes emotional conflict and stimulates an internal "alarm" reaction. In the absence of a permissive social communications environment, allowing expressions of doubt or alternative perceptions, the communication pattern established as "routine" will be preferred, and the individual's own emotive representation will be suppressed (Kahn et al. 1964). Once more, the individual's suppression reaction is instrumental for self, not for organization. The response generated is a form of coping with personal stress, not an organizational decision.

Individual contributions of thinking, problem solving and judgment have become a focal point of much theory and research on organizational structure and behavior (Morgan, 1997). The construct of "organizational learning" has received great attention recently as a conceptual scheme for distributed, interdependent cognitive activity functioning on behalf of a collective purpose. Theorists have suggested two basic modes of cognitive processing: (1) automatic, habitual responding using a minimum of attention resources and well-defined stimulus-response schemas stored in procedural memory, and (2) purposive, effortful cue scanning, interpretation, comparison, contrast, and evaluation using declarative memory (Cohen and Bacdayan, 1996; Dutton, 1990). Models of organizational learning do not establish that a "collective cognition" is possible, in which cognitive processing tasks are divided and coordinated in the same way suggested by formal theory of bureaucracy (at the level of the whole organization), or by a theory of the brain (at the level of the individual mind). Organizational learning theory suggests that individuals have redundant schemas and shared language representations for their joint experiences, making coordinated, collective responding possible, but not necessary. The development of collective routine is a method for establishing joint understanding and behavioral patterns, entrainment of rhythmic activities, and social reinforcement mechanisms. Routines are socially persistent because they contain internally consistent, self-referencing logic as representations of acceptable thinking and behavior.

In reviewing the multiple, diverse literatures related to decision making processes, a parallel for "habit" can be observed at several different levels of theory. At the organizational level, the individual may be called to respond to situations automatically as determined by specified procedure or formal rule. At the task group level, or "nearer" work environment, responses may be dictated by socially acceptable routines-in-use or informally espoused behavioral norms; these may have been created through "group learning" over repeated experience (Cohen, 1996; Cook and Yanow, 1996). At the level of the individual, prior experience may also have generated tacit "habits" or schemas for defining emotional urgency, tolerance for ambiguity, and sense of personal control over tasks. Those habitual patterns of thought and appraisal form the backdrop for the evaluation of "stressful" experiences and the motivational triggers to cope with them (Anderson et al. 1977).

Each of those levels: organizational structure, person/environment congruence, and individual personality, contributes to an overall pattern of *automaticity* in information processing and decision making (Beach, 1990; Dutton, 1990). The literature does not clearly define, however, whether these forms of automaticity are sources of stress, or methods of stress relief, in cognitive tasks. Moreover, there has been no evidence to show how those different factors affecting cognitive automaticity are associated with different types of coping response. Finally, and most importantly, there does not appear to be a significant body of research indicating how those factors are related to each other in producing decision processes at the level of the individual. The concept of automaticity is not limited to machine information processing or electronic communications transfer methods, though degree of mechanization in the information system may play a role in the degree of automaticity present. Automaticity refers to the degree to which decision processes are not unique in their deployment of information content, information search sequences, and/or temporal pace, duration and horizon for choice. A highly automatic decision process is one which repeatedly uses the same information inputs, engages the same sequence of search and action, and uses a similar frame of time for linking problem discovery (decision trigger) with chosen action or generated solutions (Dutton, 1990).

The idea of automaticity would include March and Simon's (1993) concept of *program*, the organization-level construct for routine procedure. It would also include Cohen and Bacdayan's (1996) finding of *collective routine* established in repeated cycles of group activity, or what they refer to as "organizational learning." At the individual level, automaticity relies on use of Singley and Anderson's (1989) concept of *procedural memory*, Harris's idea of socially shared schema (1996), and Polanyi's concept of "*subsidiary awareness*" (Polanyi, 1962). All of these concepts suggest a well-developed, internally consistent and self-maintaining system of rote learning founded on rigid framing of experience, and comparison through cybernetic control. In addition to those ideas of cybernetic response programming, however, the present author argues that automaticity also includes an embedded, time-marking mechanism for controlling temporal measurement as cycle, pace, rhythm, or sequence (McGrath, 1988). In a pattern of habituated, or automatic decision making, the flow of time, as well as the procedural content and process, are structured by prior learned experience, social expectation, and organizational mandate.

Decision automaticity is not useful in decision situations requiring long-range vision and strategy. Strategic decisions involve irregular information, ambiguous causal links, and multiple possible outcomes for which values are unknown. Dutton (1990) argues that automaticity is anathema to accurate assessments of strategic issues. Automatic decision processes and strategic decision imperatives are incompatible. Dutton (1990) buttresses her arguments for the difference between "automatic" versus "active" strategic issue diagnosis (SID) using many of the same psychological constructs and findings already enumerated in this chapter. Specifically, Dutton argues that automatic SID is positively associated with: (1) greater issue familiarity (prior experience, tenure, and learning), (2) greater self-relevance to the decision maker (more emotional valence), (3) stronger issue valence, (4) greater time pressure, (5) greater information load, (6) greater role routinization, (7) higher norms for behavioral consistency, and (8) higher past performance success. The argument presented here agrees with all Dutton's points, except that the definition of automaticity adopted here also includes a pacing or entrainment factor, making the individual's time and communications activity more structured or routinized. The time structure element is part of Simon's (1976) model of decision making, in which "time deadlines" are a limiting constraint to decision making optimality. "Time deadlines" are not necessarily limited to internal representations of time and time passage (as in temporal urgency), but also represent social constructions and collective commitments for entrained behavior. Therefore, automaticity in decision making is also directly associated with greater time structuredness, or the degree to which the individual' s time is committed to tasks without autonomy.

Research hypotheses connecting several sources of automaticity to organizational structure, climate, time perception and stress are detailed in the following chapter. These hypotheses will be related to the selected population of interest more specifically in chapter 4: product management/engineering specialists in the telecommunications products and services industries.

CHAPTER 4
RESEARCH HYPOTHESES

4.1 Introduction

The purpose of this chapter is to assert hypotheses and a research model to be tested. The prior section, in two chapters, reviews research on macro-level and micro-level factors from which this chapter draws its collection of constructs and arguments. The arguments presented for each hypothesis will be brief, assuming that the reader is already familiar with the major theory and logic supporting each proposition.

The objective of the research model is to examine how characteristics of organization and its individual agent are related to measures of perceived stress and decision making behavior in a transceiver or boundary-spanning role, as described by Holland (1970). In that role, information for organizational decision making is received, interpreted, transformed for either internal or external sense-making by other receivers, and retransmitted. That specialist role is a communication channel between internal and external environments; however, its transmission conduit also transforms the content and meaning of the incoming symbols to make them useful to other receiving parties. A transceiver is not merely a "pipe." Its functions include coding and decoding, interpreting, and recoding. Because coding and interpretation are important functions of that role, both organizational uncertainty and personal stress are believed to affect the decision and cognition processes of individuals occupying those roles.

As the individual within the role copes with both organizational and personal sources of stress, the organization functions assigned to that role will be affected, thus introducing potential effects at the level of organizational action. The sample selected for representing a population of "transceivers" in the research is detailed in chapter 5. The population has been identified as a group of people who must reconcile the demands of organizational uncertainty and personal stress frequently. Specifically, this population is assumed to encounter: (1) very high environmental uncertainty within markets and technologies in which their organization competes (i.e., the organization, as a collective, in dealing with high market volatility, technological unpredictability, and high economic risk); (2) very high role stress, in the form of role ambiguity, role conflict, and role overload, due to the nature of their role functions as product managers/developers within their respective organizations, and (3) very high levels of personal stress due to the nature of their cognitive work, high demands on their personal time, high performance and attention expectations, high needs for achievement and perceived control over their work, and high levels of industry turnover in their role, coupled with high industry-wide demands for their unique specialist skills.

Although much research has been performed using many of the constructs included here, there is no evidence linking all constructs together in a single model, particularly in a managerial decision making context. Specifically, research has not related constructs theorized here to create the context for automaticity in decision making, the subjects' perception of his/her own stress and coping behavior, and the observation of individual decision making process in a field experiment setting. Therefore, this research is exploratory in nature.

Several constructs included in the model do not have existing measures with well-established "track records" for reliability and validity. Where possible, constructs in the model are measured with well-established instruments whose reliability has been reported in the literature. Some wording modification has been necessary to tap into the language representations of the sample population and their specific work environments. Instrument reliability, as measured in this research, is reported in the appendices.

4.2 Caveat: Multi-level Constructs

Chapter 2 presents the argument that the individual subject is the primary source of perception, communication, and cognitive representation of organizational information and decision making tasks. Based on that argument, most constructs used in this research are measured as individual perceptions because the *effects* of contextual automaticity on cognition and decision making are combined at the locus of the individual mind. Measurement of individual perceptions and individual-level decision processes are assumed to represent the most valid and unambiguous rendering of the interrelationships among the constructs.

This particular research assumption has some empirical support. Latack (1986, 382) found, in a study of coping responses in work settings, that social reports of coping (as opposed to self-reports of coping) were not able to provide interpretable data because the "others" did not "know their subordinates well enough to provide valid data." Latack concluded:

> Finally, the challenge of presenting appropriate multitrait-multimethod evidence is considerable. The difficulties encountered here raise serious questions about the appropriateness of collecting data from supervisors who may not know their subordinates well enough to provide valid assessments of coping strategies...Behavioral observation may serve as a method for assessing some coping strategies, but the intrapsychic nature of cognitive reappraisal would not be measurable in this fashion (Latack, 1986, 384).

Latack was able to show, using multitrait-multimethod matrices, that the self-report data indicated adequate convergent and discriminant validity, as well as construct validity. Individuals were able to clearly distinguish between behavioral and cognitive features of their thinking and responding to stressful work situations, and were able to communicate those distinctions using a self-report instrument. "Other" reports of their behavior were not as distinctive, and proved to be too "noisy" to be used as "other-referent" data.

The sources of automaticity, just explained in the prior section summary, emanate from several levels, both organizational and individual. Though intermediate levels may be identifiable, such as the task group, the present research assumes that the individual is the best locus for data collection and observation. For the sake of parsimony, subgroup influence or "local" structure is not separated from "organizational" structure in construct definition.

4.2.1 Substance and Representation in Measurement

The proposed research model will use *a* tiered system of constructs to present a complete representation of automaticity influences, following several authors' views described below. However, the tiers will be operationalized in measures involving *two levels of analysis*: organizational and individual. In between the organizational and psychological, a construct in the "middle" represents person/organization congruence or "fit" (Lewin, 1951), and is measured as the "climate" perceived at the level of the individual reporting his or her organizational domain. Because the data for this tier come from an individual perception, they are not "organizational level" data in an objective sense; however, the data "refer to" organizational properties, influences, and relationships of organizations, not individuals nor their self-reflections (Denison, 1996).

"Strictly" organizational-level constructs are supposed to measure organizational properties with equivalent precision and representation across researchers, times and organizations. The person/organization congruence constructs measure "referential properties" of organizations as cognitive constructions of people inside or outside its activities and identity. As such references, congruence constructs are not stable across times and observations; they do not "measure" organizations equivalently from one observer to another. They are outcomes of language constructions, and language is an outcome of personal scheme as well as social convention. This conception of multiple, interacting levels is supported by several prior theories of organization/person influence (Payne and Pugh, 1976). Several authors offer models of multi-level research in which organization level and individual level perception are combined (Glick, 1985; McGrath, 1976; Denison, 1996).

4.2.2 Multi-level Research and Interpretation

A significant debate ensued in the 1980's regarding the measurement and interpretation of the organizational climate construct (Denison, 1996; Glick, 1985; 1988; James, Joyce and Slocum, 1988). Some insisted that climate was a psychological construct, measuring individual perceptions of environment, whereas others suggested that organizational climate was indeed an organizational level construct, particularly as often measured as some arithmetic average of perception (Glick, 1988). This research adopts the position that organizational climate is perceived by subjects as their "near" organizational environment, as suggested in the arguments presented by Powell and Butterfield (1978). The logic for considering climate to be a construct distinct from "organizational structure" is that subjects are reporting their experience within an organization *as they know it*, and as been pointed out earlier, that knowledge is significantly constrained by the scope and variability of personal experience. However, the logistics of obtaining a large and broad enough sample of separate climates is beyond the scope of this research. Therefore, the climate measures reported here cannot be argued as anything other than psychological climate (James et al. 1988). In this research, reported "climate" will be associated with subjects' daily pattern of social relations, communications and task activities.

4.3 The Conceptual Model of Automaticity

Figure 2 depicts a graphic representation of the concepts and relationships believed to produce decision making automaticity. This figure is shown on the next page. The model is based on theories discussed in chapters 2 and 3, combining theoretical levels of

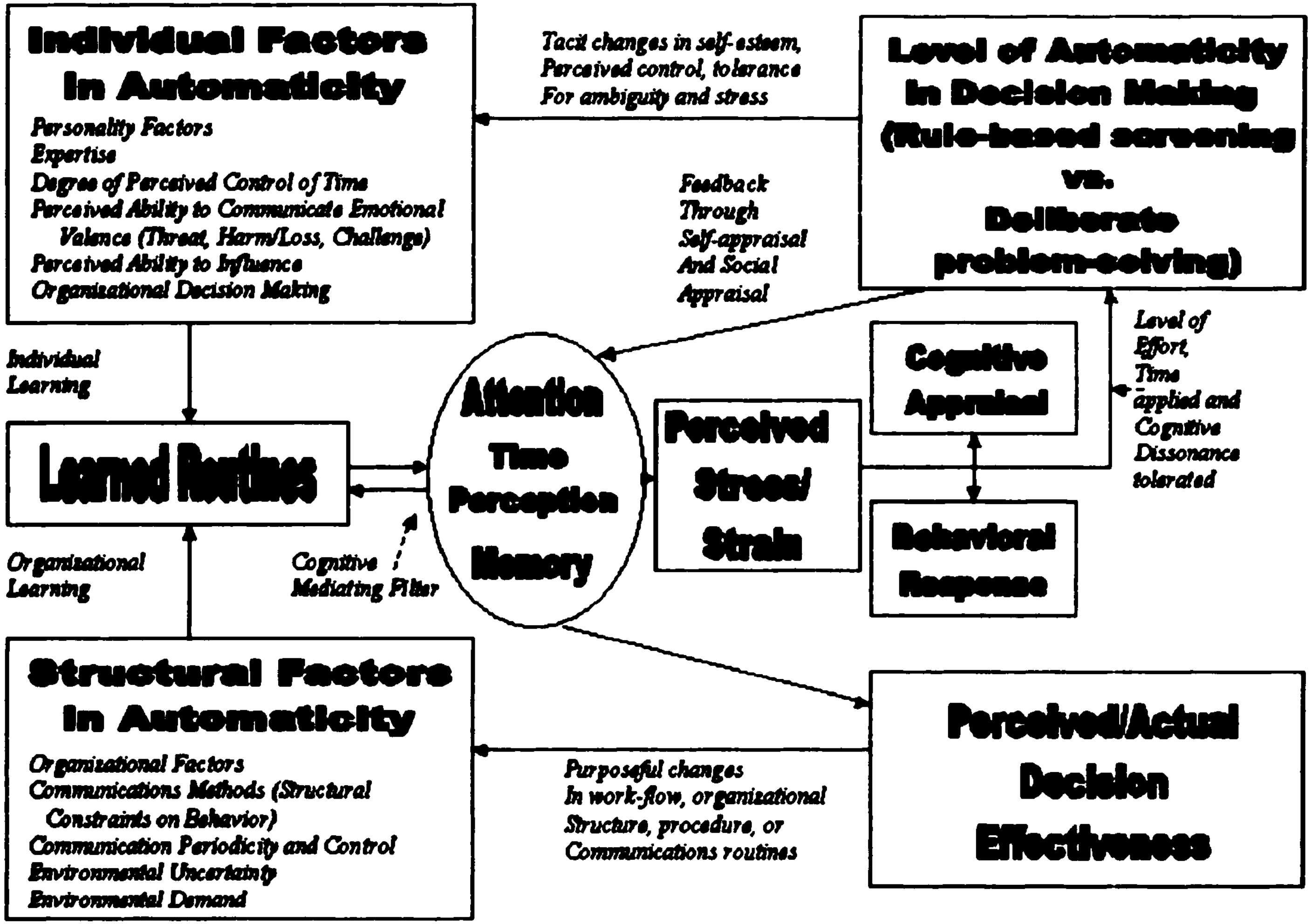


Figure 2. Conceptual Model of Decision Process.

analysis for both organization and individual. As shown, this model indicates a recursive process involving complex, tacit intra-psychic functions. In short, this model suggests that the presence of learned routines will influence the cognitive mediation process for perceiving a decision task stressor (Lazarus, 1998; Newell and Simon, 1972). The stressor is left out of the picture for simplicity. In the process of coping with the stressor, the individual will cognitively appraise and behaviorally respond to the decision task stressor in an effort to adjust to it and gain satisfaction (Edland and Svenson, 1993; Lazarus and Folkman, 1984; Latack, 1986; Segovis, 1990). That appraisal process will influence the level of attention, motivation and behavioral effort applied to the decision task.

If a procedural "rule" or schema promotes routine responding, and the task at hand conforms to that rule, and furthermore, no special "attentiveness" is required or solicited, then routine responding results. The choice to use the rule may or may not be conscious. However, the process used to determine choice is probably similar to a function with a binary set of outcomes, similar to a "yes/no" or "on/off" control switch. Beach's discussion of "threshold" acceptability criteria in image theory describes the image comparison process as "either/or," suggesting decision process automaticity (Mitchell and Beach, 1990).

If no procedural rule or schema is recognized from memory, or if the level of effort or motivation to attend to the decision is relatively greater than usual, then the decision task is more likely to be evaluated using a complex compensatory process like that discussed by Payne et al. (1988). The normative problem-solving approach describes the theoretical multi-attribute, multi-alternative decision process: (1) define problem space; (2) define possible alternatives; (3) define outcome valences, probabilities and risks; (4) define relationships of alternatives and outcomes to each other in sequence and time; (5) choose preferred alternative, and (6) evaluate decision regret (Yates, 1990).

In the post-decision period, the individual decision maker will receive both self-appraisal feedback and social feedback through communications about his or her decision. Such feedback will have an effect on post-decisional confidence (Edland and Svenson, 1993). Under chronically stressful conditions, post-decisional feedback may eventually alter perceived self-efficacy as a decision maker in future situations (Aldwin and Brustrom, 1997; Hamilton, 1979). Repeated cycles of organizational decision making with either repeated success or repeated failure eventually become the basis for more learned, routinized responding (Cohen and Bacdayan, 1996; Newell and Simon, 1972; Starbuck, 1983) and procedural formalization (Jablin, 1987; March and Simon, 1993).

4.3.1 The Research Model Revised for Testing

Figure 2 concepts are difficult to measure directly. Many of those links have been studied in tightly controlled laboratory settings, one link at a time, with subjects randomly assigned to varying treatment conditions. Because managerial populations are rarely studied this way, the results from these lab experiments are often questioned as they apply to work environments.

Figure 2 illustrates a recursive process. A longitudinal study would be required to confirm how automatic decision processes form, and how communication and other types of feedback interact in that formation. Unfortunately, longitudinal analysis is not possible here. Therefore, the model for testing is given in figure 3. Figure 3 constructs are viewed to have significant influence on the formation of decision making processes, as indicated in previous empirical and theoretical work. Also, the constructs in figure 3 have been measured with point-in-time, cross-sectional methods of data collection such as self-report surveys and decision task traces. Figure 3 constructs are basic inputs to the intra-psychic "automatic decision making" process in figure 2. Unlike the process depicted in figure 2, which is partially "tacit" and hard to measure directly, the measures in figure 3 are available in *representational/communicated symbolic forms*.

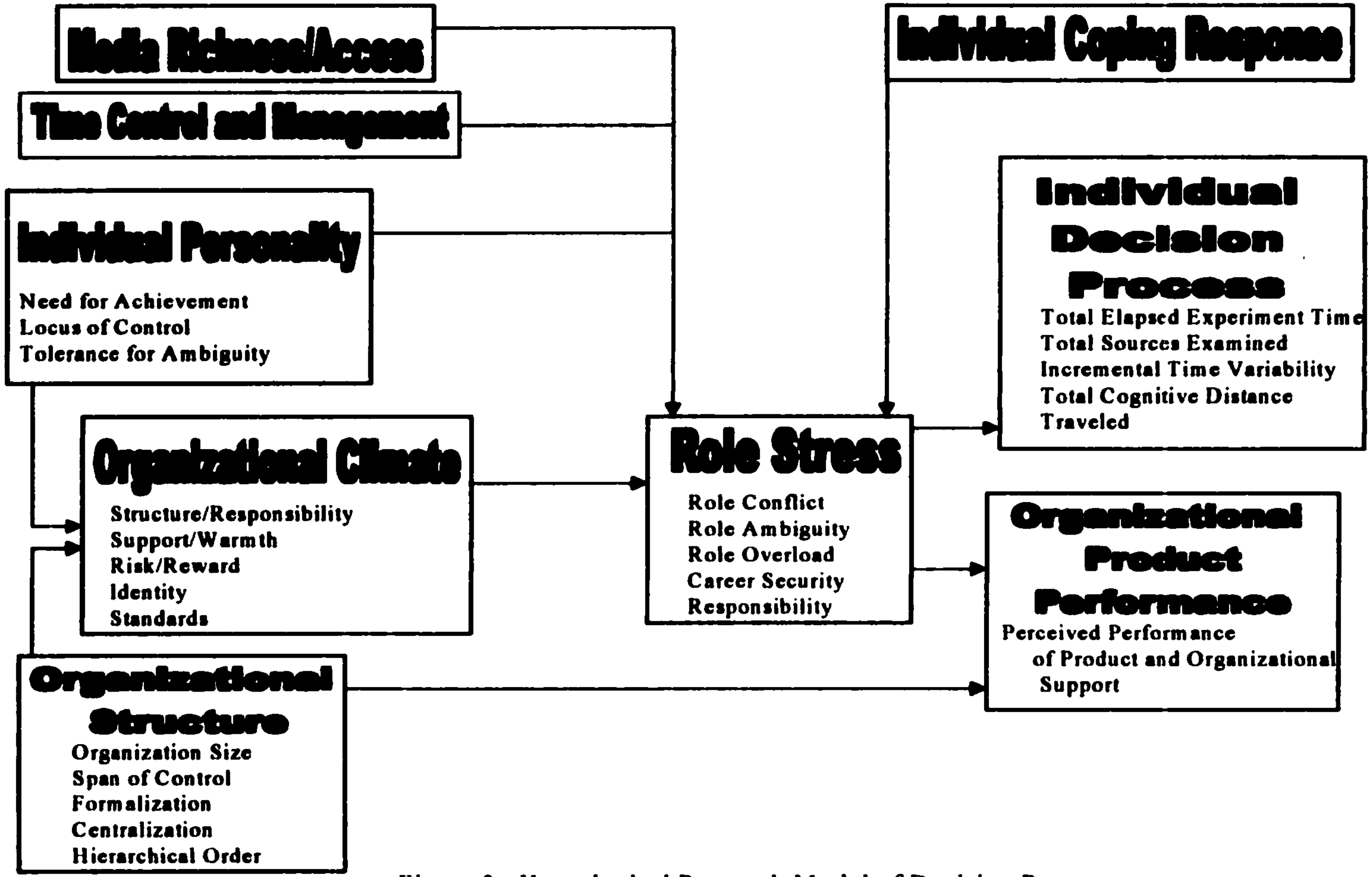


Figure 3. Hypothetical Research Model of Decision Process.

The major constructs in figure 3 include variables of organizational structure, variables of personality, and factors of individual/organization "fit" measured in organizational climate. Measures of time structure and time management, variables relating to perceived personal control over one's time, are distinct from personality variables but still regarded as influential factors in the perception of role stress. Factors of communication structure, including media richness, communication frequency, and communication periodicity are all regarded as behaviorally constraining influences, adding to the effects of organizational structure variables in producing the perception of role stress.

The perceived experience of stress includes perceptions of role conflict, role ambiguity, role overload, social responsibility, career uncertainty, and perceived time pressure (Ivancevich and Matteson, 1980; Kahn et al. 1964). The distinction drawn in the literature between stress and perceived stress (or reported strain) is not drawn in this model; the present researcher assumes that the perception of stress may or may not be associated with significant strain symptoms. Because the emphasis in the research question in on cognitive issues, reports of coping response as a cognitive effort are deemed more critical than reports of physical strain per se.

The construct, Individual Satisfaction with Decision Making, measures a general level of decision confidence with work-related decisions (past and current), and is included as a measure of perceived organizational climate. The organizational product performance construct is intended to capture a generalized perception of relative market position for the product(s) managed by the responding subject, whose functions are defined as primarily product-management/planning related tasks.

Finally, the decision process outcome variables are generated from a computer-based decision process tracing software program developed by the researcher. The structure and measures of the decision task tracing software are patterned after a similar process tracing instrument, Search Monitor (Brucks, 1988). The program output is the result of the subject's voluntary participation in an experimental decision task. The task involves individual evaluation and selection of one preferred product management case history out of a set given for evaluation. Each case history has been adapted by the researcher from actual product histories presented by Bowen et al. (1994). The procedure for creating the decision task from the case content is discussed in detail in the next chapter.

Besides the constructs shown in figure 3, several demographic characteristics, including job tenure, organization tenure, industry tenure, educational background, type of educational curriculum (e.g., engineering, business administration, liberal arts. These variables will be used to evaluate group differences that cannot be controlled through systematic sampling strategy. Because of the highly volatile nature of the industry, the present researcher anticipates numerous changes in company identities, new product introductions, and shifts in employment among subjects during the course of this study. A systematic sampling procedure, requiring a stable population base, is not considered feasible for the selected population. The remainder of this chapter discusses each construct in figure 3 with greater detail, and lists study hypotheses at the end of the sections.

4.4 Organizational Structure Factors

The five structural variables considered significantly related to decision making automaticity are organizational size, span of control, hierarchical order (as placement within the larger organizational hierarchy), centralization, and formalization. Each of these five constructs will be considered separately in the sections below.

4.4.1 Organization Size

Though there are some disagreements about how to determine organizational size and how it relates to other structural properties (Gupta, 1980), a well-accepted measure of size is simply the number of full time employees. Robbins (1990) reports that size as number of employees is highly and significantly correlated with output, workflow throughput, and accumulated assets.

This research defines organizational size as the total number of full-time employees. Employees working on an occasional basis, such as part-time, contract and temporary labor, are not included in this definition. This definition of size has been found highly correlated with other structural characteristics of organizational complexity, occupational specialization, and increased hierarchical structure. As a respondent-reported measure of organizational structure, it is easier to determine accurately in minimal time, and requires less effort to interpret than other correlated measures.

Organizational structure research also relates size to age of organization (Greiner, 1972; Miller and Droge, 1986). Size has been positively related to formalization in most reported studies, though the results for this link are less clear (Robbins, 1990). As organizations get larger, they tend to proliferate rules and procedural documentation as a means of gaining control over more widely distributed and specialized functions. Another explanation, adopted from organizational learning literature, is that as size and age tend to be related, increased formalization results from the accumulation of routines as learned collective behavior. Jablin (1987) summarizes the relation of size to communication practices as weak support for the negative relation between increasing size and communication quality; other measures, such as frequency, are not clear.

A direct hypothetical relationship between organizational size alone and outcome variables of role stress and decision process do not seem reasonable to hypothesize, given prior research findings. Kahn et al. (1964) found that large organizations (over 500 persons) tended to have members who reported more stress, though this relationship diminished with increasing size (Ford et al. 1988).

Size, as one dimension of organizational structure, is more likely related to the perception of stress and decision process by means of perceived "fit" between individual respondent and organizational context. In the context of the larger construct of organizational structure, size is considered to be a variable with little theoretical influence on the dependent variables of interest, but highly correlated with other measures of structure, making it a potential confound for other interesting structural variables. As such, the variable of size will be controlled through grouping by organizational size class.

4.4.2 Span of Control

Span of control is defined as the number of subordinates reporting directly to a supervisor (Jablin, 1987; Robbins, 1990; Pugh et al. 1968). Generalized span of control theory suggests that the smaller the span, the greater the hierarchical arrangement of management (i.e., the organization's structure gets "taller"). However, research has shown that spans of control vary greatly from one organization to another depending on level of professionalism (ability to work independently without constant supervision) and level of formalization (Jablin, 1987; Ford et al. 1988). Jablin's review of the relationship between span and communications behavior indicates that even though narrower spans are assumed to provide more communications frequency, they are not necessarily associated with type of communication method, perceptions of emotional openness or acceptance, or closeness of supervision. Spreitzer (1996) found that a wider span of control was associated with greater subjective perceptions of work-place empowerment for a sample of 393 middle managers in one large organization.

In this study, the sampled population is assumed to range from a first-level manager to an upper level manager. The span of control measure used in this research, therefore, is bi-directional. The manager may have subordinates (a downward span) and will be supervised by at least one or more direct superiors (an upward span). Both measures will be taken and summed, and will not be assumed to reflect the organization's general span of control practices due to nature of the product management functions. Like the size variable, this measure is easy to report and usually unambiguous in meaning for respondents. Likewise, it does not require a relative, evaluative judgment or subjective estimation of structure (Payne and Pugh, 1976).

The product management and strategic technology management literature also indicate that multiple direct reporting relationships are probable in this sample due to the use of team management practices and matrix forms (Dussuage et al. 1996; Schilling and Hill, 1998). The study attempts to measure span of control in those relations as well to the extent possible. In sum, the relations between span of control and stress, and between span of control and decision making process, are not clearcut. Smaller spans are usually claimed to afford greater communication potential, and therefore more informal exchange of ideas as well as more emotional valence (Pelz and Andrews, 1966; Holland, 1970). Spreitzer's findings, however, suggest that larger spans create the basis for greater feelings of empowerment and self-determination. Span of control, like size, is part of a larger structural framework for receiving, distributing, and processing environmental information and uncertainties.

4.4.3 Hierarchical Order

As span of control is linked to hierarchical "tallness" in the general case and relates theoretically to communication frequency and monitoring potential, hierarchical order, as defined here, measures the ranked level of the respondent's role in the hierarchy of the organization. Because the sample population may have nonstandard reporting relationships and great variation in authority structures, and may not be knowledgeable, individually, of organization-wide authority distribution, the variable of hierarchical order is measured to understand where the individual respondent places self in the vertical span of the organization. Hierarchical order may have two "directions" like span of control relations; there may be a number of hierarchical levels "above" the respondent and also levels "below." By asking for information on each, the total hierarchical structure can be estimated by adding the two indices and adding the level of the respondent.

4.4.4 Centralization

The definitions of centralization in the literature are somewhat varied, though they all focus on a common theme. Their differences, however, account for the variety of ways that centralization has been measured. Robbins (1990, 104) defines centralization as "the degree to which decision making is concentrated at a single point in the organization." Miller and Droge (1986, 542) define it as "concentration of authority" while Pugh et al. (1968, 76) define it as the last person in the hierarchy of authority "whose assent must be obtained before legitimate action is taken."

Hage and Aiken (1967, 77) split the construct into two different subdimensions, "participation in decision making" and "degree of hierarchy of authority". Decision making participation is described as "how much the occupants of various positions participate in decisions about the allocation of resources and the determination of organization policies." Hage and Aiken offer a composite, average measure of participation by subdividing the decision types into different categories, such as hiring of personnel, promotion, policy adoption, and new service introduction. The average measure in their research was computed using multiple organizational respondents across multiple decision categories.

John and Martin (1984, 172) modified the Hage and Aiken measure to adapt it to marketing management contexts and validated it through factor analysis, yielding two distinct factors: locus of authority and participation in decision making. "Locus of authority" was defined as "the extent to which decisions about marketing planning activities are made by a relatively small group". "Participation" was defined as "the extent to which marketing area personnel have input on the activities in question." These two subconstructs were measured using survey items in a 7-point Likert format and administered to individual respondents. Like the Hage and Aiken instrument, the John and Martin instrument was used as a collective measure (computed as an average of multiple responses).

Simon (1976) provides a thorough explanation of how centralization affects decision making practices in organizations. Centralization has three useful purposes: (1) it secures coordination of decisions; (2) it conjoins multiple sources of expertise in arriving at a single action, and (3) it focuses responsibility for action. Simon concludes that the choice of whether to centralize or decentralize decision making depends on what results are desired. Centralization can be used to (1) correct *wrong decisions* by subordinates with limited knowledge and information, by subjecting them to more generalized review; (2) appraise subordinates' need for decision making guidance, if *incorrect decision processes* are used, (i.e., combining the activities of information search, judgment, evaluation and choice), and finally (3) discover where subordinates' decision resources need to be strengthened.

The present research will define centralization consistent with the definitions provided by Hage and Aiken (1967), and later modified by John and Martin (1984), thus capturing two sub-dimensions for centralization of authority. The third dimension, from Pugh et al. (1968), reflects the highest level of authority whose work is required for enacting certain common business decisions.

John and Martin (1984) found their measures of centralization to be differentially related to their dependent measures of marketing plan credibility and utilization by marketing planning managers. Higher locus of authority was negatively related to greater perceived marketing plan credibility, acceptance and use, while higher participation in decision making about the plan was positively related to the same dependent variables. Similarly, Lysonski, Levas, and Lavenka (1995), using the same instrument, found that centralization (as locus of authority) was not significantly different for product managers facing different perceived levels of environmental uncertainty, although their level of decision making participation did vary depending on the level of perceived environmental uncertainty, PEU (Duncan, 1972). Managers who faced greater PEU in their product environments were allowed greater levels of decision participation than those facing lower PEU. Lysonski et al. conclude by saying that even though upper management may use the ideas and inputs of its product managers for decision making, they do not typically relinquish control over the final choices made.

4.4.5 Formalization

Finally, formalization, has been related to the use and proliferation of procedure, rule, routine and accumulation of organizational habit. However, like the centralization variable, it has several definitions and measures, and has been differentially linked to other aspects of structure.

Robbins (1990, 93) provides a simple definition of formalization as "the degree to which jobs within the organization are standardized." Pugh et al. (1968, 74-75) distinguish between standardization of procedures and formalization of those procedures. Standardization refers to "an event that has regularity of occurrence and is legitimized by the organization…rules or definitions that purport to cover all circumstances and that apply invariably." Formalization, in contrast, "denotes the extent to which rules, procedures, instructions, and communications are written." Hage and Aiken (1967, 79) assert that: "formalization represents the use of rules in an organization. Job codification is a measure of how many rules define what the occupants of positions are to do while rule observation is a measure of whether or not the rules are employed." Hage and Aiken's concept has been operationalized more frequently than the measure from Pugh and colleagues because it is easier to determine empirically at the locus of the individual respondent. Hage and Aiken's idea, therefore, includes the notions of job specificity, task behavior detail, and the degree to which behavioral conformance is demanded and monitored as rules. Hage and Aiken's survey measures are combined to provide an average measure of formalization, as an organization-level construct.

Hall et al. (1967, 906), combining the ideas of both Pugh and colleagues and Hage and colleagues, developed multiple indicators of formalization: (1) the presence of written job descriptions; (2) the degree to which authority structure is formalized, i.e., "written down"; (3) the degree of emphasis on written (formal) versus oral (informal) communications; (4) the degree of emphasis on following established formal communication channels; (5) the number of written rules and policies; (6) the degree to which sanctions for rule violations are clear and penalties recorded in writing, and (7) the degree of formal new member orientation training and ongoing in-service training as part of formal work requirements. Miller and Droge (1986, appendix) abbreviated the ideas of Hall et al. into a series of dichotomous measures for the presence of certain written documents, books, manuals, and charts.

In a marketing planning context, John and Martin (1984, 172) suggest that formalization is an outcome of leadership and style as well as organizational mandate, representing order and stability. Jablin (1987) also expands the concept of formalization to include unwritten "rules" and norms that govern organizational behavior. John and Martin include a relatively novel facet in the formalization concept: "adhering to a time schedule of process activities and planning jobs, the conduct of meetings with specifically defined memberships and agenda, documentation of activities, and the generation of planning documents." This dimension of formalization provided by John and Martin reflects a greater acknowledgement of the impact of information technology and information overload that is characteristic of product management and planning (Lysonski et al. 1995).

This research involves multiple facets of formalization as described by these researchers above. In fact, no single definition provided by any single author or set of authors is considered to be complete in capturing the full construct. Because the emphasis for John and Martin's research is marketing organizations, their concept of formalization probably comes closest to the aims of this study. However, it does not measure formalization at the level of the organization per se, but rather, the marketing planning component. This research issue suggests that overall organizational formalization, including product planning and management, but also including administrative policies, strategic mission statements, and general degree of rule-bound behavior and constraint, is important to how an individual member experiences stress and how decision processes are exercised (Simon, 1976). Therefore, measurement of formalization will also entail job and work process codification, decision-making codification, extent of formal written communications, especially rules and sanctions for behavior, written statements of policy, purpose, belief, or other representations of organizational identity. Each of these formally legitimized forms of communication are assumed to have the function of "creating a mindset" for the purpose of social communication, maintaining joint identity and provoking behavioral control (Simons, 1995; Spreitzer, 1996). In the context of attention and cognition theory, written, explicit, widely distributed forms of communications require resources of attention to process, create the opportunity for learned schematic formation between symbolic representations and behavioral responses, and solidify social ratification of shared meanings. In Simon's explanation, written forms of communication create avenues for perpetuating a sense of collective understanding and multi-actor behavioral coordination and control.

The evidence linking formalization with other structural properties and communications behavior is equivocal. Robbins (1990) reports that overall, research supports the direct relation between formalization and other structural properties of specialization, standardization and size. However, he notes, highly professional organizations often have low formalization because professionals have a high degree of internal control over their own work and behavior. Jablin (1987, 405) summarizes formalization and communication research by commenting that work-related practices appear to be inversely related to "oral, horizontal, unscheduled communication." One study suggests that formalization is negatively correlated with perceived performance feedback from peers and supervisors (Jablin, 1987).

John and Martin (1984) found formalization of planning activities to be positively correlated with marketing plan credibility, acceptance and use. This finding corroborates the idea that formal, written communications buttresses social acceptance and coordinated behavior, but does not provide evidence of product or organizational performance outcomes. Similarly, Menon, Bharadwaj, Sundar and Howell (1996) found that formalization was associated with lower dysfunctional conflict in product planning and introduction, resulting in greater inter-functional coordination and less role ambiguity. Lysonski et al. (1995), in their study of product management under varying perceived uncertainty conditions, found that greater formalization of product management activities was positively associated with greater degree of PEU.

In a different vein of research on formalization, Marino and White (1985) found formalization (measured via Hage and Aiken's instrument) was significantly related to the report of job stress in a medical services organization (N = 278). The personality variable of locus of control (defined later in the chapter) was shown to moderate the relationship between formalization and stress. Those with a personality described as "internal" experienced a higher degree of stress when their job was reported as highly specific, whereas "externals" reported lower feelings of stress under high job specificity.

Adler and Borys (1996) summarize and critique a vast number of research studies on formalization and its effects on numerous dependent constructs, including innovation, satisfaction, structure, stress, and others. They argue forcefully for a distinction between enabling and coercive forms of formalization: enabling provides coordination, empowerment, reduction of role and interrelational ambiguity, and collective understanding, while coercive forms promote punishing rules, boredom, over-monitoring, and passive compliance. Research evidence, they claim, provides rationale for both forms of formalization. They suggest, in concluding, that perhaps individual characteristics and general perceptions of the work environment may play significant roles in untangling the difference between enabling and coercive forms of formalization as an influence on stress.

Agarwal (1993) studied formalization, as job codification and rule observation on samples of salespersons from the United States and India, finding that there are distinctive and significant differences between perceived formalization and the experience of role stress, role ambiguity, organizational commitment and work alienation. Overall, the United States sample reacted more negatively to formalization practices than the sample from India. In opposition to Adler and Borys's (1996)) arguments, Agarwal found that formalization was associated with greater role ambiguity and role conflict for U.S. respondents. Indian respondents did not report as much stress from formalized rule observation. Agarwal cautioned that his results might be due to significant differences in the mean age of the two samples (reflecting their degree of work experience and self-confidence).

Jaworski and Kohli (1993) studied formalization using Hage and Aiken's measures for its relationship to a market orientation of organizations, defined as market intelligence, dissemination of the intelligence, and organization-wide response. They found that formalization was not related to market orientation, as hypothesized.

On balance, it appears quite difficult to specify a hypothetical relationship between formalization and the dependent variables of role stress, coping, and decision process automaticity without further specification and linkage to the other variables of structure. The next section summarizes the organizational structure relationships and concludes with hypotheses.

4.5 Organization Structure Hypotheses

Each of the dimensions of organizational structure given above has been studied as an independent construct in its own right in a wide variety of contexts. However, they have been studied as gestalts or patterns of structural attributes as well, whose constellations are theoretically preset (for example, Burns and Stalker's ideas of "mechanistic" versus "organic" structural forms, or Porter's (1980) typology of "generic" strategies). Unfortunately, no single typology exists to deliver the exact "patterning" of the structural variables of interest here, despite the widespread acclaim and support for the Burns and Stalker model.

A problem with using the variables individually in the model, however, is that each will "burn" degrees of freedom in explaining the total variability. Moreover, previous research has shown these variables to be highly intercorrelated, so that using them as independent constructs in largely untenable. The remaining alternative seems to be to create a scale using each of these factors as sub-dimensions and then assessing which of these factors "hang together" as truly independent components of structure. The statistical route to independent factor generation is exploratory factor or principal components analysis.

The arguments presented in this paper so far have suggested that the organization and individual agent are a dual-component system for absorbing environmental uncertainty, absorbing information, and interpreting stimuli. Together, organization and individual comprise a communication linking system with limited attention, time, and cognitive resources. The design of this dual system has the potential to induce stress on the individual where organizational structural design is not adequately positioned to absorb environmental uncertainty in a coordinated, distributed, and timely way. Galbraith's conception of the organization as a communication throughput channel is the paradigm that best describes the process of organization, structure, and individual interaction, though it does not delve into the intrapsychic nature of the communication channel also involved in the uncertainty absorption process: the individual mind.

To link the various aspects of organizational structure with the intrapsychic factors involved in decision making, the present author has argued for the focal assumption that the mind is a locus for generation and control of representational, symbolic forms (Newell and Simon, 1972; Pylyshyn, 1983). It is limited in capacity (Eysenck, 1982) but nonetheless affected by emotion (Lazarus, 1998), motivation (Kahneman, 1973) and the perception of time and context as frames of reference (Block, 1993; Yates, 1990; Zakay, 1993).

In keeping with that paradigm, organizational structural variables, as they are commonly defined, must be reviewed as influencers on the process of communication, symbolic transmission, "paying attention", expending effort, and controlling sense of time. Under this paradigm, the generalized (and untested) form of the hypotheses for the research are enumerated as follows:

Hypothesis 1: Organizational structures that sponsor more frequent, routine messaging will be negatively associated with perceived role stress.

Hypothesis 2: Organizational structures that sponsor more frequent, routine messaging will have no direct, independent effect on automaticity in individual decision processes.

These two hypotheses relate to the conceptual model in figure 2. Hypothesis 1 suggests that organizational structure attributes will alleviate stress by making information processing and decision making tasks more programmed, procedurally clear-cut, and socially ratified, as some researchers have found (e.g., John and Martin, 1984; Adler and Borys, 1996). However, reducing the perception of stress at the individual level does not necessarily provide optimal performance in decision making at the organizational level; research also indicates that limiting environmental data may prevent noticing relevant product-influencing events and competitive developments. Also, individuals may become conditioned to the "routine mindset" provided in a routine communication procedure, as given in hypothesis 2.

In terms of the organizational factors measured in this research, these conceptual hypotheses are restated and grounded in more traditionally used organizational constructs:

Hypothesis 1a: Greater spans of control and less formalization together are positively associated with perceived role stress.

Hypothesis 1b: Centralization will be positively associated with perceived role stress.

Hypothesis 1c: Hierarchical order will be positively associated with perceived role stress.

Hypothesis 2a: Span of control will be related in an inverted U-shape function with organizational product performance (indicating a relative maximum relation).

Hypothesis 2b: Formalization and centralization together will be negatively related to product/organizational performance.

Hypothesis 2c: Hierarchical order will have no effect on product/organizational performance.

Hypothesis 3: Span of control, formalization, centralization and hierarchical order will have no individual, independent effects on individual decision process.

The justification for these relationships is as follows. Greater spans and less formalization require more individual attention to environmental uncertainty sources because there is greater use of informal communications processes, more information "load" on the individual (with fewer associates to take the load), less routine communication forms available, and less guidance and support in interpreting the symbolic load and pressures. Greater centralization results in greater stress because the individual has less legitimate authority, and may be offered fewer ways to "represent" his thinking in useful ways. Lower hierarchical order (or vertical span) indicates fewer layers to buffer the uncertainty and informational demands put on by the environment and the individual processor; the individual simply has more information processing work to do. Span of control literature suggests that there is a relative optimal superior/subordinate span; too few subordinates results in over-monitoring, while too many subordinates results in communication overload (Jablin, 1987; Urwick, 1974).

Rresearch using the Burns and Stalker (1961) model has indicated that higher formalization and higher centralization together thwart innovativeness (Damanpour, 1991) and are associated with superior organizational performance only for certain strategies, such as the cost leadership (Porter, 1980). For the industry used in the present sample, considered to be highly unpredictable and dynamic on many strategic dimensions, a combined structural approach of high formalization and high centralization is not likely to be highly successful (Burns and Stalker, 1961; Miles and Snow, 1978). Research on vertical span alone does not exist to predict its relationship to product performance, so a "no effect" relationship is theorized here.

Finally, span of control, formalization, centralization, and hierarchical order variables are hypothesized to have no direct effect on individual decision making processes as measured in this research. Organizational structure effects are hypothesized as mediated by the perception of stress, which in turn impacts coping and learned decision processes.

The hypotheses listed above link organizational structure factors directly with perceptions of role stress. The direct relation between organization structure and stress is well-documented in empirical work (Kahn et al. 1964; Marino and White, 1985; McGrath, 1976). However, others have suggested that the relationship is mediated by perceived organizational climate, or the perception that an individual has of himself or herself in relation to the organization and its properties (Denison, 1996; Litwin and Stringer, 1968). Still others contend that individual personality factors play a direct role in stress, particularly cognitive stress (Hamilton, 1979), whether or not those factors are mediated by climate. Before turning to the climate construct, relevant personality factors will be discussed.

4.6 Individual Personality Factors

Though many personality factors have been studied in relation to perceived stress, coping, anxiety, and decision making, this study focuses on three personality variables: achievement motivation, locus of control, and ambiguity tolerance. Other variables considered include dogmatism and rigidity; however, research evidence has shown high correlations between those two variables and at least one of the first three mentioned.

Even though this study is principally concerned with organizational outcomes, research has shown that individual personality factors account for a significant portion of systematic variability in stress perception and coping responses. Hamilton (1979, 96-97) defends an "information processing view" of the relation between personality and stress with the following reflection:

> the interesting outcomes of cognitive processing experimentation (have) been the demonstration of irreducible individual differences which used to be discarded as error variances. Secondly, recent studies of the representation of knowledge, of primary orientation towards external data or towards internal conceptualization, of processing limits and the depth of cognitive processing, are all areas of functioning in which individual differences can and do appear.

Hamilton suggests that the relation between personality and stress/coping is so consistent and significant, a researcher cannot avoid examining potential direct effects of personality on stress and other outcome variables linked with it. Therefore, hypotheses linking personality traits with the dependent measures are outlined in the next section.

4.6.1 Achievement Motivation

Achievement motivation generally reflects a person's "conception of...important relationships between personal strivings and the psychological well-being of the individual" (Cassidy and Lynn, 1989, 301). Though need for achievement is often used to reflect a unitary construct, multiple authors who have provided instruments for it have concluded that it is multifactorial (Cassidy and Lynn, 1989). Based on the work of McClelland (1961) and others, Cassidy and Lynn propose a construct with six distinct factors: work ethic, pursuit of excellence, status aspiration, competitiveness, acquisitiveness for money and material wealth, and mastery.

In the context of this research, achievement motivation is expected to influence (1) the degree and type of stress perceived in one's organizational environment; and (2) the degree to which effort, concentration, and motivation are expended in information processing and decision making tasks. The personal trait of achievement motivation is hypothesized to account for variance in perceived stress for similar job requirements (product management) in similar or equivalent organizational structure/climate contexts.

Miller and Droge (1986) found that CEO need for achievement was significantly related to organizational structure variables of formalization, integration and centralization in young and small firms. Therefore, the effects of this variable must be examined independently of organizational structure and climate. Prior research indicates the following hypothesis:

Hypothesis 4: Individual achievement motivation will be positively associated with perceived role stress.

4.6.2 Locus of Control

Rotter (1966, 1) defines "locus of control" as: "the degree to which the individual perceives that the reward follows from, or is contingent upon, his own behavior or attributes versus the degree to which he feels the reward is controlled by forces outside of himself and may occur independently of his own actions." Like achievement motivation, locus of control is a personality factor with a well-established empirical history. The construct suggests a basic dichotomy among people as those who perceive rewards to come to them based on their own abilities and actions ("internals"), and those who perceived rewards to come on the basis of "luck, chance, fate, or powerful others" ("externals"), Rotter, 1966, 1). Locus of control has also been linked to the constructs of self-efficacy, general passivity, and disengagement (Folkman et al. 1979). Research has shown that internals, feeling that they should be more "in control" over situations, exhibit higher stress levels than their external counterparts. Marino and White (1985) found that internals experienced higher stress when job specificity was high and lower stress when job specificity was low, while externals had patterns between job specificity and stress that were reversed from the former the personality type. Prior research suggests the following hypothesis:

Hypothesis 5: Locus of control is associated with role stress (internal locus of control is positively related to role stress).

