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ABSTRACT

TIME CONSTRAINTS, INFORMATION REDUNDANCY,
AND DECISION BEHAVIOR: A PROCESS TRACING APPROACH

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The effects of time constraints and information redundancy on decision behavior were studied using a process tracing methodology. Information redundancy was defined both as dimension similarity as indicated by dimension labels (expected redundancy) and as actual intercorrelations among dimensions (actual redundancy). Undergraduate psychology students (n = 140) completed three job choice task on the computer, each comprised of selecting the best job from among ten job offers. Decision behavior was studied with measures of depth, latency, nonlinearity, and pattern of search. Main effects of time constraints and expected redundancy, and an interaction between expected and actual redundancy were found for a number of the search behavior measures. As the direction of effects was not always as predicted, a number of hypotheses were generated in the discussion of the results. The success of this study as exploratory research can be observed in the many directions for future research that were identified.

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TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

INTRODUCTION

Decision making is the process of gathering and combining information to form evaluations or choices and then learning from these outcomes. Decision making processes are of interest to many areas of psychology and related disciplines for both theoretical and practical reasons. Theoretically, the study of decision making offers insight into cognitive processes and information processing limitations. Practically, job choice, performance appraisal, and selection and promotion decisions are all work related decision situations that can benefit from decision research. A dominant issue of both practical and theoretical interest is the fact that people do not always attend to all available information nor combine information in an "optimal" manner. Two approaches that have been widely used to study this decision making issue are policy capturing and process tracing.

Policy capturing is concerned with predicting the outcome of a decision task based on the input information (Abelson & Levi, 1985). One common policy capturing approach is to fit a linear regression equation using input information to predict an outcome. As these models typically demonstrate good predictive accuracy (Abelson & Levi, 1985), the weights attached to the input cues are used to simluate actual strategy use by the decision maker. Recently the assumptions of policy capturing have been challenged (Einhorn, Kleinmuntz, & Kleinmuntz, 1979), and process tracing approaches have been proposed as techniques that can more directly inform the researcher about the decision maker's cognitive processes (Ford, Schmitt, Schechtman, Hults, & Doherty, 1989; Payne, 1976).

Process tracing is concerned with the process by which information is accessed. Search for information is monitored such that amount, pattern, and duration of information access is traced and information integration is assumed to reflect this search. Congruent with information processing approaches of cognitive psychology, the cognitive processes underlying decision strategies are inferred from external behavior (Abelson & Levi, 1985). The decision outcome is collected in process tracing studies, but the information search process prior to the decision is typically of primary interest. The two most common process tracing techniques are verbal protocol analysis (e.g. Olshavsky, 1979; Svenson, 1979) and use of an information board (e.g. Capon & Burke, 1980; Jacoby, Chestnut, & Fisher, 1978). Verbal protocol analyses involve having the decision maker "think aloud" or report what they are doing as they make the decision. Information boards present subjects with a hidden array of dimensions for a number of alternatives, and the behavior involved in accessing the information is recorded.

Process tracing techniques tend to be descriptive and indicate how decisions are made (Abelson & Levi, 1985). In keeping with this orientation, much of the research conducted in the process tracing framework has been descriptive, demonstrating the influence different variables have on information search (Ford et al., 1989). Little effort has been directed toward developing a theoretical framework from which process tracing research could adopt a more useful, predictive orientation. One exception is the contingency model of decision making (Beach & Mitchell, 1978) in which a cost/benefit approach is utilized to predict information access.

A number of issues involved in "real world" decision making can be investigated using the process tracing methodology. Redundancy of information is commonly found in nonexperimental decision making situations (Abelson & Levi, 1985) but has received no attention in the process tracing literature. Redundancy refers to the intercorrelations among information cues and can be theory driven or data driven or both. In terms of theory driven redundancy, dimension labels may lead the decision maker to infer a relationship between dimensions based on past experience. Schema theory has often been used to conceptualize and define such perceived relationships in domains other than decision making. Data driven redundancy refers to the statistical correlations between dimensions based on information cue values.