4.6.3 Tolerance for Ambiguity

The construct of tolerance for ambiguity is like, but not exactly opposite to, the idea of intolerance for ambiguity. MacDonald (1970, 791) asserts that "intolerance for ambiguity may be viewed as a general tendency to perceive ambiguous material or situations as threatening...Conversely, tolerance of ambiguity implies that contact with ambiguity is desirable." He continues by defining it as "a willingness to accept a state of affairs capable of alternate interpretations, or of alternate outcomes." Norton suggests that a general personality factor of ambiguity tolerance affects "how a person psychologically copes with ambiguous information (in) the perception, interpretation, and weighting of cognitions...ambiguity tolerance interacts in any situation in which there is too little, too much, or seemingly contradictory information...(Norton, 1975, 607).

Theoretical arguments linking tolerance for ambiguity and stress indicate a paradox. On the one hand, classical decision theory argues that those experiencing ambiguous and uncertain situations seek information to reduce uncertainty (Yates, 1990). However, Folkman et al. (1979, 281) suggest that the greater the ambiguity, and thus the greater the emotional threat, the more important generalized beliefs and emotional state are in determining what course of action is taken, if any: "For example, whether the environment is viewed as generally unmanageable and hostile, or as supportive and readily subject to control, should affect the appraisal, and the consequent emotional impact."

Hamilton (1979) suggests that a low tolerance for ambiguity may be a learned personality trait, triggered by chronic or repeated exposure to stressors and highly complex situations that create high anxiety and threat. At the exposure to a stressor, the person with low tolerance "closes down" information processing tasks prematurely, through information avoidance and denial. This form of reaction, though sub-optimal as an information processing behavior, is instrumental to the individual by limiting the degree of anxiety perceived.

Trevino et al. (1990) studied the effects of tolerance for ambiguity using an earlier instrument (Norton, 1970) on managerial use of communication media. They hypothesized that a highly tolerant person would prefer rich media to lean media because it offers contact with greater situational and message ambiguity. Using a sample of graduate business students, they were not able to support their hypothesis.

In summary, the hypothetical relation between tolerance for ambiguity and role stress appears unclear. On one hand, higher tolerance would suggest that the individual might perceive greater stress from information processing, but still enjoy it more than the alternative of being bored and constrained by having too little to do, which is also found to produce perceived role stress (Kahn et al. 1964). In comparing two models of person/environment congruence, Edwards (1996) found that the optimal "fit" involved high-ability individuals working in highly demanding work environments—those with great capacity sought work with high complexity and load.

In a different view, Hamilton's (1979) argument suggests that a person with low tolerance may avoid stress by neglecting the information and uncertainty that is really present in the environment, thereby claiming low stress perception. It seems plausible to suggest that a moderating influence on this seeming contradiction is whether or not the individual is constrained through organizational structure and systems. In the case of the highly tolerant person, a tightly controlled, formalized or centralized structure would create the "stress" of not getting access to all the "ambiguity" desired, whereas, in the low tolerance person, a tightly controlled setting would fit with needs to avoid or limit ambiguity. The mirror image argument would be possible for the more "organic" structure.

For direct effects only, the hypothesized relation between ambiguity tolerance and perceived stress is:

Hypothesis 6: Individual tolerance of ambiguity is related to role stress (direction not established).

4.7 Other Person-Specific Factors and Stress

Besides the individual personality factors listed above, two other factors appear theoretically linked to the manner in which the individual perceives and manages information situations, and thus how he or she might feel disposed to perceive them as "stressful." Those two factors are how one perceives self to be in control of one's own time and what communications methods and instruments one prefers (as opposed to what one has access to using) in routine and stressful situations with other people. Both factors reflect the degree of ability to take action, or feel restrained from taking action, to relieve whatever information stress is present. For example, upon finding out that her top customer is about to sign a major contract with a chief competitor, a product manager will perceive a great deal of stress if she is constrained by schedule conflicts or lack of suitable communications avenues to deal with the situation in a personally controlled way. Like personality factors, these factors of time structure and media accessibility are theorized as more strongly determined by individual differences in taste and experience than organizational constraint. However, to rule out "blaming" organizational structural constraints as culprits for time abuse and media limitations, measures of personal preference are collected.

4.7.1 Time Structure and Management

Bond and Feather (1988, 321) define time structure as "the degree to which individuals perceive their use of time to be structured and purposive." Using several samples of respondents, including students, aging populations, and unemployed versus employed populations, their research has shown that greater perceived time structure is positively related to better overall health, less depression, greater self-esteem, and greater feelings of self-efficacy. Their survey measure of time structure appears to tap five uncorrelated subdimensions: sense of purpose, structured routine, present orientation (versus thinking about the past or the future), effective time organization, and persistence. This construct has not been studied extensively, and there is no evidence of study between time structure and work-related stress specifically.

Macan, Shahani, Dipboye and Phillips (1990) developed an instrument to measure time management behavior. Perceiving a need for time management involves feelings of being overwhelmed by too many responsibilities and events, and includes perceptions of trying to control one's time through instrumental action in scheduling, planning, time allocation and procrastinating. Using student samples, Macan et al. report significant relationships between time management behavior and role ambiguity, job satisfaction, self-rated and other-rated performance measures, and somatic tension. The most significant factor in the scale was an attitudinal factor they named "perceived control of time." This factor was highly and significantly related to measures of role conflict, role ambiguity, role overload, Type A behavior, job-induced tension, job satisfaction, and performance.

Mudrack (1997) conducted confirmatory studies with 407 subjects using both surveys for time structure and time management constructs. He concluded that the two most important dimensions of both scales were sense of purpose (from Bond and Feather, 1988) and perceived control of time (from Macan et al. 1990) He also suggested, as did both sets of prior authors, that the total score from each scale was not relevant because the constructs were not unitary. Each factor in each construct should be theoretically linked to a particular research question and used independently of the other construct factors.

In this study, the two most relevant factors from these two constructs are perceived control of time and perception of structured routine. From the analysis presented by Mudrack and Macan et al., greater perceived control over time should be associated with more opportunities to take instrumental action to relieve stressors effectively. Similarly, if one feels that one's routine is stable and planned, less perceived stress is likely. Therefore, these arguments suggest:

Hypothesis 7: Perceived control of time is negatively associated with perceived stress.

Hypothesis 8: Perceived time structure is negatively associated with perceived stress.

4.7.2 Media Richness/Access

Media richness is defined as the capacity of a particular communication medium to carry or transmit rich information as an instrument for conveying consensual meaning (Bodensteiner, 1970; Trevino et al. 1990). Daft and Lengel's definition asserts that information richness is "the ability of information to change understanding within a time interval" (Daft and Lengel, 1986, 560). Information processing takes place in organizations to reduce uncertainty (lack of information) and to reduce equivocality (ambiguity and indeterminate meaning in information). According to media richness theory, the information sender should select a communication method to suit the level of uncertainty and/or equivocality of the information task (Trevino et al. 1990). A media richness score is measured in reference to the communication method used. Face-to-face meeting provides the highest score, while routine written documents or widely distributed memos receive lowest scores. Face-to-face communications provides a multiplex set of sensual cues within a certain time period, whereas written documents provide a serial stream of visual data only.

Media richness and access research has been the subject of many studies over the previous two decades. Several authors have provided literature and research reviews in detail (Carlson and Davis, 1998; Culnan and Markus, 1987; Daft, Lengel and Trevino, 1987; Fulk and Boyd, 1991; Rice and Shook, 1990; Webster and Trevino, 1995). The general hypothesis that managers attempt to select media meeting the requirements of the situation has received fairly broad support, though some exceptions have been noted (Carlson and Davis, 1998). For example, higher level managers, such as directors and executives, tend to use whatever media are convenient and easy to use without placing much emphasis on choosing media to meet their communication partner's needs (Carlson and Davis, 1998). In contrast, lower and middle level managers tend to place more emphasis on their partner's style or on the message content itself as a form of social influence. Use of media and messaging behavior has also been linked to sex; women tend to use less frequent, leaner media than men in exempt (managerial) positions, and have fewer messaging contacts in the vertical chain of command (Allen and Griffith, 1997). Webster and Trevino (1995) found that although equivocality was significantly important in media selection for given task scenarios, other considerations, such as the need for multipoint messaging, partner distance, need for social influence, and type of symbolic cues presented also affect media selection practice. Carlson and Zmud (1999), using several communication simulation trials between partners, illustrated that media considered "lean" by media richness standards (e-mail) could take on the attributes of a richer medium through repeated messaging with the same partner (however, interpersonal contact outside of the experimental simulation was not controlled in their research). Trevino et al. (1990) found that individual personality characteristics may also explain media choice; they found that individuals with more perceptive, rather than judging, attitudes toward others were more likely to use richer media than "judging" individuals for the same task.

On balance, media richness and access factors appear to have a significant role to play in the relationship between organization structure, personality and stress perception. Media access and richness choice can be determined individually where the organization affords a wide menu of options and opportunities. When the organization has constrained choice, or has placed significant time constraints and overload on the role, media choice may not be chosen on the basis of personal preference and comfort, but rather, by what is available and easy to use at the time. If constraints become chronic, then communication methods may alter behavioral patterns permanently, forcing stress through avoidance and denial of one's preferences. If constraints are unpredictable, or partnering becomes a highly complex process of social influence, bartering temporal schedules, and juggling time-pressured tasks, then stress loads may not become stable enough to predict which communication choices will "work." Therefore, it appears likely that media access and richness preference will have a direct impact on perceived stress.

Hypothesis 9: The perceived disparity between media access and preferred media richness choice is positively associated with perceived stress.

4.8 Organizational Climate

Litwin and Stringer (1968) provide the foundation work on organizational climate cited in numerous other studies following it. They define "climate" as: "a set of measurable properties of the work environment, perceived directly or indirectly by the people who live and work in this environment and assumed to influence their motivation and behavior (Litwin and Stringer, 1968, 1). They continue:

> The concept of climate provides a useful bridge between theories of individual motivation and behavior, on one hand, and organization theories, on the other. Organizational climate, as defined here, refers to the perceived, subjective effects of the formal system, the informal "style" of manager, and other important environmental factors on the attitudes, beliefs, values, and motivation of people who work in a particular organization (Litwin and Stringer, 1968, 5).

Climate research is important, in their view, because it studies what motivates people to work. People are motivated by their need for achievement, their need for affiliation, and their need for power. Organizational theories alone cannot provide explanations of drive, attention, and motivation to persist and communicate in task situations. Similarly, personality factors alone cannot predict what people will do in actual work contexts. The climate construct is an attempt to bridge those two factors in view of field theory (Lewin, 1951; Denison, 1996).

Schneider and Rentsch (1988) provide a definition that fits better with the research issue in the present study. They assert that the term "climate" refers to "the network of routines and rewards (that) are said to create a sense of imperative, which in turn guides behavior. It is this sense of imperative that is *climate*." (Schneider and Rentsch, 1988, 182).

Several omnibus reviews of the literature are available (Denison, 1996; Falcione et al. 1987; Glick, 1985; Hellriegel and Slocum, 1974; James and Jones, 1974; Payne and Pugh, 1976). Schnake (1983) warns against affective response bias in climate research, claiming that climate measures often capture job satisfaction rather than true climate description. Falcione et al. (1987) focus on communications climate specifically, and warn that the construct often overlaps considerably with other constructs such as organizational structure, depending on how the constructs are operationalized. Falcione et al. suggest carefully analyzing the data for overlap effects. Payne and Pugh (1976) compare research findings and instruments for both organizational structure and climate and find a great degree of correlation among different factors of each construct. To avoid confounding the two variables, the present research limits certain climate dimensions by discarding the items believed to correspond with structural factors already described in an earlier section of this chapter. Also, the structural components will be measured with as few "perceptually-based" items as feasible.

Organizational climate has also been compared and contrasted to the organizational culture construct (Denison, 1996; Schneider and Rentsch, 1988). Theoretically, both constructs tap into perceptions of an organization, though culture research appears to focus on the underlying continuity and wholeness in organizational symbolism, social interaction, and language forms. Denison elaborates on the methodological differences between the two research streams, arguing that climate research tends to use cross-sectional survey approaches rather than the field-based, longitudinal methods of anthropology. Also, climate research investigates the person-environment link specifically (as person psychologically "distant" from environment as an objective onlooker), whereas culture research takes the whole system of language, referents, rituals, and so on as its focus, with the individual inextricably embedded as a part in that system.

Due to the resource and time constraints of the present research effort, the climate perspective is used here. Moreover, the assumption that individual respondents provide a more-or-less "objective" view of their organization is defensible for this subject population because the industry, firms and managements for whom they work are in a great deal of turmoil and change. Most subjects in the sample have ample opportunities to look beyond their own organization for other well-paid career opportunities, owing to their significant technical training in combination with rapid growth and turnover in the industry at large. In the demographic items, education, tenure, and prior employment questions will provide a check to see how "invested" the subjects are in their current organizational status. The present researcher expects to find that subjects have had exposure to multiple work contexts and "climates," and thus have multiple "anchors" in mind for making useful climate comparisons. Similarly, measures of satisfaction with decision making, as a subdimension of climate, will be taken to examine whether Schnake's finding of response bias is operative in this sample.

Denison (1996) provides a recent comparison of several climate instruments, concluding that they measure similar but not equal organizational dimensions. Litwin and Stringer's (1968) measure includes the following dimensions: structure/responsibility, supportiveness/warmth, risk/reward, identity, and standards. Though Litwin and Stringer claim to tap nine distinctive factors, Denison argues that their measure captures only five, in keeping with many other climate and culture survey instruments. For this study, the most important climate dimensions (apart from structure and personality variables) are supportiveness/warmth, risk/reward, and identity. Structure and standards appear to be mostly redundant with items of organizational structure as centralization, formalization and hierarchy.

The focus of the study is to determine how structure, personality, and methods influence information processing and decision making tasks as stimuli for perceived stress and coping responses. The arguments presented from the stress literature suggest that interpersonal contexts containing warmth, support, openness, positive reward, and self-esteem reinforcement are less stressful than cold, negative self-effacing contexts, whether or not standards and structure are great or small in magnitude. However, personality characteristics of individuals and constraining or liberating forces of organizational structure may influence these perceptions of climate and stress. Therefore, direct, moderating and mediating hypotheses are given for the relationships between organizational climate, organizational structure, and individual personality:

Hypothesis 10a: Climates perceived as supportive, rewarding and reinforcing will be negatively associated with perceived role stress.

Hypothesis 10b: Climates are associated with perceived role stress, and moderated by individual personality factors (achievement motivation, locus of control and tolerance for ambiguity).

Hypothesis 10c: Climates are associated with perceived role stress, and moderated by organizational structure (span of control, formalization, centralization and hierarchical order).

Hypothesis 10d: Climate factors mediate the association between organizational structure and perceived role stress.

Hypothesis 10e: Climate factors mediate the association between individual personality characteristics and perceived role stress.

4.9 Perceived Role Stress

The definition of stress used in this research follows concepts from Kahn et al. (1964). Stress is not "a non-specific demand" but rather a special form of cognitive-emotional load placed by conflict, ambiguity and overwork. Chapter 3 explores this relationship in more precise detail. In perceiving stress, the respondent is likely to report perceiving several different forms of conflict (time conflict, interpersonal conflict, "structural" conflict from competing role duties), ambiguity (unclear expectations, unclear lines of reporting, uneasiness with the status quo), and overload (too many things to do, not enough time, over-scheduling, working long hours).

The assumption made at the beginning should be restated: if the organization is not designed to properly distribute the load and cognitive resources appropriately, the individual, not the organization, will face the ultimate stress from the shortfall. The individual's cognitive and emotional systems, combined with personal tolerance, motivation, and state of anxiety, will determine how information is processed, appraised, retransmitted to others, and acted upon in decision making.

Perceived role stress is the "central mediator" in this research model. Several researchers have used the stress construct as a mediator variable in organizational work settings (Anderson et al. 1977; Bodensteiner et al. 1989) though others have used it as the independent variable (Kaufmann and Beehr, 1989; Puffer and Brakefield, 1989) and still others as the dependent variable (Rizzo et al. 1970; House and Rizzo, 1972). The model used in this research plan follows McGrath's arguments for conceptualizing stress to come from three "embedding systems": physical, social environment, and person-system (McGrath, 1976, 1390). Respectively, the "physical" system coincides with the "organizational structure" component—seen here as the "hard numbers" on how the individual "fits into the complex scheme of things" somewhat independently of his or her personality and evaluation. The "social environment" system corresponds to the "organizational climate" component of the model—how the individual sees self in relation to the attributes and interfacing presence of those around self and role. Finally, the "person-system" is believed to equate to the self-perception of one's own personality and tastes, insofar as those aspects of self relate to one's striving, one's focus of attention, and one's ability to "take things in stride" in organizational life.

The focal question here is: How are these three systems patterned around the *representation*, in constrained verbal form, for the perception of stress? Do consistent patterns show up, and are they aligned as theory suggests they might be? Ultimately, do these patterns explain what people report they do to cope with stress, and most importantly, do these variables indicate a pattern in their ways of thinking, as expressed in their decision procedure used in an experimental task?

Without getting ahead too far, the point is that the stress construct is used here as a channeling variable, for the complex system of constructs and interrelationships already defined. Though there are many definitions and operations of stress, two of the most frequently cited constructs are derived by Rizzo et al. (1970) and Ivancevich and Matteson (1980). Rizzo et al. follow Kahn et al. in modeling stress as role ambiguity, role conflict, and role overload as the major dimensions. Stress associated with the role is distinctly individual (it affects the person directly in the role), while it is also not necessarily completely personal (it is not solely the result of personal factors). Reporting on role stress provides the individual with the cognitive "opportunity" to step back from his or her milieu and consider self as distinct from job and organization and yet remain cognitively attached to the "unique domain" occupied within it.

This method for measuring stress is based on the respondent's ability to (mindfully) represent and willingly disclose personal emotional and evaluative data without experimental intervention and with more or less "vague" anchors on what is creating the "stress" at work. It contrasts with other measures of stress, such as those taken in the laboratory, those examined directly in the field in naturally unfolding situations, and those captured retrospectively through content analysis. However, because the interest here is to see how people "represent" their perceptions of stress in informational forms, this process of data collection seems reasonable and valid. Latack (1986) presented a thorough statistical analysis of her self-report data on stress and its relation to coping, showing that even though her data suffered from single source and method of data collection, respondents appeared able to clearly differentiate and order distinct, stressful factors and their responses to those factors. In other words, individuals have an internally consistent, orderly frame of reference for determining and delimiting cognitive features of experience. Using Latack's findings as defense against the criticism of mono-method bias in data collection, the construct of "perceived stress" provides a means to look for consistency and ambiguity in how respondents are thinking.

The significant hypotheses between perceived stress, as a mediating variable, and the remaining dependent variables are based on the literature review provided in chapter 3. Briefly, these constructs and hypotheses are given next.

4.10 Individual Coping Response

Coping literature suggests that at moderate levels of stress, coping responses tend to involve external focus on the problem, rather than internally "reordering" one's sense of priority and meaning. At very high levels of stress, individuals tend to avoid the stress, deny it, or take actions that are not instrumental for changing the problematic situation (for example, they may tend to overeat, smoke or drink more, tell themselves that "it won't happen again" or seek help from God, professional counselors, or significant others to deal with their anxiety). Chronic disappointment in one's decision making outcomes may result in learned helplessness, loss of self-esteem, and reduced perception of self-efficacy as a decision maker (Folkman et al. 1979; Hamilton, 1979).

Billings and Moos (1984) found emotion-focused coping, or focusing on the internal "problem" of experiencing the stress intrapersonally, was significantly associated with behaviors and cognitive attributes of clinically diagnosed cases of unipolar depression. Bodensteiner et al. (1989), in a survey of U.S. Naval Material Command project managers (N = 118), found that excessive focus on the problem, when the problem had no "solution," was associated with experience of burnout. Using the same sample, Cheney, Muir and Gerloff (1999) found that coping response was significantly associated with one of three factors obtained from analysis of the PEU scale of Duncan (1972). In particular, they discovered that the perception of not being able to predict the effects of environmental uncertainty on their project outcomes was directly associated with emotional coping patterns (as assessed with the Billings and Moos (1984) measure).

Latack (1986) found that different perceptions of stress (conflict, ambiguity, overload) were significantly related to Type A personalities and propensity to leave the organization, though each of those factors was differentially related to anxiety. Latack suggested that she found three basic coping responses to stress at work: control, escape, or manage symptoms. Further, she found that control coping responses were less likely to be used in cases of high role ambiguity; these situations tended to be more chronic and unavoidable, thus creating a need for either escape or symptom management.

Puffer and Brakefield (1989) found that procrastination and time management was a routine coping response used to deal with perceived time pressure, schedule conflicts, and task overload for museum managers. In their taxonomy of coping behavior, they used Latack's distinction of behavioral versus cognitive coping with active versus avoidant forms of response.

As discussed in an earlier chapter, some researchers have also distinguished forms of social coping, involving interpersonal relations in the coping process (O'Brien and DeLongis, 1997). Social coping is often associated with chronic stress relief, as in the case of joint decision making, expression of empathy, or concerted efforts to conceal hurtful information. Social coping can also be destructive, as in direct conflict and manipulation. Kaufmann and Beehr (1989) found that police officers were more likely to consider social support as a "negative buffer" against stress, implying that social support from supervisors often magnified the stress problem rather than relieving it.

In summary, these findings suggest the following hypothesis:

Hypothesis 11: Degree of perceived stress is associated with type of coping response; a moderate degree of perceived stress is associated with active behavioral or problem-focused coping, while a high degree of perceived stress is associated with avoidant behavior or emotional coping.

4.11 Satisfaction with Decision Making

Multiple research studies have suggested that perceived stress is related to job satisfaction and propensity to leave the organization (Hepburn et al. 1997; Kahn et al. 1964; Latack, 1986; Rizzo et al. 1970). Greater perceived stress is associated with low job satisfaction. However, as discussed earlier, general job satisfaction has been found highly correlated with organizational climate (Schnake, 1983). Also, the primary interest in this study is the effects of stress on decision outcomes and the process used to make decisions. Therefore, a measure of individual satisfaction that appears most relevant is how effective the respondent considers self to be as a decision maker at work. A transceiver role, such as product management, provides a focal decision making and information dissemination function. If that individual is not self-assured in decision making ability, then the organization's market responsiveness and product performance may also be suffering, as a result of ineffective boundary spanning (Holland, 1970; Leifer, 1975).

A high degree of satisfaction would indicate that the person has received positive feedback and experiences with decision making tasks, whereas a low degree of satisfaction may signal the conditions for learned helplessness, lack of self-esteem, closure, and emotional passivity toward decision tasks. The link between stress and individual decision making, therefore, is probably a measure of chronic work conditions arising from role ambiguity or overload (Latack, 1986) and a "learned" self-perception in response (Hepburn et al., 1997). Evidence and logic underly the following hypothesis:

Hypothesis 12a: Perceived stress is negatively associated with individual satisfaction with decision making.

In the present study, individual satisfaction with decision making will be measured as a dimension of organizational climate.

4.12 Organizational Product Performance

Moderate levels of stress are theorized to provide optimal individual performance levels because the mix of effort versus perceptual efficacy is believed to reach a maximum level, following the Easterbrook (1959) and Kahneman (1973) hypotheses. Numerous experiments on distraction, multi-tasking, and time pressure have appeared to confirm this basic relationship. Research on time structure (Bond and Feather, 1988) also suggest that people are happier, have more self-esteem, and have a sense of purpose in life if they feel that their time requires structure to order their stream of activities, rather than simply let life happen "moment to moment."

Two product performance measures are used to obtain a specific organizational outcome rating, corresponding more closely to the activities reported by and related to the respondent. Performance data for the respondent's single product producing the most firm revenue are requested as a relative ranking on several distinctive attributes, as derived from the industry literature and discussions with industry specialists. As a supposed expert in the product field, the present researcher expects that the product manager would have definite, realistic performance opinions, and would have a relatively high degree of agreement with a qualified industry expert (however, unequal distributions of industry knowledge, particularly competitive knowledge, may prove that assumption untenable).

The organizational literature offers some evidence that managerial cognitions and individual-level characteristics affect the performance outcomes of the larger organization (Anderson et al. 1977; Miller and Droge, 1986; Hambrick and Mason, 1984; Priem, 1990; Simons, 1995). However, usually this research is conducted at the CEO level, where it is assumed that the individual has more direct and substantial control over organizational outcomes. That literature generally does not view the CEO or other top executives as "stressed persons" except under conditions of catastrophe (e.g., Anderson et al. 1977). The need for decentralization is based, however, on a cognitive "stress" concept: the need to distribute power and authority to lower levels in the organization to (1) avoid information overload at the "top" and (2) to put some of the specialized decision making functions into the hands (and minds) of those specialists most trained and able to make them (Galbraith, 1974; Huber and McDaniel, 1986; Tushman and Nadler, 1978).

Unlike CEO characteristics, the likelihood that any single product manager's perceived stress will be responsible for poor performance organization-wide is small indeed. However, it is more likely that a combined product portfolio accounting for a large margin of revenue activity will affect firm performance. The reported "stress" among multiple product managers may signal an internal coordination and integration problem not being addressed at higher levels of management.

Therefore, as a second measure of organizational performance, the managerial respondent is asked to rate his or her organization as a support tool for achieving his or her product performance goals. This measure allows the respondent to critique various elements of the organization as a mechanism available for achieving strategic product aims, thereby allowing the lack of personal control over product performance outcomes to be weighed against the manager's perceived appraisal of the total organization. Unlike the individual "inverted U" relationship offered by behavioral decision research and time pressure experiments, the macro-level relation between stress and organizational performance is theorized to be more linear:

Hypothesis 12b: Perceived role stress is negatively associated with a composite measure of organizational product and support performance.

4.13 Individual Decision Process

According to Simon (1976), the variables of attention, time, value and memory are the primary inputs to decision making. Various conceptions of decision process and sequence were discussed in detail in chapter 3. The factors of the decision process that will be analyzed in this study are: (1) the application of attention (on types and numbers of sources in a sequence); (2) the degree of attention shifting in types and numbers of sources (reflecting the use and comparison with memory for stored schemes), and (3) two factors associated with the time element in the decision process. The latter measures include total decision process duration and decision process pace (as deviation in the time interval between consecutive menu choices). Sequential choices made in information search and the expenditure of time are associated theoretically with the level of effort devoted to information processing and attending to various aspects of the decision problem (Beach and Mitchell, 1978; Payne, 1976; Payne et al. 1988; Rosman and Bedard, 1999).

4.13.1 Decision ProcessDefinitions

Several fundamental assumptions about human decision making processes have been made to develop definitions of the decision process constructs, in accord with a basic theory of human information processing (Newell and Simon, 1972). These assumptions are founded on research on attention, information processing capacity, memory use, and symbol recognition speed, as given by Newell and Simon (1972) and other research reviewed in chapter 3. These assumptions are summarized:

(1) Human information processing proceeds in a serial manner (we attend to one thing at a time in complex problem-solving tasks).
(2) Time is required to access memory stores, thus information processing proceeds at a maximum rate of speed; to a certain extent, the speed of processing is controlled by read symbolic quantity and level of abstract significance.
(3) Type of information processing task, and whether or not information must access long term memory, short term memory, and/or external memory (such as a notepad), have an effect on the rate of processing speed.
(4) Information processing programs (carried out in the human mind) involve discriminating production tasks using an array of learned production systems.
(5) Information processing is goal-directed behavior, and ends when the goal has been met relative to the testing process used to confirm it.
(6) The greater the number of symbolic structures and the number of logical operators defined in the problem space, the more complex the decision task can

> become. However, the presence of symbolic structures and numerous operators does not indicate that all will be attended to in problem solving.

A decision process, therefore, is a sequential set of cognitive and behavioral operations performed over time. This research will artificially impose a beginning on the decision task, and will assume that the respondent will attend to the information provided in the task according to learned schemas produced through association with similar work-related tasks. In Newell and Simon's terms, the respondent will use production systems already available (learned through experience as routines or cognitive "discriminant functions") to evaluate the symbolic structures and logical operators apparent in the experimental scenario.

Decision making automaticity is defined operationally as the degree to which the information processing sequence exhibited by the respondent (in terms of both information source sequence and temporal incrementation between sources examined) is limited in content and duration, and uniform in incrementation. The automaticity construct has not been defined previously using these factors. Greater duration in time used to search information is theorized to be associated with more complex mental processing, all other factors, such as reading speed, held equal. In tandem with time duration, the number of cues examined is also theorized to relate directly to level of effort. Another factor theoretically related to level of effort in processing is the number of episodes of switching between different information content frames and the degree of difference between switched frames (Payne, 1976; Rosman and Bedard, 1999).

For example, a sequence of information search that contains: a long period of information gathering (duration), a large number of cues visited (including revisits), and a high number of frame-switching episodes and high variation among frame types, would be construed as a highly complex sequence of cognitive processing, indicating that a compensatory decision process is probably at work. A compensatory process is construed in this research context as a process low in automaticity. In different words, the subject has invested a large amount of cognitive effort in the decision task and has not manifested a tendency to use rote learned procedure. In contrast, a subject who spends a short period of time examining data, examines a limited number of frames per attribute, and exhibits limited frame switching, is making a decision on comparatively little external information. This latter subject has invested relatively little effort on the task, and has probably used a more routine, internalized cognitive procedure for reaching a decision. The variety of the information and "production systems" used to produce comparisons relative to the decision goal is more limited in the latter subject than in the former (Newell and Simon, 1972).

4.13.2 Interpreting Decision Outcomes

Decision outcomes are also an important factor in determining the success of a decision made. Much decision research has explored how judgments are calibrated with "real states of affairs," such as predictive accuracy of experts (Yates, 1990). Of course, decision accuracy in making business decisions is extremely important to the survival of organizations; however, many organizational decisions require long time periods to unfold and multiple judges to assess their accuracy. Product management and product development decisions are often evaluated as either "on target" or "off target" much later in the history of the firm and its market evolution. Though this research study will take measures of decision outcomes as supplied by respondents in an experimental decision task, the decision outcomes they provide cannot be unambiguously interpreted, and do not necessarily reflect their accuracy as product management "judges" in a true sense. For this reason, the decision outcome data will not be interpreted as having any absolute significance relative to a standard decision performance criterion. The more interesting issue in this research is how the subject gets to his or her decision, in terms of information search procedure, temporal resources expended, and confidence in the choice selected.

4.13.3 Decision Process Data Collection

The decision process will be tracked as a response to a decision task mediated by a process tracing computer software developed by the present author, similar in form and function to an existing tracing technique, Search Monitor (Brucks, 1988). The Search Monitor program has been used to study decision making processes among product consumers (Brucks, 1988) chief executives (Walters, 1996) and financial analysts (Rosman, Lubatkin and O'Neill, 1994). More detailed explanation of the process tracing procedure are given in the next chapter.

A study of decision making rigidity comes closest to the concept of automaticity. Rosman et al. (1994, 1017) define decision making rigidity as "a tendency to process information in an automatic, habitual manner." Using a comparison of types of experienced financial lenders in differing problem settings, Rosman et al. found that type of experience did influence the pattern of information search, confirming the "selective perception" findings of Dearborn and Simon (1958), but only for one of two types of information provided. The subject-analysts did use "routines" for examining the information dependent on their type of experience. However, factors related to institutional context of the subjects were not examined. The process-tracing program used, Search Monitor, collected decision process data. Despite the availability of timing incrementation in the search sequences, Rosman et al. did not report this data as evidence of uniform information process and search routines in specifying their hypothetical relationships of "rigidity."

One potential confound on the temporal incrementation of the search sequence is the number of read symbols that are presented to the respondent at each step in the processing task. For example, if the number of symbols (e.g., alphabet characters in the language of the message) is double in one information frame compared to another frame, then one would expect the processing time for that frame to be at least twice that required to process the latter frame, if reading speed is maintained at equal rates.

To assure that cue length in each information screen did not affect subject's information processing rates, the number of symbols contained in each screen of the present experimental task was controlled to be approximately equal. A one-way ANOVA on the case symbol content, as well as a Levene test on the variability of cue content in each presented case, indicated that the number and variability of cues in each case presented to subjects was approximately equal. In assuring that the measured differences between incremental information times (i.e., per-screen response time) are not attributable to the information input symbol quantity, the observed differences may be explained more confidently as true differences in the ways each subject thinks about the information content in the cues presented. This measurement refinement makes it possible to examine the degree of change in incrementation of time among observed information frames. In a condition of decision automaticity, the degree of change in incrementation is expected to be low, giving a more or less uniform pattern of information processing speed, and by extension, lower level of effort and attention to the decision task. Research efforts by Rosman and colleagues did not control for symbol quantity in their decision tasks; therefore, they could not assess incremental uniformity in the information processing of their subjects.

The foregoing discussion results in the following overall hypothesis for individual decision process automaticity:

Hypothesis 13: A decision process characterized as highly automatic will exhibit: (a) relatively short duration, (b) low number of processed cues, (c) low variability in time used to process cues, and (d) lower total information variety among cues examined. Conversely, a decision process characterized as low in automaticity will exhibit: (a) relatively long *duration, (b) relatively high number of processed cues, (c) high variability in time used to process cues, and (d) relatively more total information variety among cues examined.*

4.13. 4 Role Stress and Decision Process

Role stress is defined in this research as a constellation of stress factors including role conflict, role ambiguity, role overload, task complexity, career security, and responsibility for others (Ivancevich and Matteson, 1980; Kahn et al. 1964; Rizzo et al. 1970). Perceived stress is measured here as a language representation of the subject rather than an observed behavioral outcome of a work or experimental environment. Chapter 3 discusses the differences in methodological assumptions and constructs between organizational and personal stress.

Both research streams appear to support the overall contention that increased role stress will result in more constrained information processing, and therefore, the learned effects of stress will promote the development of procedural "shortcuts" and routinized processing schemes for data evaluation and comparison. More simply, induced stress creates the need to seek economies in cognitive processing. Role conflict produces interference and noise, deflecting a continuous sequence of attention. Role ambiguity produces cognitive dissonance in how to process environmental cues and cope with them effectively. Role overload decreases the amount of time that can be afforded to processing any single cue. And finally, perceived time pressure is simply a learned representation for judging the adequacy and allotment of time expenditure.

However, the mathematical relation between reported stress and the individual decision process variables is not necessarily linear, as proposed in the theories of Kahneman (1973) and Easterbrook (1959). A moderate level of perceived stress is associated with maximum cue processing accuracy and maximum directed attention and effort. Therefore, the hypothetical relation between perceived role stress and individual decision process is curvilinear:

Hypothesis 14: Perceived role stress is associated with variables of individual decision process in a curvilinear relation; at positions of both low and high stress, the decision process will tend towards high automaticity, while at a position of moderate stress, the decision process will tend towards low automaticity.

4.14 Chapter Summary

This chapter has provided a summary of relevant hypotheses and a model combining those relations. Table 2, on the following page, presents a listing of proposed hypotheses and the sources used for developing research measures. Much of the theoretical foundations for those hypothetical statements are laid out in chapters 2 and 3. The following chapter discusses the particular instruments, sample selection procedures, and multiple data collection methods used for testing the research model relationships.

Table 2. Summary of Research Hypotheses

Hypothesis	Measure	References
Hypothesis 1a: Greater spans of control and less formalization together are positively associated with perceived role stress.	Survey	Miller and Droge, 1986 Robbins, 1990
Hypothesis 1b: Centralization will be positively associated with perceived role stress.	Survey	John and Martin, 1984
Hypothesis 1c: Hierarchical order will be positively associated with perceived role stress.	Survey	Pugh et al. 1968
Hypothesis 2a: Span of control will be related in an inverted U-shape function with organizational product performance (indicating a relative maximum relation).	Survey	Zirger and Maidique, 1990 Cooper, 1999
Hypothesis 2b: Formalization and centralization together will be negatively related to product/organizational performance.	Survey	Pugh et al. 1968 Hage and Aiken, 1967
Hypothesis 2c: Hierarchical order will have no effect on product/organizational performance.	Survey	See previous
Hypothesis 3: Span of control, formalization, centralization and hierarchical order will have no individual, independent effects on individual decision process.	Survey	See previous
Hypothesis 4: Individual achievement motivation will be positively associated with perceived role stress.	Survey	Cassidy and Lynn, 1989
Hypothesis 5: Locus of control is associated with role stress (internal locus of control is positively related to role stress).	Survey	Rotter, 1966
Hypothesis 6: Individual tolerance of ambiguity is related to role stress (direction not established).	Survey	McDonald, 1970
Hypothesis 7: Perceived control of time is negatively associated with perceived stress.	Survey	Mudrack, 1997 Macan et al. 1990
Hypothesis 8: Perceived time structure is negatively associated with perceived stress.	Survey	Schriber and Gutek, 1987
Hypothesis 9: The perceived disparity between media access and preferred media richness choice is positively associated with perceived stress.	Survey	Trevino et al. 1990
Hypothesis 10a: Climates perceived as warm, supportive, rewarding and socially reinforcing will be negatively associated with perceived role stress.	Survey	Litwin and Stringer, 1968

Table 2—*Continued*

Hypothesis	Measure	Source
Hypothesis 10b: Climates are associated with perceived role stress, and moderated by individual personality factors (achievement motivation, locus of control and tolerance for ambiguity).	Survey	Litwin and Stringer, 1968
Hypothesis 10c: Climates are associated with perceived role stress, and moderated by organizational structure (span of control, formalization, centralization and hierarchical order).	Survey	Litwin and Stringer, 1968
Hypothesis 10d: Climate factors mediate the association between organizational structure and perceived role stress.	Survey	Litwin and Stringer, 1968
Hypothesis 10e: Climate factors mediate the association between individual personality characteristics and perceived role stress.	Survey	Litwin and Stringer, 1968
Hypothesis 11: Degree of perceived stress is associated with type of coping response; a moderate degree of perceived stress is associated with active behavioral or problem-focused coping, while a high degree of perceived stress is associated with avoidant behavior or emotional coping.	Survey	Latack, 1986
Hypothesis 12a: Perceived stress is negatively associated with individual satisfaction with decision making.	Survey	Martin and Harkreader, 1993
Hypothesis 12b: Perceived role stress is negatively associated with a composite measure of organizational product and support performance.	Survey	Cooper, 1999 Zirger and Maidique, 1990
Hypothesis 13: A decision process characterized as highly automatic will exhibit: (a) short duration, (b) low number of cues, (c) low variability in time used to process cues, and (d) lower total information variety. Conversely, a decision process low in automaticity will exhibit: (a) relatively long duration, (b) relatively high number of processed cues, (c) high variability in time, and (d) relatively more total information variety.	Field Decision Experi-ment	Brucks, 1988 Payne et al. 1988 Payne, 1976 Rosman and Bedard, 1999 Newell and Simon, 1972 Simon, 1976
Hypothesis 14: Perceived role stress is associated with variables of individual decision process in a curvilinear relation; at positions of both low and high stress, the decision process will tend towards high automaticity, while at a position of moderate stress, the decision process will tend towards low automaticity.	Field Decision Experi-ment	Kahneman, 1973 Easterbrook, 1959 Yates, 1990

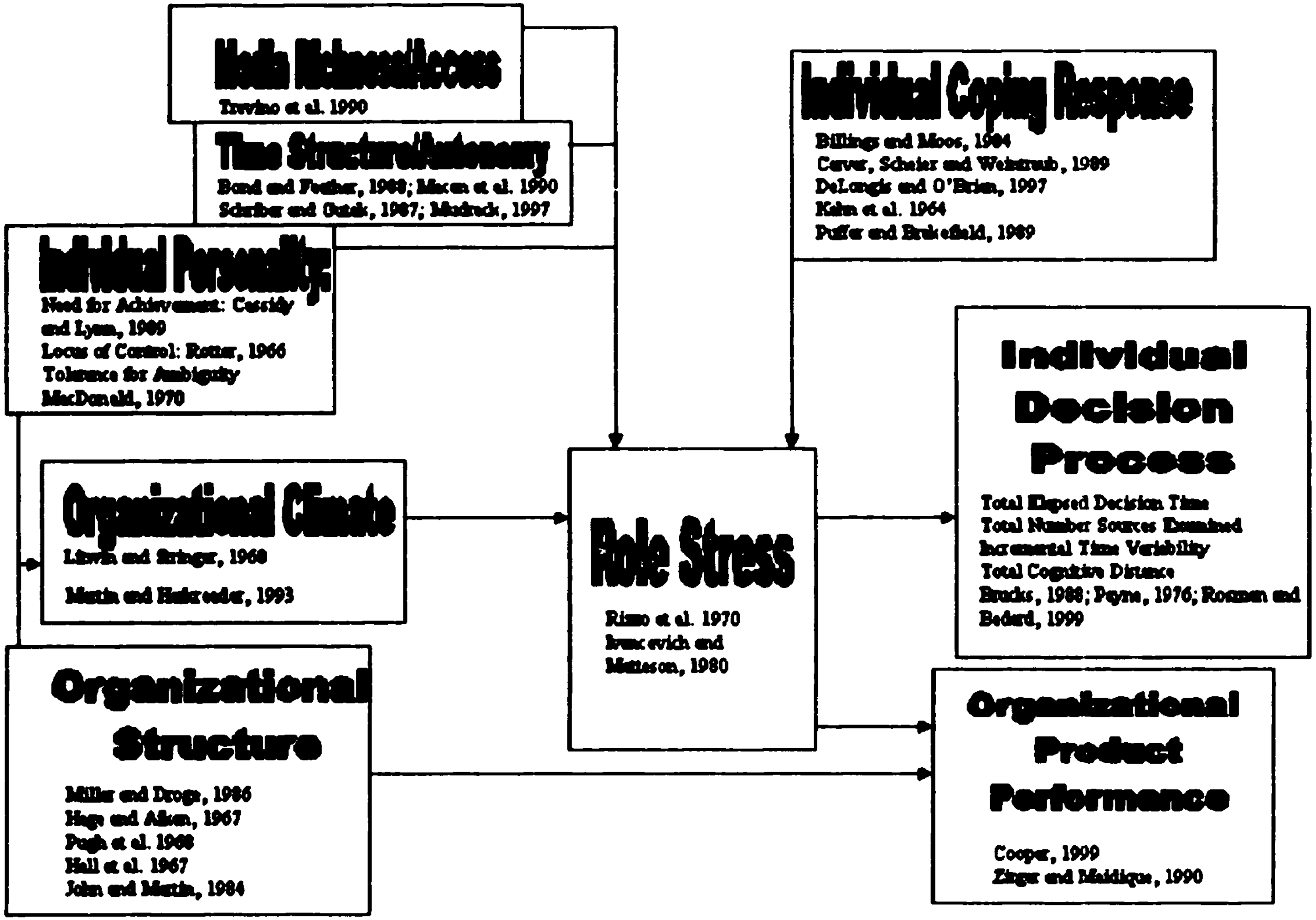


Figure 4. Suggested Sources of Measurement Scales.

CHAPTER 5

RESEARCH METHODOLOGY

5.1 Introduction

This chapter describes the research design, measurement instruments, methods of data collection, and subject sample used in the research. Several aspects of this research represent novel approaches to the study of managerial decision making, making this an exploratory research project.

5.2 Research Design

The research design incorporates two types of instrumentation: a self-report survey and a self-administered decision task. Two experimental conditions are used, representing two levels of decision task complexity. Both instruments are administered via electronic media using the subjects' local computer workstation. Three subject populations are compared, two of which are student groups. The collection of data takes place in a single time window, thus providing a "cross-sectional" study.

The research objective is to investigate associations between actual decision behavior on the task and an array of managerial subjects' cognitive representations. Those representations, as learned behavior, are theorized to coincide with (if not influence) that behavior. They form, in theory, as a function of three interdependent systems: (1) individual personality differences; (2) perceptions of role and purpose in an organizational context, and (3) organizational structures that shape and mediate social communications. The focal population of interest is the manager group; student groups are used to validate and benchmark the task complexity manipulation and the level of effort expended by the manager sample. Student groups also represent "naïve" conditions of unfamiliarity and practice with organizational environments in tenured roles. All groups are assumed to have similar native intelligence, language faculties, social skills and educational attainment.

The survey instrument represents a context-independent measure of several constructs, including organizational structure, climate, time management and perceived time control, organizational performance and role stress. Those measures are used as the independent or prediction variables in the research model. The decision task is used to represent the "outcomes" or criteria measures of the research, signifying the intra-psychic mechanics of decision making each subject uses to explore work task-related information. The general conjecture in this study is that the language representations given in the subject's report of work, environment, personal relations, and perceived stress will be related to how the subject processes information (as measured through a trace-capturing system). The mediating variable between organizational structure, climate and performance and the subject's decision behavior is hypothesized to be the subject's representation of his or her own role stress.

The decision exercise is designed as a true experiment in that (1) there has been an attempt to randomize assignment of subjects to treatment conditions and (2) there are experimental manipulations—every respondent does one form of two forms of the decision task. The research design involves a point-in-time collection of a broad spectrum of both survey and experimental measures theorized to indicate automaticity in decision making (as expressed in use of time, effort, and complexity in information search.)

5.2.1 Research Control

A true experimental design has many advantages, especially more control over variable relations. The research design also attempts to find associations in "the current scheme of things" in personal and task-related representations held cognitively by each subject, as measured through language-based survey measures. A fundamental research assumption is that the cognitive schemes for making product management decisions are forms of learned behavior that will be triggered by different structural and content features of the judgment task. That learned scheme is a result of a recursive cognitive process that has already taken place while occupying the work role. Furthermore, that learning is also assumed to relate to language representations for different aspects of self-reference, environmental perception, and social structural forms.

Despite the great care taken to include all theoretically important factors, this research design contains numerous problems of control and confounding. Besides asserting solid theoretical bases for constructs in the model, an attempt to limit potential error variability has necessitated constraining the population under observation. The industry source and the role functions of the respondents are limited to a narrowly defined range so that many confounding variables do not have to be considered as potential sources of significant variance. For example, limiting the sample to one industrial group in one type of managerial role lessens the chance that variation on the measures might be attributable to industry differences or variations in basic workflow technology (Woodward, 1965).

The self-report survey measures represent independent and mediating variables; the decision task outcome measures represent a set of dependent variables theorized to indicate decision making processes (Payne, 1976; Rosman et al. 1994.) Measures of the independent and mediating variables are taken from well-established instruments in the public domain, as discussed in the prior chapter. Dependent measures of the subject's decision making process are collected by means of a new computer-mediated instrument. This chapter reports the procedures used to develop and test that new instrument. Both task and survey are administered to subjects remotely through Internet-hosted electronic media for presentation and data collection.

The task content, task procedure, data collection mechanisms, and subject population are all new to this area of decision research. Because of its novelty, the decision task measurement method is discussed in terms of its experimental validity, generalizability, and sources of measurement error. Finally, the research output depends ultimately on the successful use and data capture capability of electronic media technologies, their reliability, and the subjects' familiarity with them. Each of these areas will be addressed independently in this chapter.

5.3 Initial Problem Identification

The impetus for this research project began in a most unplanned, unscientific way. Over the course of several years, the present researcher had numerous spontaneous, informal discussions with several members of the study population, telecommunications product management professionals, about the conduct of their work, especially regarding communications behavior. In the course of these conversations, laments were heard about being barraged by information from all sides, and still remaining uncertain, even personally doubtful, that any of the information was important enough to warrant paying attention to it. Statements such as, "I got over 600 e-mail messages while I was out of town this week," and "I don't know what to do with all this stuff except spend an hour using my 'delete' key to take care of it" indicated a source of constant frustration and concern.

Obviously, from the conversations heard, one may surmise that not enough hours in a 24-hour period would be adequate to attend to so much "stuff". Besides, e-mail is not the sole method of communication access for these managers. They have traditional communications avenues still open: voice telephone, fax, personal office visit (face-to-face meetings), written memos, stored files, and group conferences. In addition, new or improved forms of instantaneous personal communications are also apparently "required": portable schedule organizers with Web access, portable PC's, wireless telephones, pagers, electronic notepads, personal timing systems, and so on. Group communications are also facilitated with videoconferencing, decision support systems, shared nets, and other groupware tools. The number of communication outlets available (or perhaps burdening) the individual telecom product manager is staggering. Every available minute of their day (or night) is accessible to some form of work-related communications activity.

In the midst of so much "plenty," schemes to escape it all flourished. "We go to his ranch where we can really talk, nobody knows how to get a hold of us except the admin," or, "Rick (not a real name) hides out at home sometimes" or, "If I really want to get anything accomplished, I have to get to the office before anybody else does." If escape is not possible, then managers often use sophisticated message screening protocols to recognize the source and importance of their messages. For example, for one group of managers, delivering a pager message with a prefix of "911" meant "don't ignore this one, you need to call me right now." In the case of e-mail messages, some managers reported using automatic electronic file routing routines, in which incoming e-mails were automatically "dropped" into certain files (including the "deep six" file) without ever being opened. The source or time of the e-mail, rather than the content, determined its fate. Message senders that generated "spam" (unnecessary broadcasted e-mails) were ignored altogether and even socially criticized among their peers.

The individuals providing these insights are members of different firms in several facets of the telecommunications industry. In particular, they represent primarily product marketing and product management functions within their firms. Clearly, the individuals facing these overwhelming information processing roles are experiencing stress and are taking steps to cope with that stress in what they consider as productive ways. However, those individuals are also responsible for important information absorption, dissemination, and interpretation tasks as planners, boundary spanners, integrators, and coordinators of broader organizational actions (Cooper, 1999; Holland, 1970; Leifer, 1975; Schilling and Hill, 1998; Zirger and Maidique, 1990.) As a group, they empathize with each other and help each other cope with their stressful environments through various personal strategies. However, the effect of their coping on larger organizational missions does not appear to be well understood.

Moreover, the industry in which these individuals work is currently undergoing tumultuous change (they refer to it among themselves as "tornadic change") due to highly volatile technological platforms, high consumer demand for the end products they create collectively (i.e., more widespread information diffusion and rapid response), high levels of corporate reorganization and start-up, and fairly recent, far-reaching governmental interventions affecting basic competitive arenas and marketing practices (Dodd, 1998.) As theoretical literature on strategic environmental uncertainty suggests, avoiding or neglecting environmental information can be counterproductive to the organization, especially in an environment of volatile change. Their personal coping, no matter how much they perceive it as necessary, may or may not be effective for organizational decision making in the long run.

These informal, unplanned contacts with professionals in the telecommunications industry provoked this researcher to undertake a more in-depth analysis of their information processing behavior in relation to their organizational contexts. Using a narrowly defined subject population in one industrial setting limits some sources of confounds, but also limits the external validity of the findings. This subject pool, however, may represent a behavioral pattern likely to recur in highly information-intense work roles, and as such, this limited population bears studying in detail and in isolation from other types of "stressed" groups, such as minorities or expatriates. For example, other professional specialists, such as physicians, computer engineers, traffic controllers, and those who are "on call" at any time are also likely candidates for similar communications dilemmas. As information technologies proliferate worldwide and get embedded in the routines of work and social engagement, it is important to recognize the signs of stress, coping, and counterproductive cognitive processing that may develop in collective learning systems and the language that represents them. So, instead of providing results that generalize to other industries, the intention of the research is to provide exploratory results that may generalize to similarly stressful work environments and routines.

5.4 Sample Selection

A number of individual managers were contacted to see if and how they would agree to participate in a study of their work and decision making. Without knowing the details of the hypotheses and measures, some individuals expressed willingness to provide research data. Some also said that they would serve as intermediaries for identifying potential subjects.

Identification of individual subjects contacted for this research proceeded using the following resources: (1) key industry informants with access to social networks of individuals performing primarily product management/marketing/planning functions in different organizations and (2) research participants who referred other potential subjects within and outside their organizations.

Using key informants to identify potential candidates for this study was justified on the grounds that these individuals are most knowledgeable about product management job design, organizational function and authority structures among their peers in the industry. Those individuals knew how to identify the individuals occupying the roles and functions of product management, analysis, and planning under varying job titles, management levels, and organizational structures. With their help, the researcher was better able to correctly locate and solicit participation personally through direct contact with respondents.

Industry contacts suggested to me that more personal communications would be a better stimulant to participate than would third-party intervention by higher management. Despite the fact that the invitation to participate was personal and individual, the respondent was encouraged to send their response data via electronic files as anonymously as they wished, and the data collection procedure and referral process did not compromise their identity to others other than the principal investigator.

Because this study was intended to examine organizational as well as individual level relationships, multiple respondents per organization was a chief aim in identifying respondents. Originally, the present researcher had hoped to get at least five respondents from large organizations. Some smaller companies, particularly "start-up" firms, do not have a large number of product management roles. In most cases, only one subject represented a firm in the final respondent sample. Because of these sampling limitations, analysis on organizational level constructs independent of individual respondents was not feasible for this study. Therefore, hypotheses that focused on construct relationships at the level of the organization were not tested and not reported.

5.4.1 Control Measures

Several demographic factors not theoretically related to the dependent variables are measured for purposes of control and sample description. Demographic measures included educational background, industry tenure, and organizational tenure. A list of demographic variables and their univariate statistics is given in appendix A. Demographic characteristics with no relation to other independent or dependent measures, such as respondent age, sex, national origin, marital status, or other group affiliations, were not collected because doing so was judged to waste the managers' valuable time and might thwart their willingness to complete the more important segments of the research process.

Student subjects were asked to provide very limited demographic information, including job experience, current employment status, current student status, job affiliation with the telecommunications industry, and educational background. As the primary purpose of getting student respondents was to validate the decision experiment and manipulation, there were no solid theoretical reasons for getting more than basic comparison measures, and thus none were requested. Student participation was obtained via college instructors who were briefed about the nature and purpose of the experiment, and agreed to offer compensation to students in the form of extra course credit for participating. Instructors provided student access to the research website addresses as directed to assure random assignment to case condition; the assignments were given by the researcher. Because students entered the website at will, the researcher could not completely control the availability of the experiment to a given number of participants. Therefore, it is not possible to accurately compute response rates for the experiment.

5.4.2 Subject Motivation

Managerial respondents were compensated for their time with a promise to receive a summary evaluation of the research findings, deliverable by website or by mail upon request. Student subjects were also offered the same benefit; however, students received extra class credit for participating, whereas managerial subjects received no such benefit. Thus, student subjects probably had greater external incentive to participate in the research.

5.4.3 Methods of Subject Contact

Initial contact with potential managerial respondents was made via electronic mail. Industry informants suggested that e-mail is the most appropriate form of communication, and most likely to gain a favorable response. One hundred and thirty solicitation e-mails were sent during the first week of the data collection period. Names and addressed for contact came from personal business cards collected by other product managers in the industry. Approximately one third of those sent were returned as undeliverable. Ten respondents participated in the first week, and an additional five solicited returned a brief survey indicating that they "would not respond" for reasons such as: (1) "I just don't have time" (n = 3); (2) "I don't answer surveys using e-mail" (n = 1), and (3) "Company policy prevents me from responding" (n = 1). Besides those that returned the "non-respondent" survey, several other managers sent back brief personal e-mails indicating that they would not participate. Other than time conflict issues most commonly mentioned, one respondent said that he felt that he might be obliged to disclose strategic information that would compromise his firm and his employment. Another respondent reported that his firm was in the midst of a merger. In all, ten of those solicited responded with a "no intent to respond" message.

After one week with no response from the remaining subject candidate pool, follow-up e-mails and telephone calls were used to solicit participation. In some cases a third e-mail was sent. Once e-mail had been delivered successfully to the respondent, he or she had the option of linking directly to the introductory page of the electronic survey and the subsequent decision task screens. As the respondent switched among screens, the computer software recorded the data entered on the electronic form in appropriate place and order. An electronic log of the respondent's IP address (the location of the terminal on the "web") and the time of data entry was recorded for the data record. The introductory electronic mail screen and the final research screen included "hot links" to the principal investigator of the study to leave questions, complaints, or comments as needed. Also, the principal investigator's physical campus mail address, telephone number, and other relevant contact information were displayed. At the concluding screen, the respondent was offered the opportunity to request a summary report and leave contact information if desired. To preserve anonymity, each respondent was assigned a random number. Data used for analysis was compared using the random number rather than the name, IP source, or e-mail address of each respondent. Data were verified extensively for proper assignment to each random number case.

5.5 Measurement Modifications and Testing

Data were collected at the individual level of analysis. However, as argued earlier, some of the constructs in the research can be construed as operating at the level of the organization. Measures of organizational structure, organizational climate, stress and product performance are constructs that can apply to a collective level of behavior and perception as well as the individual. Other measures, such as personality, time structure, media richness, satisfaction with decision making, coping, and individual decision process are argued to be strictly individual characteristics, based on prior theory.

In the original version of the survey instrument, most of the original constructs discussed in chapter 4 were included in some form. However, after initial testing, the researcher concluded that the time required to fill out the entire survey was too great to elicit adequate participation. To improve its acceptability to subjects, several independent constructs were dropped from the final version of the survey. In particular, the measures associated with individual personality, media richness and access, and individual coping were not included. Consequently, hypotheses involving those constructs cannot and will not be tested and reported here. One reason for dropping many of the individual characteristics is that the researcher surmised that range restriction on many of those variables would result, due to the highly limited sample of managers who were solicited to participate.

5.5.1 Measurement Level and Scale Format

With the exception of the decision task, most measures for the study were taken via self-report using Likert-type response formats. Those scales were either five-point or seven-point, depending primarily on the original scale developed by prior research and testing. Some scales used the present research were abbreviated from their originals to increase the likelihood that managerial subjects would respond. An effort has been made to use the original authors' instruments and wording so that reliability and results of this study could be compared with prior studies. However, some changes were required to suit the needs of the industry sample, and some wording was changed to make certain questions briefer. The scaling range used provided the potential for statistical analysis using both parametric and nonparametric tests. Some data were relayed via a textual response field (using one or several words or numbers.) Numerical responses were treated as interval data; text was treated as categorical data. Post hoc analysis indicated suitable group assignment if appropriate for analysis. Some parametric measures were analyzed via grouping or category assignment.

The decision task outcome measures include measures of time, in increments of seconds, and measures of information search pattern, as indicated by selected data paths through the task screens. The time measurements produced ratio-level data. The search pattern measures were transformed from event occurrence (a binary outcome of "did" or "did not" occur) to an interval level of "distance traveled" during the decision process. Other outcome measures included number of screens viewed during the process sequence and the variability of time spent viewing each screen, as measured in standard deviation across screens, in seconds.

5.5.2 Explanation of Decision Task Measures

Each screen path is identified with three dimensions: *project alternative*, *project arena*, and *arena focus*. (These path definitions are explained in a later portion of this chapter.) The measures of search pattern determine the degree of path similarity from one sequential choice to another, as a sequence of accessed screens. The scoring for the search pattern strategy selected by each respondent is a derivative of the "City Block" algorithm. It is similar, but not equivalent, to Payne's metric for assessing cognitive distance (Payne, 1976). This scoring procedure is discussed in Rosman et al (1994) as a method for measuring decision making rigidity. Paths are scored as relatively "close" or similar to each other if the subject has limited his or her cognitive focus to a relatively narrow range of information on the decision problem (i.e., an "attribute-wise" or non-compensatory evaluation strategy is being followed). In contrast, two paths indicate a broader search strategy if they entail different project (case) alternatives (e.g., project Sigma switched to project Gamma), different arenas (Project Milestones switched to Strategic Definition), and different foci (Horizons switched to Goals).

This "switching" behavior was scored first as categorical events, then transformed into counts and summarized into an interval level measure of "total cognitive distance" traveled in the course of the entire task. Similarly, total elapsed time in seconds, as well as the incremental variation of time in seconds across all information screens, are measures used as surrogates for "total cognitive effort" expended to arrive at the desired decision objective (a project recommendation). Cognitive time spent on "symbol reading" is controlled as much as possible by using a similar number of symbols in each unit of information supplied to subjects in each screen, thereby equalizing the amount of time "used" at each screen to apprehend the number of symbolic cues presented (Newell and Simon, 1972). Figure 5 uses a cylinder chart to illustrate how total time at each information screen is expended in different apprehension and cognition tasks.

Statistically, these measures are treated as follows. Total cognitive distance score and total elapsed decision duration score, as interval measures, are compared as outcome measures. Both measures of distance are expected to be correlated: a subject who is willing to spend more time in looking at the data is probably going to traverse more screens, read them carefully, and "hunt around" for association and contrasting "clues" to compare the relative merits of each project. Greater time spent and more symbolic scanning are expected to indicate greater attentiveness to the task, and thus more complex cognitive processing of alternatives.

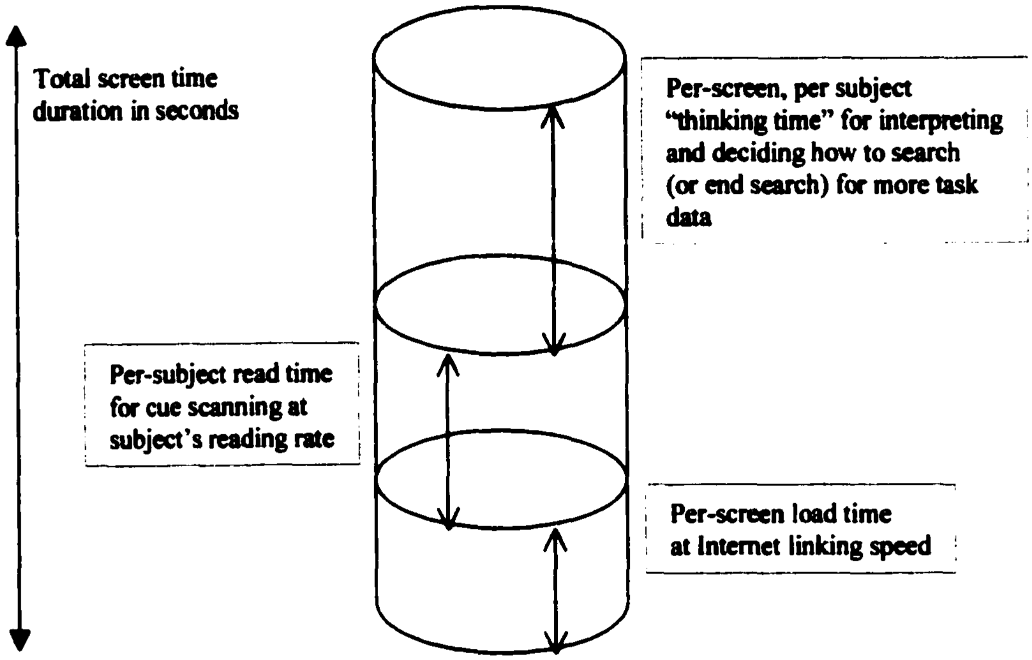


Figure 5. Tasks Included in Total Screen View Duration.

Note: Per-screen load time was controlled through using equivalent coloration, format and minimal graphics across all task screens; per-subject read time was controlled through using equivalent number of language cues on each screen (cue length means and cue variability per case were tested for equality using ANOVA and Levene tests; the null hypothesis of equal means and variances was not rejected at $\alpha = .05$; cue length was judged approximately equal for all cases used in the experiment. The sum of load time and read time are theorized to represent minimal screen visit duration, i.e., no thinking or cue interpretation is taking place).

However, each subject was expected to attend differently, and in different order, and for different increments of time. One possible way to envision the decision task is a series of self-administered "tests" of attentiveness, from one screen to another. At some point, ***the subject must make up his or her mind*** about ending the search and reaching a judgment. In perusing each data screen, the subject is sequentially and cognitively "testing" the hypothesis of "maintaining search" or "ending the search." The time afforded for search, and the process used for search, was left completely to the subject's discretion. In a sense, one might think about the subject as testing the null hypothesis verbalized as: "I do (or, do not) have enough information to make a judgment" versus "I do not (or, I do) have enough information (thus search continues)." This hypothetical choice structure is internal and individual, based on prior experience and learning (the "frame" for the hypothesis may be positive or negative, and the time constraint is self-imposed). The "level of confidence" for rejecting this cognitive "null hypothesis" is also individual and learned. Every time the subject opens another information frame, he or she decides whether to "pay more attention" (as a personal cost) to another frame, or to refrain from gaining more information and exiting the search phase. In this fashion, the subject is cognitively undergoing a sequence of decision evaluations.

Each of these "tests" requires a "cost" in time (Payne et al. 1988). The cost factor is measured here in seconds. Assuming that the symbolic cues per screen are roughly equal in number (thus "costing" time to read at an equal rate across screens), the variation in time increments spent between screens reflects variability in information absorption, self-reflection, comparison, and weighing the options to "continue" or "exit." Statistically, one might view this series of evaluation events as a repeating pattern of measures for a single subject. More specifically, the series of temporal "cost" increments expended on the tests provides a profile of cognitive behavior for each subject.

In the context of the theories presented for this research, decision making automaticity would suggest certain profile patterns. Those decision makers who more apt to use an "automatic" decision process pattern will take less time, visit fewer screens, and go less cognitive distance than the less "automatic" decision maker. More simply, the automatic decision maker will spend less time absorbing, reflecting, comparing, and choosing per screen "test."

As the decision maker tends to an absolute minimum of time spent per screen therefore reducing "cognitive cost" per test to a minimum, the increment of time spent will approach the minimum time increment required to "read and click" between screens. Graphically, this assumption is shown in figure 5. The time spent at each screen approaches a lower bound on "time to process", where only reading and electronic loading of cues takes place. In a timechart showing the profile of the decision maker's time expenditure per screen, this lower bound would appear as a sequence of screen times with a mean slope of 0 (i.e., a horizontal line) and little or no variability in heighth per duration segment.

5.6 Development of the Decision Instrument

Vinaja (1999) provided a thorough review of decision tasks used in prior research as well as the basis for their application within McGrath's (1984) taxonomy of MIS tasks. Vinaja (1999, 63) summarized the "job" of the task using five fundamental considerations:

(1) The task is expected to be manageable within the time limits for an experiment.

(2) The task is expected to elicit motivation and effort on the part of the subjects.

(3) The task is challenging to complete and is related to the subject background.

(4) The task is also relevant to the subjects so as to provide some level of realism.

(5) The task should provide usable raw data for measuring the variables.

In the language of cognition theory, the task must be capable of drawing upon relevant cognitive schemas for processing representational data provided in the task. In Cook and Campbell's (1979) terms, the task must have content and construct validity.

Finding an appropriate decision task for the population under study proved to be a significant hurdle. Though numerous decision tasks and scenarios have been used in the behavioral decision research literature, the management information and decision support system literature, and strategic decision literature, none of the tasks reviewed were determined to be suitable for the purpose of the study. Product management decision making involves complex, ill-structured decisions with considerable time pressure, ambiguous and equivocal information sources, and long time periods in feedback loops between decision and outcome evaluation.

Furthermore, the product manager is usually not in control of organizational actions relative to the specific product—numerous decision forces play a role in the eventual history of the development process, strategic orientation, and relative success. Unlike CEO's and other top-level managers, who have relatively more personal control over organizational decisions, the product manager's decisions are greatly influenced by social processes and group-level decision factors. The product manager is often called upon to orchestrate and balance competing forces, as well as take charge. Even further, organizations differ in how they structure product management tasks, how procedures are used to organize and facilitate coordinated action, and how much leverage they provide each product manager relative to the product(s) they manage.

The most appropriate task, therefore, should be ill-structured, or at least relatively complex, and require processing ambiguous, informative messages. It must be defined with a beginning and an end. It should be simple enough to yield a more-or-less confident judgment, yet be complex enough to elicit adequate "attention" to proceed to the end of the task. Also, it should have enough degrees of freedom in "cognitive pathways," or complexity, to be individualized to suit cognitive processing schemes of different individuals, providing a full range of cognitive skill and search methods. Finally, it should contain information content that the professional population can "relate to" conceptually. For example, though numerous decision experiments and judgment tasks have used auditing tasks with financial ratios (Rosman et al. 1994), such tasks do not contain information inputs that product managers would find "familiar" or "similar to" the kinds of information they process routinely. Similarly, a decision task that focuses primarily on an "accurate" judgment, as an outcome, rather than a process of intelligent search, is not necessarily a relevant measure of successful product management decision making because there are few guidelines for assessing absolute "accuracy" or calibration of product management judges (Yates, 1990.) An outcome measure alone does not provide an assessment of how time and attention are used in the process of reaching the decision outcome.

As in Vinaja's experiment using different information search strategies, the decision task chosen for this study is a combination of two phases: an information search phase, in which the subject has numerous opportunities to uncover information in screens presented by computer, and a choice phase, in which the subject selects a preferred alternative and rank orders several categories of "traits" relative to that alternative.

5.6.1 Decision Task Content and Structure

The content of the information contained in the task was developed using research models of successful product management as presented in Brown and Eisenhardt (1995), Schilling and Hill (1998), and Zirger and Maidique (1990.) Further meta-analytic results from Damanpour's (1991) study of innovation also helped to clarify the other studies. Using these studies and the theoretical work on which they are based, a task structure was developed to incorporate several dimensions of successful project, product and product development processes.

Bowen et al. (1994) provide a focused analysis of twenty different historical projects in product/process development and/or product management. The authors present the project histories in a case format. Each of the twenty cases was developed using key company informants and experts in the fields of engineering, management, and academics to code and organize the case data. Each case is systematically critiqued in a few pages using a similar framework, discussing environmental background, project timelines, organizational structure, personnel, and historical events that led up to an evaluation of the relative "success" of the product and "lessons learned" within the company. The authors also provide a numerical score for each of the twenty cases relative to each other according to four performance criteria: (1) whether or not the original product schedule was met; (2) how the product was initially accepted in the market; (3) how well the project met technical objectives, and (4) how well the project met business objectives.

The wider array of technical and industrial product management literature was checked to see if Bowen et al.'s interpretation of product management factors and performance evaluation criteria was consistent with a broader literature interpretation (Barczak, 1994; Brown and Eisenhardt, 1995; Calantone and di Benedetto, 1988; Cooper, 1999; Damanpour, 1991; Henderson, 1994; Malhotra, Grover and DeSilvio, 1996; Schilling and Hill, 1998.) The present author concluded that several cases from Bowen et al.'s histories could be adapted to a product management decision task format, with the case content coded in relatively short "bullets" of information relative to specific factors, or *arenas*, of typical product management concern and decision making. Using an abbreviated set of informative statements about each case, presented on demand through sequential screen choices, the product manager/subject could gain an overall portrayal of the important factors, and their combination in a historical frame, that produced relative product success (as judged by Bowen et al.).

Using a key informant from the telecommunication industry, the potential of using these cases as a basis for developing a decision task was explored. The present researcher coded one of the cases, according to the task structure derived from the literature, as different "categories" and "screens" to illustrate how the case would appear to a subject. The task complexity in the decision exercise equaled the degrees of freedom the subject would have in searching through the information menus. The industry informant agreed that the case information was sufficiently complex, sufficiently relevant to real product management decision making, and also sufficiently conservative in time demands to be "do-able" in an acceptable period of time while still providing adequate challenge and motivation.

A total of four cases were coded in the manner described above. The company and product identity of each case was removed from the information contained in each bullet. The information from each case was presented in individual parcels on the basis of its content in relation to certain decision factor "arenas": Competitive Environment, Strategic Definition, Direction and Leadership, Execution and Organization, and Project Milestones. Under each "arena" category, three subcategories further refine the cognitive domain of the information presented. Each subcategory was called an "arena focus."

A total of fifteen different focused pieces of information were developed as "bullets" about each case. Each information piece contains two to three sentences, conveyed in familiar product/ management terminology. Each piece of information is associated with a unique "path" in the decision system specifying the project name, the project arena, and the arena focus. In all, sixty pieces of information are presented in the four-case decision task. In the two-case condition, thirty pieces of information are presented. Approximately ten pages of verbal statements (2500 words) are contained in the maximum condition of sixty different screens, and no screen or its content is redundant with any other. The individual subject has the latitude to visit as many of the information screens as desired, as frequently as desired, until he/she chooses to exit the information search screen and record the preferred project alternative. Time duration spent at each screen is not manipulated; the subject chooses to spend as much time visiting screens as selected.

The objective of the decision task is for the subject to select one of the four projects alternatives as representing the project "most worthy of your company's capital investment." The subject is told, in the opening screen, that he/she is to "think of yourself as being evaluated for a potential promotion as a vice president for product development within your company." The subject is also told that he/she will be presented with several real, historical project cases involving products with varying levels of success, and that the purpose of the decision task is to simulate how well he or she predicts the most successful product, and on what basis those predictions are based, using certain case criteria. (The four cases selected for the task were chosen on the basis of their relative performance "distance" from each other using Bowen et al.'s scoring scheme. One of the cases had a "perfect performance score" according to Bowen et al.'s criteria, the second case was awarded 75% of possible performance "points", the third case scored 50%, and the final case scored 25%. In the two-case condition, two of the four cases were used; the two used included the maximum point-scoring case per Bowen and colleagues, and the third-highest scoring case.

Instructions about how to move among screens are given in the introductory screens. A preliminary tutorial was offered to familiarize the subject with the screen selection process to be followed in getting information displayed and moving on to the final project selection screen. After completing the tutorial, the subject then proceeded to the actual task. Throughout this process of search and selection, the subject's information selection behavior was monitored passively through recorded information logs. Though selection performance (decision quality) is not a primary variable of the research model, the subject's calibration with Bowen et al.'s performance matrix can be used to investigate the subject's assessment of project performance alongside these authors' performance assessment criteria.

5.6.2 Decision Task Structure

As one of a class of decision problems, the decision task used in the experiment is a multi-attribute choice problem with predefined alternatives. It is not "ill-structured" in the same sense as real-world product management decision problems because: (1) it is defined on a closed problem space (Newell and Simon, 1972); (2) it has a definite beginning and endpoint in time, as defined by the respondent, and (3) it is limited in symbolic cue breadth and scope as contained in the set of possible messages. However, the task has been designed to place substantial demands on cue processing capacities of respondents, including short-term memory for detail. Furthermore, it is framed in the language representations and temporal horizons of real projects, real management scenarios, and real situational complexity. The cues presented do not disclose the "success" of each project in a direct manner; the product manager subject must infer how the *combination* of project traits led up to a successful product evaluation. The subject is told in advance that not every one of the alternatives has been rated equally successful by expert raters. The subject's unique inference or "cause map" for "success" is referenced (theoretically) according to prior experience, training, and interpretation of other "comparable" product situations that can be brought to mind during the task. In final fields for respondent comments about the decision exercise, many subjects expressed their cognitive associations between the case information and their real product management experiences. Appendix B contains a list of subject comments as given.

5.6.3 Decision Process Tracing

The choice of method for recording the sequence and timing of information search and decision strategies is based on requirements for providing a valid record of subjects' thinking process. Several methods of "decision process tracing" have been used in prior experiments, some of which are computer-aided. Biggs, Rosman and Sergenian (1993) provide a review of issues relating to concurrent verbal protocol validity: the degree to which decision processes, as recorded in verbal protocols, are reactive measures of cognitive sequences. In a research study designed to investigate the relative reactivity of two process tracing methods, Biggs et al. compare a verbalized, "think-and-talk aloud" process tracing method with a computer-mediated, passive process tracing method using Search Monitor tracing software (Brucks, 1988.)

Biggs et al. found that there were no significant differences in the amount of information accessed, the pattern of information acquisition, or the accuracy of the judgment, consistent with the verbal process tracing theory (Ericsson and Simon, 1980.) However, the verbal process tracing method slows down the decision process (takes more time to complete) as compared with passive computer process monitoring. The subjects used in Biggs et al.'s research were financial lending analysts using both financial and non-financial cues. Despite the fact that the decision sequence was slower when a verbal report was being given simultaneously with cognitive appraisal, the researchers found that the process data was more complete: it provided a better "inside-the-head" view of how subjects used the cues offered to them.

Study practicality issues, as well as theoretical ones, preclude the use of verbal protocol analysis of the case data in the present study. Getting the subject population to respond in the presence of the researcher is deemed not possible due to coordination difficulties. Also, duration of cue processing, as measured in increments, is an important outcome variable in this study. Because verbal protocol analysis has proven to delay natural cognitive processing speed, it is also possible that the type of processing required to carry out simultaneous cognitive tasks would alter the level of motivation and attention directed at the cues. In turn, the measurement method would undermine the capture of "normal" or "routine" decision processes, thus making the method internally invalid. For these reasons, a passive, computer-aided monitoring technique was deemed most appropriate.

Two possible computer-mediated monitoring programs were currently available, and both were rejected as infeasible to use. The Mouselab decision process tracing software uses an electronic "information board" format and is programmed for use in DOS environments (Payne, Bettman and Johnson, 1988.) Using a screen containing a matrix of alternative-by-attribute information cells, the subject "uncovers" the information in each cell by pointing and clicking with a computer mouse. The system records the time and sequence of the cells opened. This decision structure appears to be essentially two-dimensional in a matrix format. Alternately, the software can display a series of gambles in a simple decision tree format.

A second program, Search Monitor, was investigated in detail. The Search Monitor program has been used in consumer product search and evaluation research, making it more structurally similar to many product management decision tasks. Search Monitor is structured as a researcher-defined hierarchy of decision trees with numbers of alternatives and attributes defined by the researcher. Search Monitor has been used in a variety of decision process tracing applications, including consumer brand choice problems (Brucks, 1988), CEO environmental scanning behaviors (Walters, 1996) and financial analysts' appraisals of company health and performance (Rosman et al. 1994.) Like Mouselab, Search Monitor is conducted in a DOS environment.

The Search Monitor program offers the greatest flexibility in task design. However, further investigation of its integration capability into a Windows environment showed that it was not compatible with many contemporary workstations. Unfortunately, time constraints on the project precluded recoding the software from Turbo Pascal into Java or other script language. Therefore, a search for an alternative process tracing solution was re-initiated.

Using the expertise of a programmer familiar with script language tools, a decision process tracing system was developed for use in this study. The structure of the process tracing program emulates certain aspects of both Mouselab and Search Monitor (though it uses neither's code.) In particular, the software is designed to present information in a multi-attribute, quasi-"matrix" appearance, while also providing a hierarchical arrangement of decision cues in a three-tiered "tree" structure. The complexity of the task is increased by the inclusion of both multiple cues per alternative and multiple levels of information categories per screen presented. The decision process output data was passively recorded. Output data files were matched and screened for inconsistencies.

5.6.4 Decision Task Testing

Because the decision task content, structure, and data collection method are all new, they have not been field-tested in prior research. The validity, reliability, and integrity of the measurement system have not been proven. A preliminary administration of the task and scoring procedure was conducted using several academic subjects. All pilot subjects were interviewed to find out if the task provided the intended effects. The decision task was also administered to several computer science engineering classes and one MBA class in advanced statistics. Data from the student subjects (n = 100 usable responses) indicated that the task was reasonable and valid for stimulating the desired level of cognitive activity and information discrimination among subjects. Student results are presented in appendix C. Comparisons with management subjects are given in appendix D. In general, there were some significant differences between student decision processes and managerial decision processes. As the decision exercise was not pilot tested prior to its administration, power analysis was not conducted before instrument use. An ANOVA was conducted to analyze whether the two case conditions yielded significantly different decision outcome measures across all subjects groups. That ANOVA was found significant, indicating that the experimental manipulation on decision task complexity was indeed sufficient and operating as anticipated theoretically. The ANOVA results are shown in appendix D.

5.7 Study Validity

Using Cook and Campbell's taxonomy of quasi-experimental research validities (Cook and Campbell, 1979), the research methods are evaluated in the following sections for their apparent validity. The survey measures for the independent and mediating variables are not subject to the same sorts of insrumentation failures as the dependent, experimental outcome measures; nevertheless, the validity of measurement is addressed in general terms.

5.7.1 External Validity

External validity indicates the degree to which the results of the research can be applied across other persons, settings, or times, or the degree to which it can be generalized to other situations. As discussed earlier, this research may not be generalizable to a wide spectrum of working situations. Certainly, industry or market setting is not argued here as especially important to the problem; therefore, no attempt has been made to make the research generalizable to other markets or industry types. The focal context for this research is on specific types of information processing behavior relative to role load, role structure, organizational structure, and personal attributes. Thus, the research is of limited application to similarly stressed information role situations.

The sample used for the decision experiment was not a random sample. However, there was a conscious attempt to match subjects to one of two treatment conditions randomly. Extraneous factors requiring time to load and read decision cues were controlled as much as possible using equalized cue presentation formats for each case (as addressed in an earlier section of this chapter). The researcher would expect, therefore, that the findings from this study should be replicable at least within another managerial sample drawn from a similar population.

5.7.2 Internal Validity

Internal validity refers to "the validity of assertions regarding the effects of the independent variable(s) on the dependent variable(s)" (Pedhazur and Schmelkin, 1991). In simpler terms, internal validity is the degree to which one knows that a given result was indeed caused by the factors theorized to produce it, and whether or not alternative explanations can be ruled out.

This study makes no claims on establishing causal relations with any degree of confidence. Subjects' forbearance and time constraints present a major resource limitation of the study, precluding a true within-subjects experiment. Ideally, each subject would be presented with multiple decision scenarios so that a repeated measures design would be feasible, thus controlling for subject-specific differences in cognitive processing. The full model provided in chapter 4 indicates that individual characteristics are expected to have important effects in the information process used.

However, it is precisely this type of "time pressure" that makes this particular subject pool interesting and worthy of study from the perspective of the model asserted. Therefore, despite the fact that causal inferences from the data are at best extremely tenuous, the data supplied by this unique population provide some useful exploratory insights.

Many threats to internal validity cannot be ruled out entirely, because knowing the results on the dependent measures does not indicate that they have been "caused" by any of the independent measures. In fact, the probability that the association between the dependent and independent measures is simply spurious cannot be completely ruled out, though random assignment has been used to keep such random error in check. Another problem is that there is a high likelihood of capitalizing on chance, given the particular sample obtained.

5.7.3 Construct Validity

Most constructs used in this research have been carefully screened for their prior interpretation in the literature. Every effort has been made to assure that (1) the constructs are theoretically relevant to this research, and (2) the independent measures representing the selected constructs are "tried and true". The decision process measures are not new constructs *per se*, but the measurement system for collecting data is new and unproven.

Measures of independent constructs should demonstrate high levels of convergent and divergent validity, as theoretically claimed. Prior theory and research suggests, however, that some measures included in the research model may be significantly intercorrelated. To test for intercorrelation, principal components analysis was performed on all multi-item scales. The components were checked for correspondence with theoretical structure. Also, standardized Cronbach's alpha measures were computed for each multi-item scale to indicate whether or not the scale was reliable for this managerial sample. Cronbach alpha measurements and principal components results are given in appendix E.

In some cases, the principal components factors were retained for later analysis and comparison with the criterion measures. Principal components retained were also rotated using varimax rotation, making each orthogonal with others from the same construct scale. Components were retained based on criteria provided from an analysis of eigenvalues generated from normally distributed random variables, or parallel analysis. Component eigenvalues obtained from the research sample were compared with those generated from random variables, as given in tables provided in Buja and Eyuboglu (1992). Component loadings were deemed significant for interpretation if they met Stevens' criteria for factor loading (Stevens, 1996, 371). Exploratory factor analysis was attempted on all scales also, but several runs indicated instances in which the factor communality exceeded unity and were therefore difficult to interpret. Problems with factor analysis led to the acceptance of principal components analysis as the data reduction technique of choice for these data.

High multicollinearity among independent variables reduces the incremental predictive power of each variable independent of the others, because it increases the standard error of the regression coefficient for that independent factor. The orthogonal factors retained from principal components analysis were used to circumvent the problem of multicollinearity in regressing certain constructs together on the stress measure. Standard linear and quadratic regression were used for each independent contruct theorized to be linked with role stress, in addition to any models tested with rotated factors. Regression results are provided in appendix F.

5.7.4 Statistical Conclusion Validity

Statistical conclusion validity is the degree to which a significant and/or strong association between independent and dependent measures can be detected using the given measures and methods of analysis. Several research criteria affect the power of a test, or, researcher's ability to detect relevant associations and differences: (1) the acceptable level of error in rejecting the null hypothesis when it is true (alpha); (2) sample size, and (3) effect size.

Because the research is exploratory, and the sample of respondents was relatively small, the alpha level set for rejection of the null hypotheses in this research is .10. Hypotheses were also considered at the traditional level of .05. While the traditional alpha level is .05 in most social science research, some have argued for more lenient alpha levels for exploratory research (Stevens, 1996, 4). As most hypotheses in this research study were directional, one-tailed significance tests were appropriate for most of them. The use of one-tailed tests increases the power to detect significant differences where direction can be hypothesized confidently. A pilot study was not available to determine sample size using power analysis. Effect sizes were not computed from prior research.

5.8 Self-administration and Media Issues

Subject's ability and familiarity with electronic mediated environments was an assumed condition of their participation, even their interest and motivation to participate. The assumption that potential subjects are thoroughly knowledgeable about electronic communication formats was a key factor in being confident to conduct the present study remotely. In fact, e-mail was believed to have vastly increased subject responsiveness because: (1) it is a novel approach; (2) it is convenient for them to do at work; (3) it is personal and not monitored by others without permission, and (4) it takes advantage of the industry and technological system that the subject population are so invested in providing.

Like all electronics, however, systems break down, get hiccups, and sometimes provide blank stares into cyberspace. Fortunately, no major failures in instrumentation or data collection took place during the data collection phase, and no data were lost in transmission between subjects and the researcher. The intact data stream from each participant was compared according to expected sequence, and no data appeared lost from any malfunctions. Only two of the managers who started the research did not complete it, but neither experienced technical failure as might have been indicated. The reasons for non-completion were believed to be either personal choice or work interruption.

CHAPTER 6

RESULTS AND DISCUSSION

6.1 Introduction

This chapter reports results of the hypotheses discussed and proposed in chapter 4. Specifically, it provides: (1) characteristics of all study respondents by group; (2) descriptive statistics for decision process variables measured within each group and across all groups, and (3) analysis of group differences using multiple statistical procedures. In addition, tests of parametric assumptions are reported to show the suitability of parametric analysis. Principal component analysis and correlation analysis are also used to indicate measurement reliability, construct parsimony, and construct validity for some individual study variables.

6.2 Analysis of Individual Characteristics

Certain individual training and experience levels are important to show competence and expertise in a highly technical field such as telecommunications product management. Individual background factors like education level attained, education content, industry tenure, and tenure in current position are important to measure as potential sources of variation in decision making processes. Though no attempt has been made to establish a theoretical direction for each of those variables, their influence on the respondents' thinking and attentiveness is arguable, and should be investigated apart from other theoretical constructs assumed to operate on decision making. Respondent age, sex, and ethnicity (apart from cultural participation) are not theorized to provide any relevant differences in how individuals develop habitual patterns of information use and deploy attention; therefore, data for these demographic variables were not collected from subjects.

Two samples of students also participated in this study. Similar background measures were collected from student participants for comparison with the managers. The two student groups differed in their degree content emphasis: the students in one group were seeking a computer science engineering degree, while most students in the second group were enrolled in an advanced master's level statistics course, as part of the business administration curriculum. The major theoretical difference between students and managers was believed to be the degree of full-time work experience. That experience would have exposed the managers to professional and organizational design factors that are hypothesized to make a difference in their decision processes, whereas students with little long-term professional tenure would be "naïve" to organizational factors and organizational learned routines.

Individual group demographics are described with counts and bar charts in appendix A. A total of 31 managers, 47 computer science engineering students, and 54 business students are included in the analysis presented. Exceptions to this sample count are noted in appendices and in certain sections of the hypothesis testing reports where applicable. These counts are net of cases deleted for missing data or instrumentation errors.

Table 3. Cell Frequencies for Group Sample by Experimental Condition

	Experimental Condition		
Group	Two-case Condition	Four-case Condition	Total Group n_j
Computer Science Engineering	24	23	47
Business Administration	24	30	54
Telecom Management	13	18	31
Total Group n_i	61	71	132

Approximately half of the managerial subjects had masters' degrees, with the engineering discipline predominating. Two-thirds of the managers had responsibility for one to four products in all. Reported firm size, in total employees, was most cited at the moderate to large firm level (1000-50,000 employees). The mean total tenure in the telecom industry reported was 119.71 months, or almost ten years. The mean tenure in each of the managers' firms was reported to be 34.29 months, or almost three years. Finally, the mean position tenure was just over one year at 12.39 months. These differences in position, firm and industry tenure suggest that those in the manager sample have experienced a high rate of job change within and between employer organizations during their careers. That job change may be voluntary (as in job advancement opportunities), or it may be brought about by changes in firm identity through merger, acquisition, spin-off or start-up. A cursory glance at industry literature suggests that turnover in the industry is very high due to its high growth rate and heavy competition for skilled and experienced employees.

Manager subjects were asked to specify how much time they devoted to certain common work tasks that go with product manager jobs in the industry. The question was asked to make sure that the respondent fit the required characteristics of the desired population. A series of bar graphs in appendix A indicate that the sample of respondents obtained for the study did indeed match the characteristics sought. A majority of respondents reported spending most of their time in product management and product planning tasks, with some additional time in direct customer selling or other work. The mean time for product management was approximately 30%, for product planning, 20%, and for direct sales, 20%, though each of those categories had a wide spread in answers given. Most of the respondents have subordinates reporting to them in some way, making administrative tasks important in their routines. In total hours per week, better than two-thirds of respondents reported working more than 40 hours a week at their offices. Twenty-six out of 31 respondents reported working from 1 to 20 hours at home, and more than two thirds worked during their travel periods, away from home and office. Only two respondents reported working less than an average of fifty hours per week across all modes of work location. The present researcher concludes that the sample was correctly identified as intended, and does represent the work conditions of complexity and overload originally wanted for study.

Of the 101 students used in the final sample, only five worked in the telecommunications industry. Approximately one third of those sampled were not employed, another one fourth were employed part time, and the remaining students were employed full-time. More than half of the student respondents were working on masters' degrees, and another third of the total were seniors in their programs of work. By degree content, one third were in business administration majors, one third in computer science, and the remaining third split between engineering disciplines and information systems.

In summary, the comparison of students and managers indicates that both groups were indeed similar in their educational discipline content and attainment level, though managers had completed their degrees, whereas students had not. The manager group had the characteristics desired to represent the population intended for study.

In all, twenty-seven cases were omitted from the final sample for reasons of non-compliance with instructions, instrumentation failure, or voluntary exit from the website before finishing. Of those twenty-seven cases, two were managers who did not complete the decision task, five were business students, and the remaining cases were from computer science. The computer science version of the website was inoperable for a two-day period during data collection, causing about ten cases to be negatively affected. Survey data for managers not completing the task were omitted from the final survey data used in analysis. Also, in addition to the 33 managers who voluntarily took part in the study, approximately ten more managers returned a personal note or "non-participant" survey attached to the solicitation e-mail, indicating that they would not participate in the study. The most frequently cited reason was "I just don't have time."

6.2.1 Individual Confounds: Reading Speed

Sources of confounding due to unmeasured personal traits might include: (1) familiarity and degree of fluency with the English language in a highly abstract comprehension task; (2) symbol reading speed, and (3) familiarity and level of experience with personal computer-mediated communication tasks. Lack of English fluency is not assumed to exert a strong influence in explaining subject response differences. All subjects

were either college graduates or in more advanced courses at the undergraduate level. The predominant instructional language for all programs and/or job environments in the region is English. Familiarity with personal computing and electronic mail is also assumed to be an insignificant factor in determining group differences. All subject populations in this study are assumed to have more than adequate capability for performing the required computing tasks with their prior educational background. Detailed behavioral instructions were also supplied repeatedly throughout the survey and decision task.

Reading speed is not measured directly for each subject. In place of that measure, the amount of time spent visiting a series of short survey screens was measured for each managerial respondent (the student subjects did not have a similar series of screens to measure for this covariate construct). The time taken in viewing this series of screens was substituted as a surrogate for "reading speed" because the cognitive effort and data input required at this series of screens were minimal in relation to other points in the research web. Mean and variance measures for each of those screen series durations, measured in seconds, were calculated for each manager independently, and used as a covariate with the other dependent cognitive measures in the original MANOVA analysis. The covariate term for "reading speed" was found to be insignificant and uncorrelated with any of the other dependent measures, and was subsequently eliminated from further analysis.

Incorporated into the confound, "reading speed" is the potential confound of different Internet screen loading rates due to different modem or link access transmission speed. Unfortunately, this confound could not be reasonably controlled due to the variability of remote research locations (each subject was able to access the research website from any PC or networked site available to him or her.)

Two distinct efforts were made to prevent this confound from presenting significant differences. First, no graphical images or other form of "dense" information was used in any portion of the survey or decision task. Coloration, use of symbols, fonts, pagination, hyperlink placement, and screen formatting were purposefully made similar across all screens to the extent possible. Second, in the decision task screens, each screen was highly controlled to be the same in appearance, cue position, and cue variety. These two controls on appearance and minimal use of slow-to-load images were used to minimize differences among user interface characteristics, especially transmission speed.

Because of the attempt to control stringently for cue length differences and screen loading time, the insignificant covariate result was expected. Moreover, because each subject shifted from one screen to another, maintaining reading and loading times at approximately equal rates of speed throughout the process, the present researcher is quite confident that any large deviations in per-screen viewing time were not due to instrumentation differences.

The literature review highlights numerous links between individual personality and perceptions of stress, climate, uncertainty, and decision making style. Prior research evidence suggests that individual differences in personality are a source of variation in cognitive processing tasks. To keep managerial subjects willing to respond, however, items related to individual personality were omitted from the research instrument for lack of subject time. Random assignment was used to assure that no systematic differences on personality factors create variability in these data. Individual personality factors are left to be explored in future research. As a result of not collecting individual personality and coping data, therefore, those hypotheses were not tested using the samples at hand.

6.3 Results of Decision Process Analysis

This section is subdivided to report on different tests performed on the group decision process data. The first subsection reports the general descriptive statistics on the dependent variables, with all groups combined. The second subsection reports analysis of student data, in which the two student groups are compared via MANOVA. The third subsection reports the analysis of manager data. The fourth subsection discusses the findings, comparing all tests and groups. Respondent reaction comments to the decision task and survey (for managers only) are shown in unedited form in appendix B.

Each respondent provided data for only one population category and one treatment condition. Each managerial respondent was assigned one of two Web links to the treatment conditions via an introductory solicitation letter. Each letter included one of the two URL's (Web addresses). Each decision treatment was accessible by means of entirely separate Webs; no overlap or possibility for accidentally "getting into the wrong task" existed electronically. Because each subject was approached to do the research individually, and all were generally dispersed geographically, it is improbable that they shared knowledge of the decision task, possible outcomes, or different levels of treatment.

6.3.1 General Decision Process Variables

This study was designed as a two-way analysis of variance, with three different subject populations and two experimental levels of decision task complexity. All four measures of decision process were taken for each subject group and each treatment condition.

The dependent measures in the research model relate to the omnibus construct, individual decision making process. Specifically, four different measures of process are evaluated for each subject by means of responses to an experimental decision scenario: (1) total amount of time expended on the decision task; (2) total number of information screens searched before subjects' decision was recorded; (3) the variability (measured as variance) in time increments expended "looking at" information screens during the search phase, and (4) the total "cognitive distance" traveled in the process of search. More detailed explanation of these measures is given in chapters 4 and 5. All measures are parametric in that they measure "relative interval distance" on some decision outcome criterion.

Four variables for decision process were used to compare all three groups. All four measures were theoretically highly correlated, with greater values representing more expended effort, more cognitive involvement, and greater attention to the incremental information offered. The null hypothesis for the groups comparison was that all group means would be approximately equal, as each group had approximately equal background characteristics, other than work experience and tenure in the industry in a professional role. More plainly, all subjects were expected to devote equal time and effort to the task. Though not included in the original hypotheses for the research, the manager group was expected to spend less effort and time on the experimental task because: (1) they were offered less real "compensation" for taking part, and (2) they were expected to have more legitimate time constraints than the student, given the nature and complexity of their professional work. Managers were expected to "rush" through the survey and task. Interestingly, however, the reverse happened. Appendix D provides graphs and reports from MANOVA analyses indicating that managers and students did differ substantially in response to the decision experiment. More explicit comparisons are made in a section below. Table 4 gives statistics for average and deviation scores for each of the four dependent measures of decision process. All groups are included in the table statistics.

6.3.2. Data Distributions and Statistical Assumptions

The data distributions for the decision process variables did not meet assumptions of normality, equal error variance, and equal covariance for most combinations of variables. The data were assumed independent (i.e., each respondent performed in the experiment independently of other respondents and did not share information). The distribution of scores and the values of the decision accuracy measure reflect that there was not a significant threat to the data from information sharing among students. There were several outliers in the data, making some variable distributions skewed right (i.e., a few individuals gave much more attention and effort than most others), but these outliers were deemed credible and interesting to note in themselves. They were kept in the dataset as legitimate.

Because multiple independent and dependent measures are used, and dependent measures are assumed correlated with each other, MANOVA provides optimal protection against overall Type I error while indicating treatment differences otherwise not detectable with multiple separate ANOVA tests (Stevens, 1996). The omnibus MANOVA test is followed by separate ANOVA tests to isolate specific areas where differences among groups/treatments occur. For all statistical analyses, the Type I error acceptable for rejection of null hypotheses was set at two points: alpha = .05 and alpha = .10. The more lenient alpha level increases ability to detect treatment by group differences, and has been deemed suitable for exploratory research (Cook and Campbell, 1979; Stevens, 1996). Statistical software packages NCSS and SPSS Version 10.0 for Windows were used to perform statistical analyses.

For the MANOVA and ANOVA analyses, the tests assume independence, equal error variance and normality in the data distributions. For MANOVA, an even stricter assumption of equal covariance matrices is also assumed. In almost all cases, these assumptions were not met, with the exception of the independence assumption. Levene tests for equal variances were significant in most cases, and the Box M statistic for equal covariance matrices was also significant ($p = .000$); these significance indicators suggest that normality and equal variance assumptions were not met. As the independence assumption is by far the most critical for the significance tests to represent the "true" values, the tests were performed anyway. Stevens (1996) concludes that departures from normality are not a significant threat, and having unequal variance and covariance matrices attenuates power in the test. SPSS contains post hoc tests assuming unequal covariance matrices, and these were used to interpret the data where appropriate to the comparison.