Another characteristic of "real world" decision making is the presence of time constraints. Often decisions are required quickly and efficiently, but without a sacrifice in accuracy. Time constraints can limit the amount of information attended to and can alter the strategy used to reach the decision (Wright, 1974). While contingency theorists have hypothesized that time constraints should have an effect on decision making (Beach & Mitchell, 1978; Christensen-Szalanski, 1980), only a few studies have examined the effect of time pressures within a process tracing format (Ben Zur & Breznitz, 1981; Payne, Bettman, & Johnson, 1987).

This study will investigate the effects of dimension redundancy and time constraints on information search in a process tracing decision task. The effects of both expected redundancy and actual redundancy will be investigated as will the combined effects when actual cue information is inconsistent with prior expectations of redundancy. Beach and Mitchell's (1978) contingency theory will be used to provide both a conceptual framework and an aid in generating hypotheses. Schema theory will also be used to help form hypotheses.

A Contingency Model

Decision making strategies have often been defined in the process tracing literature by the variability and pattern (inter vs. intradimensional) of information search (e.g. Billings & Marcus, 1983; Payne, 1976). Variability in the amount of information searched refers to the degree to which some dimensions are accessed more often than other dimensions and is indicative of nonlinear decision strategies. Linear decision strategies are characterized by a constant number of dimensions accessed across all alternatives. Search pattern refers to the extent to which information is accessed primarily across dimensions within one alternative (interdimensional) or across alternatives within one dimension (intradimensional). Thus, although both the additive and conjunctive strategies are characterized by interdimensional search, the latter is distinguished from the former by a variable search of dimensions.

The strategy by which individuals come to different decisions is a prominent concern in the decision making literature. The current study also addresses this question. The contingency model (Beach & Mitchell, 1978) provides a basis for predicting when particular decision strategies will be chosen. The model classifies decision strategies along a continuum which varies with respect to the resources required to use a strategy and the accuracy of that strategy. Classifications of strategies extend from aided-analytic (characterized by the use of prescribed procedures and processing tools to form optimal decisions) through unaided-analytic (dimensions accessed to some degree but no tools used to aid processing and sometimes suboptimal decisions made) to nonanalytic (preformulated decision rules that require little or no information to be processed). The decision strategies most commonly observed in process tracing research are of the unaided-analytic type. For reasons that will be developed later, this study will only classify decision strategies along a single linear-nonlinear continuum.

Beach and Mitchell (1978) proposed a contingency framework to help identify factors that influence strategy selection. This framework has proven to be useful for organizing research findings from the process tracing domain (Ford et al., 1989). Strategy selection is suggested to be a function of the decision environment, the decision task, and personal characteristics of the decision maker, as well as interactions between each of these influencing factors (Beach and Mitchell, 1978). Within this framework, each group of influences will be defined and exemplified with previous research. The variables of interest in this study will also be stated and relevant theory and research cited.

The Decision Environment

The situational characteristics that may influence choice of a decision strategy define the decision environment (Beach and Mitchell, 1978). Examples include the significance of the task, the accountability of the decision maker, and time or money constraints on the decision process. Billings and Scherer (1988) and Klayman (1985) both found effects for task significance on various measures in process tracing tasks; however, these results were imbedded within interactions with other decision factors. In a study that did not use the process tracing format, Waller and Mitchell (1984) found that when asked to select a decision strategy, participants chose more analytic strategies under conditions of high task significance than under conditions of low task significance. Accountability and money constraints have not been examined in process tracing studies. The effect of time constraints on information search will be a variable investigated in this study.

Previous studies have examined the effect of time constraints on decision behavior. In a policy capturing experiment, Wright (1974) had college students rate the likelihood that they would purchase a number of cars based on five information dimensions. Students were subject to one of three time pressure conditions: high time pressure, low time pressure, and undefined time pressure. The decision policies of students in the high time pressure condition were proportionately more similar to a negatively biased decision model than those in the low and undefined time pressure conditions. These results suggest that students operating under high time pressures were more likely to place greater weight on negative evidence, possibly as a strategy for facilitating the decision process. Billings and Marcus (1983) also found an effect of time pressure on decision strategy using a policy capturing technique. Subjects required to rate apartments in a time limited condition tended to use more interactive decision strategies (interactive use of information cues) and fewer linear decision strategies than subjects in an unconstrained condition. Christensen-Szalanski (1980) found that the imposition of deadlines on a problem solving task prevented the consideration of certain decision strategies and led subjects to use strategies other then those they would have preferred to use. Subjects faced with more distant deadlines did not exhibit these characteristics. Finally, Smith, Mitchell, and Beach (1982) found that high time constraints reduced the participants' confidence in certain decision strategies, whereas low time constraints did not. These studies all provide some support for the prediction that time constraints affect strategy use.