Table 4. Statistical Summary for Combined Sample, N = 131

Dependent Variable	*Mean*	*Standard Error*	*95% Confidence Interval*	
			Lower Bound	*Upper Bound*
Cognitive Distance	39.624	2.117	35.434	43.814
Number of Screens Viewed	29.874	1.616	26.676	33.072
Standard Deviation View Time, in Seconds	16.301	1.611	13.112	19.490
Task Duration, in Seconds	913.297	56.466	801.553	1025.041

6.3.3. Student MANOVA Results

Appendix C reports the analysis of both student groups in more detail. The MANOVA comparing students used all four measures of decision process, as given in the above section. Two separate group factors, type of case (two-case version and four-case version) and type of student (computer science and business) were used as predictors in the model. The overall MANOVA test shows significant differences between types of student and case condition. For student type, $F = 2.110$, with 4, 94 d.f. ($p = .086$). Follow-up ANOVA analysis shows the differences between student groups to be in scores for task duration and standard deviation in view time (p = .048 and p = .033 respectively). Examination of group means shows that business students spent much less time in total duration and did not vary their screen view times as much as their computer science counterparts. Though not significant, the differences between business and computer science students on cognitive distance and number of screens viewed also compares in the same direction with the first two variables. In conclusion, the business students appeared to devote less attention and time to the decision task than the computer science students.

Interestingly, however, the computer science students and business students were about equal in their decision accuracy, represented by judgment agreement with the original case authors. Both groups tended to choose the correct case more frequently than the incorrect case (case condition not specified). These accuracy results are compared with managers in appendix D.

As for type of case condition assigned, the two-case task was significantly different from the four-case task in eliciting effort and time. Three of the four decision variables were significant, as shown in appendix C: cognitive distance (p = .001); number of screens viewed (p = .003), and task duration (p = .008). The standard deviation score was not significantly different for the two groups, and there was no theoretical reason to expect it to be different for these two groups.

For the student groups, the case complexity manipulation worked well. This difference was expected because the two-case task had a total of thirty screens of information, while the four-case task had sixty screens of information. However, presenting double the amount of information in cues does not represent the analytical complexity of the two tasks. The four-case condition was judged to be at least six times more complex than the two-case version, if considered to be a series of pairwise comparisons between cases only. This complexity factor does not take into account how much effort was needed to remember which comparisons were already made, and how to pair them, as the subject saw only one screen at a time, and had to "remember" each screen to compare it to others in succession. To add to the complexity, each case had a total of fifteen different screens containing information about it, so the subject had to uncover up to fifteen screens about each case to compare it completely with any other.

Besides independent effects of case type and student type, the ANOVA for the interaction term was also significant for cognitive distance ($p = .052$), number of screens ($p = .08$), and task duration ($p = .033$). (Significance tests were one-tailed; the reported p-values are for two-tailed tests, so each p-value is halved to get the actual probability of rejecting the null for equal means.) Though just speculation, the present researcher suggests that the significant interaction is due to the fact that the case materials were more familiar to the business students than the computer science students. Computer science students may not have the facility and familiarity with the language constructs presented in the case materials, and so they had to "think through" each screen, and look at more of them, to come to a reasoned conclusion for themselves. The fact that there were differences in exhibited "diligence" among the two groups is not explained by any instrumentation factors; each group saw exactly the same screens, in self-selected order, and had the same access factors to deal with. The diligence of these two student groups was also compared with diligence of managers, who had fewer incentives to participate.

6.3.4. Manager and Student Groups Comparison

Using both case type and group type comparisons in the model with all four decision process variables, the overall MANOVA test for the manager-student comparison was significant for both independent effects. The case-type factor statistic indicated $F = 3.758$, with 4, 123 d.f. ($p = .006$). The group-type factor statistic was $F = 1.837$ with 8, 248 d.f. ($p = .071$) for Pillai's Trace analysis and $F = 2.663$ with 4, 124 d.f. ($p = .036$) for Roy's Largest Root. The interaction term for case-type and group-type was significant only using Roy's Largest Root statistic, $F = 2.464$ with 4, 124 d.f. ($p = .049$). As in the prior ANOVA analysis, cognitive distance, number of screens viewed and task duration were significantly different between the two case types. Using one-tailed significance tests, subsequent ANOVA comparisons among the group types showed significant differences on three of the four variables, including number of screens, standard deviation in seconds, and task duration. (appendix D tables present detail on significance tests and comparison means). Cognitive distance was also different among groups at close-to-significant levels (p = .061 for one-tailed test). Examining the group means, the manager group went significantly farther than business students in cognitive distance and number of screens viewed. Computer science students spent more time on the task than either of the other groups, and also varied most as to how much time was spent at each screen. Tukey Honestly Significant Difference tests were performed for group differences to see if means differed substantially. Due to unequal cell sizes, the procedure used the harmonic mean. The significance levels reported for Tukey tests were significant as a one-tailed test for all but one variable, task duration. Task duration was significant at p = .061. Stevens (1996, 204) indicates that the Tukey procedure using the harmonic mean yields true probability levels very close to the nominal (within .01 of true alpha).

A subsequent MANOVA was conducted on the manager data alone to see how the decision process variables differed with respect to type of case only. In contrast to the findings for students, the managers did not vary much in their decision process depending on case condition assigned. The overall MANOVA on case type differences was non-significant (p = .528). This result is interesting to compare with student subjects because it reflects the managers' willingness to attend and expend cognitive effort on either case condition, regardless of the "odds" of picking the correct case randomly. In the two-case condition, there is a fifty percent chance of selecting the correct case without looking at any information screens (and subjects were free to select their case at any time). In the four-case condition, the probability of picking the correct case was one out of four. Obviously, the managers did not approach their decision situation as a problem in probability, nor did they compare in their effort by virtue of the information complexity present in the information screens. Moreover, they did spend more attention and time on the task than business students, and more than computer science students on two of the four measures. In conclusion, the managers took the task very seriously and appeared to resonate with the case material well.

Paradoxically, the managers appeared not to make judgments that agreed with the case authors as often as students in either category. The present researcher hesitates to say that the managers were "inaccurate" in their decision judgment because they may have legitimate reasons for selecting the case they chose that go beyond the case authors' analysis. A closer analysis of the most commonly selected case is warranted for as a future research project.

6.3.5 Section Summary

Overall, the results of the group and case comparisons were significant and in the expected direction for the experimental manipulation of decision task complexity. The decision exercise was found to have acceptable levels of difference between the two case conditions across the total sample, though specific group differences were noted as significant. Managers tended to spend more time and effort on the task than expected, despite their work and time pressures. The "right answer" was not apparent to either students or managers, as shown by their agreement in judgment with case authors. After the task decision was made, subjects were asked to evaluate the level of challenge in the task, whether or not they used notetaking during the task, and how confident they felt in their final judgment. Appendix D shows bar charts exhibiting frequencies for each item. Across all groups, most thought the task to be relatively challenging, most were reasonably confident that they had made the correct choice, and about one third of all respondents said they took notes during the exercise. Comments from subjects in appendix B indicate their general acceptance of the decision task as a research tool; it had satisfactorily stimulated their thought and interest.

6.4 Results of Hypotheses Tests

The hypotheses given in chapter 4 involve management subjects only, whose organizational tenure and work relationships are theorized to affect their experience of stress and ultimately, their individual cognitive activity and decision making. Most of those hypothetical relationships are not applicable to the student samples, whose formal work history and level of experience are not assumed important as a source of learned decision routine. Therefore, many of the hypothetical relationships modeled in chapter 4 are not attributable to student respondents, and data for that aspect of their experience was not collected.

Hypotheses were tested using a combination of one or more analysis methods as appropriate to the question: zero-order bivariate correlation measures, univariate regression, multivariate regression, logistic regression, , multivariate analysis of variance (MANOVA) and univariate ANOVA. Principal components analysis was also used to reduce multi-item measures to a few orthogonal dimensions. Retained factors for some constructs were used in regressions, canonical correlation analysis, and MANOVA. Tests for parametric assumptions were performed with each test; in general, tests on summary score variables (summed scores for multi-item scales) were approximately normal. Most variance and covariance matrices using these summary variables indicated homogeneity, as required. To test for normality, both Kolmogorov-Smirnov and Shapiro-Wilk tests were used on the independent summary scores. To test for equal error variance, the Levene test was used. To test for equal covariance in cases of MANOVA, the Box M statistic was computed.

Most constructs were measured with multiple items. Standardized Cronbach alpha statistics were taken from NCSS assessments of correlation. Correlation tables for each construct are also shown in appendix E. Individual hypothesis tests are illustrated with charts, graphs and tables in appendix F, in order of the hypothesis number. Curve estimation graphs from regressions are displayed for each hypothetized relationship, if significant and appropriate.

Many constructs were used in the model. Due to limitation in manager sample size, data reduction techniques were necessary to decrease the dimensionality of the data. Exploratory factor analysis was conducted on some constructs, but factor loadings were not deemed reliable due to observing communality estimates greater than unity (which violates the assumptions of the factor analysis method.) To keep retained, orthogonal factors consistent in the analysis, principal components analysis was used to reduce the data dimensionality. Subsequent statistical tests were performed on retained components. As a general rule, components were retained on the basis of parallel analysis using eigenvalues greater than 2.0, from parallel analysis tables found in Buja and Eyuboglu (1992). Factor loadings of greater than .65 on retained components were interpreted as significant for the sample. These values for retaining factors and components were deemed conservative enough to make meaningful interpretations of the data for the sample, and coincide with Stevens's criteria (1996) for significance relative to sample size. For most organizational constructs, two orthogonal factors were retained for each. Principal components reports are given in appendix G for the following constructs: formalization, centralization, organizational climate, perceived (un)control of time, organizational and product performance, role stress, and decision process.

6.4.1 Hypothesis 1: Organizational Structure and Stress

Hypothesis 1 relates the dimensions of organizational structure to the mediating variable of role stress. Span of control, formalization and hierarchical ordermeasures require individual judgment to a degree, but were expected to be somewhat independent of individual perception. The measures of centralization, however, were more apt to be given as a perception measure due to the nature of the question and the lack of corroborating social reports.

Hypothesis 1a: Greater spans of control and less formalization together are positively associated with perceived role stress.

This hypothesis was not supported. It was based on the idea that greater spans and less clear-cut procedure would lead to communication ambiguity and overload at the role level. More regular, formal communication contacts, combined with the scarcity of procedural norms to define those contacts, would lead to greater time pressure, more communication confusion, and more overall coordinating work. Based on a univariate ANOVA with parametric measures for sum of spans and formalization total scores (derived from an eight-item measure), the interaction term between span and formalization was not significant in relation to total stress score (a total of 21 items). Subsequent linear regressions of each construct independently on the total stress score yielded non-significant associations. Standardized Cronbach's alpha for the formalization scale was reported as .74, which is generally considered acceptable in the management literature using Nunnally's (1978) criterion of alpha = 0.6.

Hypothesis 1b: Centralization will be positively associated with perceived role stress.

Hypothesis 1b was strongly supported using one of the two dimensions of centralization. The centralization measure, which included two scales designed to tap degree of organizational decision control with degree of participation in certain decisions, had a standardized Cronbach alpha of .92. (These scales were developed by the present researcher based on prior scales by Miller and Droge (1986) and further elaborated in John and Martin (1984). Of the two dimensions of centralization, decision participation was significant when regressed on total stress score, whereas perceived decision control was not. The linear term was significant in the former regression with $R^2 = .097$, $F = 2.90$ with

1, 27 d.f. (p = .05 for one-tailed test); the quadratic term was not significant. As hypothesized, subjects who reported greater participation in decision making also reported less total stress. The same direction was reported for stress and perceived decision control, though the relation was not significant.

Hypothesis 1c: Hierarchical order will be positively associated with perceived role stress.

Hypothesis 1c was not supported. Hierarchical order was measured as the sum of levels of authority above and below the respondent's role in the organizational hierarchy. In this sample, hierarchical order was not significantly related to reported stress in either linear or quadratic regressions. Though not significant, the analysis showed that at hierarchical order of 5 to 7 levels (for organizational total reported), the stress score was at a minimum. When hierarchy was either very flat (2-4 levels) or very tall (over 8 levels), reported stress was comparatively greater. This information compares with Kahn et al.'s findings that stress was associated with organizational size and complexity.

In conclusion, the results of association tests between organizational structure and role stress were not strong. However, the model given in chapter 4 anticipated the potential relationship between structure and stress that was mediated by climate factors, so the lack of significance is not entirely surprising. Of the structure dimensions used, centralization, or, more accurately, decentralization (the tendency to distribute decision making authority across roles) was most significantly and negatively related to stress.

6.4.3 Hypothesis 2: Structure and Performance

The relationships explored in the second hypothesis relate organizational structure dimensions with reported product and organizational support performance. The performance criterion measure was subdivided into two dimensions: the respondent's perception of his or her chief product's performance relative to market average, and the respondent's assessment of his or her organization as a support vehicle for that product's success. The differentiation in the two measures was made to verify whether the manager was just giving his or her product "high marks" as an ego-enhancing evaluation rather than an objective assessment. The product performance scale was developed using several articles in the product management literature, especially Cooper (1999). The scale contained six items related to product attributes. The second performance scale was developed using the research findings from Zirger and Maidique (1990) on successful organizational product introductions. The latter scale contained nine items. Both scales were 5-point Likert scales. The product scale was found to have unacceptable reliability, with standardized Cronbach alpha scores of well below .6. On the other hand, the organizational performance scale with nine items showed high reliability, with standardized alpha score of 0.87. The Pearson correlation between the two scales, however, was very high: $r = 0.726$ ($p = .000$).

Hypothesis 2a: Span of control will be related in an inverted U-shape function with organizational product performance (indicating a relative maximum relation).

The relation between span of control and product performance was significant, but not in the relation hypothesized. The linear term of the product performance score was significant, indicating a negative but linear, rather than quadratic, association between span of control and product performance. As the sum of spans increased (indicating more communication and coordination pressure on the manager, the product performance score decreased. In contrast, the organizational support score was not related to span of control measures. The significant finding suggests that the respondent may be more doubtful about the product performance values to assign relative to the market average because he or she is less informed about them directly, with so many other communication avenues to attend to on a routine basis. The significant finding for this relationship suggests that the initial hypothesis may have been tested using the wrong measure for span of control in this research. The measure actually used related more to the total communication load on the individual role rather than the balance of communication versus organizational complexity, as originally theorized by Graicunas (Urwick, 1974).

Hypothesis 2b: Formalization and centralization together will be negatively related to product/organizational performance.

A MANOVA with both measures of product and organization performance as dependent variables and formalization and centralization scores used as random covariates did not produce a significant result among these variables. Independently, formalization and centralization factors regressed on the performance measures showed no significant associations.

Hypothesis 2c: Hierarchical order will have no effect on product/organizational performance.

This hypothesis was not supported as stated; surprisingly, hierarchical order was significantly related to product performance, especially as a quadratic regression. For the regression of total hierarchical order on the product performance measure, $R^2 = .09665$ with 1, 31 d.f. ($p = .039$ for one-tailed test). The quadratic term in the equation was strongly significant, improving overall R^2 to .20818, with 2, 30 d.f. ($p = .000$). The strong association was in a negative direction; the flatter the organizational structure, the higher the product performance score assigned to its product. A corresponding association between hierarchical order and organizational support performance for that same product was not significant however, as a linear association. The quadratic term was nearly significant for the organizational support dimension. This finding of a local minimum value between hierarchy and performance suggests that there may be a "worst organizational form" for telecommunications product management success. Hierarchies on the order from five to eight levels do not appear to have managers with confidence in their products. According to these managers, the hierarchical structure should be kept as flat as possible for maximum product performance.

This finding is not consistent with some of the traditional theories presented in earlier chapters. However, it is consistent with current industry theories-in-use, and further substantiates the rationale for considering organizational structures as time-dependent mechanisms for ordering the conduct of work. Greater hierarchy inhibits the flow of information from the boundary of the organization to its central decision making core. In the case of fast-paced industries like telecommunications, information timeliness and throughput are essential to rapid market adjustments and timely product introductions. Flat structures are essential for rapid information flow both upward and downward through the levels of organizational authority, funding mechanisms, and product supply mechanisms. At the higher end of the hierarchy spectrum, perhaps it is simply market power, rather than speed, that accounts for product success reported. The firms with medium-range hierarchy may be too large to be responsive to rapid market changes and too small to dominate the markets they occupy.

6.4.4 Hypothesis 3: Structure and Decision Process

Hypothesis 3: Span of control, formalization, centralization and hierarchical order will have no individual, independent effects on individual decision process.

This hypothesis, in which each of the structure dimensions is independently considered opposite the decision process characteristics of the respondent, was completely supported on all dimensions tested. There was no significant relationship found for any of the dimensions. To test each dimension separately, each was regressed on the single component, retained from principal components analysis, representing the combined score for the four outcome measures of the respondent's decision process. (The high degree of association on those variables warranted a reduction in the dimensionality of the data.)

The hypothesized "no relation" association between organizational structure and decision processes was intended to show that organizational structure variables alone do not explain (in theory) how its agents think and respond in decisions. The more important relationship to examine is how that relationship is *mediated* by agent perceptions of climate and/or role stress; stress level is expected to be the most significant factor explaining the decision processes of respondents.

6.4.5 Personality and Coping Hypotheses

Hypotheses for individual personality factors, media richness, coping behaviors, and individual satisfaction with decision making were not tested in this research because no data were collected from managerial subjects, as explained earlier in an earlier chapter. The following hypotheses will not be discussed further in the research report.

Hypothesis 4: Individual achievement motivation will be positively associated with perceived role stress.

Hypothesis 5: Locus of control is associated with role stress (internal locus of control is positively related to role stress).

Hypothesis 6: Individual tolerance of ambiguity is related to role stress (direction not established).

Hypothesis 9: The perceived disparity between media access and preferred media richness choice is positively associated with perceived stress.

Hypothesis 11: Degree of perceived stress is associated with type of coping response; a moderate degree of perceived stress is associated with active behavioral or problem-focused coping, while a high degree of perceived stress is associated with avoidant behavior or emotional coping.

Hypothesis 12a: Perceived stress is negatively associated with individual satisfaction with decision making.

6.4.6 Hypotheses 7 and 8: Time

Hypotheses 7 and 8 were related to the respondent's perception of time and time management behavior. Prior research has linked perceived control of time to greater personal satisfaction and overall health. Also, the presence of more active time management skills is associated with more awareness of time pressure and a greater need to actively manage time as a resource for work accomplishment. Both constructs were considered to be independent of each other (Mudrack, 1997) and negatively linked to the experience of stress. However, findings from the study indicated that perhaps a positive theoretical association is more appropriate and can be justified from a different perspective.

Hypothesis 7: Perceived control of time is negatively associated with perceived stress.

This hypothesis was supported strongly but in the opposite direction from that expected. Those who perceive themselves to be very much in control of their time also report the highest levels of stress, as a total scale score. A simple regression of time control (as a total scale score of seven items) on total stress score (21 items) indicates a strongly significant relationship, with model R^2 = .321 with 1, 29 d.f. (p = .0009). This finding suggests that managers' perception that they must control their time (when perhaps they cannot, due to many other competing factors and tasks) may get associated with the frustration of not being able to carry out the tasks required as one wants. The variable for time control is referred to in the graphs as time (un)control to indicate the direction of the scoring; higher values on the scale represent perceptions of greater loss of control.

Hypothesis 8: Perceived time structure is negatively associated with perceived stress.

Similarly, those who scored high on the time management practice scale also report high levels of stress, though the significant relationship between the two constructs is viewed as a quadratic relationship rather than a linear one. Time management is a construct consisting of four items from Schriber and Gutek (1987). For the quadratic regression, the overall R^2 = .209 with 2, 28 d.f. (p = .019 for one-tailed test). Both predictors in the quadratic model were significant. The results indicate that at high levels of stress, time management practices are either used infrequently or they are used a great deal. Perhaps those who perceive themselves as highly stressed either do not think they have time to plan and schedule their activities, or, they cannot schedule their activities due to reliance on others for coordination of tasks. On the opposite end of the time management axis, perhaps those who are highly stressed attempt to deal with it through managing their schedules and plans rigorously. Future research using this data should consider examining other associations between time measures and other dimensions of organizational structure.

6.4.7 Hypotheses 10: Organizational Climate

Organizational climate dimensions are generally hypothesized to represent the social and instrumental aspects of the organization, as perceived by each respondent. Climate measures are not direct measures of organizational structure, nor are they direct measures of individual satisfaction with work tasks. Instead, they represent the mediating representations of the organization as an entity separate from, but including, the respondent.

The organizational climate scale adapted for this research came from items in the Litwin and Stringer (1968) instrument. The total number of scale items was reduced to decrease time demands on subjects. Litwin and Stringer suggested a total of nine separate dimensions evident in their instrument; subsequent critiques have suggested that perhaps five dimensions were more plausible (Denison, 1996). Given the authors' intended theoretical distinctions, the resulting abbreviated survey used in this research included a total of four distinct subsets of items: organizational structure and responsibility, risk-taking and conflict, warmth and supportiveness, and satisfaction with group decision making processes. The latter scale also included items from Martin and Harkreader (1995). Of those four subscales, only one showed acceptable levels of reliability. The satisfaction with decision making scale had a standardized Cronbach alpha score = .79. Other subscales had alpha levels well below the Nunnally criterion of alpha = 0.6.

Due to the poor reliability of the climate scale overall, the theoretical factors were abandoned in favor of a principal components analysis of all subscales combined. The resulting retained components yielded two distinct, orthogonal dimensions for the construct. These two dimensions were subsequently used in a regression with the total stress score. The first dimension included items related to information sharing, information availability, group decision process and risk-taking. The second dimension reflected the social supportiveness and friendliness in work relationships. Both were significantly related to total stress score in an inverse relationship: decision processes viewed as more positive, risk-seeking and ambitious were related to lower stress scores. Similarly, organizational climates viewed as supportive and trusting were significantly associated with lower stress.

Hypothesis 10a: Climates perceived as supportive, rewarding and reinforcing will be negatively associated with perceived role stress.

Using the retained climate component with high loadings on this dimension of social warmth, trust and peer support, the data indicate a strong negative association between supportiveness and stress, as hypothesized. The model R^2 = .432 with 1, 27 d.f. (p = .000). Climates where trust and peer support are evident are more likely to facilitate open communication and sharing of opportunities as well as problems for immediate attention. Peers may also offload each others' work overload to balance stress levels.

Hypothesis 10b: Climates are associated with perceived role stress, and moderated by individual personality factors (achievement motivation, locus of control and tolerance for ambiguity).

This hypothesis was not tested because data was not collected for personality factors.

Hypothesis 10c: Climates are associated with perceived role stress, and moderated by organizational structure (span of control, formalization, centralization and hierarchical order).

Hypothesis 10d: Climate factors mediate the association between organizational structure and perceived role stress.

These hypotheses were not tested as stated using regression due to poor measurement reliability. Instead, the researcher reports a canonical correlation on retained components in a later section of the report.

Hypothesis 10e: Climate factors mediate the association between individual personality characteristics and perceived role stress.

Again, individual personality data were not collected, so the hypothesis is not tested.

Hypothesis 12b: Perceived role stress is negatively associated with a composite measure of organizational product and support performance.

This hypothesis was tested two ways. First, a multivariate regression was conducted using both product and organizational support performance measures as predictors of total stress score. This model was insignificant. Next, a MANOVA was conducted using a median split variable for total stress score (with two groups representing the lower and upper halves of the stress range, respectively). Three cases were omitted in the MANOVA because they occupied the median score exactly, thus creating a total N for analysis of 28 cases. Using both product and organizational performance as outcome measures (rather than predictors) and using the stress median split as the group factor, the MANOVA indicated a strongly significant relationship between the stress groups and the performance factors ($F = 5.504$ with 2, 24 d.f., $p = .011$). Examination of the univariate ANOVAS indicated that the organizational support dimension was the most predictive of the stress score. However, the originally hypothesized direction of the relationship was reversed in the actual data. Those who experienced the highest stress also reported having the strongest organizational support for their product.

The explanation for this finding might be that those who work for high performing organizations also have high expectations set for their role and high performance standards to meet. In short, these people are highly motivated to keep succeeding in a group that they regard as already highly successful. Their level of stress indicates factors that they struggle to deal with so they can stay on top of the market and their product management tasks.

6.4.8 Canonical Correlation Analysis

The canonical correlation tables and results are included in appendix F at the end. Due to the limited number of respondents in the study, mediating and moderating relationships among the original constructs of structure, climate, time and stress were of questionable value (the prediction of the regressions would be dubious because there was high likelihood of capitalizing on chance using this small sample). To get around this difficulty, the present researcher used principal component analysis for several constructs and then subsequently conducted a canonical correlation of the retained components. The resulting model was intended to provide an exploratory omnibus test of the relationships among the "left-hand side" of the theoretical model: structure, climate, time perception; with the central mediating variable of stress. In the predictor side, two factors each from formalization, centralization, climate and one factor from time control were used. For the criterion side, two retained for stress were used. As a result of this model, two canonical variates were possible and both were highly significant (Wilks' Lambda statistics = .02235 and .2000, with 14, 44 d.f. and 6, 23 d.f. respectively). P-values were less than .000001 for each variate. Due to the conservatism in selecting the factors for retention, and the corresponding high loadings on the retained factors, each of the canonical variates was regarded as relevant and interpretable within the context of this research. Both stress factors were orthogonal through varimax rotation; the organizational factors used as predictors were not orthogonal, though correlation matrices indicate that they were not highly interdependent. Therefore, the results explained below should be interpreted with caution because intercorrelation among factors "on the same side" of the canonical equation reduces the explanatory power of the canonical result.

The principal components reports are included in the appendices for review. In summary, the two canonical correlations are explained as follows. In the first correlate, the ability to participate and control long range planning decisions (Centralization Factor II) is related to the stress of being responsible for the development of subordinates and peers, and is also related to the perception that work tasks appease one's sense of value and worth (Stress Factor II). Taken together, this correlate suggests a positive motivation to strive for future success based on a responsible, take-charge attitude with long range outlooks in mind. In terms of stress literature, this correlation suggests a "eustress" motivator: the managers view long range prospects and social responsibility as a positive driving factor in their work.

The second correlate, however, is not so positive. It relates the ability to participate in recruiting and staffing decisions (Centralization Factor I), in conjunction with ambiguous, conflicting information and group decision processes (Climate Factor I), to the sense of ambiguity, lack of clarity in expectations and evaluations, and lack of authority to enact necessary tasks. In short, this correlate suggests all the negative aspects of the boundary spanner's role in the day-to-day routine as a transceiver function. Also highly associated with this correlate is the perspective that the respondent feels he or she must look outside the company for future promotion prospects. In stress terms, this correlation indicates a "distress" situation at work.

To summarize, the canonical correlation suggests that this manager sample experiences two sides in their reported stress, one positively motivating and the other negatively distressing. Perhaps the positive offsets the negative as a motivator to keep going in a highly complex, time-pressured occupation. However, as the industry literature suggests, burnout in this industry and role is a big problem; turnover is high and getting higher, and the availability of suitably trained personnel is not keeping pace with the demand. One computer science professor, who provided access to student subjects, complained to the researcher that one third of all CSE majors attrited from the program before graduating because they could get excellent salaries without benefit of graduation.

6.4.9 Summary of Organizational Hypotheses

On balance, several hypotheses linking organizational structure, climate, time perception, and performance with role stress were significant and in the hypothesized direction. Several others were significant and strong, though not in the direction predicted. Perhaps those latter hypotheses were not founded on appropriate theory; or perhaps the directional differences can be explained by changes in the way work is organized and carried out in contemporary organizations. Overall, the hypotheses indicate that organizational structures facilitating rapid, distributed, trustworthy communication throughout the organization are most preferred as a source of superior performance and reduced role stress for this industry. However, high performance and high stress go hand-in-hand; the difference in whether the stress is acceptable may be explained in a positive, long range outlook where some personal trust and control is possible, or a negative outlook based on frustration, ambiguity, and perceived powerlessness to enact success. Those with a positive outlook appear willing to look for their future within the organization. On the other hand, those who are frustrated and beleaguered by the demands of their jobs have already made up their minds to seek opportunities elsewhere.

6.5 Decision Process and Role Stress

Despite the interesting findings presented thus far, the present researcher has not yet provided evidence for the most pressing issue argued in this dissertation report: decision automaticity. The original question to be approached in the present research was: Given what managers *say* about themselves, their work, their cohorts, and their stresses, will those representations correspond to what they actually *do* in a specific experimental decision making environment?

Hypothesis 13: A decision process characterized as highly automatic will exhibit: (a) relatively short duration, (b) low number of processed cues, (c) low variability in time used to process cues, and (d) lower total information variety among cues examined. Conversely, a decision process characterized as low in automaticity will exhibit: (a) relatively long duration, (b) relatively high number of processed cues, (c) high variability in time used to process cues, and (d) relatively more total information variety among cues examined.

This hypothesis was answered partially with the group MANOVA's. Overall, the models suggest significant associations between task duration, number of screens viewed, and total "cognitive distance" traveled in the process of the task. Those who spent more time, looked at more information, and went farther in comparing the information presented are those that would be considered, according to the hypothesis, as less automatic in their decision routine. Unfortunately, however, the statistic for screen time variability, measured as the standard deviations in view time, was not particularly noteworthy in explaining either case condition or group differences.

Of the four measures used, the variability measure was new in relation to prior decision process tracing research. Distance, duration and information complexity have been found associated in one combination or other in many cases. The significant findings for these variables as a single dimension of "cognitive diligence" are not surprising, given the plethora of studies already supporting that factor.

Curiously, extra diligence did not necessarily correlate with greater accuracy, as measured by judgment agreement on the preferred case. However, that finding can be explained by the fact that "accuracy" is defined in this research by a limited set of judges. Those expert raters had access to much more information for each case than was used in the context of this experiment. Moreover, the time scale of the decision problem was not relevant as a representation. Managers do not usually make strategic judgments involving substantial resource commitments in a matter of minutes. Furthermore, the language involved in making them is much more complex than can be captured in an experimental scenario. Nevertheless, the managers obviously found the experimental task interesting and persisted with it, despite the case condition assigned. In fact, their involvement with the experiment was contrary to expectation, due to the already pressing needs of their jobs.

Despite the fact that the standard deviation measure did not bear up to scrutiny, the present researcher decided to take another approach to the data. Instead of viewing the sequence of screens, taken one at a time, as individually meaningful for referencing variability in thought and attention, the researcher decided to divide each respondent's decision sequence into three parts: a beginning, a middle, and an end.

Upon examining a histogram showing the time duration for each screen plotted against the incremental sequence of screens in succession (for each manager separately, as a "within-subjects" view of their processing time), an interesting pattern showed up. The pattern consistently apparent in the data suggested that each subject had a beginning period where their view times tended to be longer, suggesting they might be "thinking about how to approach this task and where to go next". The middle and ending sections of each sequence tended to be associated with shorter view time durations per screen, and the final two or three screens, just before the decision was entered, tended to be associated with minimal screen time. Of course, there were variations in this pattern across all thirty-one manager subjects (individual student sequences were not subjected to this analysis).

The present researcher decided to investigate the differences among *sequence thirds* in the data for all manager respondents taken as individual groups of screen view times. In simpler terms, each sequence of per-screen viewing times was segmented into three equal parts per subject using the total number of screens viewed and divided by 3. Times for screens viewed in each segment were grouped together for all subjects, forming three separate groups of screen view times.

The research question asked of these data was: are the mean times for each viewing segment, across all subjects, equal for all segments, or were they different, with the first segment being the longest? The null hypothesis for this question was that the segmented screen times had equal means. The alternative hypothesis was formulated as a one-tailed test, under the condition that the mean of the first group was significantly larger than the mean view times of either of the other two segments. Prior research by Bavelas (1950) using groups of decision makers indicated that the first stage of decision making took the longest time because the group engaged in self-organization and set up coordinating strategies for communicating among its members during the first stage of problem solving (Wofford, Gerloff and Cummings, 1977).

Using a one way ANOVA, this hypothesis was supported. The overall ANOVA provided $F = 2.602$ with 2, 90 d.f. ($p = .04$ for one-tailed test). The linear term for the first contrast was significant with $F = 4.075$ ($p = .0235$). In comparing the three time segment groups, the first segment of the task had the highest mean viewing time, and the other two segments had approximately equal times.

A subsequent ANOVA was done, using segmentation groups, case type, and stress group type as factors. Again, the overall ANOVA statistic suggested that the segment of mean view time was the significant factor explaining the data; stress group or case condition were not statistically significant. The stress group assignment of each respondent was carried out using Ivancevich and Matteson's (1980) recommended splitting criterion for determining low, moderately low, moderate, moderately high, and high levels of stress, based total stress score on 30 items. The scoring criterion was adjusted for the ratio of 21 used items to the original scale of 30 items. With that grouping of scores, three groups emerged from the sample data, ranging from Ivancevich and Matteson's moderate score level to high score level, in three groups. The lower two groups of stress score, indicating very low and low moderate stress, were not represented in this sample. Their absence was anticipated because the sample is representing a population under more stress than the general working public (which is why it is of particular interest to this research).

Despite the fact that the stress group factor did not prove to be statistically significant, the graphs of marginal group means tells the story. Tables for the MANOVAS and graphs of group marginal means are provided in Appendix H. The graphs indicate that as stress levels increase I the sample, there is a tendency for the marginal means for view time to decrease as well, and case conditions are different in how marginal mean view times are sequenced. For the two case task, the mean view times steadily decreased in duration from beginning to end segment. For the four case task, the mean view times were longer in the beginning, shortest in the middle, and moderate at the end of the decision task. The group means for the different stress group levels show clearly that those under the highest levels of stress, whether in the two or four case condition of the task, had the shortest view times of all groups (with the exception of the beginning segment; the high stress group exceeded the view time of the middle stress group). *As the respondents traversed from beginning to end, the duration for per screen view times got increasingly shorter, on average, in direct relation to how much stress the subject reported.*

Although this relationship was not found to be significantly apparent with statistical tests of group comparison, it is plainly visible in the mean values shown in the plots. The sample used for this exercise was small, attenuating power to find significant differences. Nevertheless, the graphic evidence suggests that indeed, representations of stress are associated with greater automaticity, as measured in time devoted to examining each information screen. This evidence suggests tentative, qualified support for the following final hypothesis:

Hypothesis 14: Perceived role stress is associated with variables of individual decision process in a curvilinear relation; at positions of both low and high stress, the decision process will tend towards high automaticity, while at a position of moderate stress, the decision process will tend towards low automaticity.

The curvilinear relationship expected was not found; perhaps there was simply not enough data to find it. The relation expected under condition of high stress was found, and in the expected direction.

The research significance of this finding, though tentative, indicates that existing decision research theory should be modified. Currently, the literature tends to support the overall idea that decision making can be split into two types: compensatory processes, which use pairwise comparisons of attributes and construction of a complex value function for choice; and non-compensatory processes, which tend to focus quickly on a single dominant value or attribute and then make subsequent data comparisons based on that single important factor. The first type of process is theorized to represent a more rigorous, analytical, and cognitively complex process than the second. The literature has explained these differences in terms of whole processes in which there is not necessarily as shift in the process somewhere along the way. The present research indicates that indeed, perhaps decision makers do shift from compensatory to non-compensatory processes, once they have "made up their mind" somewhere in the sequence, and continue to validate their choice to themselves by seeking information to bolster their own confidence to act in declaring their choice publicly. Moreover, being under stress appears to force that sequential process of "weighing the evidence" to come to a conclusion early in the process, with late-coming evidence is merely scanned.

For those in strategic planning and product planning roles, coming to a conclusion too early, without benefit of adequate evidence, may be a problem for organizational effectiveness. While it gets the stress of decision off the back of the agent, it does not fulfill the long range goals of the organization if it leads to sub-optimal and unsupported choices. In a market where timing is everything, it is hard to know when it is better to go ahead and take action, before somebody else rushes in ahead, and when it is preferable to wait for the opportunity that only takes shape for those willing to see it unfold over time.

CHAPTER 7

CONCLUSION

7.1 Introduction

This chapter provides concluding comments, discussion and implications for future research. The limitations of the research are also discussed, as well as suggestions for improvement in further research using the constructs theorized in the original model. Finally, the contributions of the present dissertation study are outlined as they apply to research and practice.

Currently, information technology is in a heyday. According to one of the management participants, one sector of the telecommunications industry, optical transport systems, is expected to grow 100% annually over the short term and probably 30 to 40 percent annually over the next decade or more. Undoubtedly, information in various forms, speeds and uses is being demanded at larger and larger quantities throughout the world. World population is growing, and infrastructure to support increased use of telecommunications and information systems is also growing in underdeveloped areas. However, the growth prediction for information transport is not based on those factors alone. Growth is also expected to come from greater intensity and broader use of information in its many forms throughout business and society in the developed sectors of the world economy. In short, the prediction is that the general public will consume more and more data via electronic media, despite the fact that every human being is limited to some fraction of a 24-hour day in devoting attention to that data stream.

Certainly, many sectors of society are not flooded with electronic data; there is indeed tremendous room for growth and expansion of this valuable social resource.

However, in a few small pockets of society, particularly in business, electronic data exposure is reaching less-than-comfortable levels. One of the research objectives of this study was to investigate a subject population in one of those "pockets". The general aim was to see if and how effort and attention paid to information processing on a given task might be associated with subjects' reports of their work environments, relationships, management practices and stress levels. The assumption underlying the expected association between work environment and information processing mechanics was that information processing is a learned behavior, dependent to a great degree on the routine channeling and social systems that support it. Repeated exposure to stress and overload was theorized to produce coping patterns providing relief from information and stress over-exposure. Those coping behaviors, as discussed in several literatures, were expected to show up as certain information processing mechanics or behavioral routines at the level of individual cognition in an experimental exercise.

A sample of telecommunications managers, noted as one of the most uncertain, dynamic industries in current business, has indicated that decision process and information search pattern is indeed associated with self-reports of stress, ambiguity and responsibility. Interestingly, those managers who appear to report the greatest stress are also more likely to rate their organization as more supportive and effective in managing its product resources. This finding runs counter to the expectation in this study.

Even more interesting, however, is the alarming contrast between what managers say they experience (as stressors), how they rate their organizations as support systems for their product efforts (as potential stress-relievers), and how they actually carry out a decision exercise requiring search and evaluation of different product scenarios. Those who tend to give their organization highest marks for performance are also those who tend to spend the least effort and time attending to information in this experimental situation.

Why did those who say they are more "stressed" spend less time and effort in coming to their decision evaluation—did they feel obligated to terminate as quickly as possible because of too many other pressing work matters? Alternatively, why did those who spent greater time and effort on this research also report being under less stress? From the measures of work and stress collected, none of the individuals in the sample is bored; on the basis of established stress measure criteria (Ivancevich and Matteson, 1980), all subjects in the research sample indicate that they fall into one of the top three levels of stress scores. All participants in this study are therefore experiencing at least moderate stress, in terms of the general population. Is the real issue uncovered in this research benchmarked by some objective measure of information overload or task complexity, or is it more accurately the self-assessed *representation* of overload that makes the difference in spending time and effort? This research cannot supply the answer. Nevertheless, the research did uncover a relation between the language representation of stress, as measured via survey items, and a behavioral process of information search and decision making, as measured via a process tracing system. More detailed discussion and analysis of data are explored in the previous chapter.

7.2 Limitations of the Current Study

As McGrath, Martin and Kulka (1982) explain, all research is fundamentally flawed. Time and resource constraints prevent any investigator from presenting evidence without ambiguity, much less indisputable proof. This research is no exception. Figure 6 uses McGrath's circumplex of research designs to indicate what tradeoffs have been made in the present design and data measurements. The reader is cautioned to take its shortcomings into account when interpreting the findings.

Type and quantity of respondents in the sample are narrow in relation to the population of business decision makers. The use of one particular industry to represent the

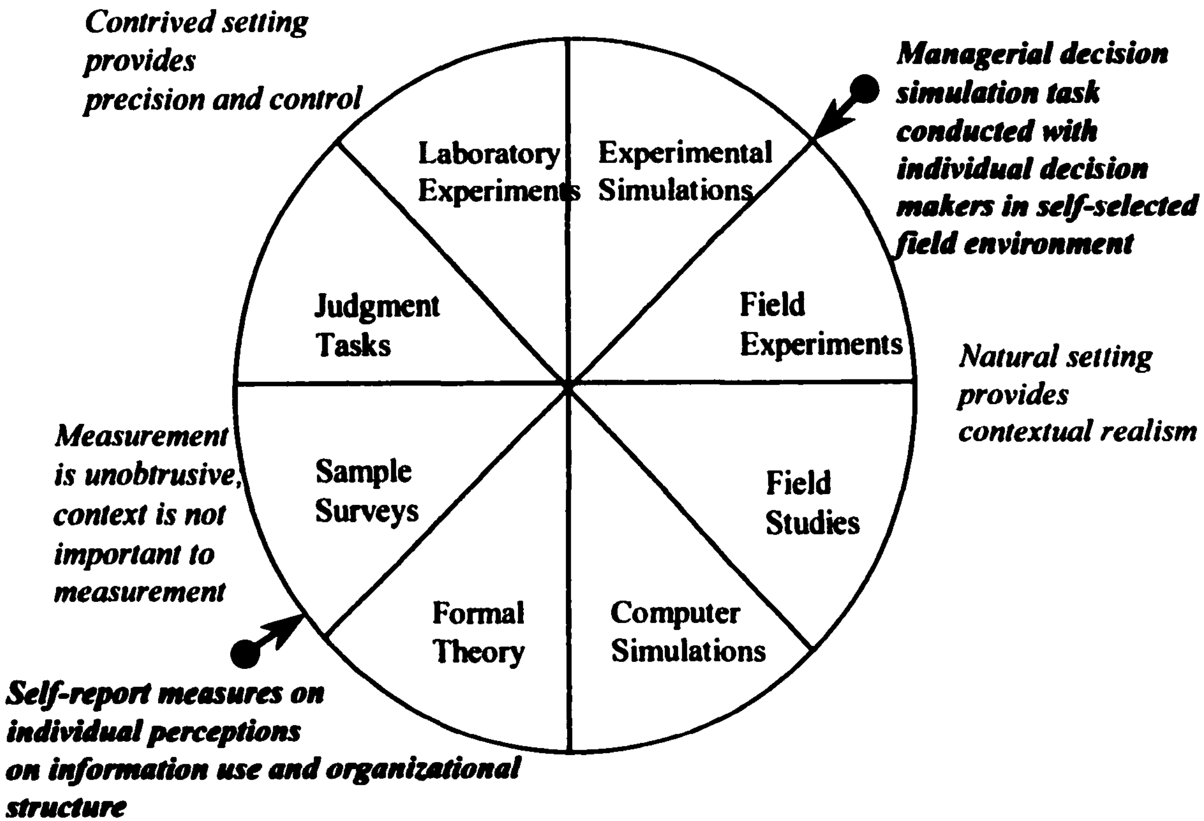


Figure 6. Location of Measurement Methods in McGrath's Research Circumplex.

general business population is intentional, based on assumed environmental (industry) attributes and resulting assumed decision stresses on agents (as detailed in chapter 5). Nevertheless, that research choice poses threats to external validity across other decision agents in other industries.

The research tool for the dependent measure does not reflect a well-established protocol taken from a prior domain. Furthermore, many of the measures included in this research design are self-report measures. A wider array of measurement methods enhances construct definitions and their hypothesized relations (Pedhazur and Schmelkin, 1991). This research design uses two types of instruments. Because this research is a field investigation of a complex cognitive process embedded in a complex organizational system, any causal relations are merely suggested through associations of measures. Confirmatory analytical evidence for any current theory is neither assumed nor tested. Unfortunately, sample size was not adequate to permit confirmatory testing.

Measurement is taken from subjects at a point-in-time, and to a great extent, that point-in-time is selected by the subject. Spurious events or decision conditions may have caused certain decision responses. For example, a sudden personal or work-related emergency, illness or exhaustion may play have played a significant role in subjects' responses. The present researcher has tried to make the instrumentation as "context-free" as possible to avoid the problems of rival causes arising from the particular field context. However, as a field investigation, many factors remain uncontrolled. The hope is that the benefits of gaining access to real-time learned decision process behavior offsets the limitations of field confounding. A parallel laboratory study with other subjects, in which context conditions are tightly controlled, might provide a basis for measuring the degree to which field contexts have confounded (or enhanced) the distinctions among modes of decision making behavior. Such a study might be the basis for a future research project.

A focal research issue is whether or not certain organizational characteristics facilitate certain kinds of decision processes as learned behavior. Underlying is the assumption that decision behavior is really *learned*, i.e., exhibits some routine or algorithm repeated over time, and that learning is determined by both organizational (contextual) and individual psychological factors (Argyris and Schon, 1978; Huber, 1991; Weick, 1979). Moreover, the research assumes that if decision behavior is a learned behavior, at least in part, then it is also a caused behavior. As cause must precede an effect in time (Kelly and McGrath, 1988), then the present researcher has assumed that whatever has caused the decision behavior being measured is already in the subject's "past." Furthermore, that cause is not being captured in the method of the research because the study is not really longitudinal. It does not capture the entire learning process involved in generating decision responses to the simulated tasks; instead, it relies on the assumption that subjects will behave as if confronted with a decision task similar to those already "learned" from exposure to their organizational settings. This distinction is important because the reader should not be led to think that the decision simulation reflects the organizational learning process of generating routines in decision making, even though there is an element of temporal sequencing and time elapse in the simulation instrument. Rather, the research intent was to capture the subject's decision process, ***assuming that similar behavior already takes place routinely under actual organizational decision conditions***, with certain organizational traits having already made their influence on the subject's cognitive apparatus.

This study involves cross-level hypotheses and constructs. The literature review summarizes important considerations where empirical results at one level of analysis are compared with those at another level. Because this research takes cues from both individual and organizational definitions of "uncertainty," comparing research as it applies to the relevant level of analysis is important to this study's hypotheses.

Finally, the measurement of the decision process and sequence was at best rudimentary. Though significant relationships and patterns emerged from these data, undoubtedly a more refined system of data collection would be preferred. Confounds such as transmission irregularities, differences in computing and transmission machinery, differences in ambient interference experienced while engaged in the task, and other random factors cannot be ruled out as inconsequential. Nevertheless, the results were generally significant and in the hypothesized directions in many cases, and those outcomes are encouraging for the model proposed.

Unfortunately, the time constraints for the subject population precluded collecting data on many individual level factors theorized to make relevant differences in the experience of role stress. For example, degree of perceived "control" over one's general lifestyle, tolerance for ambiguous circumstances, types of preferred coping style, and needs for achievement were not compared and contrasted within the sample. The fact that differences in reported stress existed and were significantly associated with differences in decision process make individual factors even more relevant to study in future research.

7.3 Directions for Future Research

Future study in this area should focus on overcoming the most serious limitations present in this study. From the perspective of the present researcher, the most serious weaknesses in the current study are related to sample size, sample characteristics, cross-sectional design, and measurement validity. Each will be addressed below.

7.3.1 Sample Size and Characteristics

The sample of managerial subjects was not large, though it was quite difficult to obtain voluntarily. Perhaps future managerial samples can be encouraged to participate on the basis of the significant findings in the present study. Other than the summary of findings promised to all respondents, perhaps greater participation can be achieved with better "compensation" for volunteered time and effort. Probably the most appropriate reward that does not include monetary compensation is the potential to receive a private briefing as to the individual subject's decision behavior and performance. Those subjects who reported the greatest stress might be interested to note what stress may be doing to affect their information processing behavior at work.

The differences between management and student subjects were somewhat surprising, especially when the similarities in educational background and level are considered. Managers showed more diligence in doing the research tasks, despite the fact that students were promised more reward for participating. In contrast, managers did not show greater accuracy in reaching a product case decision. However, the diligent search behavior is probably a reflection of managers' willingness and learned persistence to evaluate ambiguous information, as well as their sense of ego involvement with the task expectations and language representations of the task content. The difference between the management and student samples, however, suggests that student subjects should not be used as surrogates for managerial counterparts in this type of research. There is obviously more to managerial cognition than students may be able to demonstrate, even with their education considered.

The original aim of the research was to take several subjects from each organization and compare their decision behavior both within and between organizations. Also, the research issues involved exploring where individuals from the same organization diverged in their opinions as well as their behavior. Unfortunately, the sample obtained was not large enough to make those comparisons. Future research might try to examine a limited set of organizations, with a specified number of participants in each, to uncover organization-level similarities and differences, captured as cognitions. Perhaps a practical way to approach an organizational question is to get the support of senior marketing or product management, who might be very interested to know how their "organizational thinking patterns" are similar and different to others in their industry or in other industries with similar work technologies and information demands. Senior management might then be able to solicit internal support for participation, though anonymity must be assured. The present researcher believes, however, that this approach may yield very different results than those obtained here. Having top management knowledge and sponsorship of the project might turn away those very individuals who are experiencing the most stressful situations at work for fear of reprisal. Thus, range restriction on certain key variables might result.

At the very least, a second sample of telecom managers might prove very useful in confirming the results obtained from this sample. Confirmatory factor analysis could investigate the robustness of relationships shown to be significant in the present findings.

7.3.2 Alternatives to Cross-sectional Design

As mentioned in a prior section, this research design is cross-sectional, even though longitudinal time measurements were taken for the decision task. The assumption was made that the behavior demonstrated on the decision task would be similar to that process followed in most normal work-related cognitive processing tasks. Of course, this is a huge assumption in explaining the data obtained. As noted earlier, many confounding factors that typically plague cross-sectional studies cannot be ruled out.

One of the simplest ways to control for individual subject-related factors is to design a decision experiment using repeated measures. This experimental design alternative would allow each subject to be his or her own "blocking factor", controlling for many sources of extraneous measurement error. Besides the error associated with individual differences, a repeated measures design might also successfully control for differences in computer and communication instrumentation used for the task. If each subject used the same workstation and network for receiving and transmitting data remotely, then any increments in duration that might vary with those factors could be dismissed. The hurdle in creating a repeated measures design is varying the case content between exposures so that the subject does not "learn" the intended response pattern. Furthermore, the time between task exposures should be great enough so that the subject is not bored or overly motivated to concentrate on the decision experiment in uncontrolled ways.