Two studies in the process tracing literature have examined the effects of time constraints on decision behavior. Ben Zur and Breznitz (1981) examined the effect of high (8 seconds), medium (16 seconds), and low (32 seconds) time pressures on risky choice behavior. Results indicated that subjects spent more time examining, and accessed a greater proportion of negative dimensions in the high pressure condition than in the medium and low pressure conditions. These results are consistent with Wright's (1974) findings. Payne et al. (1987) used a computer controlled, four alternative by four dimension information board with either no time pressure or a 15 second time limit on information search. Results indicated that in the time constrained condition, compared to the unconstrained condition, subjects accessed fewer items, spent less time accessing each item, and exhibited more variability in accessing dimensions. The last result suggests greater use of nonlinear strategies in the time constrained condition. Finally, this study found that processing was marginally more intradimensional under time constraints. No process tracing studies have examined the effects of more distant time limits (e.g. 10 minutes vs. 20 minutes) on decision behavior in a somewhat more complex decision task.

Beach and Mitchell (1978) suggested that strategy choice involves a cost/benefit analysis. Strategy selection is based on a compromise between the desire to make a correct decision and the reluctance to spend personal resources while making the decision. The strategy selected is the one that maximizes the probability of making a correct decision (benefit) while minimizing costs such as effort and resources (Christensen-Szalanski, 1978). This model suggests that as the cost of accessing information increases and the benefit the information provides toward making a correct decision remains constant, a decision maker will tend to use a strategy that limits information search (i.e. a nonlinear strategy). The above research on time limits clearly offers support for the cost/benefit model, because the imposition of time limits serves to limit the probability of making a correct decision (limit benefit). In an attempt to maintain accuracy, simplifying decision strategies are adopted.

One difficulty with the cost/benefit approach is that many factors contribute to both total costs and benefits. It is hard to define all possible costs and all possible benefits, especially since both are likely dependent on the context of the decision problem (Einhorn & Hogarth, 1981). In order to use this model for predictive purposes, one must isolate the variables of interest and vary them sufficiently such that the manipulated effects dominate the influence of the remaining unmanipulated factors. Another criticism of this model focuses on the inability to measure individual perceptions of costs and benefits (Payne, 1982). In order to determine if people actually use a cost/benefit analysis to select a decision strategy one must measure the various costs and benefits that are being weighed. Additionally, the assumption must be made that the decision maker is aware of the strategy selection process. Thus far, this assumption has not been tested (Payne, 1982). However, this study is not concerned with whether people actually use a cost/benefit analysis in decision making, rather the cost/benefit model is used as a theoretical approach for generating hypotheses.

The Decision Task

Characteristics of the decision task include those items that define or differentiate decision problems. Beach and Mitchell (1978) proposed four task characteristics likely to be important influences on strategy selection; problem complexity, ambiguity, instability, and unfamiliarity. Task complexity refers to the amount of information that must be processed by the decision maker and has been manipulated by varying the number of alternatives and/or the number of dimensions in the decision matrix. Complexity has undoubtedly been the most frequently manipulated variable in process tracing studies. Ford et al. (1989) found 20 studies that investigated task complexity and almost all reported that as complexity increased there was a greater tendency to access less information, access information in a more variable search pattern, and spend less time examining each accessed information cue. Increased complexity was also associated with nonlinear strategy use. Oddly enough, Beach and Mitchell (1978) predicted the opposite effect, that as complexity increased the decision maker would likely use a more analytic strategy. One can question the basis of this prediction from the cost/benefit approach in that with a more complex problem there is more information to examine so there are greater costs involved in using a linear decision strategy. As the benefit of the linear strategy is approximately equal for problems of varying complexity, the costs are more likely to outweigh the benefits in a complex decision problem than in a less complex problem. Therefore, with increasing task complexity there should be a greater preference for the use of less analytical, nonlinear strategies.