As an alternative to a fully repeated decision exercise, perhaps subjects could be asked to respond to more than one intellective task, where learning effects are not judged likely to play a role in the responses. With more than one type of cognitive exercise, variations in decision and search pattern could be compared between multiple types of tasks, rather than between multiple occasions for the same task. In the present research design, the comparison was made between multiple conditions of the same task, and between multiple groups randomly assigned to only one condition. This research plan showed relevant differences between subject groups, but was not designed to show contrasting behavior within each subject, independently of others. To get a more thorough picture of stress and its relationship to decision process, a more refined measure of individual subject behavior is desirable.

7.3.3 Future Research Measurement Validity

Finally, future research would benefit from using multiple operations for the stress construct, as well as multiple operations and social report measures for many of the organizational constructs. Further, there are probably other ways to capture the decision process of the respondents in greater detail and with greater accuracy. While remote monitoring of subjects' decision behavior had the advantage of allowing each subject to participate at his or her convenience, it also introduced the potential for many instrumentation errors, confounds and outright failures. It is possible that another set of data from an equivalent population of subjects might not produce the same result, despite random assignment efforts. Unfortunately, the task environments were not randomly assigned to subjects along with the task condition; therefore, it is possible that there were systematic differences in "stress" reported among subjects that were truly dependent on the type of mediation technologies available to the respondents. The present researcher suggests that instrumentation error may very well account for some of the relationships found significant, and therefore, the results may be due to systematic, unmeasured associations rather than measured construct relationships. The significance levels for the hypothesis tests do not take systematic, unmeasured factors into account. Replication of the experiment would tell that tale.

7.4 Implications for Practice

The present research has provided several "take away" messages worth noting. The first one is that managers under higher relative stress appear to decide *differently* and *less thoroughly* than those under less stress. They are less thorough in that: (1) they take less time, (2) look at fewer cues, and (3) deviate less in their cognitive exploration as they come to their choices. This research finding supports prior laboratory studies of decision making under time pressure, distraction, and other factors that alter one's concentrated effort to pay attention.

An important distinction between the present research design and prior laboratory studies is how "stress" is manipulated. In many laboratory experiments, the researcher manipulates information cues through their presentation in pace, duration, complexity and infusion of irrelevant information. The present research, however, has relied on varying levels of self-reported stress, or *cognitive representations* of pace, complexity and frustration with routine information processing tasks at work. Interestingly, the managers in the sample behaved like their laboratory counterparts as their reported "stress" increased; however, their "stress" rule is self-determined rather than researcher-imposed.

If the decision process captured here is similar to the learned decision behavior of the respondent in their normal work routine, then the data suggest that those who *say* they are under greater stress really do decide differently. What this research cannot answer is whether or not *any* individual experiencing similar work conditions would indeed report the same level of "stress" as the individual respondent reporting. Nevertheless, what the manager "says" about being under stress, and what he or she "does" in decision making, do appear to have a significant relationship in these data.

One implication is that managers can reach a critical stress threshold for undermining effective decision making that is much lower than the stress threshold for simply "scanning" high numbers of cues or reaching the crisis of "burnout" (Shapero, 1985, 173). Having too much to do and too much to absorb is not necessarily just a personal complaint to be dismissed as individual overwork. The complaint may signal that the individual decision maker has surpassed that point of effective thinking and interpreting as a subsystem of the *organizational mind*. The symptoms of "burnout" are discussed in terms of emotional overload, but not necessarily as a learned cognitive response to symbolic overload. Even the individual who apparently "thrives" on fast-paced, complex situations with high ambiguity (e.g., the Type A personality) is not necessarily optimizing his or her ability to thoroughly consider, compare and evaluate decision alternatives using a variety of reference frames.

Even when the individual decision maker's believes that he or she is operating in an optimal "stress" comfort zone, the cognitive contribution of that person as a "thinking agent" may not be optimal for organizational purposes. Many tasks such as product management require special skills, expertise, and high levels of professional training. The salaries demanded for such specialists are relatively high, representing significant costs to the organization at large. The organization hiring those individual specialists expects to receive corresponding expert judgment and thinking from those people as its organizational decision making agents. If the information systems used by its cadre of specialized "thinkers" *routinely* undermines their capacity to make thorough judgments, then the organization is not getting full value from its own expertise, and may eventually erode their valuable judgment skills by limiting their ability to practice them.

The difficulty remaining, which the research does not address, is assessing when reports of "stress" are really systematically detrimental or just plain complaining. One guideline might be to take assessments of personal "stress" and look for more widespread agreement among groups or managerial divisions. Isolated high stress roles may have special information processing duties that might be more usefully distributed among several roles. A showing of common "high-stress" reports among managers working together may signal a work unit that thinks suboptimally as a group. As a single "thinking unit," important environmental cues may missed as each team member fails to recognize and communicate data and relationships important to the group outcome.

The research also appears to support two different interpretations for the old adage, "Take your time." The first is that some decisions cannot be rushed; if they are, a different decision will probably result because the data considered may be analyzed differently. The problem solved with the hurried decision is not necessarily the one that deserved the attention in the first place. Moreover, as an individual and as a team member, it is important to develop a good sense of when "enough is enough." Some decisions must be made with the information available within a certain time frame, because the frame, and not necessarily the information, is the *raison d'etre* of the decision *at the time*.

Finally, the marked differences between students and practicing managers indicates just how much manager judgment has probably changed through their exposure to organizations, learned routines, and repeated decision tasks. Using student subjects as surrogates for practicing managers in decision research is shown here to be a highly questionable substitution of cognitive processing ability. Learning through experience appears to be important to judgment process as well as judgment outcomes.

7.5 Summary

The purpose of the research project reported in this dissertation was to explore the relationships among factors of organizational structure, work climate and social relations, perception of time, and organizational performance as they are associated with different levels of attentiveness and cognitive effort shown on an actual experimental task. The task was derived to elicit cognitive processing that has been learned over time through exposure to various task-related constraints, routines and strains. Some of the expected relationships were found significantly related as hypothesized. A few relationships were found significant, but not in the expected direction. On balance, this research has shown some interesting evidence to link cognitive representation with actual decision behavior using a sample of managers from the telecommunications industry. The findings from this study suggest that much more work is needed to expose and clarify the underlying causal relations that operate in the associations shown here.

As a contribution to research on decision making, the research project involved creating and validating a new decision process tracing instrument, design, and data collection methodology using remote monitoring. The data outcomes from the new approach were surprisingly easy to verify for each subject. The software system provided a detailed trace capture for several important and well-accepted measures of decision process and some new measures that may not have been gathered with prior process tracing tools.

In addition to the process tracing system, a new product management decision task was created and tested on more than 130 qualified subjects in business and advanced university courses in related subject areas. The decision task showed evidence of validity with managerial subjects; task conditions also showed differences in complexity necessary to manipulate the desired cognitive effort expended. The decision task, as it is now formulated, can be used on other subject samples for research and teaching purposes. In addition, the information content of the task can be adapted by using other case materials suitable for other decision scenarios and other subject populations.

Other than the introduction of new approaches to decision process tracing and the decision task content, the research results indicated significant practical relationships between reports of stress in managerial subjects and their cognitive effort and processing in an actual decision task, as hypothesized. Moreover, most relationships uncovered in the research were in the hypothesized direction, suggesting that stress does indeed inhibit the expenditure of effort and cognitive complexity when it is experienced at high levels. These findings corroborate with researchers studying stress both at the organizational level, as role stress, and at the individual level, as cognitive stress. This cross-level evidence indicates that organizational information design factors do have a role to play in the cognitive functioning and effort of its agents, acting in their roles as information processors and decision makers on behalf of the organization. The important practical issue suggested with that finding is that individuals may not be fully aware of the toll that their stress is taking on their good judgment and thorough thinking. Just as in Wheaton's (1997) image of the rusting bridge, the organizational agent whose cognitive processing is overly stressed may miss seeing the important cues that prevent the organization from serious judgment mistakes.

APPENDIX A

SAMPLE DEMOGRAPHIC CHARACTERISTICS

LIST OF MANAGER TITLES INCLUDED IN SAMPLE

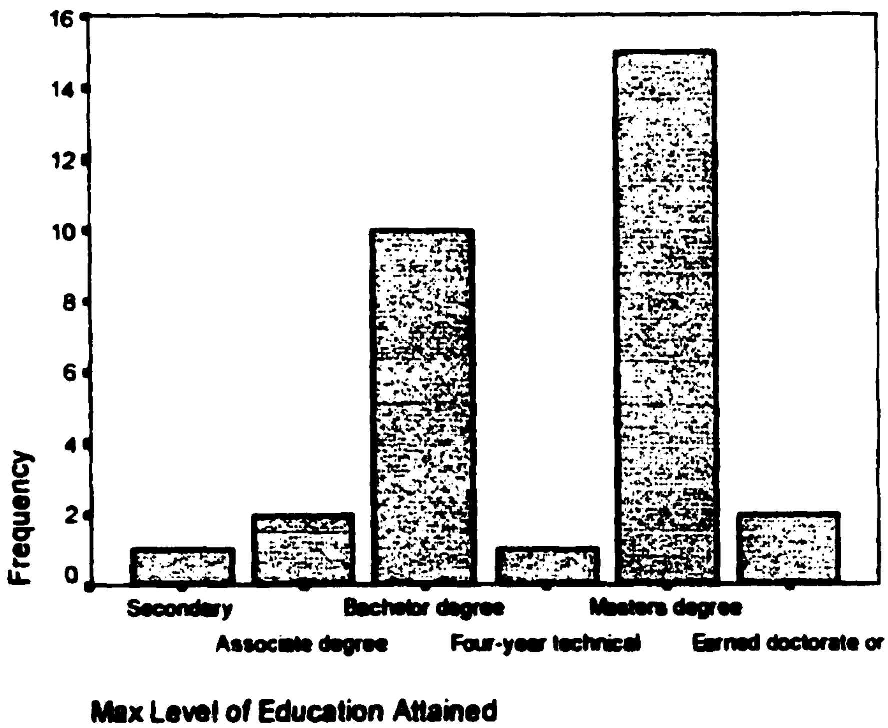
Vice President, Product Management
Director Technical Operations
Solutions Engineer
Product Line Manager
Senior Account Engineer
Account Manager
Regional Manager, Sales
Manager, Special Projects / Local
Director of Applications Engineering
Senior Systems Engineering Manager
Manager, Access Product Line Product Management
Regional Manager
Senior Manager
Staff Manager Network Services
Senior Manager, Products
Interconnections Services Consultant
Vice President of Business Development
Vice President, Product Marketing and Services
Consulting Systems Engineer
Product Manager
Test Engineer
Applications Engineer
Product Planner
Account Manager
Director, Marketing

Note: Some titles appeared more than once in the responses; duplicates were omitted.

Max Level of Education Attained for Manager Sample

Max Level of Education Attained

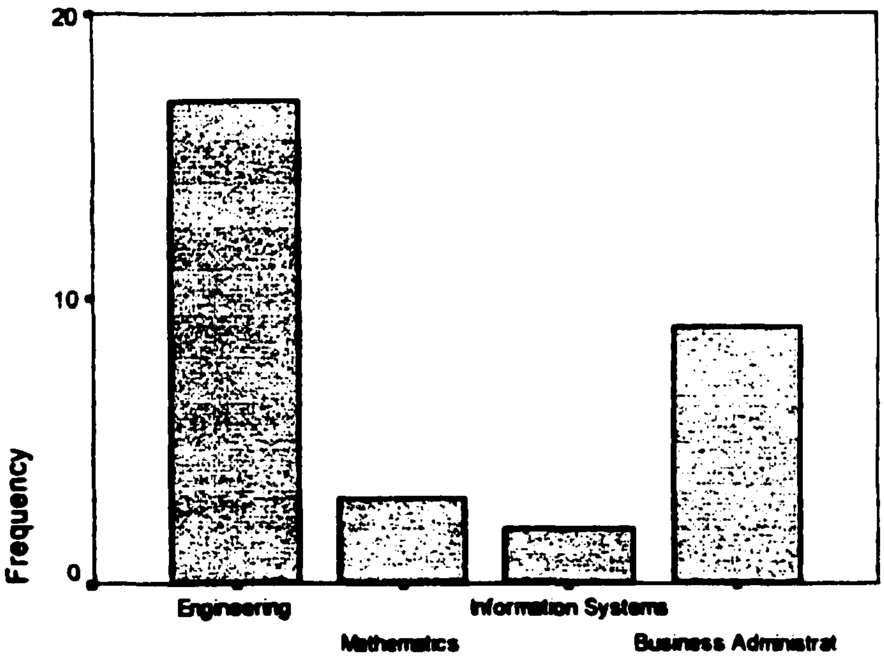
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Secondary	1	3.2	3.2	3.2
	Associate degree	2	6.5	6.5	9.7
	Bachelor degree	10	32.3	32.3	41.9
	Four-year technical degree	1	3.2	3.2	45.2
	Masters degree	15	48.4	48.4	93.5
	Earned doctorate or Ph.D	2	6.5	6.5	100.0
	Total	31	100.0	100.0	



Education Content, by Discipline for Manager Sample

Education Content, by Discipline

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Engineering	17	54.8	54.8	54 8
	Mathematics	3	9 7	9 7	64.5
	Information Systems	2	6 5	6 5	71 0
	Business Administration	9	29 0	29 0	100.0
	Total	31	100 0	100 0	

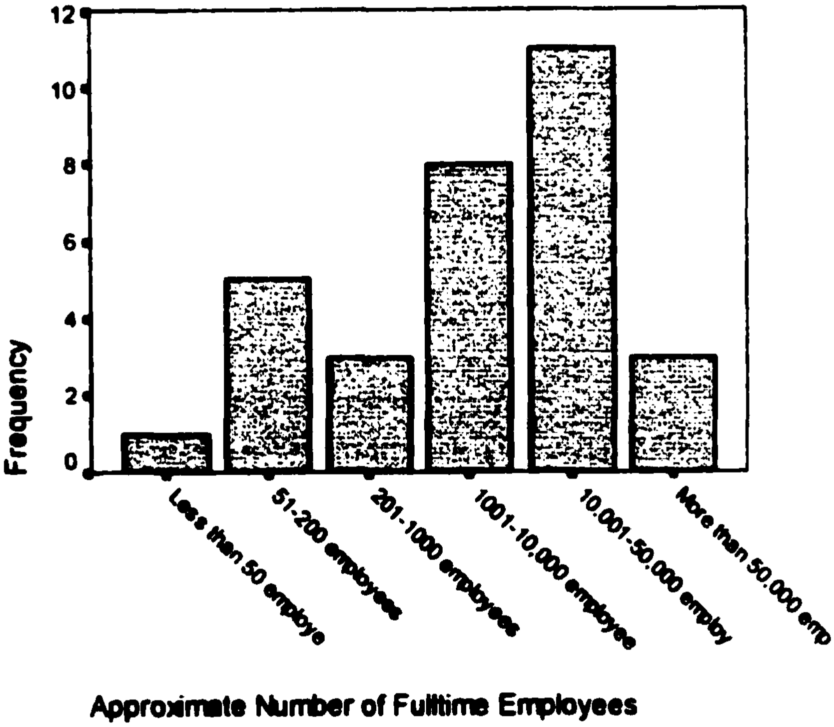


Education Content, by Discipline

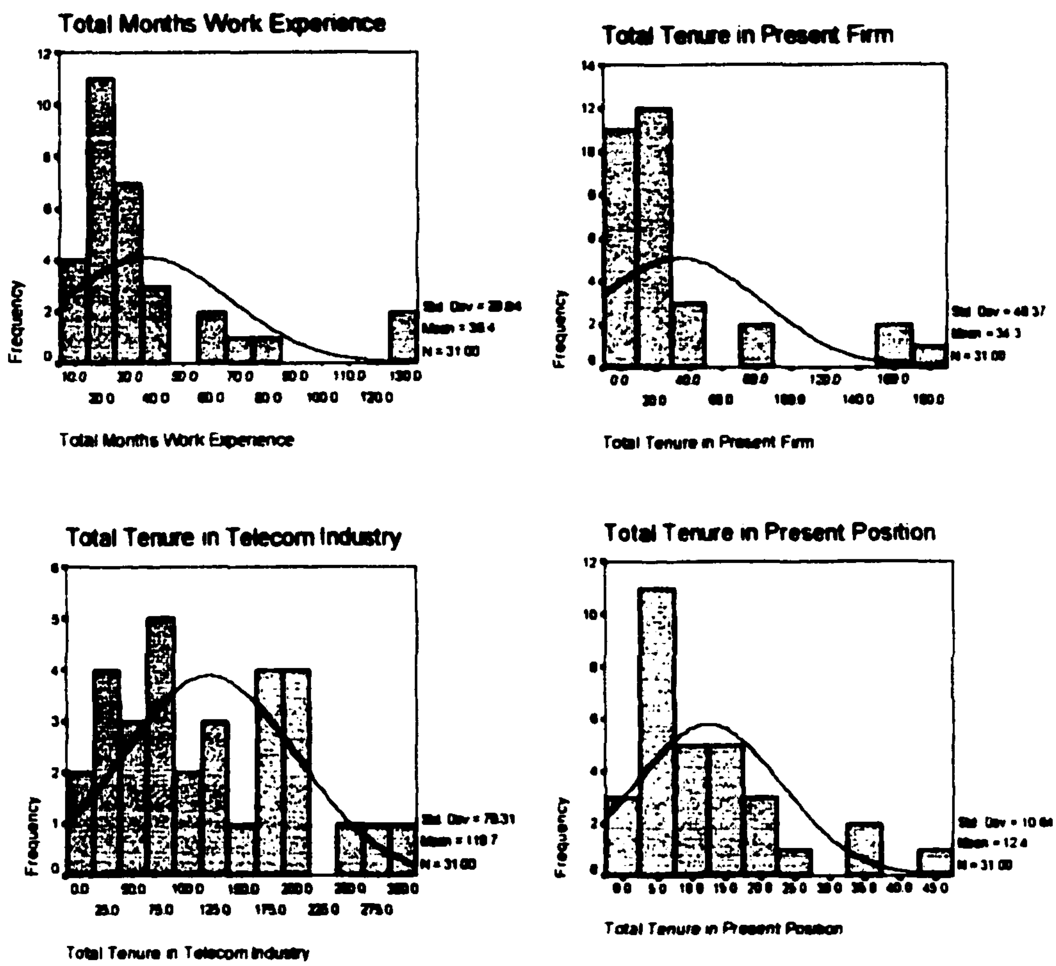
Approximate Number of Fulltime Employees in Respondents' Firms

Approximate Number of Fulltime Employees

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 50 employees	1	3.2	3.2	3.2
	51-200 employees	5	16.1	16 1	19 4
	201-1000 employees	3	9 7	9 7	29 0
	1001-10,000 employees	8	25 8	25 8	54 8
	10.001-50,000 employees	11	35 5	35.5	90 3
	More than 50,000 employees	3	9 7	9 7	100 0
	Total	31	100.0	100 0	



Tenure and Experience Statistics for Manager Respondents



Statistics

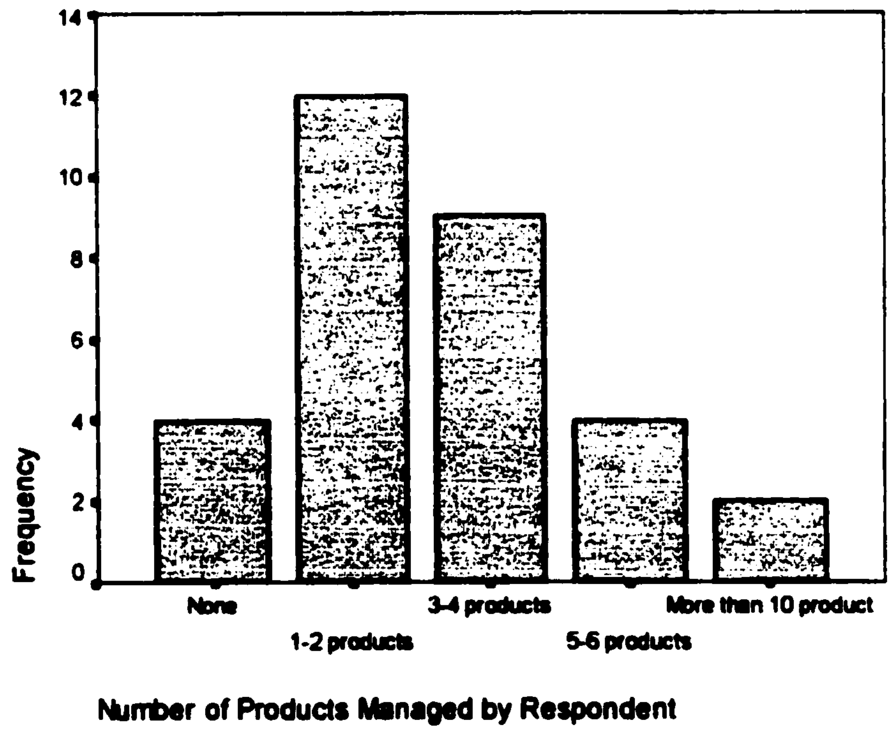
		Total Months Work Experience	Total Tenure in Present Firm	Total Tenure in Present Position	Total Tenure in Telecom Industry
N	Valid	31	31	31	31
	Missing	0	0	0	0
Mean		36.35	34.29	12.39	119.71
Median		25.00	15.00	9.00	107.00
Std Deviation		29.94	48.37	10.64	79.31

All measures are given in months of tenure or experience

Number of Products Managed by Respondent

Number of Products Managed by Respondent

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	4	12.9	12.9	12.9
	1-2 products	12	38 7	38 7	51 6
	3-4 products	9	29 0	29 0	80 6
	5-6 products	4	12.9	12 9	93 5
	More than 10 products	2	6.5	6 5	100 0
	Total	31	100 0	100 0	



Time Spent on Work Tasks, Manager Sample

Time Spent Working at Home

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	4	12.9	12.9	12.9
	1-10 hours	18	58.1	58.1	71.0
	11-20 hours	8	25.8	25.8	96.8
	51-60 hours	1	3.2	3.2	100.0
	Total	31	100.0	100.0	

Time Spent Working at Regular Office

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-10 hours	4	12.9	12.9	12.9
	11-20 hours	1	3.2	3.2	16.1
	21-30 hours	5	16.1	16.1	32.3
	31-40 hours	5	16.1	16.1	48.4
	41-50 hours	5	16.1	16.1	64.5
	51-60 hours	9	29.0	29.0	93.5
	More than 60 hours	2	6.5	6.5	100.0
	Total	31	100.0	100.0	

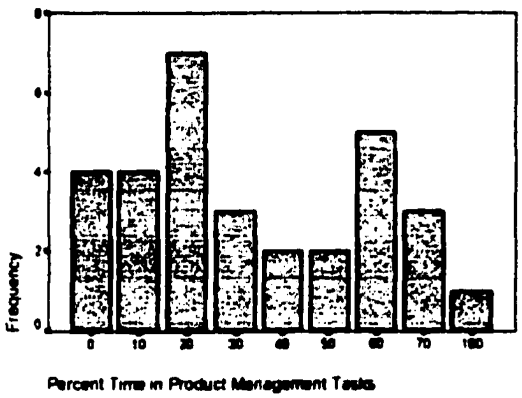
Time Spent Working while Traveling

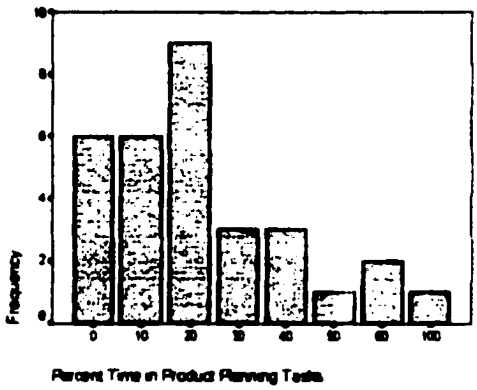
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	4	12.9	12.9	12.9
	1-10 hours	14	45.2	45.2	58.1
	11-20 hours	9	29.0	29.0	87.1
	21-30 hours	2	6.5	6.5	93.5
	31-40 hours	1	3.2	3.2	96.8
	99	1	3.2	3.2	100.0
	Total	31	100.0	100.0	

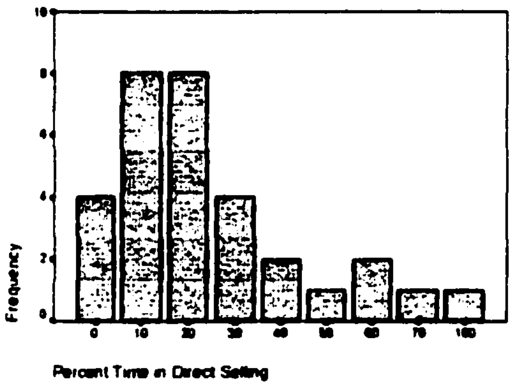
Percent Worktime Devoted to Product Management Functions

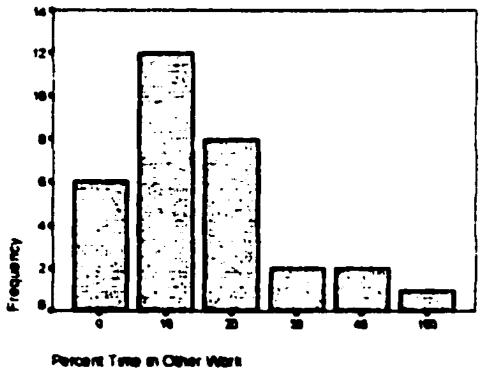
Statistics

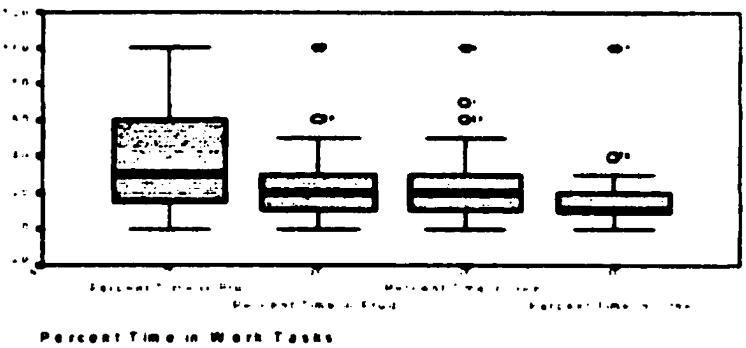
		Percent Time in Product Management Tasks	Percent Time in Product Planning Tasks	Percent Time in Direct Selling	Percent Time in Other Work
N	Valid	31	31	31	31
	Missing	0	0	0	0











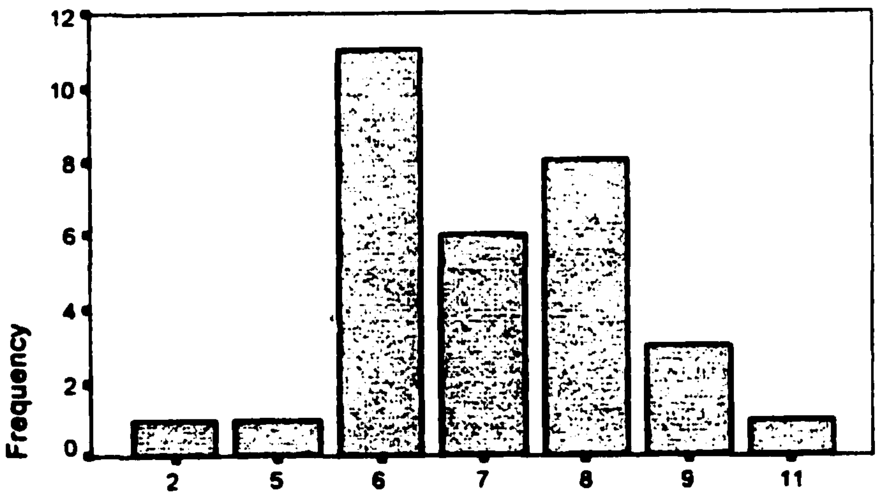
Total Work Time per Week for Manager Sample

(as a combined sum of ordinal categories

Total Worktime per Week, as Ordinal Measure

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	1	3.2	3.2	3 2
	5	1	3 2	3.2	6.5
	6	11	35.5	35.5	41.9
	7	6	19 4	19 4	61.3
	8	8	25 8	25 8	87 1
	9	3	9.7	9 7	96.8
	11	1	3 2	3.2	100 0
	Total	31	100.0	100.0	

Total Worktime per Week, as Ordinal Measure

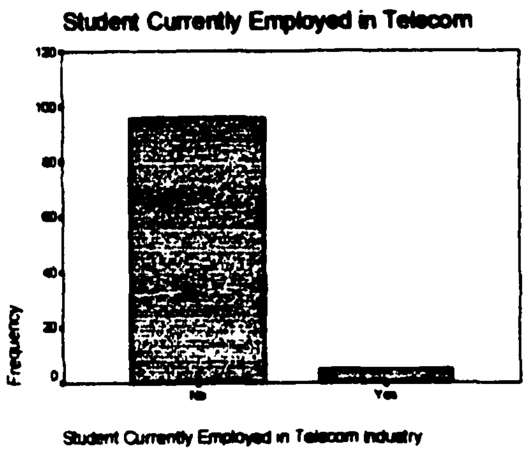


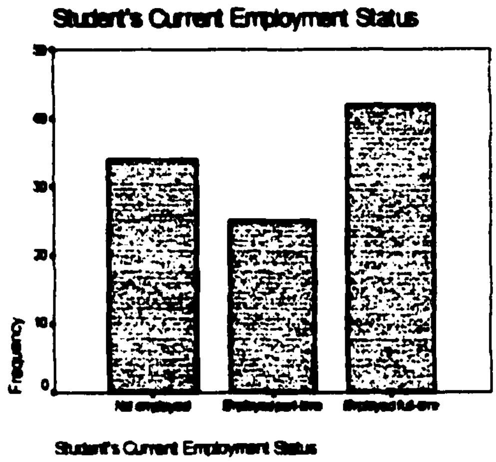
Total Worktime per Week, as Ordinal Measure

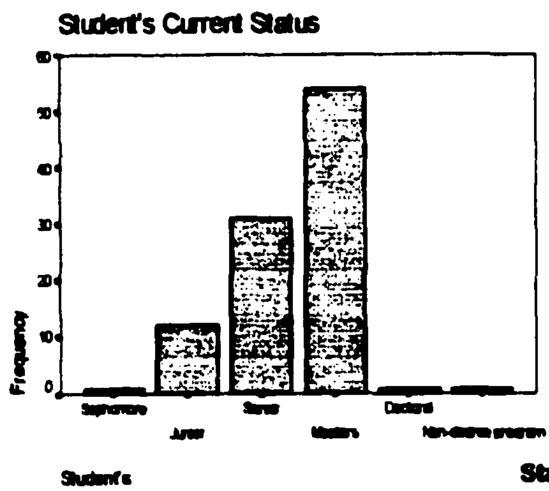
X axis values are combined %iles for office, home and travel

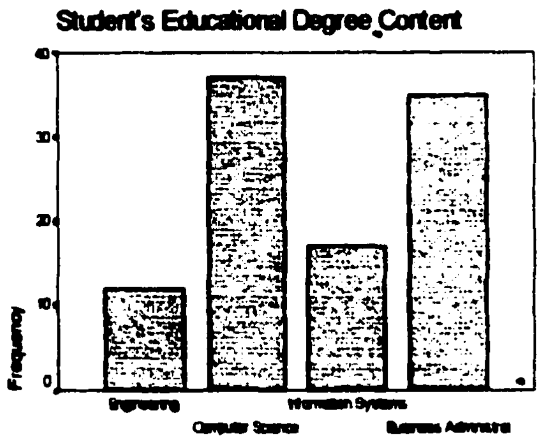
Bar values may range from 3 to 30 hours in actual value

Student Demographic Characteristics









Statistics

		Student's Current Status	Student's Educational Degree Content	Student's Current Employment Status	Student Currently Employed in Telecom Industry
N	Valid	100	101	101	101
	Missing	1	0	0	0

Group * Task Condition Crosstabulation

Count

		Task Condition		
		Two-case condition	Four-case condition	Total
Group	CompSciEngrg Stude	24	23	47
	Business Student	24	30	54
	Manager	13	18	31
Total		61	71	132

Cell counts reflect total cases analyzed after deleting cases unsuit inclusion in the final analysis samples.

APPENDIX B

RESPONDENT COMMENTS

Part 1. Student Comments on Final Screen (not in any order, not edited)

Pretty good interface

Questions were too vague, using words with ambiguous meanings.

Also, THETA goals was to offer high quality and high volume, low-cose products.

Compared to SIGMA, THETA products meet the project's deadline on time,

but SIGMA's product shipped to customers two years later than originally planned and

THETA's product was delivered within 14 months of project initiation.

Also, THETA's product has good quality and performance.

It would have been nice to have some concrete descriptions on the product that is being developed.

I understand the surveyors

You asked the question which do you think would be rated highest by an expert,

I said the second. I am currently enrolled in the Software Engineering class, and

have learned about how some software companies are "Judged by Experts" based on their

software processes. It is based on preset defined processes with strict plans and

large amounts of data collection. The second company seemed to have goals and

set processes, while the first did not have them as fixed. Thus, I believe it would win

this test. Nevertheless, I firmly believe in a less ordered plan. From my class I have

come to understand the need for some of the strict processes, but only see them as

beneficial in limited ways that do not upset the final product. However, to answer the

real question, which company do I think will do the best in the end, it would be the first.

This researh projecti is challange for me improve my skill.

I found the information given to be very helpful in the decision making process.

However, it becomes difficult to remember which company does which from screen to screen.

Delta was the choice for me due to 33% increase of share and that from what I could tell, it's only obstacle was a number of "bugs" in the process that can be ironed out.

I think you could make it a better decision if it was known that all the companies projects are competing at the same time over the same market share.

Then you could make the decision easier as these projects would be directly competing with each other.

Excellent real-life example

Very interesting! The examples reminded me of the move to digital wireless comunications. (Motorola, Erickson, Sony/Qualcom? , Nokia)? The company I selected was very similar to the one that I work for, which was a small factor in my decision.

too many screens of information... all focus topics could have been put on one screen. I did not look at all the information because it was taking too long to click through and read everything

The research project itself is no problem, however, the initial questionaire regarding my employment status was confusing to me. Specifically, the wording did not seem to really apply to someone like myself who has quit their fully time job and returned to school.

Very unique survey. Pretty interesting overall.

I don't quite like the format of the information presented, one has to go back and forth to recall the information. However, I like the content of the information presented. They are subtle enough to make me think hard; but they are not impossible to solve.

Most important factors were competitive position and internal structure of the company

It would be helpful to have more information on one screen instead of reselecting.

It is good research projejct. However, could have more questions.

The project desciption for Sigma appeared to have more of a negative connotation to it than Theta. This might have subconciously influenced some of the survey participants. Perhaps this was intended.

The last page for ranking should have been shown in the tutorial so we know what to expect for justifying the selection.

I had a feeling all the way up to the end of the exercise that the final decision I would have to make would be about the success/failure of certain management practices not the success/failure of a product. It is probably impractical to attempt to determine the success of a product from the limited information made available. The Arenas part of the decision appeared more "on target". The structure of the survey may be dictated by the goals of the academic project, but it would have been more useful and exciting to give participants greater choice of actions/decisions. Good luck.

I didn't like the design. I would rather have been given an outline with links so I would have been clicking so much and I could possible have weighed the information side by side.

I didn't have a passion for the material so my response was based on my keeping track in my mind and selecting the best fit. Sorry for such a bland response but its hard to make managerial decisions for Theta and Sigma.

It is very iteresitng.

Part 2. Manager Comments from Final Screen (not in any order, not edited)

A tad long. The decision exersise was interesting given data presentation

The best project selection exercise would have been easier if all the data sould

have printed out to enable comparisons. I got confused on trying to remember

which company was strong\weak in which area.

Coordination between Engineering and Manufacturing."""

The most important thing to be weighed is the market oppty and condition, little information was given.

fun exercise

Survey covered key points regarding the workplace environment. These are many of the things I consider when picking a job/career path. The case study spurred thought on key philosophical issues.

It's a little long.

I found the exercise difficult from the perspective that I had to keep clicking back and for to compare like categories for Sigma and Theta. This may have been done on purpose as part of the exercise. However, I fel I would have made a better decision if there were two columns for SIgma and Theta with the like categories side by side.

I'm generally in favor of free thinking and allowing for everyone to get in on the idea crunching aspect of any project. However, for this to be really functional it requires a strong upper management leadership and good strategic plan. I generally like the freedom of the Sigma company however it seemed destined to fail because no one seem willing to take charge and lead the company.

I found the survey well done and easy to follow. It was interesting and I'm anxious to see the results of the research.

APPENDIX C

STUDENT SAMPLE ANALYSIS

•

MANOVA for Student Groups Comparison

Multivariate Tests[b]

Effect		Value	F	Hypothesis df	Error df	Sig
Intercept	Pillai's Trace	762	75 378[a]	4 000	94 000	000
	Wilks' Lambda	238	75 378[a]	4 000	94 000	000
	Hotelling's Trace	3 208	75 378[a]	4 000	94 000	000
	Roy's Largest Root	3 208	75 378[a]	4 000	94 000	000
STUDTYPE	Pillai's Trace	082	2 110[a]	4 000	94 000	086
	Wilks' Lambda	918	2 110[a]	4 000	94 000	086
	Hotelling's Trace	090	2 110[a]	4 000	94 000	086
	Roy's Largest Root	090	2 110[a]	4 000	94 000	086
CASETYPE	Pillai's Trace	139	3 795[a]	4 000	94 000	007
	Wilks' Lambda	861	3 795[a]	4 000	94 000	007
	Hotelling's Trace	162	3 795[a]	4 000	94 000	007
	Roy's Largest Root	162	3 795[a]	4 000	94 000	007
STUDTYPE * CASETYPE	Pillai's Trace	075	1 913[a]	4 000	94 000	115
	Wilks' Lambda	925	1 913[a]	4 000	94 000	115
	Hotelling's Trace	081	1 913[a]	4 000	94 000	115
	Roy's Largest Root	081	1 913[a]	4 000	94 000	115

a Exact statistic

b Design Intercept+STUDTYPE+CASETYPE+STUDTYPE * CASETYPE

MANOVA for Student Groups Comparison

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Cognitive Distance	9496.557[a]	3	3165.519	5.234	.002
	Number of Screens Viewed	4932.532[b]	3	1644.177	4.627	.005
	Standard Deviation in Seconds	1921.131[c]	3	640.377	1.745	.163
	Task Duration in Seconds	7164697.074[d]	3	2388232.358	5.041	.003
Intercept	Cognitive Distance	137280.845	1	137280.845	226.981	.000
	Number of Screens Viewed	77328.825	1	77328.825	217.611	.000
	Standard Deviation in Seconds	26903.125	1	26903.125	73.297	.000
	Task Duration in Seconds	81141650.2	1	81141650.24	171.287	.000
STUDTYPE	Cognitive Distance	1016.077	1	1016.077	1.680	.198
	Number of Screens Viewed	783.189	1	783.189	2.204	.141
	Standard Deviation in Seconds	1715.656	1	1715.656	4.674	.033
	Task Duration in Seconds	1896669.256	1	1896669.256	4.004	.048
CASETYPE	Cognitive Distance	6809.501	1	6809.501	11.259	.001
	Number of Screens Viewed	3384.933	1	3384.933	9.526	.003
	Standard Deviation in Seconds	3.958E-03	1	3.958E-03	.000	.997
	Task Duration in Seconds	3525205.009	1	3525205.009	7.442	.008
STUDTYPE * CASETYPE	Cognitive Distance	2335.484	1	2335.484	3.862	.052
	Number of Screens Viewed	1115.542	1	1115.542	3.139	.080
	Standard Deviation in Seconds	148.162	1	148.162	.404	.527
	Task Duration in Seconds	2219663.392	1	2219663.392	4.686	.033
Error	Cognitive Distance	58666.809	97	604.812		
	Number of Screens Viewed	34469.330	97	355.354		
	Standard Deviation in Seconds	35602.909	97	367.040		
	Task Duration in Seconds	45950638.9	97	473717.926		
Total	Cognitive Distance	205841.000	101			
	Number of Screens Viewed	116804.000	101			
	Standard Deviation in Seconds	63501.981	101			
	Task Duration in Seconds	133227834	101			
Corrected Total	Cognitive Distance	68163.366	100			
	Number of Screens Viewed	39401.861	100			
	Standard Deviation in Seconds	37524.040	100			
	Task Duration in Seconds	53115335.9	100			

a. R Squared = .139 (Adjusted R Squared = .113)

b. R Squared = .125 (Adjusted R Squared = .098)

c. R Squared = .051 (Adjusted R Squared = .022)

d. R Squared = .135 (Adjusted R Squared = .108)

Estimated Marginal Means for Student Samples

1. Grand Mean

Dependent Variable	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Cognitive Distance	37.068	2.460	32.185	41.951
Number of Screens Viewed	27.821	1.886	24.078	31.564
Standard Deviation in Seconds	16.410	1.917	12.605	20.214
Task Duration in Seconds	901.194	68.858	764.530	1037.859

2. Group

Dependent Variable	Group	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Cognitive Distance	CompSciEngrg Student	40.257	3.588	33.136	47.379
	Business Student	33.879	3.368	27.196	40.563
Number of Screens Viewed	CompSciEngrg Student	30.620	2.750	25.162	36.079
	Business Student	25.021	2.581	19.898	30.144
Standard Deviation in Seconds	CompSciEngrg Student	20.554	2.795	15.006	26.101
	Business Student	12.266	2.623	7.059	17.472
Task Duration in Seconds	CompSciEngrg Student	1038.976	100.417	839.676	1238.277
	Business Student	763.412	94.245	576.361	950.464

3. Task Condition

Dependent Variable	Task Condition	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Cognitive Distance	Two-case condition	28.813	3.550	21.767	35.858
	Four-case condition	45.324	3.408	38.560	52.088
Number of Screens Viewed	Two-case condition	22.000	2.721	16.600	27.400
	Four-case condition	33.641	2.612	28.457	38.826
Standard Deviation in Seconds	Two-case condition	16.416	2.765	10.928	21.904
	Four-case condition	16.403	2.655	11.134	21.672
Task Duration in Seconds	Two-case condition	713.354	99.343	516.185	910.523
	Four-case condition	1089.035	95.377	899.738	1278.332

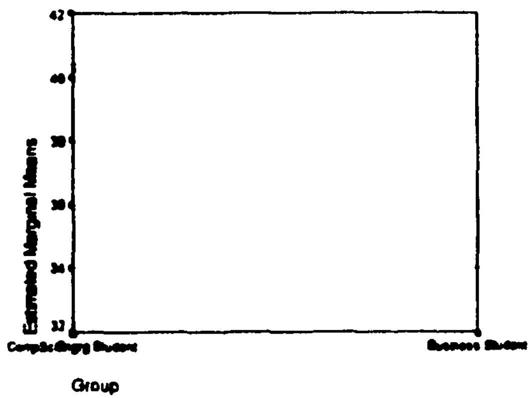
MANOVA for Student Groups Comparison

4. Group * Task Condition

Dependent Variable	Group	Task Condition	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Cognitive Distance	CompSciEngrg Student	Two-case condition	27.167	5.020	17.203	37.130
		Four-case condition	53.348	5.128	43.170	63.525
	Business Student	Two-case condition	30.458	5.020	20.495	40.422
		Four-case condition	37.300	4.490	28.389	46.211
Number of Screens Viewed	CompSciEngrg Student	Two-case condition	21.458	3.848	13.821	29.095
		Four-case condition	39.783	3.931	31.981	47.584
	Business Student	Two-case condition	22.542	3.848	14.905	30.179
		Four-case condition	27.500	3.442	20.669	34.331
Standard Deviation in Seconds	CompSciEngrg Student	Two-case condition	19.342	3.911	11.580	27.104
		Four-case condition	21.765	3.995	13.836	29.694
	Business Student	Two-case condition	13.490	3.911	5.728	21.251
		Four-case condition	11.042	3.498	4.099	17.984
Task Duration in Seconds	CompSciEngrg Student	Two-case condition	702.083	140.493	423.244	980.923
		Four-case condition	1375.870	143.515	1091.033	1660.706
	Business Student	Two-case condition	724.625	140.493	445.786	1003.464
		Four-case condition	802.200	125.661	552.798	1051.602

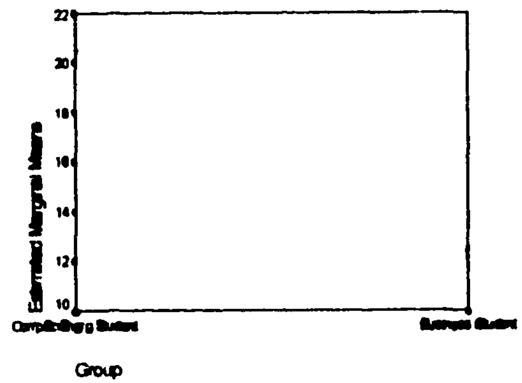
MANOVA for Student Groups Comparison
Profile Plots for Student Groups

Estimated Marginal Means of Cog Distance

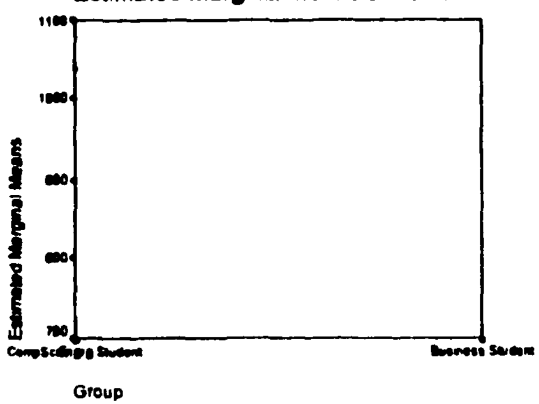


Estimated Marginal Means of Std Dev in Seco

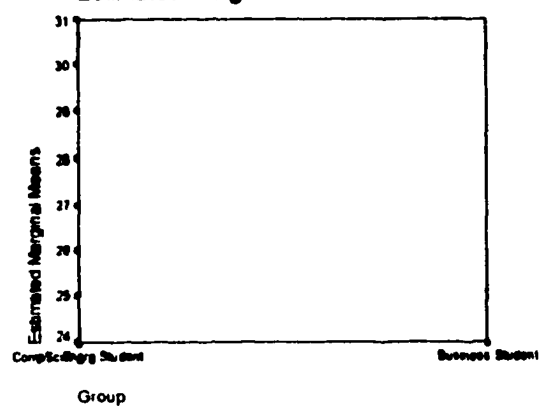
Screen Viewing Variability



Estimated Marginal Means of Task Duration



Estimated Marginal Means of Screen Number



APPENDIX D

COMPARISON OF MANAGER AND STUDENT GROUPS ON DECISION EXERCISE

MANOVA for Managers and Students Combined

Between-Subjects Factors

		Value Label	N
Task Condition	2	Two-case condition	61
	4	Four-case condition	71
Group	1	CompSciEngrg Student	47
	2	Business Student	54
	3	Manager	31

Box's Test of Equality of Covariance Matrices[a]

Box's M	229.955
F	4.189
df1	50
df2	17476.074
Sig.	.000

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept+CASETYPE+STUDTYPE+CASETYPE * STUDTYPE

Levene's Test of Equality of Error Variances[a]

	F	df1	df2	Sig.
Cognitive Distance	8.815	5	126	.000
Number of Screens Viewed	9.305	5	126	.000
Standard Deviation in Seconds	2.015	5	126	.081
Task Duration in Seconds	8.224	5	126	.000

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+CASETYPE+STUDTYPE+CASETYPE * STUDTYPE

MANOVA for Managers and Students Combined

Multivariate Tests[d]

Effect		Value	F	Hypothesis df	Error df	Sig.	Noncent Parameter	Observed Power[a]
Intercept	Pillai's Trace	786	112 612[b]	4 000	123.000	000	450.450	1.000
	Wilks' Lambda	214	112 612[b]	4.000	123 000	.000	450 450	1.000
	Hotelling's Trace	3.662	112 612[b]	4 000	123 000	.000	450.450	1.000
	Roy's Largest Root	3.662	112 612[b]	4.000	123 000	.000	450.450	1.000
CASETYPE	Pillai's Trace	109	3 758[b]	4 000	123 000	.006	15.032	878
	Wilks' Lambda	891	3 758[b]	4 000	123 000	.006	15.032	878
	Hotelling's Trace	.122	3 758[b]	4 000	123 000	.006	15 032	.878
	Roy's Largest Root	122	3 758[b]	4 000	123 000	.006	15.032	.878
STUDTYPE	Pillai's Trace	.112	1 837	8 000	248 000	.071	14 699	774
	Wilks' Lambda	.891	1 832[b]	8 000	246.000	.072	14.659	.773
	Hotelling's Trace	120	1 827	8 000	244.000	.073	14 617	.771
	Roy's Largest Root	086	2.663[c]	4 000	124.000	.036	10 654	.728
CASETYPE * STUDTYPE	Pillai's Trace	079	1 282	8 000	248 000	253	10.253	.585
	Wilks' Lambda	921	1.291[b]	8 000	246 000	248	10 330	588
	Hotelling's Trace	.085	1 301	8.000	244 000	.244	10 405	.592
	Roy's Largest Root	079	2 464[c]	4 000	124 000	049	9 858	690

a. Computed using alpha = 05

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level

d. Design Intercept+CASETYPE+STUDTYPE+CASETYPE * STUDTYPE

MANOVA for Managers and Students Combined

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[a]
Corrected Model	Cognitive Distance	11690.220[b]	5	2338.044	4.240	.001	21.200	.955
	Number of Screens Viewed	6190.182[c]	5	1238.036	3.853	.003	19.264	.933
	Standard Deviation in Seconds	2119.706[d]	5	423.941	1.327	.257	6.636	.457
	Task Duration in Seconds	7217187.437[e]	5	1443437.487	3.680	.004	18.399	.921
Intercept	Cognitive Distance	193154.960	1	193154.960	350.288	.000	350.288	1.000
	Number of Screens Viewed	109794.523	1	109794.523	341.692	.000	341.692	1.000
	Standard Deviation in Seconds	32690.833	1	32690.833	102.339	.000	102.339	1.000
	Task Duration in Seconds	102616524	1	102616524.3	261.610	.000	261.610	1.000
CASETYPE	Cognitive Distance	5774.960	1	5774.960	10.473	.002	10.473	.895
	Number of Screens Viewed	2741.006	1	2741.006	8.530	.004	8.530	.826
	Standard Deviation in Seconds	89.355	1	89.355	.280	.598	.280	.082
	Task Duration in Seconds	1938367.269	1	1938367.269	4.942	.028	4.942	.597
STUDTYPE	Cognitive Distance	2453.093	2	1226.546	2.224	.112	4.449	.447
	Number of Screens Viewed	1715.308	2	857.654	2.669	.073	5.338	.521
	Standard Deviation in Seconds	1715.748	2	857.874	2.686	.072	5.371	.524
	Task Duration in Seconds	1943740.582	2	971870.291	2.478	.088	4.955	.490
CASETYPE * STUDTYPE	Cognitive Distance	2689.690	2	1344.845	2.439	.091	4.878	.483
	Number of Screens Viewed	1337.098	2	668.549	2.081	.129	4.161	.421
	Standard Deviation in Seconds	288.688	2	144.344	.452	.637	.904	.122
	Task Duration in Seconds	2950954.204	2	1475477.102	3.762	.026	7.523	.678
Error	Cognitive Distance	69478.689	126	551.418				
	Number of Screens Viewed	40487.060	126	321.326				
	Standard Deviation in Seconds	40249.171	126	319.438				
	Task Duration in Seconds	49423442.2	126	392249.541				
Total	Cognitive Distance	281006.000	132					
	Number of Screens Viewed	159670.000	132					
	Standard Deviation in Seconds	75959.284	132					
	Task Duration in Seconds	163955193	132					
Corrected Total	Cognitive Distance	81168.909	131					
	Number of Screens Viewed	46677.242	131					
	Standard Deviation in Seconds	42368.677	131					
	Task Duration in Seconds	56640629.7	131					

a. Computed using alpha = .05

b. R Squared = .144 (Adjusted R Squared = .110)

c. R Squared = .133 (Adjusted R Squared = .098)

d. R Squared = .050 (Adjusted R Squared = .012)

e. R Squared = .127 (Adjusted R Squared = .093)

MANOVA for Managers and Students Combined

Estimated Marginal Means for All Groups

1. Grand Mean

Dependent Variable	Mean	Std Error	95% Confidence Interval Lower Bound	Upper Bound
Cognitive Distance	39.624	2 117	35 434	43 814
Number of Screens Viewed	29.874	1 616	26.676	33 072
Standard Deviation in Seconds	16 301	1 611	13.112	19 490
Task Duration in Seconds	913 297	56 466	801 553	1025 041

2. Task Condition

Dependent Variable	Task Condition	Mean	Std Error	95% Confidence Interval Lower Bound	Upper Bound
Cognitive Distance	Two-case condition	32 772	3.133	26 571	38 974
	Four-case condition	46 475	2 848	40 839	52 111
Number of Screens Viewed	Two-case condition	25 154	2 392	20 420	29 888
	Four-case condition	34 594	2 174	30 292	38 896
Standard Deviation in Seconds	Two-case condition	17 153	2 385	12 434	21 873
	Four-case condition	15 449	2 168	11 159	19 738
Task Duration in Seconds	Two-case condition	787 775	83 573	622 385	953 164
	Four-case condition	1038 819	75 954	888 509	1189 130

3. Group

Dependent Variable	Group	Mean	Std Error	95% Confidence Interval Lower Bound	Upper Bound
Cognitive Distance	CompSciEngrg Student	40.257	3 426	33 477	47 037
	Business Student	33 879	3 215	27 516	40 242
	Manager	44 735	4 273	36 278	53 192
Number of Screens Viewed	CompSciEngrg Student	30 620	2 615	25 445	35 796
	Business Student	25 021	2 455	20 163	29 878
	Manager	33 981	3 262	27 525	40 437
Standard Deviation in Seconds	CompSciEngrg Student	20.554	2 608	15 393	25 714
	Business Student	12 266	2 447	7 422	17 109
	Manager	16.084	3 253	9 647	22 521
Task Duration in Seconds	CompSciEngrg Student	1038 976	91 376	858.147	1219 806
	Business Student	763 412	85 759	593 697	933 128
	Manager	937 502	113 979	711 941	1163 063

MANOVA for Managers and Students Combined

Post Hoc Tests

Cognitive Distance

	Group	N	Subset 1
Tukey HSD[a,b]	Business Student	54	34.26
	CompSciEngrg Student	47	39.98
	Manager	31	45.39
	Sig.		.078

Means for groups in homogeneous subsets are displayed.
Based on Type III Sum of Squares
The error term is Mean Square(Error) = 551.418.

a. Uses Harmonic Mean Sample Size = 41.636.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.

Number of Screens Viewed

	Group	N	Subset 1
Tukey HSD[a,b]	Business Student	54	25.30
	CompSciEngrg Student	47	30.43
	Manager	31	34.39
	Sig.		.054

Means for groups in homogeneous subsets are displayed.
Based on Type III Sum of Squares
The error term is Mean Square(Error) = 321.326.

a. Uses Harmonic Mean Sample Size = 41.636.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.

MANOVA for Managers and Students Combined

Post Hoc Tests

Standard Deviation in Seconds

	Group	N	Subset 1
Tukey HSD[a,b]	Business Student	54	12.13
	Manager	31	15.67
	CompSciEngrg Student	47	20.53
	Sig.		.081

Means for groups in homogeneous subsets are displayed.
Based on Type III Sum of Squares
The error term is Mean Square(Error) = 319.438.

a. Uses Harmonic Mean Sample Size = 41.636.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.

Task Duration in Seconds

	Group	N	Subset 1
Tukey HSD[a,b]	Business Student	54	767.72
	Manager	31	937.65
	CompSciEngrg Student	47	1031.81
	Sig.		.132

Means for groups in homogeneous subsets are displayed
Based on Type III Sum of Squares
The error term is Mean Square(Error) = 392249.541.

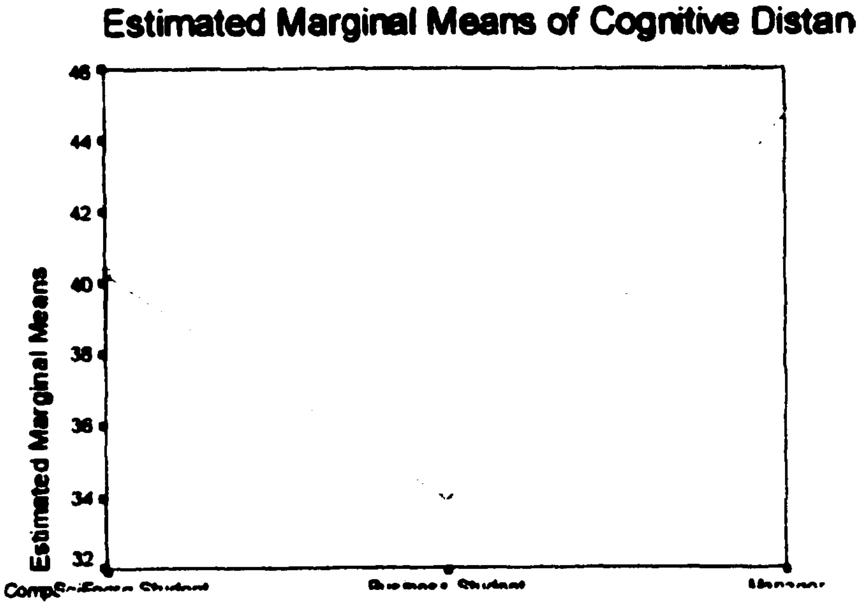
a. Uses Harmonic Mean Sample Size = 41.636.

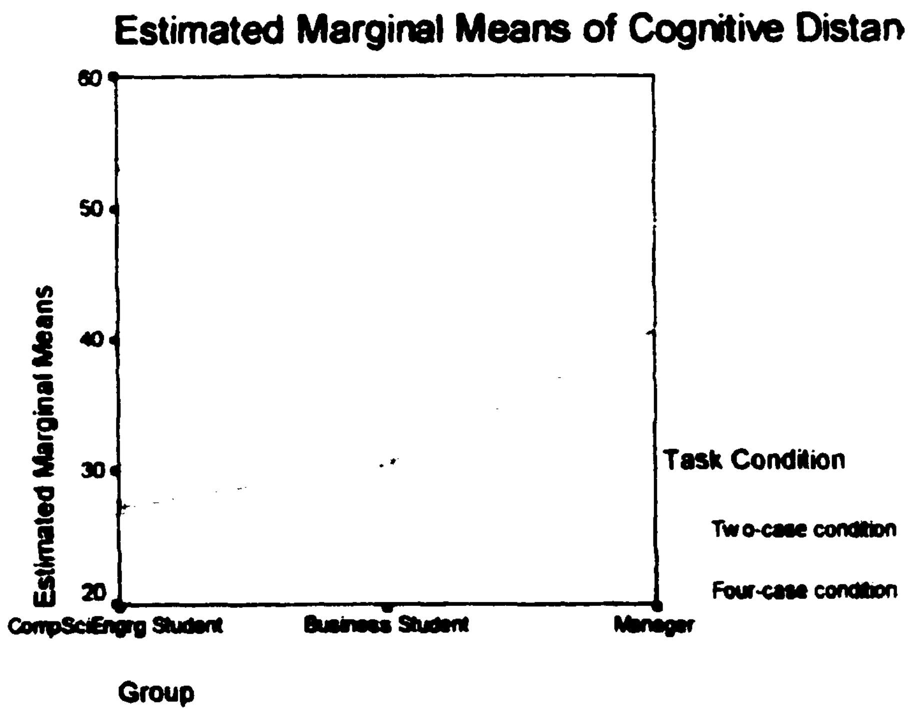
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05

MANOVA for Managers and Students Combined

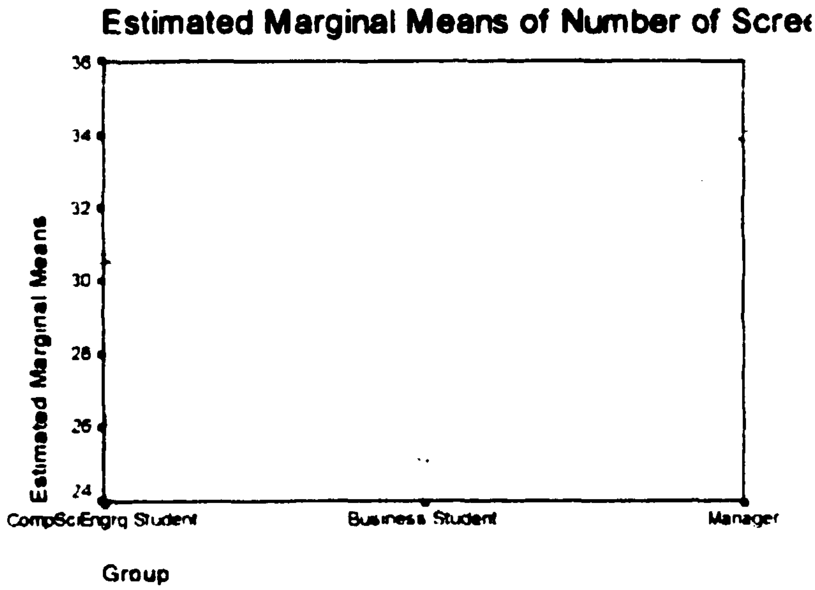
Profile Plots

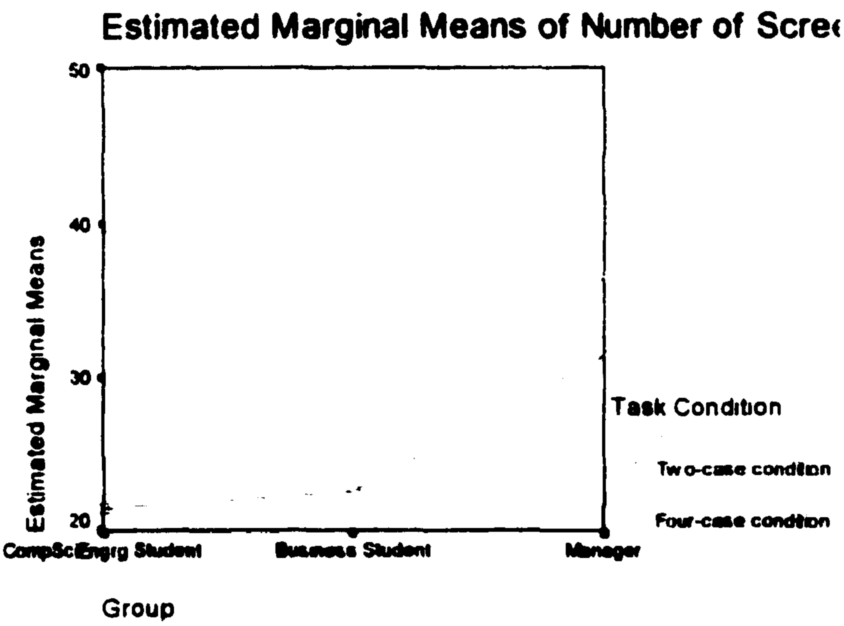




MANOVA for Managers and Students Combined

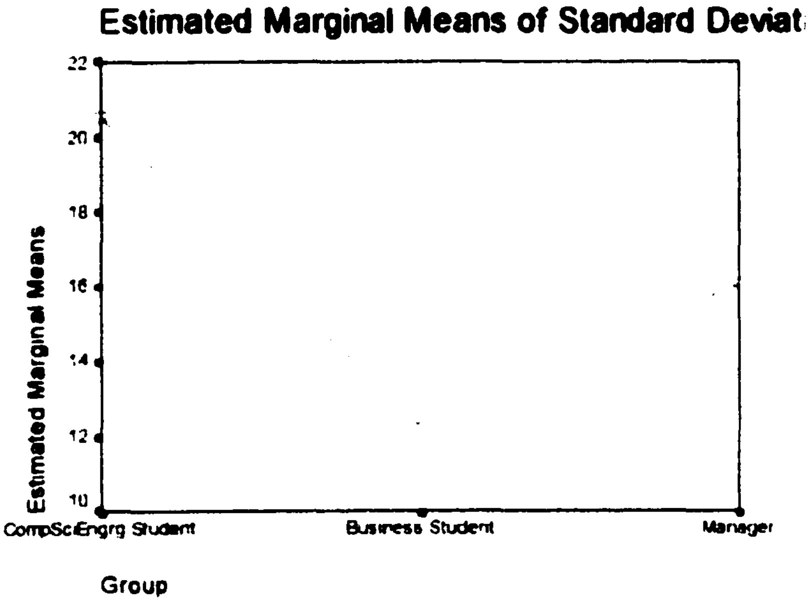
Profile Plots

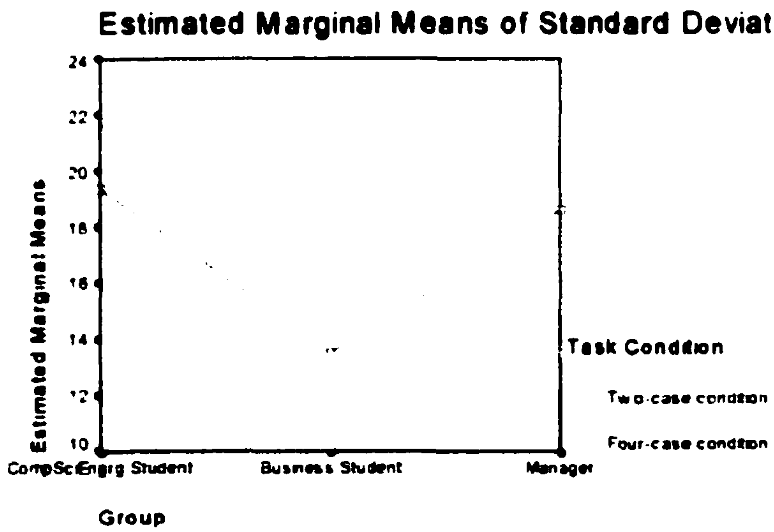




MANOVA for Managers and Students Combined

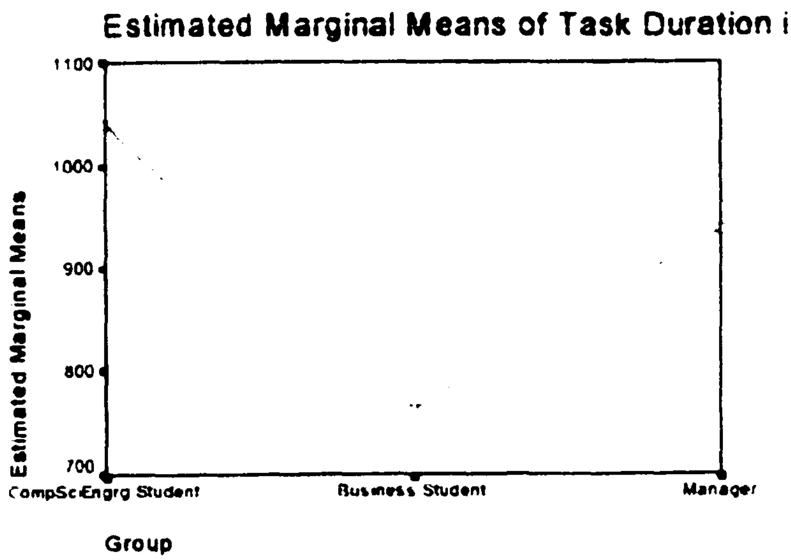
Profile Plots

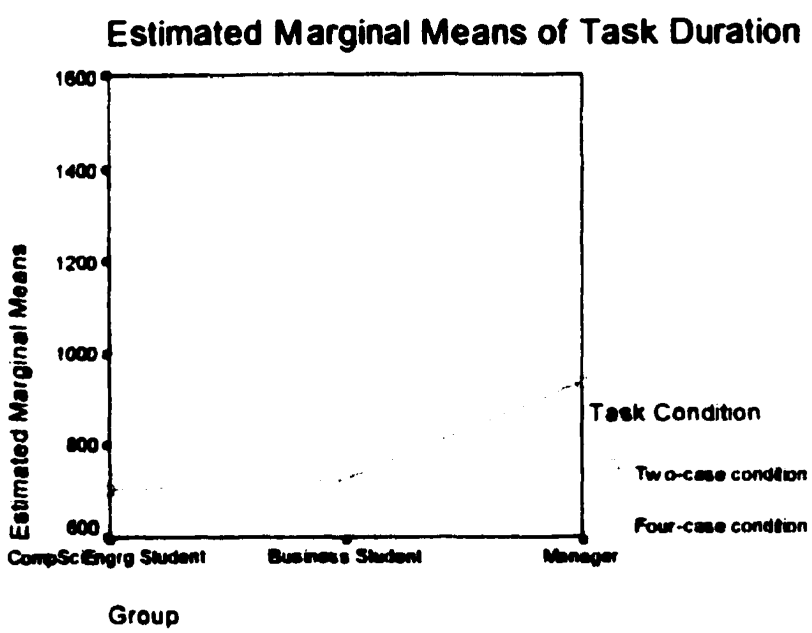




MANOVA for Managers and Students Combined

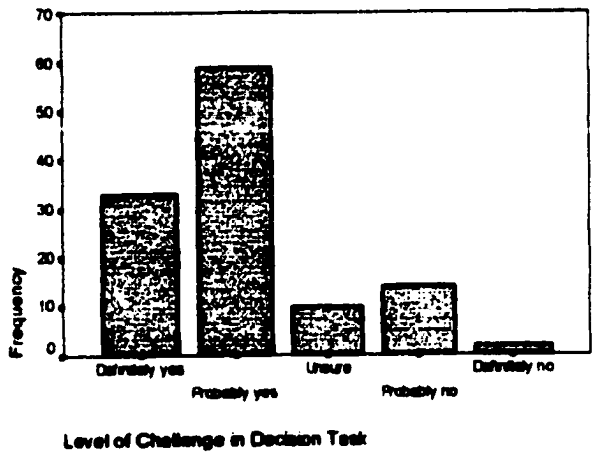
Profile Plots



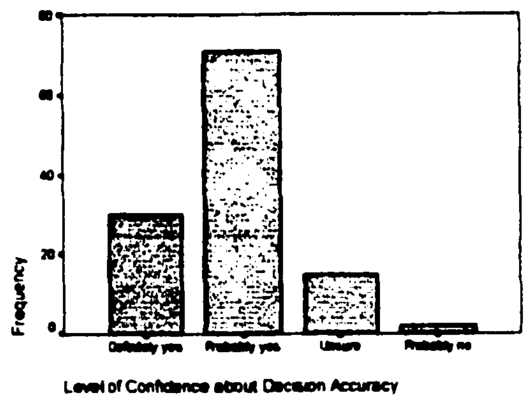


Post-Decision Task Survey Results

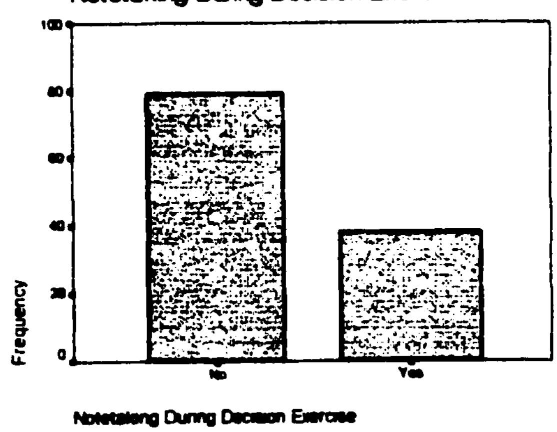
Level of Challenge in Decision Task



Level of Confidence about Decision Accuracy



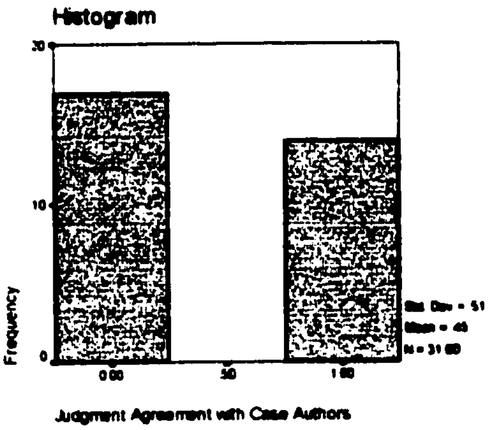
Notetaking During Decision Exercise



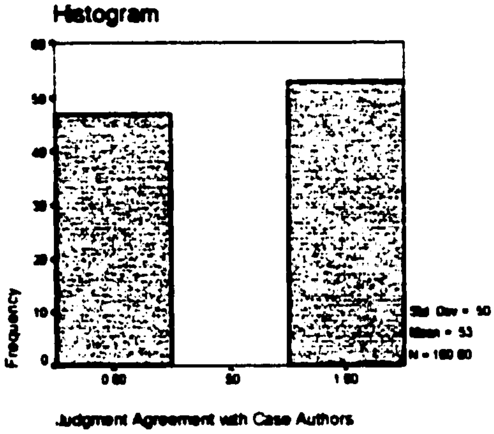
Note: Respondents were not required to fill out this screen

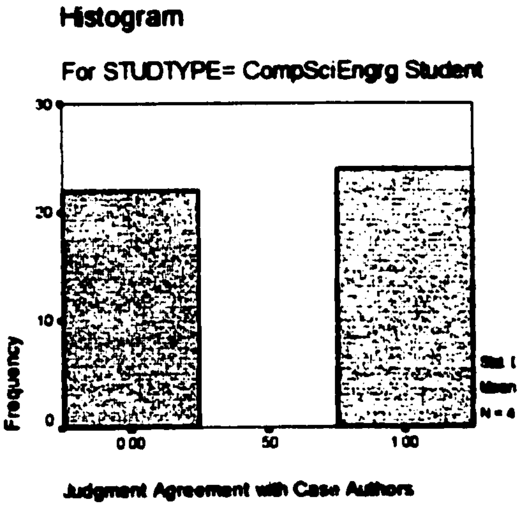
Decision Accuracy Results

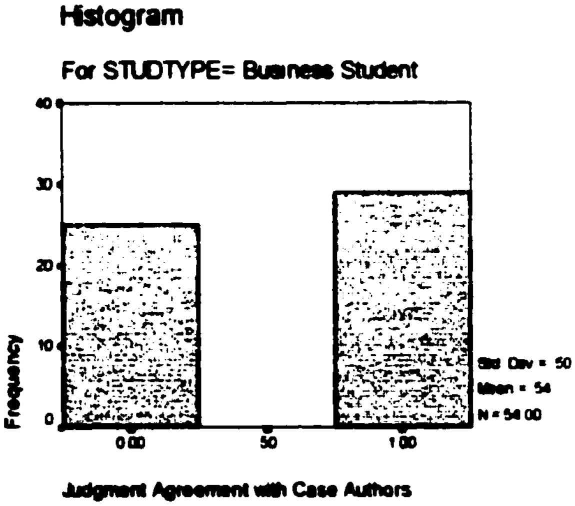
Respondent Type = Manager



Respondent Type = Student

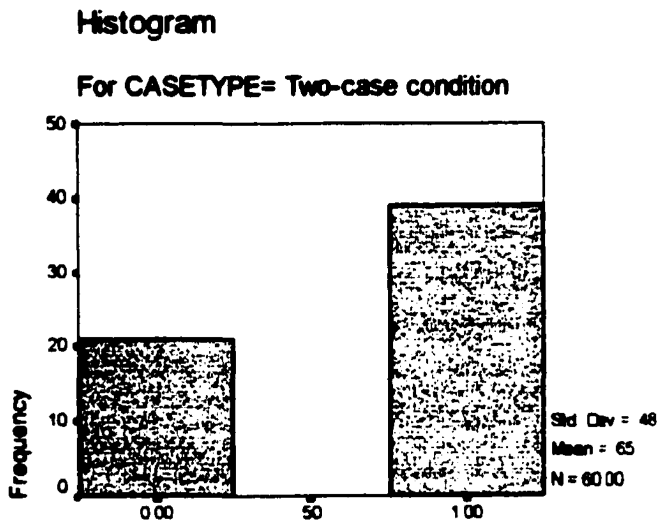


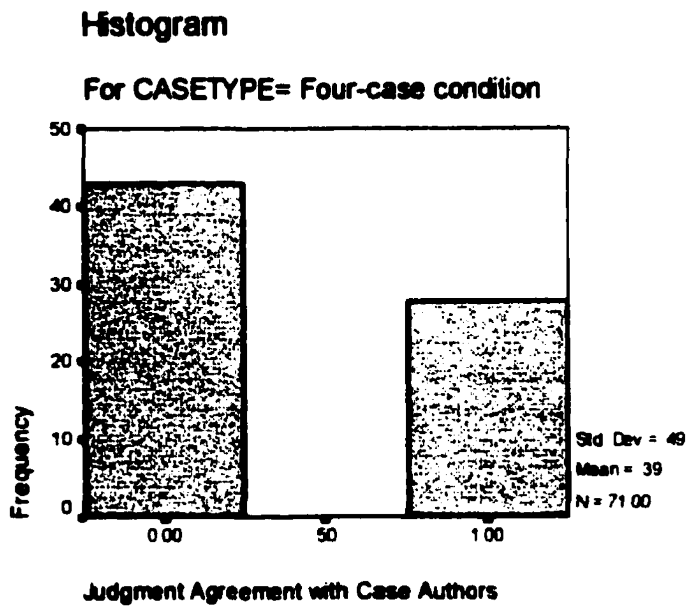




Decision Accuracy Results

Histograms for Accuracy by Case Condition





MANOVA for Manager Group

Between-Subjects Factors

		Value Label	N
Task Condition	2	Two-case condition	13
	4	Four-case condition	18

Multivariate Tests[b]

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.892	53.525[a]	4.000	26.000	.000
	Wilks' Lambda	.108	53.525[a]	4.000	26.000	.000
	Hotelling's Trace	8.235	53.525[a]	4.000	26.000	.000
	Roy's Largest Root	8.235	53.525[a]	4.000	26.000	.000
CASETYPE	Pillai's Trace	.111	.813[a]	4.000	26.000	.528
	Wilks' Lambda	.889	.813[a]	4.000	26.000	.528
	Hotelling's Trace	.125	.813[a]	4.000	26.000	.528
	Roy's Largest Root	.125	.813[a]	4.000	26.000	.528

a. Exact statistic

b. Design: Intercept+CASETYPE

MANOVA for Manager Group

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig
Corrected Model	Cognitive Distance	493 474[a]	1	493 474	1 324	259
	Number of Screens Viewed	191 624[b]	1	191 624	923	345
	Standard Deviation in Seconds	195 432[c]	1	195 432	1.220	278
	Task Duration in Seconds	23 742[d]	1	23 742	000	989
Intercept	Cognitive Distance	60424 055	1	60424.055	162 071	000
	Number of Screens Viewed	34864 269	1	34864 269	168 014	000
	Standard Deviation in Seconds	7810 963	1	7810 963	48 753	000
	Task Duration in Seconds	26537419 4	1	26537419 35	221 603	000
CASETYPE	Cognitive Distance	493 474	1	493 474	1 324	259
	Number of Screens Viewed	191 624	1	191 624	923	345
	Standard Deviation in Seconds	195 432	1	195 432	1 220	278
	Task Duration in Seconds	23 742	1	23 742	000	989
Error	Cognitive Distance	10811 880	29	372 823		
	Number of Screens Viewed	6017 731	29	207 508		
	Standard Deviation in Seconds	4646 262	29	160 216		
	Task Duration in Seconds	3472803 355	29	119751 840		
Total	Cognitive Distance	75165 000	31			
	Number of Screens Viewed	42866.000	31			
	Standard Deviation in Seconds	12457 303	31			
	Task Duration in Seconds	30727359 0	31			
Corrected Total	Cognitive Distance	11305 355	30			
	Number of Screens Viewed	6209 355	30			
	Standard Deviation in Seconds	4841 695	30			
	Task Duration in Seconds	3472827 097	30			

a. R Squared = 044 (Adjusted R Squared = 011)

b. R Squared = 031 (Adjusted R Squared = - 003)

c. R Squared = 040 (Adjusted R Squared = 007)

d. R Squared = 000 (Adjusted R Squared = - 034)

Estimated Marginal Means for Manager Group

1. Grand Mean

Dependent Variable	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Cognitive Distance	44.735	3.514	37.548	51.922
Number of Screens Viewed	33.981	2.622	28.619	39.342
Standard Deviation in Seconds	16.084	2.304	11.373	20.795
Task Duration in Seconds	937.502	62.977	808.699	1066.305

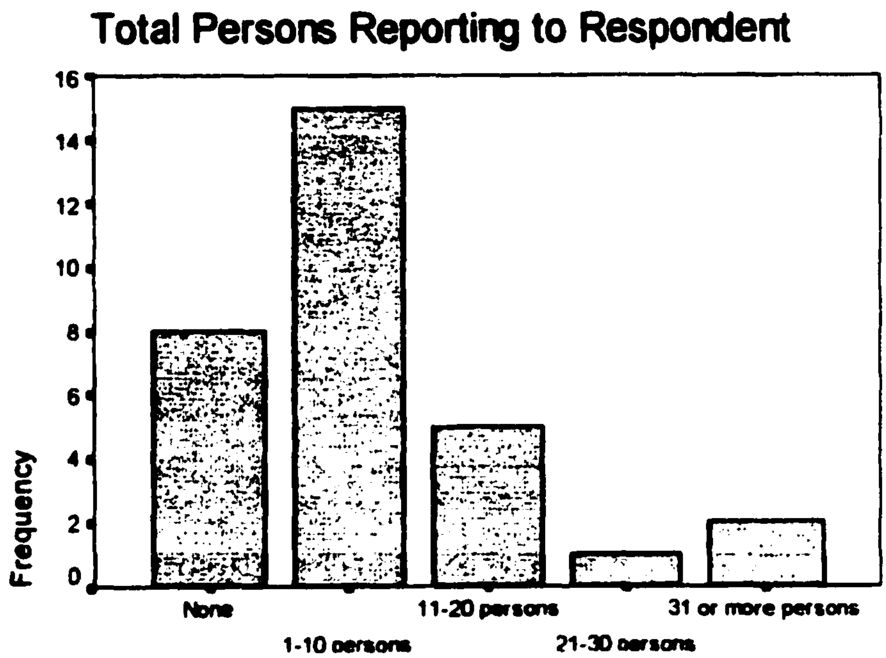
2. Task Condition

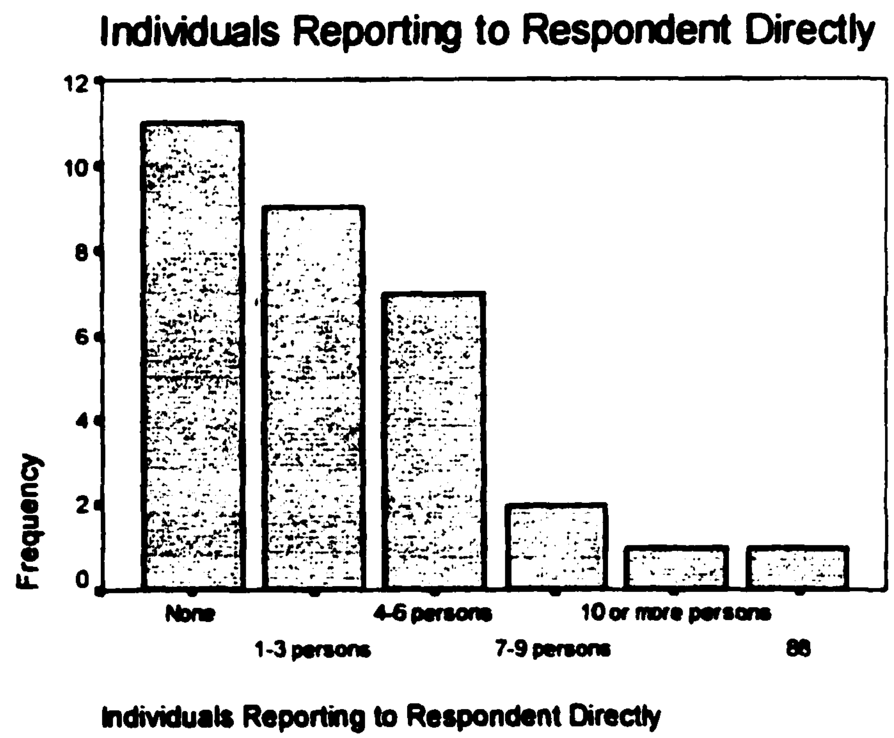
Dependent Variable	Task Condition	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Cognitive Distance	Two-case condition	40.692	5.355	29.740	51.645
	Four-case condition	48.778	4.551	39.470	58.086
Number of Screens Viewed	Two-case condition	31.462	3.985	23.290	39.633
	Four-case condition	36.500	3.395	29.556	43.444
Standard Deviation in Seconds	Two-case condition	18.628	3.511	11.448	25.808
	Four-case condition	13.540	2.983	7.438	19.642
Task Duration in Seconds	Two-case condition	936.615	95.977	740.319	1132.911
	Four-case condition	938.389	81.565	771.569	1105.208

APPENDIX E

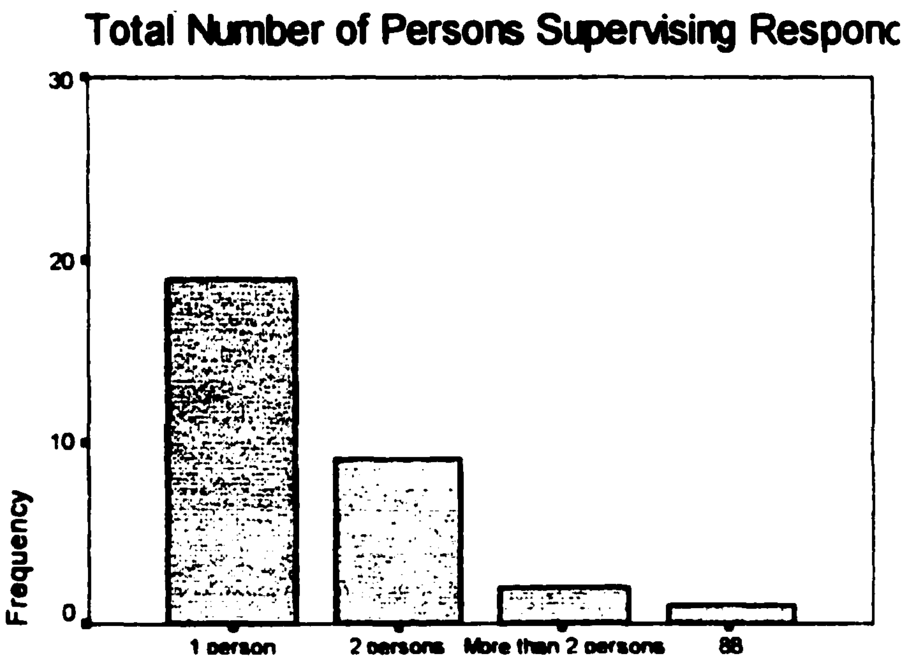
CORRELATION ANALYSIS AND MEASURES OF RELIABILITY

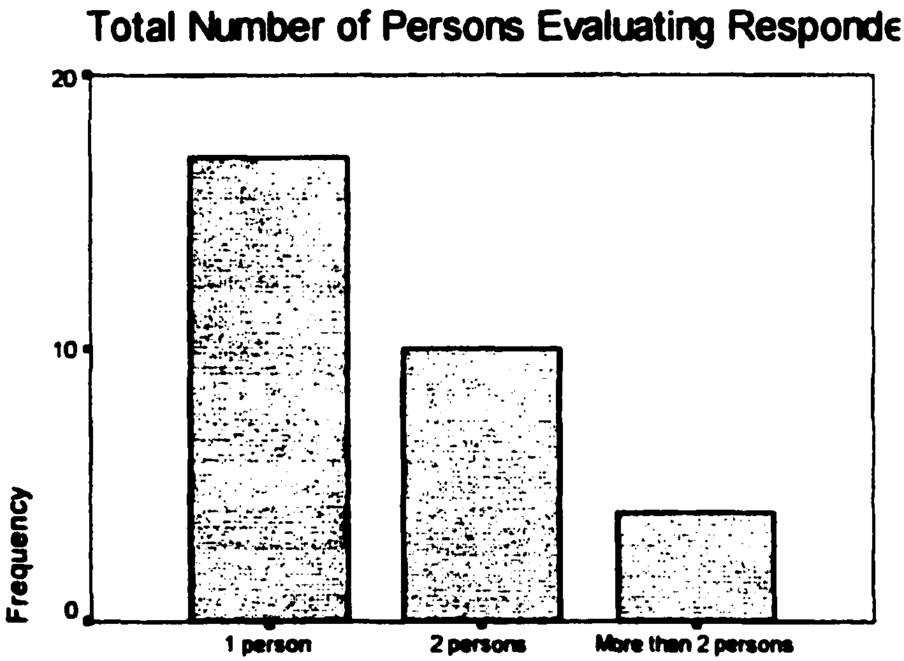
Span of Control





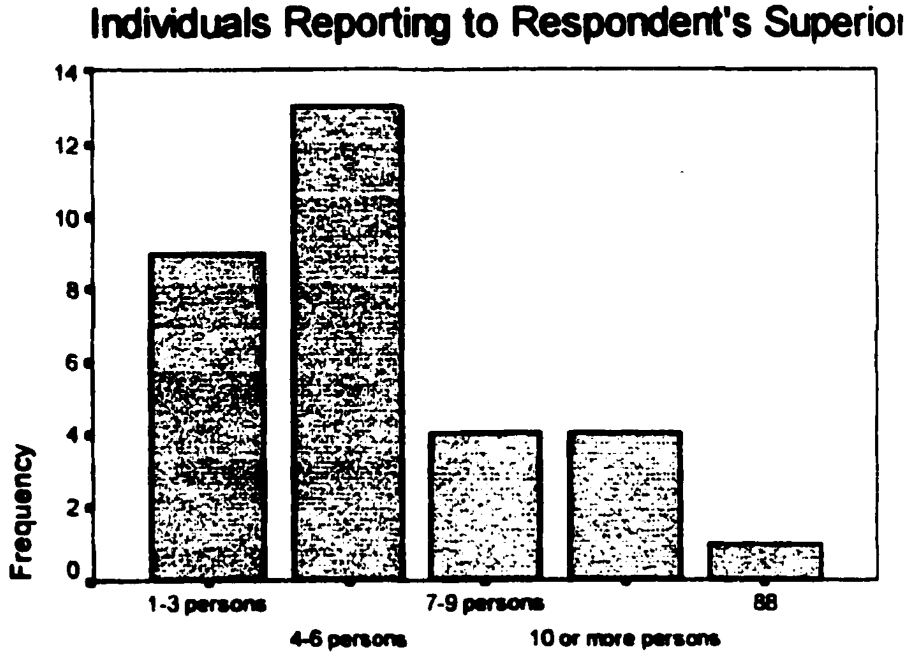
Span of Control

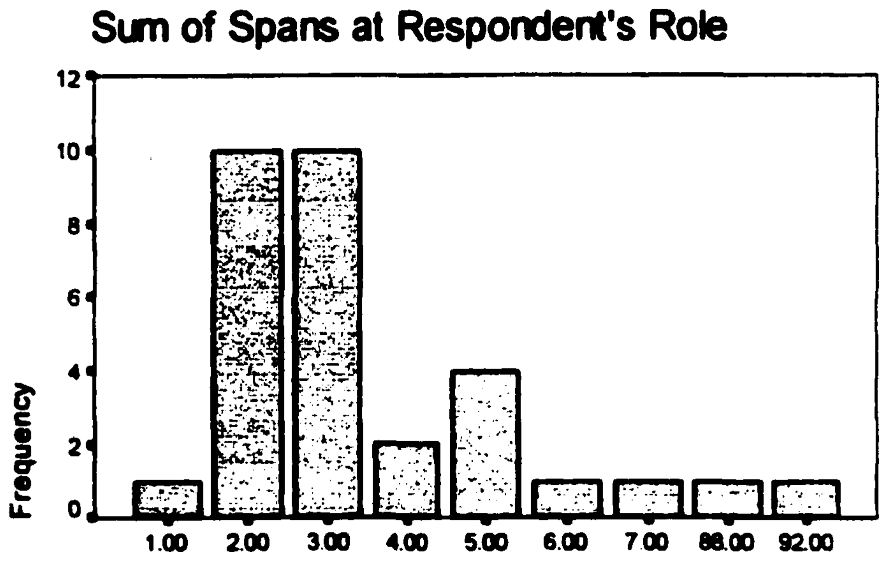




Total Number of Persons Evaluating Respondent

Span of Control





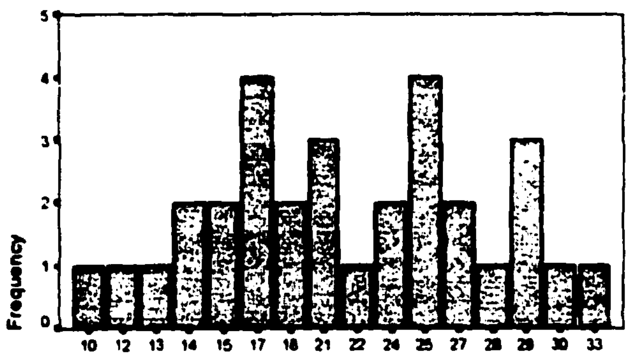
Sum of Spans at Respondent's Role

X values represent combined ordinal level of 3 each

1 = 1-3 persons, 2= 2-6 persons, 3= 5-9 persons, 4= 8-12 persons, etc.

Centralization

Total Decision Participation Score

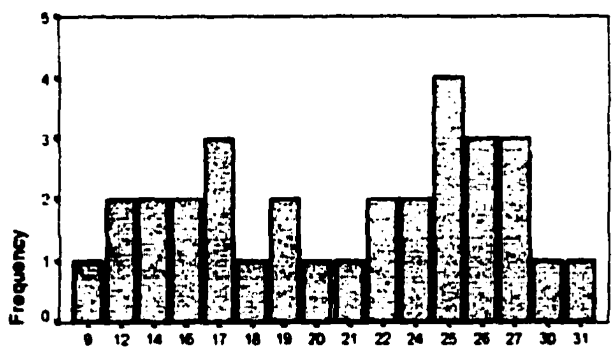


Total Decision Participation Score

Higher scores reflect greater decision autonomy

Minimum score = 7, Maximum score = 35

Total Perceived Decision Control Score



Total Perceived Decision Control Score

Higher scores reflect more perceived control

Minimum score = 7, Maximum score = 35

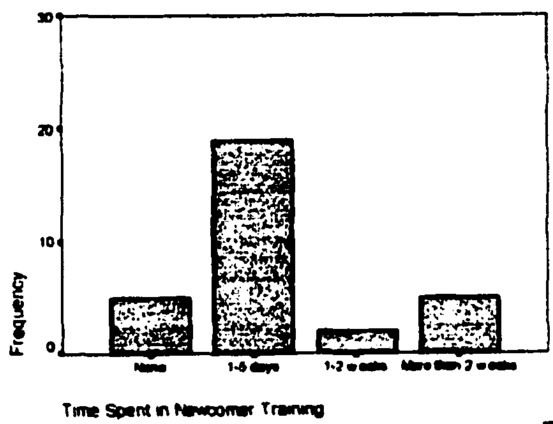
Correlations

		Total Stress Score	Total Decision Participation Score	Total Perceived Decision Control Score
Total Stress Score	Pearson Correlation	1.000	.290	-.192
	Sig. (1-tailed)		.057	.150
	N	31	31	31
Total Decision Participation Score	Pearson Correlation	.290	1.000	.932**
	Sig. (1-tailed)	.057		.000
	N	31	31	31
Total Perceived Decision Control Score	Pearson Correlation	-.192	.932**	1.000
	Sig. (1-tailed)	.150	.000	
	N	31	31	31

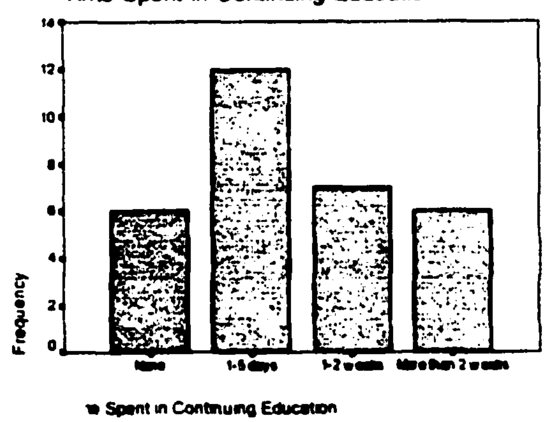
** Correlation is significant at the 0.01 level (1-tailed).