Task ambiguity and instability refer to different dimensions of uncertainty associated with the decision problem. Ambiguity is the extent to which the goals of the task, the decision alternatives, and the decision information are unclear or ambiguous. Instability refers to the extent to which these characteristics change some time during or after the decision process. Neither of these variables have been investigated using process tracing methods (Ford et al., 1989). The final task characteristic, unfamiliarity, could easily be classified as a characteristic of the decision maker. It refers to the decision maker's prior experience with the decision task. Although not extensively studied, some research has demonstrated a relationship between prior experience and search behavior. For example, Jacoby et al. (1978) measured purchasing experience with brand name cereals and found significant correlations with amount of information accessed and number of alternatives accessed.

One task characteristic that was not identified by Beach and Mitchell (1978) but that is likely to influence decision behavior is the redundancy of the dimension information. Dimension redundancy refers to the intercorrelations between information dimensions. Dimensions that are highly correlated are said to be redundant, whereas those that are uncorrelated are orthogonal. Both expectations of redundancy and actual redundancy may affect decision behavior. Expectation of redundancy refers to prior theories the decision maker has about dimension intercorrelations based on the dimension labels. For example, when choosing a job and examining job characteristics, one would expect individual autonomy to be highly correlated with supervisory characteristics. This expected redundancy will be discussed in detail in the next section as a characteristic of the decision maker. Actual redundancy refers to the dimension intercorrelations in the data presented in the decision task and will be the focus of the current discussion.

Research in the process tracing domain has not examined the effects that dimension redundancy may have on search behavior. In fact, data characteristics in general have been largely ignored in process tracing studies. However, two lines of research with different focusses are relevant to this investigation: Covariation assessment research that has examined a person's ability to perceive intercorrelations in data, and decision making research that has examined the effects of information redundancy in policy capturing and multiple cue probability learning.

Covariation assessment. One precondition to subjects using knowledge of information redundancy in an optimal manner when making a decision is their ability to detect the redundancy. Considerable research has been directed toward human covariation assessment, and after a limited review of this research, Nisbett and Ross (1980) conclude than people are "extremely limited" in their ability to detect covariation. However others, who have conducted more extensive reviews, disagree with this conclusion (Alloy & Tabachnik, 1984; Crocker, 1981).

Experiments that examine people's covariation detecting abilities have used both continuous and bivariate data. The former is typically studied by presenting subjects with a series of number pairs and collecting subjective estimates of the covariation in these pairs. These estimates are then compared to the Pearson r between the data pairs (e.g. Erlick & Mills, 1967). Bivariate covariation studies typically present subjects with 2 X 2 contingency tables and compare subjects' covariation estimates with one or more appropriate statistics such as the chi-square, the phi coefficient, or the delta coefficient (e.g. Arcuri & Forzi, 1988). The bivariate approach has been used in many more covariation assessment studies than the examination of continuous variables (Crocker, 1981). However, as this study is concerned with redundancy in continuous variables, the research reviewed will emphasize this orientation.

Erlick (1966) and Erlick and Mills (1967) presented subjects with pairs of dials with five dividing marks but no numbers on each dial. Subjects saw 20 dial pairs and then estimated the degree of relationship between the pairs. Actual correlations between the pairs ranged from -1.00 to +1.00. Results indicated that estimates were better for positive correlations than for negative but with both subjects tended to underestimate the actual correlation. Similar evidence that people are conservative in their estimates of covariation was presented by Beach and Scopp (1966). Subjects were presented with pairs of numbers that ranged from 1 to 10 and judgments were obtained of whether the relationship was positive or negative. Ratings of confidence in judgments were also collected. Accuracy of judgments and confidence increased as the actual correlations increased, but subjective ratings of confidence in their estimates were lower than predicted using a Bayesian model. When subjects were presented with sets of 10 number pairs, Jennings, Amabile, and Ross (1982) found greater underestimates of covariance between pairs that were weakly correlated. As actual correlations increased the accuracy of subjects' estimates also increased. Crocker (1981) concluded that although subjects tend to underestimate covariance of continuous variables, "there is a strong ordinal relationship between actual and estimated correlations" (p 279). Similar conclusions were reached after a review of covariation detection with bivariate data, however accuracy was dependent on data presentation format, question framing, and direction of relationship (Alloy & Tabachnik, 1984; Crocker, 1981).