Formalization: Enculturation and Standardization

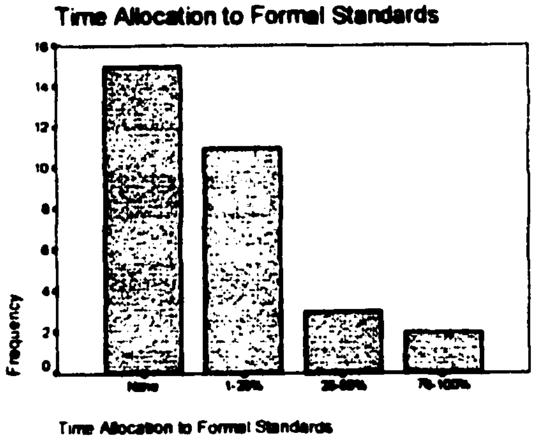
Time Spent in Newcomer Training



Time Spent in Continuing Education

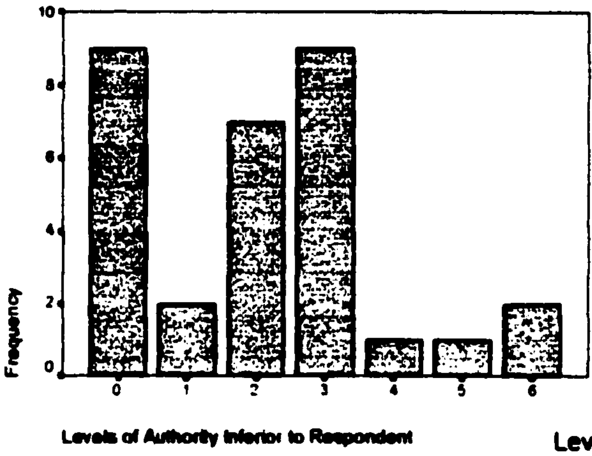


Time Allocation to Formal Standards

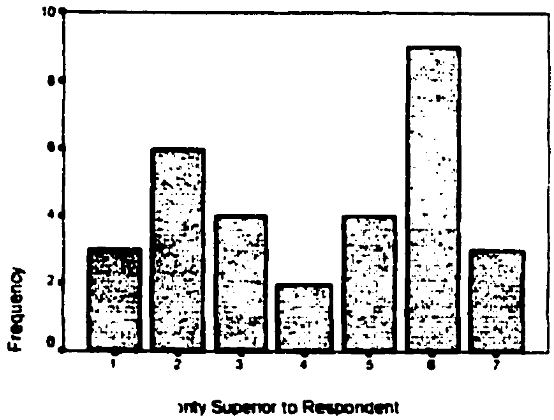


Hierarchical Order

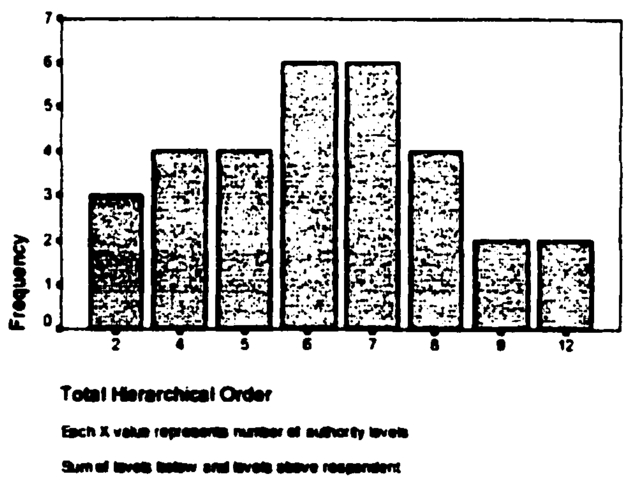
Levels of Authority Inferior to Respondent



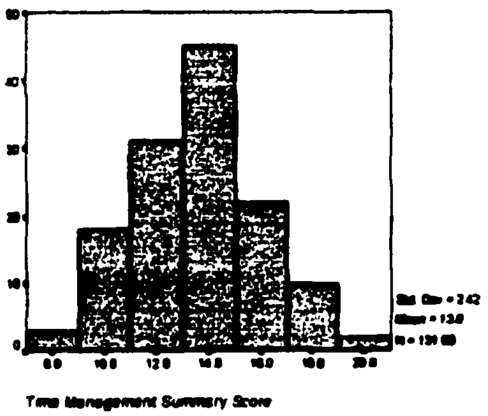
Levels of Authority Superior to Respondent

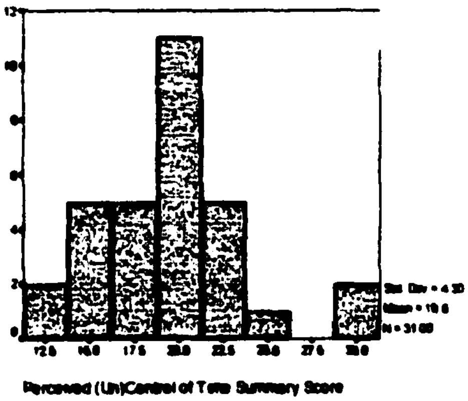


Total Hierarchical Order



Time Control and Time Management





Correlations

		Time Management Summary Score	Perceived (Un)Control of Time Summary Score	Total Stress Score
Time Management Summary Score	Pearson Correlation	1 000	- 045	180
	Sig (1-tailed)		405	166
	N	31	31	31
Perceived (Un)Control of Time Summary Score	Pearson Correlation	- 045	1 000	-.567**
	Sig (1-tailed)	405		000
	N	31	31	31
Total Stress Score	Pearson Correlation	180	- 567**	1 000
	Sig (1-tailed)	166	.000	
	N	31	31	31

** Correlation is significant at the 0 01 level (1-tailed)

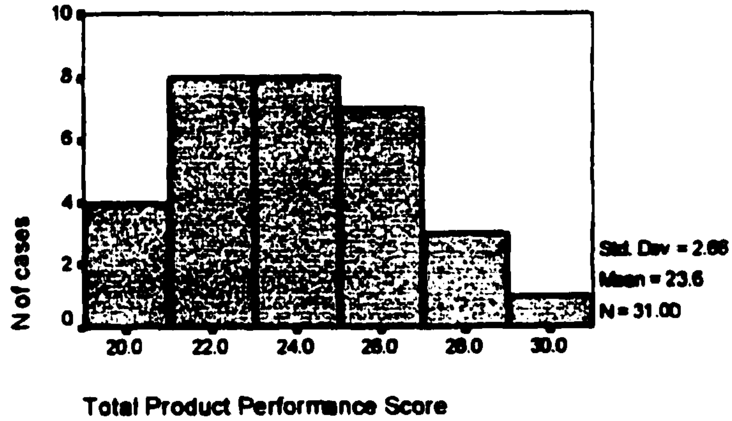
Descriptive Statistics

	Mean	Std. Deviation	N
Time Management Summary Score	12 8065	2.6510	31
Perceived (Un)Control of Time Summary Score	19 6129	4.3025	31
Total Stress Score	87 8387	12 2368	31

Organizational Product and Support Performance

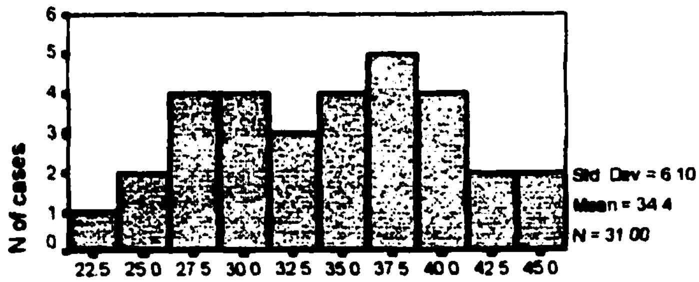
Self-report Score for Product Managed

Sum of Six Items



Self-report Score for Organizational Support for Rated Product

Sum of 9 items



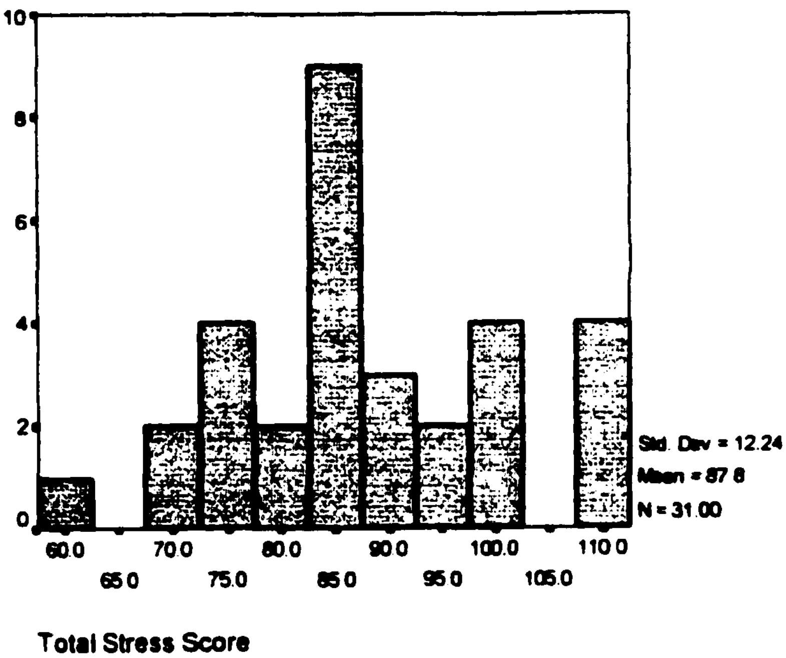
Correlations

		Total Product Performance Score	Organizational Performance Total Score
Total Product Performance Score	Pearson Correlation	1.000	.726**
	Sig. (2-tailed)	.	.000
	N	31	31
Organizational Performance Total Score	Pearson Correlation	.726**	1.000
	Sig. (2-tailed)	.000	.
	N	31	31

**. Correlation is significant at the 0.01 level (2-tailed).

Total Stress Score for Manager Group

21 items included



Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std Deviation
Total Stress Score	31	49 00	61 00	110 00	87 8387	12.2368
Valid N (listwise)	31					

Correlation Report

CENTRALIZATION FACTORS: DECISION MAKING PARTICIPATION AND PERCEIVED CONTROL OVER DECISIONS

Pearson Correlations Section

	parhire	parspecf	parpromo	pardisms	parwload	parfunds
parhire	1.000000	0.688923	0.655821	0.710972	0.630406	0.715367
	0.000000	0.000018	0.000062	0.000007	0.000144	0.000006
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
parspecf	0.688923	1.000000	0.623318	0.578734	0.537047	0.484928
	0.000018	0.000000	0.000180	0.000648	0.001839	0.005695
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
parpromo	0.655821	0.623318	1.000000	0.885070	0.568012	0.457890
	0.000062	0.000180	0.000000	0.000000	0.000859	0.009591
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
pardisms	0.710972	0.578734	0.885070	1.000000	0.565564	0.413470
	0.000007	0.000648	0.000000	0.000000	0.000914	0.020775
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
parwload	0.630406	0.537047	0.568012	0.565564	1.000000	0.476674
	0.000144	0.001839	0.000859	0.000914	0.000000	0.006706
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
parfunds	0.715367	0.484928	0.457890	0.413470	0.476674	1.000000
	0.000006	0.005695	0.009591	0.020775	0.006706	0.000000
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
parlongr	0.420892	0.432308	0.181292	0.252284	0.314291	0.411868
	0.018381	0.015149	0.329049	0.170936	0.085083	0.021324
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
conhire	0.793263	0.495662	0.745015	0.696643	0.571787	0.584260
	0.000000	0.004576	0.000002	0.000013	0.000778	0.000558
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
conpromo	0.615145	0.503264	0.870596	0.796446	0.533869	0.472434
	0.000231	0.003903	0.000000	0.000000	0.001980	0.007283
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
conwload	0.581151	0.554450	0.556254	0.503892	0.744619	0.494964
	0.000607	0.001209	0.001156	0.003851	0.000002	0.004642
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
conlongr	0.362938	0.336541	0.099514	0.125247	0.313238	0.396698
	0.044779	0.064141	0.594294	0.502003	0.086190	0.027139
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000

Cronbachs Alpha = 0.917368 Standardized Cronbachs Alpha = 0.919592

	parlongr	conhwe	conpromo	conwload	conlongr
parhwe	0.420892	0.793263	0.615145	0.581151	0.362938
	0.018381	0.000000	0.000231	0.000607	0.044779
	31.000000	31.000000	31.000000	31.000000	31.000000
parspect	0.432308	0.495662	0.503264	0.554450	0.338541
	0.015149	0.004576	0.003903	0.001209	0.064141
	31.000000	31.000000	31.000000	31.000000	31.000000
parpromo	0.181292	0.745015	0.870586	0.556254	0.099514
	0.329049	0.000002	0.000000	0.001156	0.594294
	31.000000	31.000000	31.000000	31.000000	31.000000
pardisms	0.252284	0.698643	0.798446	0.503892	0.125247
	0.170936	0.000013	0.000000	0.003851	0.502003
	31.000000	31.000000	31.000000	31.000000	31.000000
parwload	0.314291	0.571787	0.533889	0.744619	0.313238
	0.085083	0.000778	0.001980	0.000002	0.086190
	31.000000	31.000000	31.000000	31.000000	31.000000
parfunds	0.411868	0.584260	0.472434	0.494964	0.398698
	0.021324	0.000558	0.007283	0.004642	0.027139
	31.000000	31.000000	31.000000	31.000000	31.000000
parlongr	1.000000	0.187940	0.144198	0.498464	0.896392
	0.000000	0.311318	0.438976	0.004317	0.000000
	31.000000	31.000000	31.000000	31.000000	31.000000
conhwe	0.187940	1.000000	0.777187	0.509690	0.201079
	0.311318	0.000000	0.000000	0.003402	0.278065
	31.000000	31.000000	31.000000	31.000000	31.000000
conpromo	0.144198	0.777187	1.000000	0.523612	0.071165
	0.438976	0.000000	0.000000	0.002503	0.703627
	31.000000	31.000000	31.000000	31.000000	31.000000
conwload	0.498464	0.509690	0.523612	1.000000	0.472386
	0.004317	0.003402	0.002503	0.000000	0.007290
	31.000000	31.000000	31.000000	31.000000	31.000000
conlongr	0.896392	0.201079	0.071165	0.472386	1.000000
	0.000000	0.278065	0.703627	0.007290	0.000000
	31.000000	31.000000	31.000000	31.000000	31.000000

Cronbachs Alpha = 0.917368 Standardized Cronbachs Alpha = 0.919592

Correlation Report

Pearson Correlations Section

	formmiss	formstra	formchar	formdesc	formeval	formcont
formmiss	1.000000	0.367602	0.502113	0.483677	0.198849	0.212544
	0.000000	0.041904	0.003999	0.005839	0.283539	0.250993
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
formstra	0.367602	1.000000	0.484773	0.502025	0.084688	-0.067777
	0.041904	0.000000	0.005712	0.004006	0.650576	0.717147
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
formchar	0.502113	0.484773	1.000000	0.524955	-0.027454	-0.073186
	0.003999	0.005712	0.000000	0.002429	0.883443	0.695602
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
formdesc	0.483677	0.502025	0.524955	1.000000	-0.092377	0.012921
	0.005839	0.004006	0.002429	0.000000	0.621124	0.945001
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
formeval	0.198849	0.084688	-0.027454	-0.092377	1.000000	0.729274
	0.283539	0.650576	0.883443	0.621124	0.000000	0.000003
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
formcont	0.212544	-0.067777	-0.073186	0.012921	0.729274	1.000000
	0.250993	0.717147	0.695602	0.945001	0.000003	0.000000
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
formoper	0.524951	0.207048	0.307753	0.218129	0.169105	0.113242
	0.002429	0.263743	0.092136	0.238461	0.363128	0.544149
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
formsids	0.339486	0.292998	0.288440	0.521323	0.318710	0.169409
	0.061703	0.109679	0.115573	0.002635	0.080555	0.362255
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000

Cronbachs Alpha = 0.729371 Standardized Cronbachs Alpha = 0.735160

Pearson Correlations Section

	formoper	formstds
formmiss	0.524951	0.339486
	0.002429	0.061703
	31.000000	31.000000
formstra	0.207048	0.292998
	0.263743	0.109679
	31.000000	31.000000
formchar	0.307753	0.288440
	0.092136	0.115573
	31.000000	31.000000
formdesc	0.218129	0.521323
	0.238461	0.002635
	31.000000	31.000000
formeval	0.169105	0.318710
	0.363128	0.080555
	31.000000	31.000000
formcont	0.113242	0.169409
	0.544149	0.362255
	31.000000	31.000000
formoper	1.000000	-0.100419
	0.000000	0.590925
	31.000000	31.000000
formstds	-0.100419	1.000000
	0.590925	0.000000
	31.000000	31.000000

Cronbachs Alpha = 0.729371 Standardized Cronbachs Alpha = 0.735160

Pearson Correlations Section (Row-Wise Deletion)

	newtrain	*contrain*	*codetime*
newtrain	1.000000	0.320091	0.213546
	0.000000	0.079178	0.248714
	31.000000	31.000000	31.000000
contrain	0.320091	1.000000	0.166385
	0.079178	0.000000	0.371010
	31.000000	31.000000	31.000000
codetime	0.213546	0.166385	1.000000
	0.248714	0.371010	0.000000
	31.000000	31.000000	31.000000

Cronbachs Alpha = 0.469636 Standardized Cronbachs Alpha = 0.477283

CLIMATE: RESPONDENT SATISFACTION WITH ORGANIZATIONAL DECISION MAKING

Correlation Report

Pearson Correlations Section

	satdminf	clsatis4	satdmmee	satdmlvl	satdmqkl	satdmwor
satdminf	1.000000	0.576110	0.347910	0.478520	0.309175	0.025700
	0.000000	0.000695	0.055127	0.006468	0.090565	0.890845
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
clsatis4	0.576110	1.000000	0.623375	0.428685	0.391370	-0.057553
	0.000695	0.000000	0.000180	0.016119	0.029466	0.758443
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
satdmmee	0.347910	0.623375	1.000000	0.772020	0.678883	0.105615
	0.055127	0.000180	0.000000	0.000000	0.000027	0.571763
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
satdmlvl	0.478520	0.428685	0.772020	1.000000	0.600186	0.144876
	0.006468	0.016119	0.000000	0.000000	0.000358	0.436802
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
satdmqkl	0.309175	0.391370	0.678883	0.600186	1.000000	0.337009
	0.090565	0.029466	0.000027	0.000358	0.000000	0.063749
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
satdmwor	0.025700	-0.057553	0.105615	0.144876	0.337009	1.000000
	0.890845	0.758443	0.571763	0.436802	0.063749	0.000000
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000

Cronbachs Alpha = 0.781116 Standardized Cronbachs Alpha = 0.789129

CLIMATE: ORGANIZATIONAL STRUCTURE AND RESPONSIBILITY

Correlation Report

Pearson Correlations Section

	clstruc1	clsruc2	clstruc3	clrespo1	clrespo2
clstruc1	1.000000	-0.352218	-0.173500	-0.088773	0.030945
	0.000000	0.051984	0.350605	0.634863	0.868744
	31.000000	31.000000	31.000000	31.000000	31.000000
clsruc2	-0.352218	1.000000	0.325169	0.034880	0.020265
	0.051984	0.000000	0.074273	0.852224	0.913834
	31.000000	31.000000	31.000000	31.000000	31.000000
clstruc3	-0.173500	0.325169	1.000000	0.202192	0.094602
	0.350605	0.074273	0.000000	0.275356	0.612706
	31.000000	31.000000	31.000000	31.000000	31.000000
clrespo1	-0.088773	0.034880	0.202192	1.000000	0.264952
	0.634863	0.852224	0.275356	0.000000	0.149737
	31.000000	31.000000	31.000000	31.000000	31.000000
clrespo2	0.030945	0.020265	0.094602	0.264952	1.000000
	0.868744	0.913834	0.612706	0.149737	0.000000
	31.000000	31.000000	31.000000	31.000000	31.000000

Cronbachs Alpha = 0.220480 Standardized Cronbachs Alpha = 0.156775

Correlation Report

Pearson Correlations Section (Row-Wise Deletion)

	temprout	tempsame	tempplan	tempdead
temprout	1.000000	0.461611	0.221062	-0.137513
	0.000000	0.000000	0.012155	0.121650
	128.000000	128.000000	128.000000	128.000000
tempsame	0.461611	1.000000	0.083439	-0.268488
	0.000000	0.000000	0.349078	0.002182
	128.000000	128.000000	128.000000	128.000000
tempplan	0.221062	0.083439	1.000000	0.140694
	0.012155	0.349078	0.000000	0.113183
	128.000000	128.000000	128.000000	128.000000
tempdead	-0.137513	-0.268488	0.140694	1.000000
	0.121650	0.002182	0.113183	0.000000
	128.000000	128.000000	128.000000	128.000000

Cronbachs Alpha = 0.278966   Standardized Cronbachs Alpha = 0.267010

CLIMATE: CONFLICT AND RISK

Correlation Report

Pearson Correlations Section

	clrisk1	clconfl3	clconfl2	clrisk4	clrisk5	clrisk6
clrisk1	1.000000	-0.277309	0.125865	0.338995	-0.297845	-0.471874
	0.000000	0.130956	0.499880	0.062104	0.103661	0.007362
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
clconfl3	-0.277309	1.000000	0.445422	-0.203150	0.192874	0.390882
	0.130956	0.000000	0.012035	0.273039	0.298549	0.029887
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
clconfl2	0.125865	0.445422	1.000000	-0.035526	0.281022	0.082004
	0.499880	0.012035	0.000000	0.849519	0.125667	0.660982
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
clrisk4	0.338995	-0.203150	-0.035526	1.000000	-0.342389	-0.654176
	0.062104	0.273039	0.849519	0.000000	0.059371	0.000066
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
clrisk5	-0.297845	0.192874	0.281022	-0.342389	1.000000	0.394191
	0.103661	0.298549	0.125667	0.059371	0.000000	0.028215
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
clrisk6	-0.471874	0.390882	0.082004	-0.654176	0.394191	1.000000
	0.007362	0.029887	0.660982	0.000066	0.028215	0.000000
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000

Cronbachs Alpha =- 0.128956 Standardized Cronbachs Alpha =- 0.012535

Correlation Report

Pearson Correlations Section

	clwarm1	clsuppt1	clsuppt2	clsuppt3	clsuppt4
clwarm1	1.000000	0.033097	-0.268016	-0.366377	0.520308
	0.000000	0.859705	0.144909	0.042644	0.002695
	31.000000	31.000000	31.000000	31.000000	31.000000
clsuppt1	0.033097	1.000000	-0.115809	-0.120591	0.249224
	0.859705	0.000000	0.535000	0.518153	0.176360
	31.000000	31.000000	31.000000	31.000000	31.000000
clsuppt2	-0.268016	-0.115809	1.000000	0.585421	-0.254974
	0.144909	0.535000	0.000000	0.000541	0.166267
	31.000000	31.000000	31.000000	31.000000	31.000000
clsuppt3	-0.366377	-0.120591	0.585421	1.000000	-0.459856
	0.042644	0.518153	0.000541	0.000000	0.009247
	31.000000	31.000000	31.000000	31.000000	31.000000
clsuppt4	0.520308	0.249224	-0.254974	-0.459856	1.000000
	0.002695	0.176360	0.166267	0.009247	0.000000
	31.000000	31.000000	31.000000	31.000000	31.000000

Cronbachs Alpha =- 0.077191 Standardized Cronbachs Alpha =- 0.107263

Correlation Report

Pearson Correlations Section

	prodqual	prodrely	prodopts	prodara	prodbene	prodinno
prodqual	1.000000	0.696705	0.123899	-0.013049	-0.394253	-0.368643
	0.000000	0.000013	0.506652	0.944454	0.028188	0.041283
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
prodrely	0.696705	1.000000	-0.033764	-0.141079	-0.336497	-0.337859
	0.000013	0.000000	0.856904	0.449043	0.064178	0.063041
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
prodopts	0.123899	-0.033764	1.000000	0.144139	0.031105	0.640299
	0.506652	0.856904	0.000000	0.439166	0.868070	0.000105
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
prodara	-0.013049	-0.141079	0 144139	1.000000	0.427531	-0.049721
	0.944454	0.449043	0.439166	0.000000	0.016439	0.790528
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
prodbene	-0.394253	-0.336497	0.031105	0.427531	1.000000	0.270395
	0.028188	0.064178	0.868070	0.016439	0.000000	0.141240
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
prodinno	-0.368643	-0.337859	0.640299	-0.049721	0.270395	1.000000
	0.041283	0.063041	0.000105	0.790528	0.141240	0.000000
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000

Cronbachs Alpha = 0.250320 Standardized Cronbachs Alpha = 0.216181

ORGANIZATIONAL PERFORMANCE: PRODUCT SUPPORT

Correlation Report

Pearson Correlations Section

	orgtimg	orgmktg	orgsales
orglevel	0.401297	0.636061	0.284445
	0.025254	0.000120	0.120932
	31.000000	31.000000	31.000000
orgplang	0.503336	0.402107	0.537203
	0.003897	0.024933	0.001832
	31.000000	31.000000	31.000000
orgsuppt	0.616313	0.489475	0.495830
	0.000223	0.005195	0.004560
	31.000000	31.000000	31.000000
orgengmt	0.318205	0.464790	0.327934
	0.081062	0.008429	0.071702
	31.000000	31.000000	31.000000
orgcusto	0.340095	0.216693	0.412259
	0.061208	0.241642	0.021189
	31.000000	31.000000	31.000000
orgcorec	0.324017	0.378568	0.630455
	0.075365	0.035726	0.000144
	31.000000	31.000000	31.000000
orgtimg	1.000000	0.591911	0.462915
	0.000000	0.000452	0.008732
	31.000000	31.000000	31.000000
orgmktg	0.591911	1.000000	0.518183
	0.000452	0.000000	0.002826
	31.000000	31.000000	31.000000
orgsales	0.462915	0.518183	1.000000
	0.008732	0.002826	0.000000
	31.000000	31.000000	31.000000

Cronbachs Alpha = 0.869197 Standardized Cronbachs Alpha = 0.872096

ORGANIZATIONAL PERFORMANCE: PRODUCT SUPPORT

Correlation Report

Pearson Correlations Section

	orglevel	orgplang	orgsuppt	orgengmt	orgcusto	orgcorec
orglevel	1.000000	0.515173	0.304239	0.526077	0.217448	0.290514
	0.000000	0.003019	0.096105	0.002368	0.239966	0.112863
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
orgplang	0.515173	1.000000	0.481552	0.624542	0.330097	0.398996
	0.003019	0.000000	0.006091	0.000173	0.069741	0.026183
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
orgsuppt	0.304239	0.481552	1.000000	0.568881	0.303319	0.395847
	0.096105	0.006091	0.000000	0.000840	0.097166	0.027501
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
orgengmt	0.526077	0.624542	0.568881	1.000000	0.064417	0.398846
	0.002368	0.000173	0.000840	0.000000	0.730635	0.026245
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
orgcusto	0.217448	0.330097	0.303319	0.064417	1.000000	0.745416
	0.239966	0.069741	0.097166	0.730635	0.000000	0.000002
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
orgcorec	0.290514	0.398996	0.395847	0.398846	0.745416	1.000000
	0.112863	0.026183	0.027501	0.026245	0.000002	0.000000
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
orgtrnmg	0.401297	0.503336	0.616313	0.318205	0.340095	0.324017
	0.025254	0.003897	0.000223	0.081062	0.061208	0.075365
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
orgmktg	0.636081	0.402107	0.489475	0.464790	0.216693	0.378568
	0.000120	0.024933	0.005195	0.008429	0.241642	0.035726
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
orgsales	0.284445	0.537203	0.495830	0.327934	0.412259	0.630455
	0.120932	0.001832	0.004560	0.071702	0.021189	0.000144
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000

Cronbachs Alpha = 0.869197 Standardized Cronbachs Alpha = 0.872096

STRESS SCALE: DIMENSION FACTORS CORRELATION
SIX FACTORS:
CONFLICT, AMBIGUITY, OVERLOAD, TASK COMPLEXITY, CAREER SECURITY, AND RESPONSIBLITY

Correlation Report

Pearson Correlations Section

	strscont	strsambt	strsorrt	strscomt	strscart	strsacct
strscont	1.000000	0.519205	0.357191	0.459288	0.488187	-0.210104
	0.000000	0.002762	0.048535	0.009346	0.005333	0.256604
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
strsambt	0.519205	1.000000	0.515981	0.572189	0.387155	-0.252558
	0.002762	0.000000	0.002966	0.000770	0.031420	0.170456
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
strsorrt	0.357191	0.515981	1.000000	0.342947	0.085880	0.242979
	0.048535	0.002966	0.000000	0.058930	0.645977	0.187807
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
strscomt	0.459288	0.572189	0.342947	1.000000	0.276056	-0.215059
	0.009346	0.000770	0.058930	0.000000	0.132778	0.245297
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
strscart	0.488187	0.387155	0.085880	0.276056	1.000000	-0.353315
	0.005333	0.031420	0.645977	0.132778	0.000000	0.051208
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
strsacct	-0.210104	-0.252558	0.242979	-0.215059	-0.353315	1.000000
	0.256604	0.170456	0.187807	0.245297	0.051208	0.000000
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000

Cronbachs Alpha = 0.629321   Standardized Cronbachs Alpha = 0.620851

Correlation Report

Pearson Correlations Section (Row-Wise Deletion)

	timectrl	timekeep	timeover	timegoal	timenone	timelong
timectrl	1.000000	-0.257074	0.025224	-0.325371	-0.458923	-0.091205
	0.000000	0.162684	0.892855	0.074083	0.009409	0.625579
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
timekeep	-0.257074	1.000000	0.224489	0.088871	-0.171027	0.229892
	0.162684	0.000000	0.224707	0.634488	0.357621	0.213451
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
timeover	0.025224	0.224489	1.000000	-0.060579	0.223734	0.445419
	0.892855	0.224707	0.000000	0.746146	0.226311	0.012036
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
timegoal	-0.325371	0.088871	-0.060579	1.000000	0.370086	0.261743
	0.074083	0.634488	0.746146	0.000000	0.040435	0.154918
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
timenone	-0.458923	-0.171027	0.223734	0.370086	1.000000	0.192900
	0.009409	0.357621	0.226311	0.040435	0.000000	0.298484
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
timelong	-0.091205	0.229892	0.445419	0.261743	0.192900	1.000000
	0.625579	0.213451	0.012036	0.154918	0.298484	0.000000
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000
timecomp	-0.082809	0.253979	0.370896	0.272899	0.250085	0.611670
	0.657854	0.167962	0.039964	0.137450	0.174822	0.000256
	31.000000	31.000000	31.000000	31.000000	31.000000	31.000000

Cronbachs Alpha = 0.452920 Standardized Cronbachs Alpha = 0.471619

PERCEIVED TIME (UN)CONTROL

Pearson Correlations Section

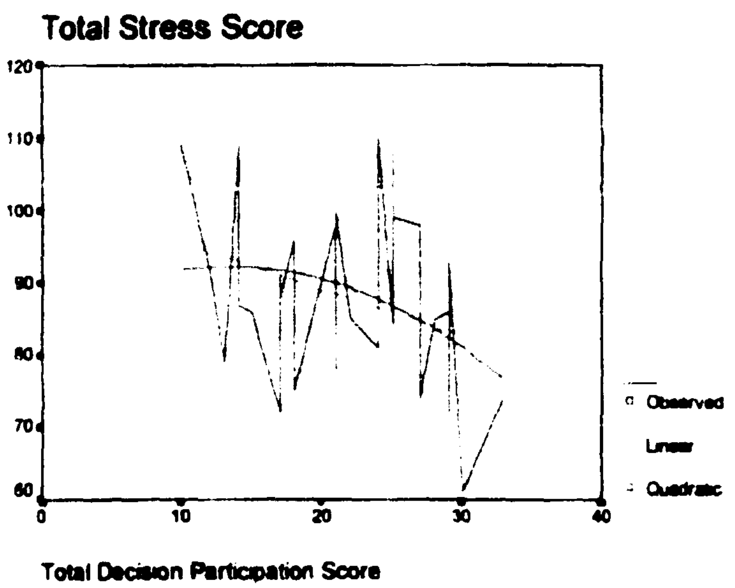
	timecomp
timectrl	-0.082809
	0.657854
	31.000000
timekeep	0.253979
	0.167982
	31.000000
timeover	0.370896
	0.039964
	31.000000
timegoal	0.272899
	0.137450
	31.000000
timenone	0.250085
	0.174822
	31.000000
timelong	0.611670
	0.000256
	31.000000
timecomp	1.000000
	0.000000
	31.000000

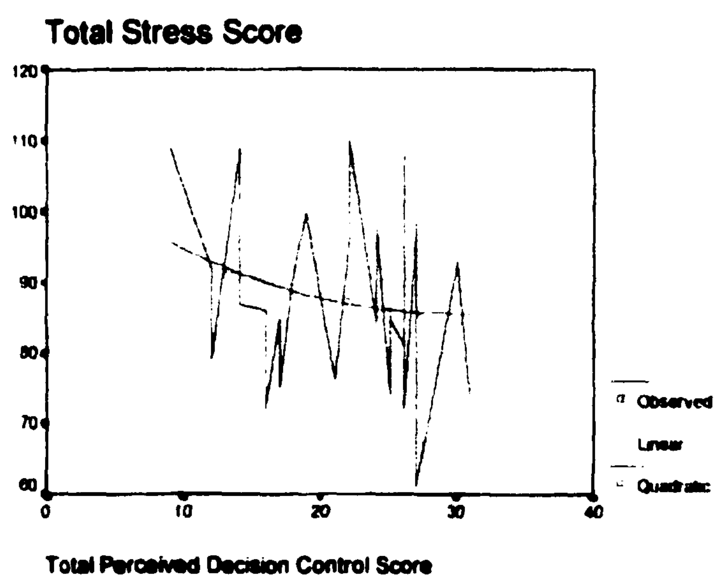
Cronbachs Alpha = 0.452920 Standardized Cronbachs Alpha = 0 471619

APPENDIX F

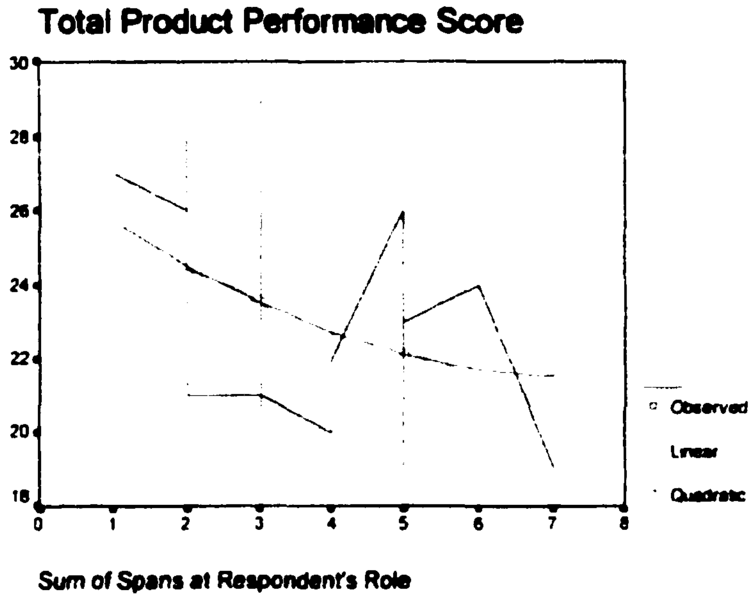
REGRESSION RESULTS

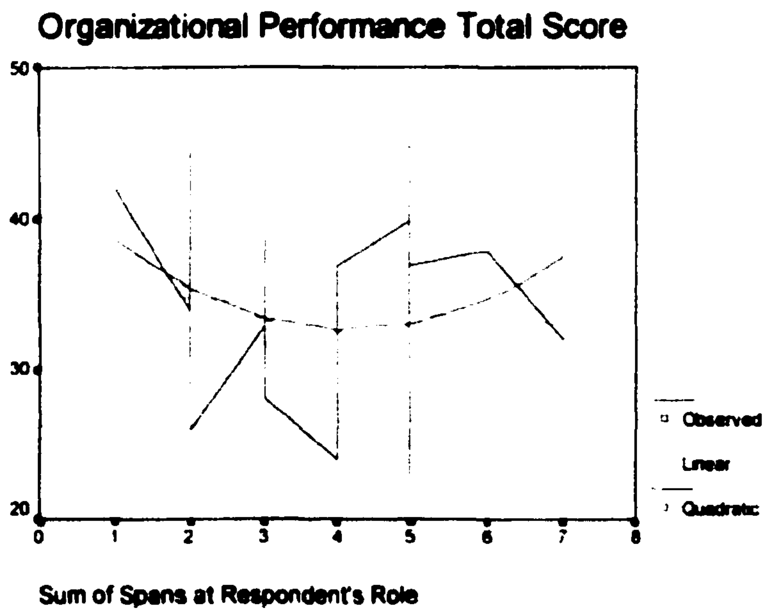
Centralization: Decision Participation and Control Dimensions





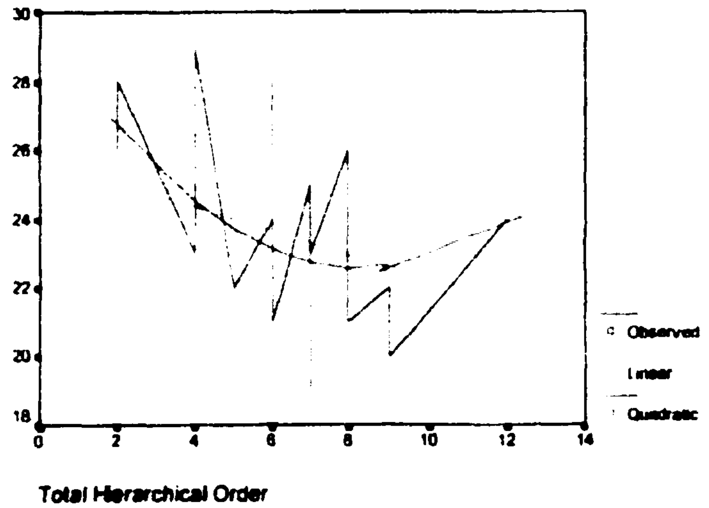
Regression: Span of Control with Product Performance



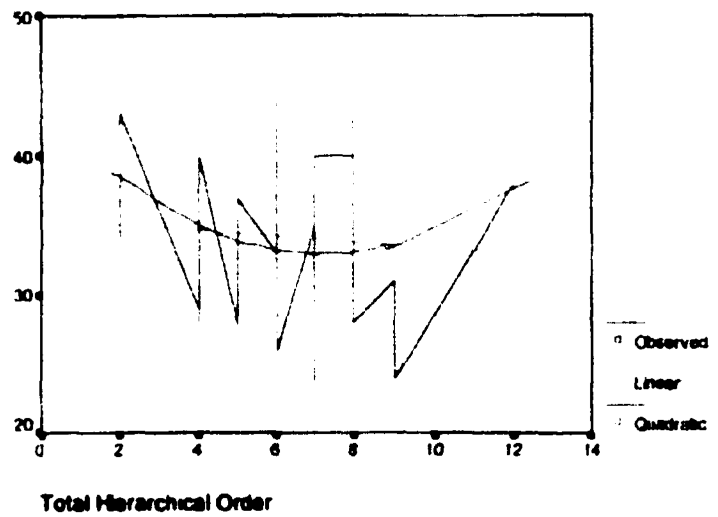


Regression with Product Performance and Hierarchical Order

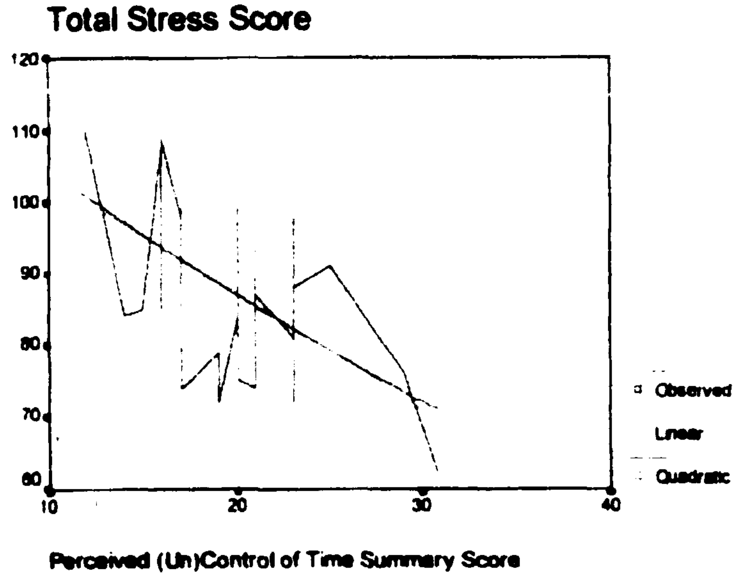
Total Product Performance Score

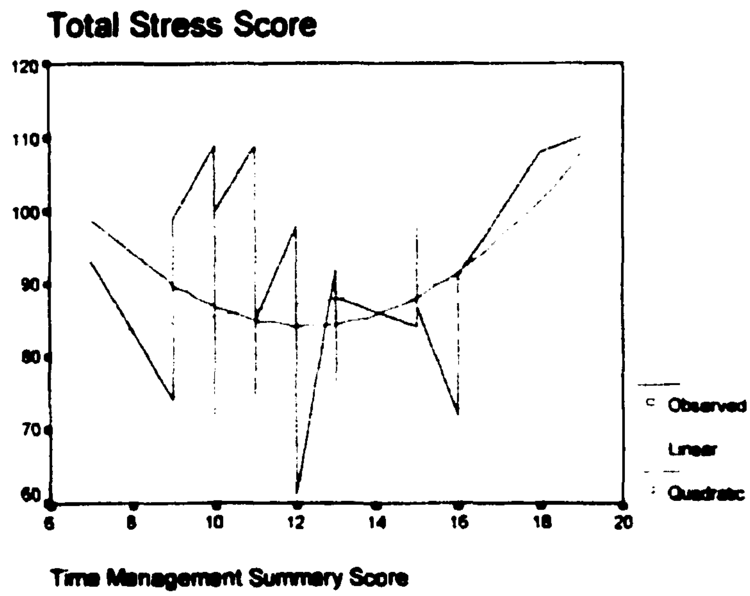


Organizational Performance Total Score

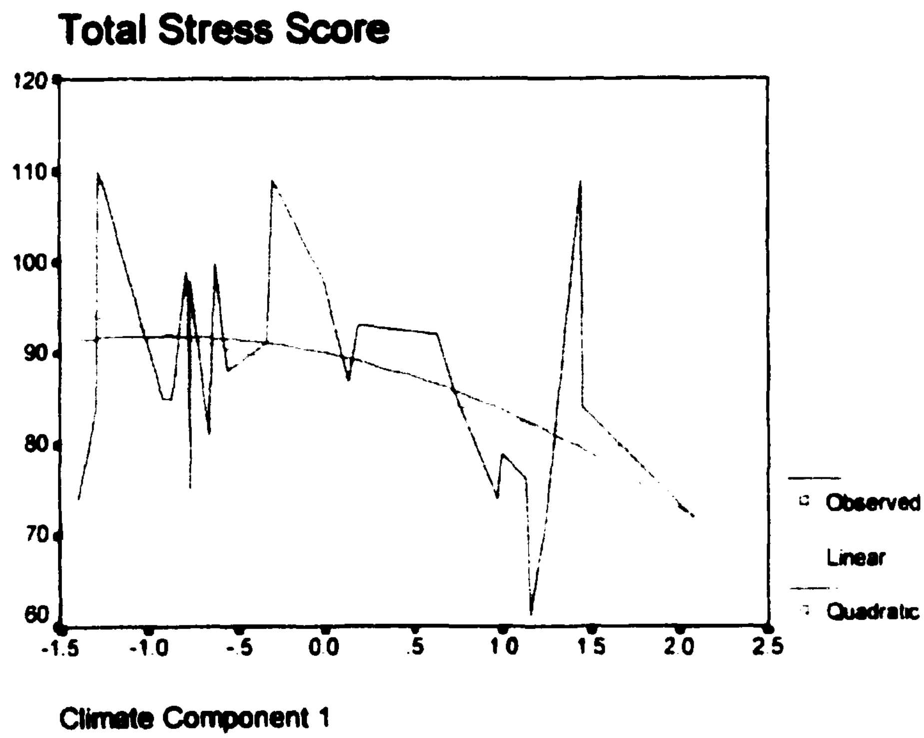


Regression: Perceived Control of Time and Time Management

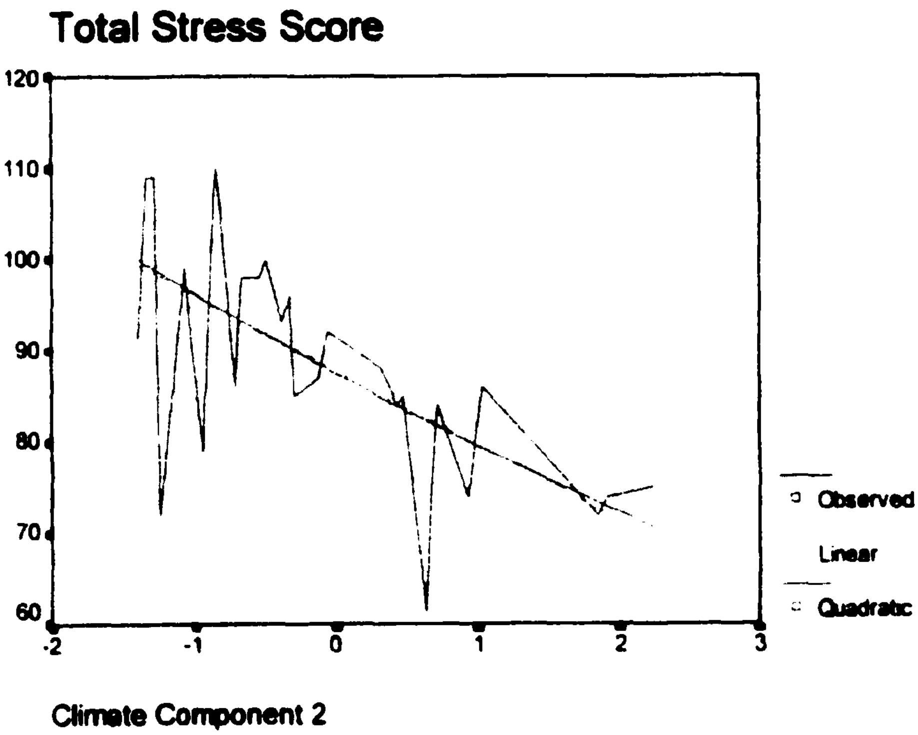




Regression: Climate Factor 1 with Stress



Regression: Climate Factor 2 with Stress



MANOVA: Organizational and Product Performance with Stress Median Split

Between-Subjects Factors

		Value Label	N
Stress Median Split	0	Bottom half	14
	1	Top half	14

Box's Test of Equality of Covariance Matrices[a]

Box's M	2.818
F	.861
df1	3
df2	121680.0
Sig.	.460

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept+STRSHALF

Levene's Test of Equality of Error Variances[a]

	F	df1	df2	Sig.
Total Product Performance Score	.023	1	26	.879
Organizational Performance Total Score	.276	1	26	.604

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+STRSHALF

Multivariate Tests[c]

Effect		Value	F	Hypothesis df	Error df	Sig.	Noncent. Parameter	Observed Power[a]
Intercept	Pillai's Trace	.989	1167.407[b]	2.000	25.000	.000	2334.814	1.000
	Wilks' Lambda	.011	1167.407[b]	2.000	25.000	.000	2334.814	1.000
	Hotelling's Trace	93.393	1167.407[b]	2.000	25.000	.000	2334.814	1.000
	Roy's Largest Root	93.393	1167.407[b]	2.000	25.000	.000	2334.814	1.000
STRSHALF	Pillai's Trace	.379	7.642[b]	2.000	25.000	.003	15.284	.919
	Wilks' Lambda	.621	7.642[b]	2.000	25.000	.003	15.284	.919
	Hotelling's Trace	.611	7.642[b]	2.000	25.000	.003	15.284	.919
	Roy's Largest Root	.611	7.642[b]	2.000	25.000	.003	15.284	.919

a. Computed using alpha = .05

b. Exact statistic

c. Design: Intercept+STRSHALF

MANOVA: Organizational and Product Performance with Stress Median Split

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[a]
Corrected Model	Total Product Performance Score	6.036[b]	1	6 036	940	341	940	154
	Organizational Performance Total Score	295 750[c]	1	295 750	10 842	003	10 842	887
Intercept	Total Product Performance Score	15510 036	1	15510 036	2415 769	000	2415 769	1 000
	Organizational Performance Total Score	32300 036	1	32300 036	1184 129	000	1184 129	1 000
STRSHALF	Total Product Performance Score	6 036	1	6 036	940	341	940	154
	Organizational Performance Total Score	295 750	1	295 750	10 842	003	10 842	887
Error	Total Product Performance Score	166 929	26	6 420				
	Organizational Performance Total Score	709 214	26	27 277				
Total	Total Product Performance Score	15683 000	28					
	Organizational Performance Total Score	33305 000	28					
Corrected Total	Total Product Performance Score	172 964	27					
	Organizational Performance Total Score	1004 964	27					

a. Computed using alpha = 05

b. R Squared = 035 (Adjusted R Squared = - 002)

c. R Squared = 294 (Adjusted R Squared = 267)

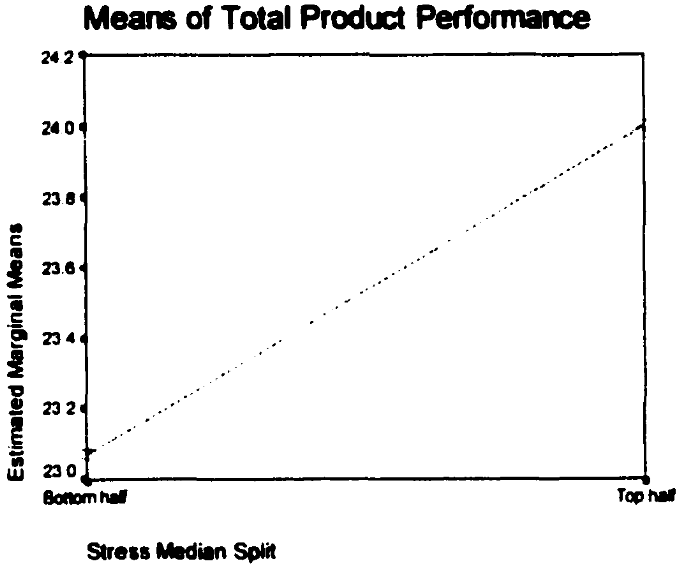
1. Grand Mean

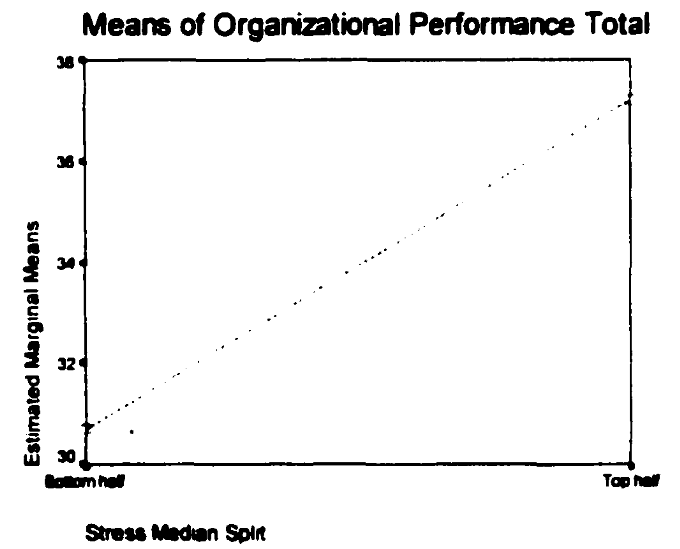
Dependent Variable	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Total Product Performance Score	23.536	.479	22.551	24.520
Organizational Performance Total Score	33.964	.987	31.935	35.993