Redundancy and decision making. It has often been recognized that in order to more closely simulate "real world" decisions, information dimensions that are intercorrelated rather than orthogonal must be used (Lane, Murphy, & Marques, 1982; Schmitt & Dudycha, 1975b). However, intercorrelated dimensions produce problems when regression techniques are used to capture the decision maker's decision policy (Abelson & Levi, 1985). Standardized regression weights demonstrated instability when predictors are highly correlated (Schmitt & Levine, 1977). Although there are a number of indices of importance besides standardized beta weights, these are also problematic when dimensions are correlated. Schmitt and Levine (1977) calculated five different policy capturing indices with a set of highly intercorrelated data. These indices were: the squared correlation between predictor and criterion, the standardized regression weight (beta), beta multiplied by r, the usefulness index (U), and Englehart's measure (E). Considerable variability was observed among the different importance indices, even with regard to rankings of dimension importance based on these indices.

Dudycha and Naylor (1966) varied the intercorrelations among dimensions in a multiple-cue probability learning study and found that both pattern and levels of validity coefficients varied across the different intercorrelation conditions. Lane et al. (1982), however, suggested that raw-score regression weights are consistent across varying dimension intercorrelations. They argue that the assumption of orthogonal cues is not necessary if raw-score beta weights are used. Evidence was also provided that demonstrated the stability of raw-score beta weights across variations in cue intercorrelation structure. Clearly, the issue of how to assess importance of intercorrelated dimensions in policy capturing experiments has not yet been resolved.

The effect of cue intercorrelations on learning has been examined in multiple-cue probability learning (MCPL) studies. One question addressed is whether subjects can use knowledge of cue redundancy to aid their learning in a decision task. In a series of studies, Schmitt and Dudycha (1975a, 1975b) manipulated cue intercorrelations and cue validities on MCPL tasks. Generally, cue intercorrelations had little effect on the correlation between subjects' judgments and actual values of the predicted phenomenon, although there was some evidence to indicate that redundancy actually depressed this correlation when cue validities are positive. Some studies found redundancy to increase the consistency with which subjects used a particular decision strategy, while others found no effect. The degree to which subjects' strategies matched the optimal strategy inherent in the decision task was consistently shown to be inversely related to cue intercorrelations when cue validities were positive. Lindell and Stewart (1974) obtained similar results with a MCPL task that was designed to investigate whether redundancy impedes learning. As predicted, redundancy was inversely related to performance, when performance was defined as the correlation between subjects judgments and linearly weighted criterion.

While the MCPL literature failed to indicate that redundancy facilitates decision making, other judgment and decision literature offers some support for this notion. Phelps and Shanteau (1978) demonstrated that livestock judges can use 9 to 11 dimensions of information when judging female pigs based on written descriptions of 11 dimensions. However, when presented with photographs of pigs, judges were found to use fewer than three dimensions to make their judgment. These results were suggested to indicate that dimensions are intercorrelated, and that knowledge of these intercorrelations is used to reduce the number of dimensions during decision making. This conclusion is somewhat speculative. When asked to make ratings of hypothetical people based on trait adjectives, subjects appeared to take information redundancy into account (Dustin & Baldwin, 1966; Schmidt, 1969). Ratings were less extreme when adjectives were highly redundant than when they were less redundant. Wyer (1970) assessed redundancy of adjectives by their conditional probabilities. Ratings of likability were less polarized as adjectives were increasingly redundant. The above results suggest that in some situations people may be aware of information redundancy and that they may use this knowledge in a logically efficient manner when making decisions.

<u>Costs and benefits of redundancy</u>. The cost/benefit approach outlined previously (Beach & Mitchell, 1978) can be used to formulate predictions of how a decision maker may incorporate dimension redundancy into the decision process. Decision making can be conceptualized as

consisting of three processes: Information search, information combination, and learning from feedback (Einhorn et al., 1979). These authors suggested that the positive effects that redundancy provides to the decision process are mainly during information search, and the detriments of redundancy are incurred primarily in the information combination and learning from feedback processes. Three positive effects possibly arise from information redundancy (Einhorn et al., 1979). First, information search can be limited without a significant reduction in decision accuracy (decrease effort costs without decreasing accuracy benefits). That is, as redundant information need not be accessed, the number of dimensions in the information matrix can be reduced to those dimensions that are orthogonal to each other. Rarely will dimensions be either orthogonal or redundant, rather degrees of intercorrelation are more common. While the reduction of effort costs with redundancy will not be affected by the degree of intercorrelation, the accuracy benefit involved in accessing partially orthogonal dimensions will not be realized if dimensions thought to be redundant are not accessed.

Second, a benefit redundant information may provide is that cues from redundant dimensions can be substituted for each other. This may not be of great value in a controlled decision environment, such as a process tracing experiment; but in "real world" decisions, incomplete information may be a problem that can be alleviated by interchanging redundant information cues. A final benefit possibly provided by redundancy is that unreliability of information can be reduced. If multiple redundant dimensions are used when making a decision, errors associated with inaccurate cue information in one dimension will be minimized by the other dimensions.

Four negative effects can be associated with using redundant information (Einhorn et al., 1979). First, if a decision is based on a number of redundant dimensions, discrimination of decision alternatives on the basis of those dimensions is more difficult than when dimensions are orthogonal. Counter to the initial positive effects of redundancy, the reduction in the number of independent dimensions can reduce decision accuracy in some decision making situations because decisions will be made based on fewer independent dimensions. Second, if redundant information is used without realizing the benefit of increased cue reliability, processing resources are wasted on information that does not increase predictive power. Third, if redundant information is accessed without realization of the redundancy, decision makers may have inflated confidence in their decision accuracy. Unknowingly using redundant information can lead a person to believe a decision was based on a greater amount of independent evidence than was actually the case. Finally, as previously noted in MCPL studies, redundant information can sometimes depress learning (Schmitt & Dudycha, 1975a, 1975b).

As the present investigation is a process tracing study, the dependent measures of interest are related to information search behavior. Therefore the effects of the above mentioned costs will not likely be observed. Additionally, as the information matrix will be complete and will not contain unreliable data, the primary benefit that redundancy may provide is in terms of reducing the number of independent dimensions. Phelps and Shanteau (1978) suggest that this benefit is observed with livestock judges and stimuli presented in a naturalistic decision situation. This study will investigate the benefit of information redundancy in a process tracing decision simulation.

The Decision Maker

There are a number of personal characteristics of the decision maker that likely influence search behavior. Beach and Mitchell (1978) suggested three characteristics: Knowledge of available decision strategies, ability, and motivation. Of these three variables ability is the only one that has received research attention. Doherty and Schmitt (1988) assessed cognitive complexity of college students and found this measure to have no effect on search behavior (both depth of search and linearity of decision strategy). However, Klayman (1985) assessed memory ability in school children and found an effect on proportion of information searched. Specifically, as the number of alternatives increased, children in the high-memory ability group demonstrated greater search on decision tasks judged to be more important than those tasks judged less important. This interaction was not observed in the low-memory group. Thus, there exists only weak evidence that ability effects search behavior.

Even though decision makers' knowledge of decision strategies has not received empirical attention, researchers have examined the effects of prior knowledge or experience with the decision task. The research conducted by Jacoby et al. (1978) was mentioned in the task characteristics section under the guise of task familiarity. Another individual difference variable found to affect search behavior is socioeconomic status (Capon & Burke, 1980). In a consumer decision task, subjects of mid to high SES accessed more information than low SES subjects.

While the above personal variables are mainly directed toward exploring individual differences, other decision maker variables focus on how individual perceptions influence search behavior. Capon and Burke (1980) found that products with a high perceived risk were searched in greater depth than low perceived risk products. Subjective rankings on importance were also found to affect search behavior (Klayman, 1985). Children's rankings of dimension importance correlated significantly with order of dimension search. Similarly, Ben Zur and Breznitz (1981) found rated dimension importance to be significantly correlated with proportion of information accessed.

One individual perceptual variable that has received no attention in the process tracing literature is prior expectations of dimension redundancy. As previously stated, expectations of redundancy refer to prior theories about the relationships between dimensions that the decision makers bring to the decision task. These redundancy expectations are based on the labels of the dimensions. A cost/benefit model was used in the previous section to generate predictions of how redundancy may affect the decision process. While the focus of that section was on the actual redundancy in the data, it seems logical that the decision maker's perception of the redundancy among information dimensions will have the greater effect on decision behavior. The remainder of this section will focus on the effects of labels and prior knowledge structures on decision making and information processing.