2. Stress Median Split

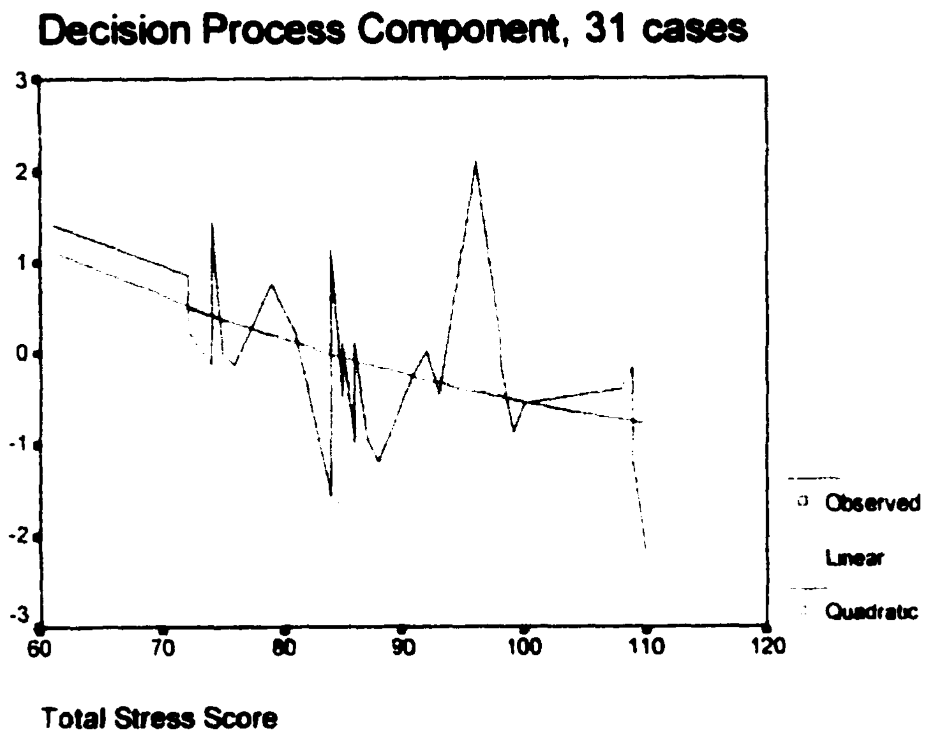
Dependent Variable	Stress Median Split	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Total Product Performance Score	Bottom half	23.071	677	21.679	24.463
	Top half	24.000	.677	22.608	25.392
Organizational Performance Total Score	Bottom half	30 714	1.396	27 845	33 583
	Top half	37 214	1.396	34.345	40.083

MANOVA: Organizational and Product Performance with Stress Median Split





Regression: Total Stress Score with Retained Decision Process Component



APPENDIX G

CANONICAL CORRELATION AND PRINCIPALCOMPONENTS ANALYSIS

FOR ORGANIZATIONAL FACTORS AND ROLE STRESS

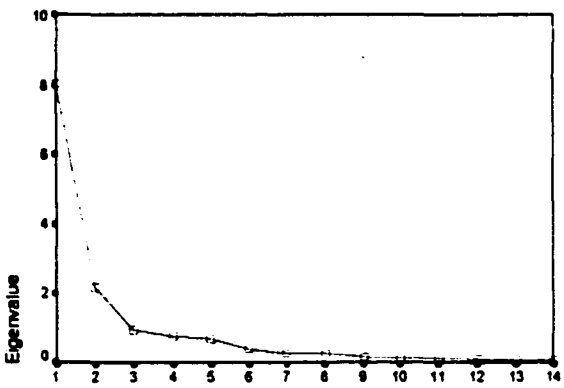
Principal Components Analysis: Centralization

Communalities

	Initial	Extraction
PARHIRE	1.000	.780
PARSPECF	1.000	.591
PARPROMO	1.000	.872
PARDISMS	1.000	.814
PARWLOAD	1.000	.580
PARFUNDS	1.000	.619
PARLONGR	1.000	.780
CONHIRE	1.000	.780
CONSPECF	1.000	.711
CONPROMO	1.000	.842
CONDISMS	1.000	.818
CONWLOAD	1.000	.585
CONFUNDS	1.000	.603
CONLONGR	1.000	.799

Extraction Method: Principal Component /

Scree Plot



Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8 004	57 174	57 174	8 004	57 174	57 174	6 357	45 404	45 404
2	2 158	15.414	72.588	2 158	15 414	72.588	3 806	27 184	72.588
3	957	6 835	79 423						
4	767	5 478	84 900						
5	689	4.920	89 821						
6	408	2.914	92 735						
7	272	1 944	94 679						
8	244	1 742	96 421						
9	147	1 053	97 474						
10	111	794	98.268						
11	.960E-02	711	98 980						
12	.645E-02	475	99 454						
13	.832E-02	345	99 799						
14	.810E-02	201	100 000						

Extraction Method Principal Component Analysis

Principal Components Analysis: Centralization

Rotated Component Matrix[a]

	Component	
	1	2
PARHIRE	.730	
PARSPECF		
PARPROMO	.925	
PARDISMS	.892	
PARWLOAD		
PARFUNDS		
PARLONGR		.889
CONHIRE	.841	
CONSPECF	.709	
CONPROMO	.914	
CONDISMS	.900	
CONWLOAD		
CONFUNDS		.689
CONLONGR		.893

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Component Transformation Matrix

Component	1	2
1	.847	.531
2	-.531	.847

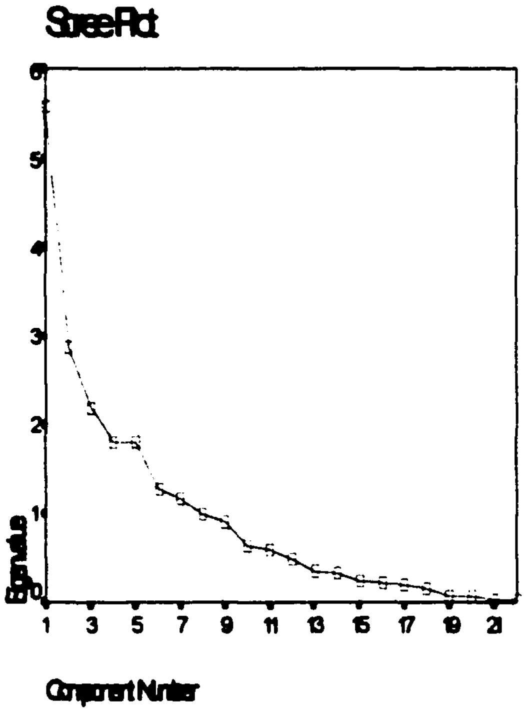
Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Principal Component Analysis: Climate

Communalities

	Initial	Extraction
SATDMINF	1.000	.509
CLSATIS4	1.000	.517
SATDMMEE	1.000	.623
SATDMLVL	1.000	.634
SATDMQKL	1.000	.470
SATDMWOR	1.000	4.968E-02
CLSTRUC1	1.000	.328
CLSRUC2	1.000	.232
CLSTRUC3	1.000	.184
CLRESPO1	1.000	.320
CLRESPO2	1.000	.232
CLRISK1	1.000	.355
CLCONFL3	1.000	.333
CLCONFL2	1.000	.191
CLRISK4	1.000	.664
CLRISK5	1.000	.101
CLRISK6	1.000	.482
CLWARM1	1.000	.415
CLSUPPT1	1.000	.330
CLSUPPT2	1.000	.275
CLSUPPT3	1.000	.513
CLSUPPT4	1.000	.690

Extraction Method: Principal Component An



Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.580	25.363	25.363	5.580	25.363	25.363	5.069	23.042	23.042
2	2.869	13.039	38.402	2.869	13.039	38.402	3.379	15.360	38.402
3	2.186	9.937	48.339						
4	1.814	8.247	56.586						
5	1.807	8.211	64.797						
6	1.284	5.836	70.633						
7	1.169	5.315	75.948						
8	.995	4.524	80.472						
9	.909	4.132	84.604						
10	.641	2.912	87.516						
11	.605	2.748	90.265						
12	.482	2.190	92.454						
13	.345	1.566	94.020						
14	.333	1.512	95.532						
15	.251	1.141	96.673						
16	.212	.963	97.637						
17	.189	.859	98.496						
18	.164	.747	99.243						
19	6.878E-02	.313	99.556						
20	6.029E-02	.274	99.829						
21	2.642E-02	.120	99.949						
22	1.111E-02	5.051E-02	100.000						

Extraction Method: Principal Component Analysis.

Principal Component Analysis: Climate

Rotated Component Matrix [a]

	Component 1	Component 2
SATDMINF	.707	
CLSATIS4	718	
SATDMMEE	.774	
SATDMLVL	.728	
SATDMQKL	.685	
SATDMWOR		
CLSTRUC1		
CLSRUC2		
CLSTRUC3		
CLRESPO1		
CLRESPO2		
CLRISK1		
CLCONFL3		
CLCONFL2		
CLRISK4	-.801	
CLRISK5		
CLRISK6		
CLWARM1		.610
CLSUPPT1		
CLSUPPT2		
CLSUPPT3		-.673
CLSUPPT4		.829

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Component Transformation Matrix

Component	1	2
1	.901	.434
2	-.434	.901

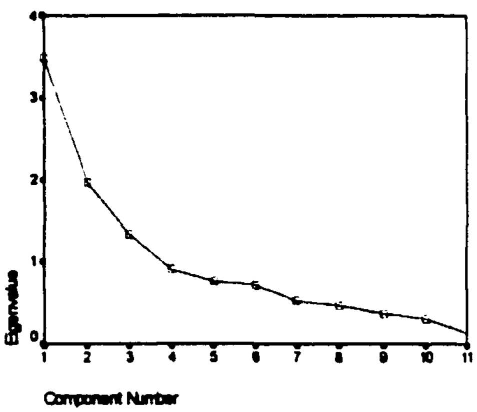
Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Principal Component Analysis: Formalization

Communalities

	Initial	Extraction
FORMMISS	1.000	.590
FORMSTRA	1.000	.493
FORMCHAR	1.000	.632
FORMDESC	1.000	.654
FORMEVAL	1.000	.766
FORMCONT	1.000	.774
FORMOPER	1.000	.307
FORMSTDS	1.000	.268
Time Allocation to Formal Standards	1.000	.311
Time Spent in Continuing Educatio	1.000	.288
Time Spent in Newcomer Training	1.000	.368

Extraction Method: Principal Component A



Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.479	31.624	31.624	3 479	31 624	31 624	3 353	30 483	30 483
2	1.972	17 927	49.551	1 972	17 927	49 551	2 097	19 067	49 551
3	1 333	12.117	61.667						
4	918	8.346	70.014						
5	763	6 932	76.946						
6	721	6.556	83.501						
7	532	4 836	88.337						
8	470	4.276	92.614						
9	372	3.378	95.991						
10	311	2.830	98 822						
11	130	1.178	100 000						

Extraction Method: Principal Component Analysis.

Principal Component Analysis: Formalization

Rotated Component Matrix[a]

	Component	
	1	2
FORMMISS	.720	
FORMSTRA	.689	
FORMCHAR	.784	
FORMDESC	.805	
FORMEVAL		.874
FORMCONT		.880
FORMOPER		
FORMSTDS		
Time Allocation to Formal Standards		
Time Spent in Continuing Education		
Time Spent in Newcomer Training		

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Component Transformation Matrix

Component	1	2
1	.957	.289
2	-.289	.957

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

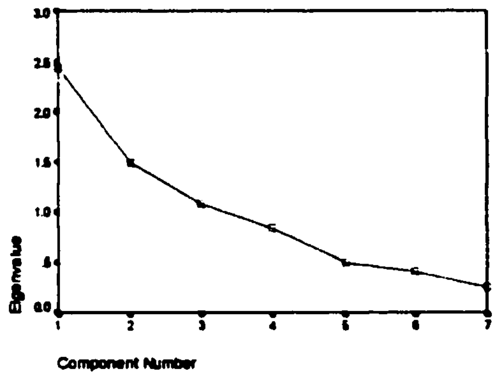
Principal Component Analysis: Time

Communalities

	Initial	Extraction
TIMECTRL	1.000	.587
TIMEKEEP	1.000	.251
TIMEOVER	1.000	.552
TIMEGOAL	1.000	.541
TIMENONE	1.000	.634
TIMELONG	1.000	.696
TIMECOMP	1.000	.663

Extraction Method: Principal Component Ana

Scree Plot



Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Componen	Total	% of Varianc	Cumulative %	Total	% of Varianc	Cumulative %	Total	% of Varianc	Cumulative %
1	2.432	34.748	34.748	2.432	34.748	34.748	2.088	29.826	29.826
2	1.491	21.301	56.049	1.491	21.301	56.049	1.836	26.223	56.049
3	1.083	15.466	71.515						
4	.844	12.052	83.567						
5	.491	7.020	90.588						
6	.405	5.789	96.376						
7	.254	3.624	100.000						

Extraction Method: Principal Component Analysis.

Principal Component Analysis: Time

Rotated Component Matrix[a]

	Component	
	1	2
TIMECTRL		-.766
TIMEKEEP		
TIMEOVER	.740	
TIMEGOAL		.726
TIMENONE		.789
TIMELONG	.811	
TIMECOMP	.778	

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Component Transformation Matrix

Component	1	2
1	.796	.605
2	.605	-.796

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

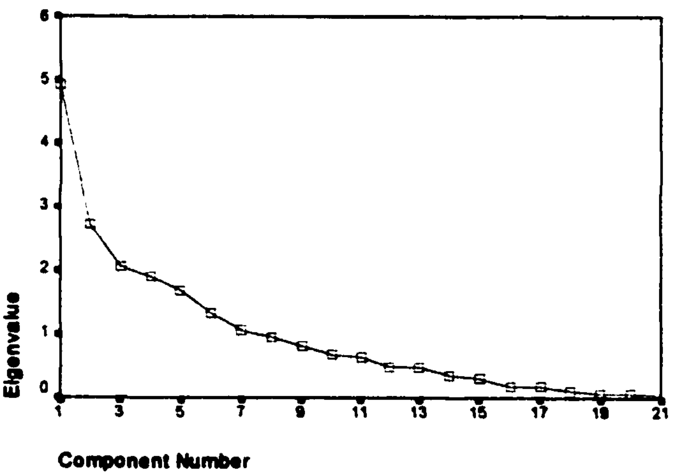
Principal Component Analysis: Role Stress

Communalities

	Initial	Extraction
STRSAMB1	1.000	.648
STRSCON1	1.000	.504
STRSORR1	1.000	.429
STRSCOM1	1.000	8.324E-02
STRSCAR1	1.000	.320
STRSACC1	1.000	.697
STRSAMB2	1.000	.268
STRSCON2	1.000	.244
STRSORR2	1.000	.443
STRSCOM2	1.000	4.786E-03
STRSCAR2	1.000	.513
STRSACC2	1.000	.120
STRSAMB3	1.000	.425
STRSCON3	1.000	.246
STRSORR3	1.000	.249
STRSCOM3	1.000	.533
STRSACC3	1.000	.452
STRSAMB4	1.000	.492
STRSCON4	1.000	.604
STRSGRP1	1.000	.179
STRSGRP2	1.000	.174

Extraction Method: Principal Component Analysis.

Scree Plot



Principal Component Analysis: Role Stress

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.915	23.406	23.406	4.915	23.405	23.406	4.790	22.809	22.809
2	2.712	12.915	36.320	2.712	12.915	36.320	2.837	13.511	36.320
3	2.064	9.780	46.100						
4	1.892	9.012	55.112						
5	1.672	7.963	63.075						
6	1.324	6.306	69.381						
7	1.061	5.051	74.431						
8	.953	4.539	78.970						
9	.825	3.929	82.899						
10	.684	3.259	86.158						
11	.632	3.011	89.169						
12	.492	2.342	91.511						
13	.474	2.259	93.771						
14	.359	1.710	95.480						
15	.309	1.470	96.950						
16	.182	.868	97.818						
17	.170	.810	98.628						
18	.108	.514	99.142						
19	7.211E-02	.343	99.485						
20	6.670E-02	.318	99.803						
21	4.143E-02	.197	100.000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

	Component	
	1	2
STRSAMB1	.795	
STRSCON1	.709	
STRSORR1	-.606	
STRSCOM1		
STRSCAR1		
STRSACC1		.832
STRSAMB2		
STRSCON2		
STRSORR2		
STRSCOM2		
STRSCAR2		
STRSACC2		
STRSAMB3	-.632	
STRSCON3		
STRSORR3		
STRSCOM3	-.726	
STRSACC3		.662
STRSAMB4		
STRSCON4		.776
STRSGRP1		
STRSGRP2		

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Component Transformation Matrix

Component	1	2
1	.971	-.238
2	.238	.971

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalizat

CANONICAL CORRELATION BETWEEN RETAINED ROLE STRESS FACTORS (DEPENDENT) AND ORGANIZATIONAL FACTORS OF CENTRALIZATION, FORMALIZATION, CLIMATE, AND PERCEIVED (UN) CONTROL OF TIME

Canonical Correlations Section

Variate Number	Canonical Correlation	R-Squared	F-Value	Num DF	Den DF	Prob Level	Wilks' Lambda
1	0.939424	0 882517	17 35	14	44	0 000000	0 023515
2	0.894339	0.799842	15 32	6	23	0 000001	0.200158

F-value tests whether this canonical correlation and those following are zero

Note. Only two canonical correlates are feasible with only two dependent variables (for stress)

Variation Explained Section

Canonical Variate Number	Variation in these Variables	Explained by these Variates	Individual Percent Explained	Cumulative Percent Explained	Canonical Correlation Squared
1	ORG FACTORS	ORG FACTORS	14 7	14 7	0 8825
2	ORG FACTORS	ORG FACTORS	19 8	34 4	0 7998
1	ORG FACTORS	ROLE STRESS	13.0	13.0	0 8825
2	ORG FACTORS	ROLE STRESS	15 8	28 8	0 7998
1	ROLE STRESS	ORG FACTORS	44 1	44 1	0.8825
2	ROLE STRESS	ORG FACTORS	40 0	84 1	0 7998
1	ROLE STRESS	ROLE STRESS	50 0	50 0	0 8825
2	ROLE STRESS	ROLE STRESS	50 0	100 0	0 7998

Variable - Variate Correlations Section

	ORG FACTORS1	ORG FACTORS2	ROLE STRESS1	ROLE STRESS2
timefac1	-0 250309	-0.259739	-0.235146	-0.232294
climfac1	-0.054718	0 418801	-0 051404	0 374550
climfac2	0 300159	0 614744	0.281977	0 549789
centfac1	0 398013	0 672795	0.373903	0 601707
centfac2	-0 839380	0 485523	-0 788534	0 434222
formfus1	0 077792	0.238721	0 073080	0 213498
formfus2	0 049227	-0 129918	0.046245	-0 116191
STRSF1	0 461359	0 779057	0 491109	0.871098
STRSF2	-0 818330	0 439218	-0 871098	0 491109

CANONICAL CORRELATION BETWEEN RETAINED ROLE STRESS FACTORS (DEPENDENT) AND ORGANIZATIONAL FACTORS OF CENTRALIZATION, FORMALIZATION, CLIMATE, AND PERCEIVED (UN) CONTROL OF TIME

Canonical Correlation Report

Descriptive Statistics Section

Type	Variable	Mean	Standard Deviation	Non-Missing Rows
ORG FACTORS	timefac1	-3 724619E-16	1	31
ORG FACTORS	clmfac1	-7 162729E-17	1 061068	31
ORG FACTORS	clmfac2	-1 360919E-16	1 10901	31
ORG FACTORS	centfac1	7 162729E-18	1 080811	31
ORG FACTORS	centfac2	-2.327887E-16	1 078195	31
ORG FACTORS	formfus1	-5 372047E-16	1	31
ORG FACTORS	formfus2	2.005564E-16	1	31
ROLE STRESS	STRSF1	-1.289291E-16	1	31
ROLE STRESS	STRSF2	-1 683241E-16	1	31

Correlation Section

	timefac1	climfac1	climfac2	centfac1	centfac2
timefac1	1 000000	-0 152648	-0 353106	-0 121287	-0.075804
climfac1	-0 152648	1 000000	0 049270	-0 003672	-0.003063
climfac2	-0 353106	0 049270	1 000000	0.443209	0 177500
centfac1	-0 121287	-0 003672	0 443209	1 000000	-0 016620
centfac2	-0.075804	-0.003063	0.177500	-0 016620	1 000000
formfus1	-0 358438	0 224155	0 318941	0 300051	0 088307
formfus2	0 004757	0 206215	-0 143427	-0 216317	-0 127457
STRSF1	0 317833	0 351515	0 617402	0 707773	-0 009006
STRSF2	0 090753	-0 139167	0 024377	-0 030203	0 900141

Correlation Section

	formfus1	formfus2	STRSF1	STRSF2
timefac1	-0 358438	0 004757	-0.317833	0 090753
climfac1	0 224155	0 206215	-0 351515	0 139167
climfac2	0 318941	-0 143427	0.617402	0 024377
centfac1	0 300051	-0.216317	0 707773	-0.030203
centfac2	0.088307	-0 127457	-0.009006	0 900141
formfus1	1 000000	0.000000	0 221867	0 041191
formfus2	0 000000	1 000000	-0 078503	-0 097346
STRSF1	0 221867	-0 078503	1 000000	0 000000
STRSF2	0 041191	-0 097346	0 000000	1 000000

CANONICAL CORRELATION BETWEEN RETAINED ROLE STRESS FACTORS (DEPENDENT) AND ORGANIZATIONAL FACTORS OF CENTRALIZATION, FORMALIZATION, CLIMATE, AND PERCEIVED (UN) CONTROL OF TIME

Standardized ORG FACTORS Canonical Coefficients Section

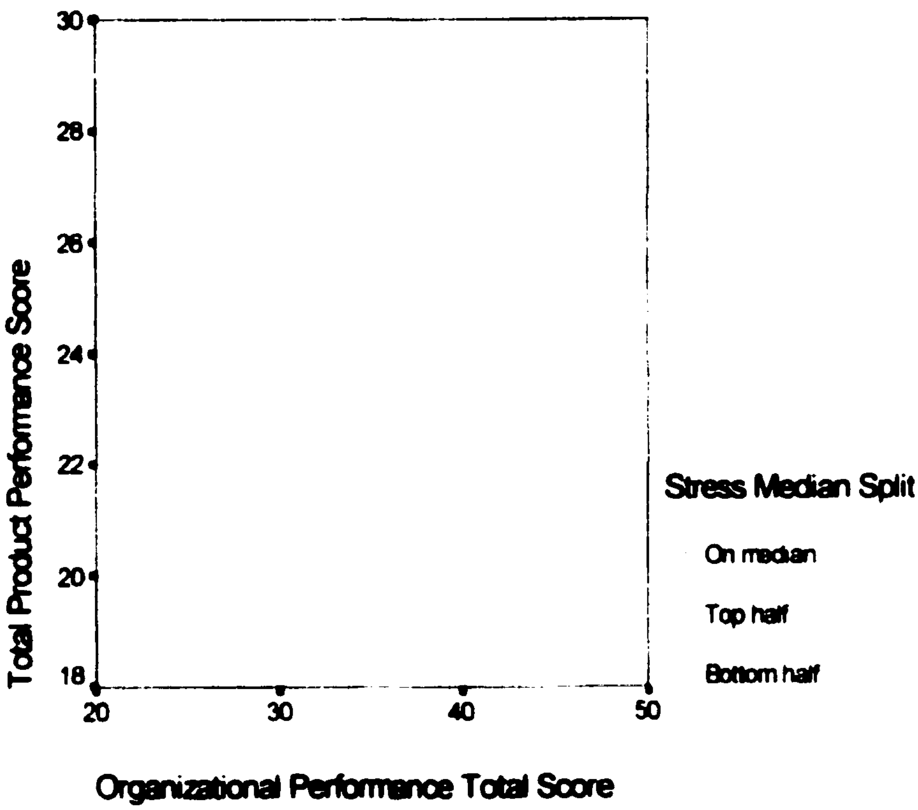
	ORG FACTORS1	ORG FACTORS2
timefac1	-0.221882	-0.131580
climfac1	-0.100316	-0.488877
climfac2	0.303452	0.282836
centfac1	0.255727	0.580930
centfac2	-0.892443	0.458859
formfus1	-0.073958	-0.003895
formfus2	0.056062	0.196238

Standardized ROLE STRESS Canonical Coefficients Section

	ROLE STRESS1	ROLE STRESS2
STRSF1	0.491109	0.871098
STRSF2	-0.871098	0.491109

Note: Both Canonical Correlates are significant; the first correlate relates the ability to participate and control long range planning decisions (CENTFAC2) with the stress of being responsible for the development of subordinates and others and being able to perform responsibilities that suit one's value system (STRSF1). (This correlate appears to represent a positive motivation to strive for the future and predicted success.) The second correlate relates the ability to participate in hiring, promoting, anddismissing decisions (*recruiting?*) (CENTFAC1), combined with the frustration of trying to work through negatively perceived organizational information and decision making processes (CLIMFAC1, negative sign), with the stress of having to work under ambiguity (lack of clear evaluation guidelines, lack of clear orders, task conflict) and little perceived authority to carry out necessary work (STRSF2). This correlate is also strongly associated with the respondent's perception that he/she must look outside the company for future promotion (in CLIMFAC1).

Organizational Product and Support Performance



APPENDIX H

ANALYSIS OF DECISION PROCESS SEGMENTS FOR MANAGER RESPONDENTS

Univariate Analysis of Variance for Decision Process Segments

Between-Subjects Factors

		Value Label	N
Decision Process Segment	1	Beginning segment	31
	2	Middle segment	31
	3	Ending segment	31
Task Condition	2	Two-case condition	39
	4	Four-case condition	54
Stress Level Group	3	Moderate	33
	4	High moderate	45
	5	High	15

Levene's Test of Equality of Error Variances[a]

Dependent Variable: Mean Per Screen View Time in Seconds

F	df1	df2	Sig.
1.819	17	75	.041

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept+GROUP3+CASETYPE+STRSGRP+GROUP3 * CASETYPE+GROUP3 * STRSGRP+CASETYPE * STRSGRP+GROUP3 * CASETYPE * STRSGRP

Univariate Analysis of Variance for Decision Process Segments

Tests of Between-Subjects Effects

Dependent Variable: Mean Per Screen View Time in Seconds

Source	Type III Sum of Squares	df	Mean Square	F	Sig	Noncent. Parameter	Observed Power[a]
Corrected Model	228084.524[b]	17	13416 737	844	638	14 355	530
Intercept	4864928.939	1	4864928.939	306.182	000	306 182	1 000
GROUP3	90831 343	2	45415.671	2 858	.064	5 717	544
CASETYPE	7233.871	1	7233.871	455	502	455	102
STRSGRP	42814 004	2	21407 002	1.347	266	2 695	282
GROUP3 * CASETYPE	31710 273	2	15855 137	998	.374	1 996	218
GROUP3 * STRSGRP	20807 083	4	5201.771	327	859	1 310	120
CASETYPE * STRSGRP	34204.765	2	17102.383	1.076	346	2 153	232
GROUP3 * CASETYPE * STRSGRP	30724.238	4	7681.059	483	.748	1.934	159
Error	1191677.667	75	15889.036				
Total	8146878.767	93					
Corrected Total	1419762 191	92					

a. Computed using alpha = 05

b. R Squared = .161 (Adjusted R Squared = - 030)

1. Grand Mean

Dependent Variable: Mean Per Screen View Time in Seconds

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
259.939	14.855	230.346	289.533

Estimates

Dependent Variable: Mean Per Screen View Time in Seconds

Decision Process Segment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Beginning segment	309.506	25.730	258.248	360.763
Middle segment	242.207	25.730	190.950	293.464
Ending segment	228.106	25.730	176.848	279.363

Univariate Analysis of Variance for Decision Process Segments
2. Decision Process Segment

Pairwise Comparisons

Dependent Variable: Mean Per Screen View Time in Seconds

(I) Decision Process Segment	(J) Decision Process Segment	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	Upper Bound
Beginning segment	Middle segment	67.299	36.388	.068	-5.190	139.787
	Ending segment	81.400*	36.388	.028	8.911	153.889
Middle segment	Beginning segment	-67.299	36.388	.068	-139.787	5.190
	Ending segment	14.101	36.388	.699	-58.387	86.590
Ending segment	Beginning segment	-81.400*	36.388	.028	-153.889	-8.911
	Middle segment	-14.101	36.388	.699	-86.590	58.387

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Univariate Tests

Dependent Variable: Mean Per Screen View Time in Seconds

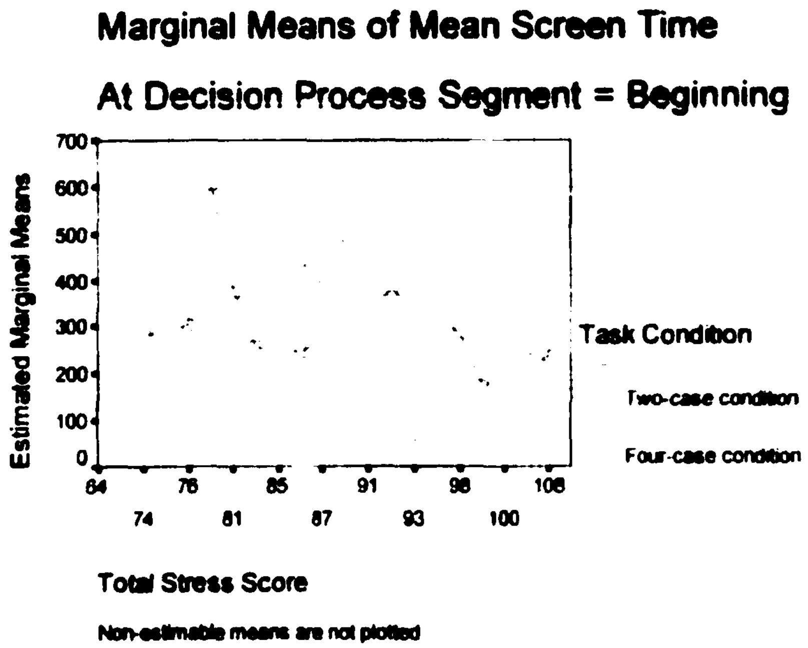
	Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[a]
Contrast	90831.343	2	45415.671	2.858	.064	5.717	.544
Error	1191678	75	15889.036				

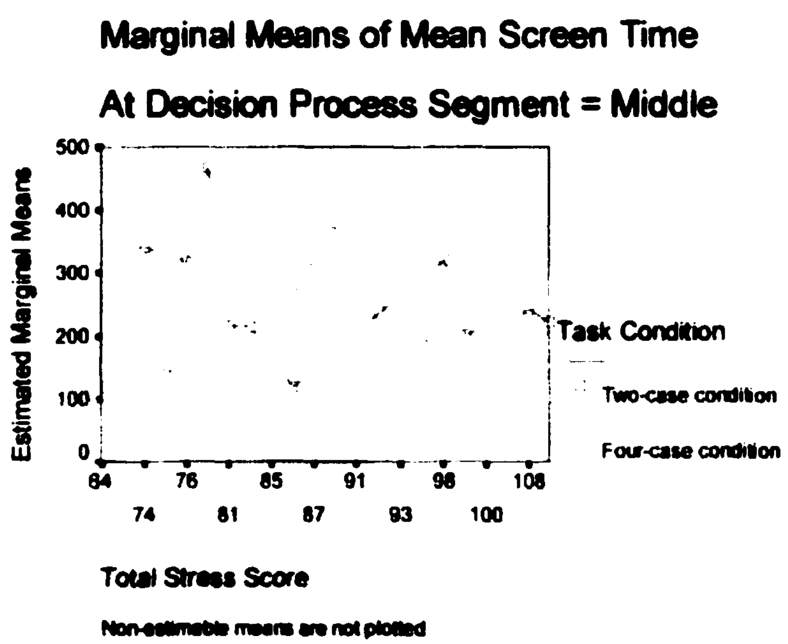
The F tests the effect of Decision Process Segment. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Computed using alpha = .05

Univariate Analysis of Variance for Decision Process Segments

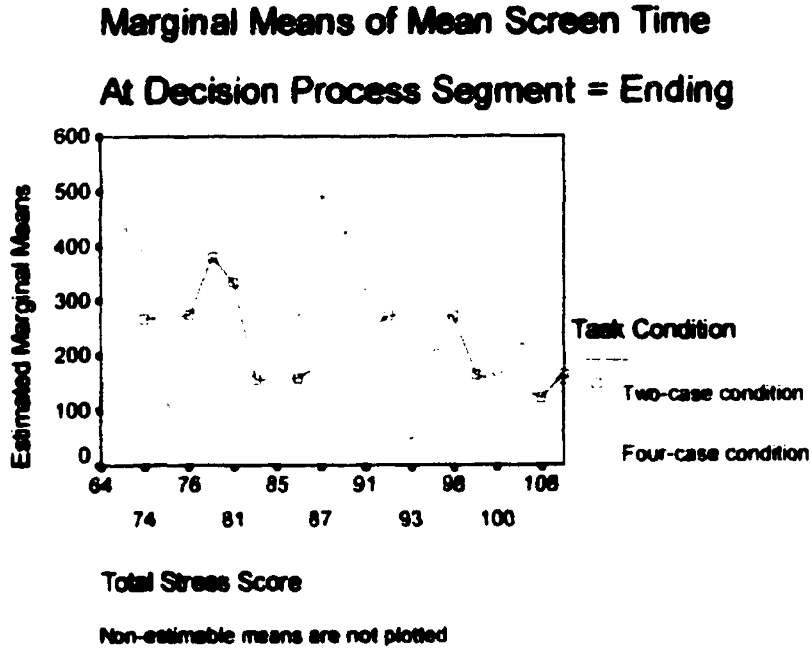
Profile Plots





Univariate Analysis of Variance for Decision Process Segments

Profile Plots



Univariate Analysis of Variance for Decision Process Segments
3. Task Condition

Estimates

Dependent Variable: Mean Per Screen View Time in Seconds

Task Condition	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Two-case condition	269.963	22.584	224.974	314.952
Four-case condition	249.916	19.306	211.457	288.375

Pairwise Comparisons

Dependent Variable: Mean Per Screen View Time in Seconds

(I) Task Condition	(J) Task Condition	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	95% Confidence Interval for Difference[a] Upper Bound
Two-case condition	Four-case condition	20.047	29.711	.502	-39.140	79.234
Four-case condition	Two-case condition	-20.047	29.711	.502	-79.234	39.140

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments)

Univariate Tests

Dependent Variable: Mean Per Screen View Time in Seconds

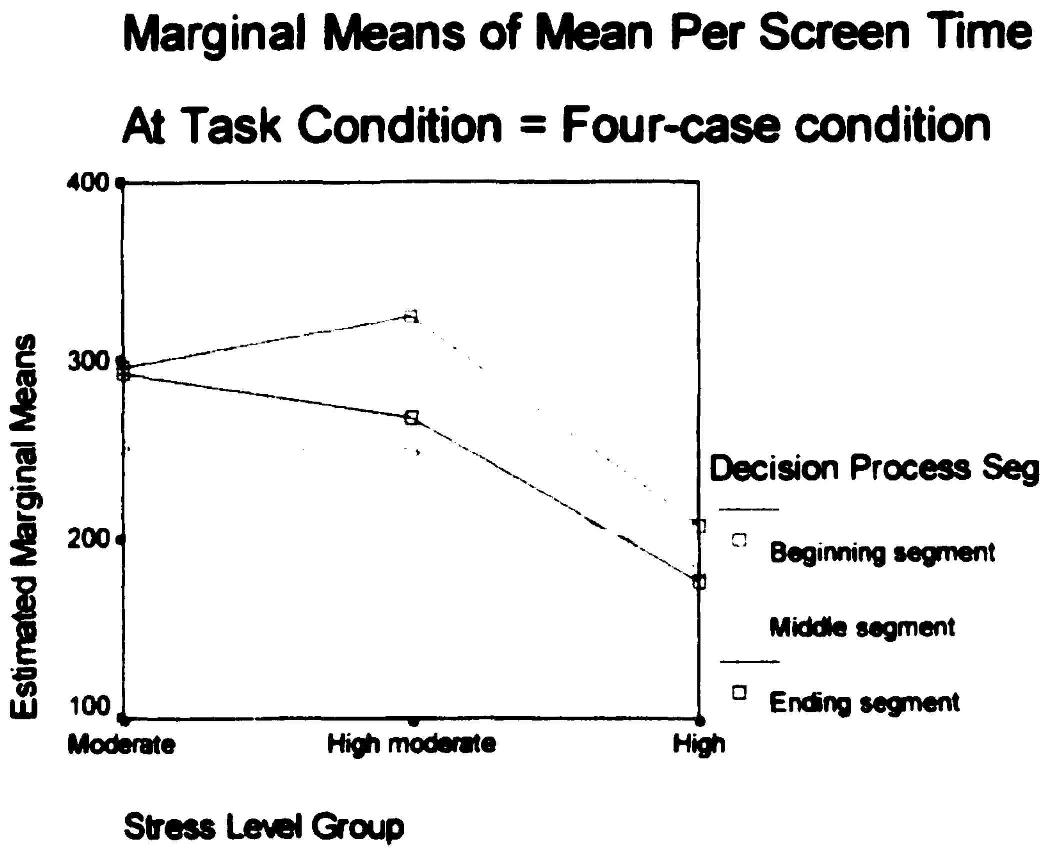
	Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[a]
Contrast	7233.871	1	7233.871	.455	.502	.455	.102
Error	1191678	75	15889.036				

The F tests the effect of Task Condition. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Computed using alpha = .05

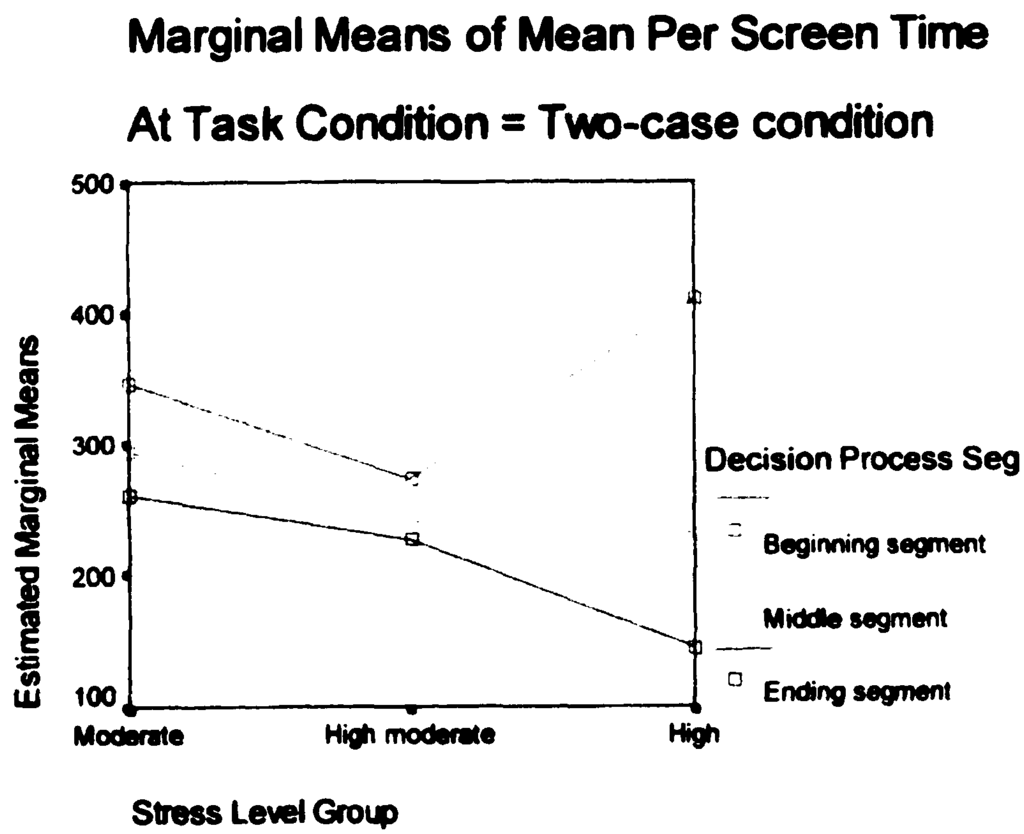
Univariate Analysis of Variance for Decision Process Segments

Profile Plots



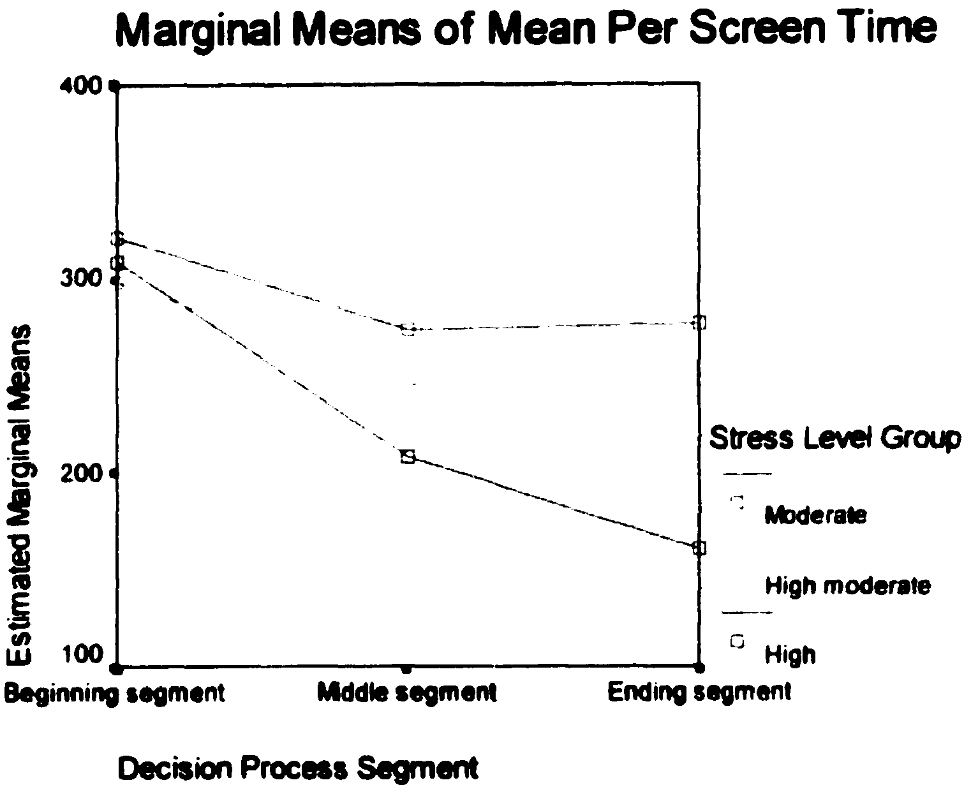
Univariate Analysis of Variance for Decision Process Segments

Profile Plots



Univariate Analysis of Variance for Decision Process Segments

Profile Plots



Univariate Analysis of Variance for Decision Process Segments
5. Stress Level Group

Estimates

Dependent Variable: Mean Per Screen View Time in Seconds

Stress Level Group	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Moderate	290.361	22.034	246.467	334.255
High moderate	263.746	19.931	224.042	303.449
High	225.712	33.218	159.539	291.884

Pairwise Comparisons

Dependent Variable: Mean Per Screen View Time in Seconds

(I) Stress Level Group	(J) Stress Level Group	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	95% Confidence Interval for Difference[a] Upper Bound
Moderate	High moderate	26.615	29.711	.373	-32.571	85.802
	High	64.649	39.861	.109	-14.758	144.057
High moderate	Moderate	-26.615	29.711	.373	-85.802	32.571
	High	38.034	38.738	.329	-39.136	115.204
High	Moderate	-64.649	39.861	.109	-144.057	14.758
	High moderate	-38.034	38.738	.329	-115.204	39.136

Based on estimated marginal means

a. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Univariate Tests

Dependent Variable: Mean Per Screen View Time in Seconds

	Sum of Squares	df	Mean Square	F	Sig.	Noncent. Parameter	Observed Power[a]
Contrast	42814.004	2	21407.002	1.347	.266	2.695	.282
Error	1191678	75	15889.036				

The F tests the effect of Stress Level Group. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

a. Computed using alpha = .05

Univariate Analysis of Variance for Decision Process Segments

6. Decision Process Segment * Stress Level Group

Dependent Variable: Mean Per Screen View Time in Seconds

Decision Process Segment	Stress Level Group	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Beginning segment	Moderate	321.100	38.164	245.073	397.127
	High moderate	298.250	34.521	229.481	367.019
	High	309.167	57.534	194.552	423.781
Middle segment	Moderate	273 199	38.164	197 173	349.226
	High moderate	245.287	34.521	176.518	314.055
	High	208.135	57.534	93.520	322.749
Ending segment	Moderate	276.783	38.164	200 757	352.810
	High moderate	247.700	34.521	178.931	316.469
	High	159.833	57.534	45.219	274.448

7. Task Condition * Stress Level Group

Dependent Variable: Mean Per Screen View Time in Seconds

Task Condition	Stress Level Group	Mean	Std Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Two-case condition	Moderate	300.688	29.711	241.502	359.875
	High moderate	246.700	32.546	181.864	311.536
	High	262.500	51.460	159.986	365.014
Four-case condition	Moderate	280.033	32.546	215.198	344.869
	High moderate	280.791	23.014	234.945	326.637
	High	188.923	42.017	105.220	272.626

8. Decision Process Segment * Task Condition * Stress Level Group

Dependent Variable Mean Per Screen View Time in Seconds

Decision Process Segment	Task Condition	Stress Level Group	Mean	Std Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Beginning segment	Two-case condition	Moderate	346 000	51.460	243.486	448.514
		High moderate	272 600	56.372	160.301	384 899
		High	411.000	89 132	233 440	588.560
	Four-case condition	Moderate	296.200	56 372	183 901	408.499
		High moderate	323.900	39 861	244.493	403.307
		High	207 333	72 776	62.356	352 311
Middle segment	Two-case condition	Moderate	294 899	51 460	192.384	397 413
		High moderate	240 300	56.372	128.001	352 599
		High	232 500	89.132	54.940	410.060
	Four-case condition	Moderate	251 500	56.372	139.201	363.799
		High moderate	250.273	39.861	170 866	329.681
		High	183.769	72.776	38 792	328.746
Ending segment	Two-case condition	Moderate	261 167	51 460	158.652	363 681
		High moderate	227.200	56 372	114.901	339 499
		High	144.000	89 132	-33.560	321.560
	Four-case condition	Moderate	292.400	56 372	180.101	404.699
		High moderate	268.200	39 861	188.793	347.607
		High	175.667	72 776	30.689	320.644

Univariate Analysis of Variance for Decision Process Segments

Post Hoc Tests

Mean Per Screen View Time in Seconds

	Decision Process Segment	N	Subset 1
Tukey HSD[a,b]	Ending segment	31	247.16
	Middle segment	31	249.92
	Beginning segment	31	309.77
	Sig.		.130

Means for groups in homogeneous subsets are displayed.
Based on Type III Sum of Squares
The error term is Mean Square(Error) = 15889.036.

a. Uses Harmonic Mean Sample Size = 31.000.

b. Alpha = .05.

Mean Per Screen View Time in Seconds

	Stress Level Group	N	Subset 1
Tukey HSD[a,b,c]	High	15	218.35
	High moderate	45	269.43
	Moderate	33	291.30
	Sig.		.107

Means for groups in homogeneous subsets are displayed.
Based on Type III Sum of Squares
The error term is Mean Square(Error) = 15889.036.

a. Uses Harmonic Mean Sample Size = 25.169.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Alpha = .05.

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BIOGRAPHICAL STATEMENT

Mavis Cheney Sauer was born in Fort Worth, Texas. She lived with her family in Uvalde and Fort Worth until entering Austin College in Sherman, Texas. She graduated from Austin College with majors in Philosophy and Religion.

After graduation, she was employed as a telecommunications systems consultant for Southwestern Bell, a division of AT&T. Subsequently she was employed in telecommunications systems management with the Western Company of North America.

With encouragement from higher company management, she relocated to Austin to complete a MBA program at the University of Texas. While in the MBA program she was concurrently enrolled in the Ph.D. program in Management. During that time she had several independent telecommunications consulting engagements in Dallas/Fort Worth. She also served as graduate research and teaching assistant to several professors in business policy, strategy, organization theory, and the IC^2 Institute. Personal circumstances made it imperative for her to voluntarily withdraw from the Ph.D. program while still working on her dissertation.

Subsequently she reentered the University of Texas at Arlington, graduating with a Ph.D. in Business Administration in 2000. Her research in business strategy and organization theory has emphasized the problems of information systems design and organizational decision making. She has presented papers on organizational learning and uncertainty at several national meetings of the Academy of Management and the Institute for Operations Research and Management Science (INFORMS).