<u>Labeling in decision making</u>. Although not extensively studied, the effects of labels on the decision process has been examined. One study in the process tracing literature documented the effect of decision alternative labels on decision behavior (Herstein, 1981). This study had subjects make a decision between two political candidates running

for office. The political orientations of the candidates influenced search behavior such that when the two candidates were both labeled as being centralist in their views, more information was accessed than when the candidates were given labels that suggested divergent views. A MCPL study conducted by Miller (1971) demonstrated that dimension labels influence learning achievement. Subjects were given correlations between three scholastic predictors and exam results and were asked to predict later exam results based on the predictors. Additionally, some subjects received labels for the predictors that were consistent with the correlations while others received inconsistent labels. Subjects demonstrated greater learning achievement in conditions where the labeling was consistent than in conditions where the labeling was inconsistent. The Herstein (1981) and Miller (1971) studies demonstrate that labels influence the decision process, and that these labels produce a stronger effect than the actual decision information in some situations.

Theory-based covariation assessment. In a previous section, people's ability to assess actual covariation was examined. Similar research has investigated how prior expectations or theories can influence judgments of covariation. Theory-based covariation assessment has been studied both in the absence and presence of actual data. Jennings et al. (1982) had subjects make estimates of the correlation between pairs of variables such as height and weight of students. These judgments were made without actually observing any data. For most variable pairs, subjects tended to overestimate the actual correlation between the variables. Recall that this is opposite to the conservativism findings of data-based covariation estimates.

The more interesting studies for the focus of this research are those in which covariation assessments are based on both theory and actual data. Chapman and Chapman (1969) presented to college students pairings of Rorschach interpretations and homosexuality symptoms or neutral symptoms. The Rorschach interpretations included both items that were diagnostically valid but not face valid and items that were face valid but not diagnostically valid. The degree of covariation between homosexuality symptoms and diagnostically valid interpretations was varied while face valid interpretations were never correlated with homosexuality symptoms. Regardless of true covariation, subjects incorrectly reported correlations between the face valid interpretations and homosexuality symptoms. That is, subjects failed to notice true covariation and instead made judgments congruent with their prior expectations.

Arcuri and Forzi (1988) obtained similar results in a study involving estimates based on bivariate data. Subjects estimated the relationship between data from a 2 X 2 contingency table after their prior expectations about the relationship were assessed. Prior expectations tended to correlate more strongly with covariation estimates when no actual relationship existed than when a relationship actually existed in the data. Alloy and Tabachnik (1984) review the literature on covariation estimates that are based on both prior theories and data. The conclusion reached is that in situations where prior expectations are inconsistent with the actual data, people tend to make judgments based more heavily on their prior expectations. This conclusion is consistent with results found in the literature from a schema theory perspective.

Schema theory. Schema (or script) theory has been suggested as a possible foundation upon which process tracing research may build (Ford et al., 1989). Schemata are knowledge structures that represent concepts and experiences stored in memory (Fiske & Linville, 1980). Previous research has shown that schemata can influence perceptions, memory, and inferences (Fiske & Taylor, 1984). There are many different types of schemata (e.g. scripts and person schemata), but for the purpose of this paper a schema will refer, more generally, to a prior theory about some concept. Therefore, people likely possess schemata that include information on the interrelationships or redundancies between various factors. For example, Kozlowski, Kirsch, and Chao (1986) demonstrated that cognitive schemata for performance dimension similarities are strongly associated with some raters' performance ratings. Subjects made ratings of the similarities between a number of performance dimensions and then rated baseball players along the same dimensions. Perceived dimension intercorrelations were strongly correlated with subsequent rating intercorrelations, especially when knowledge of actual performance was low.

The majority of schema research has focussed on the effects of knowledge structures on information processing and recall, while few studies have examined information search. Process tracing techniques, on the other hand, examine the information acquisition processes. Although this situation may suggest a lack of applicability of schema theory to process tracing, a number of findings from the schema literature are important to note with respect to the interaction between people's expectations of dimension redundancy and actual dimension redundancy. First, some research has shown that schemata can affect what information is sought and perceived. People are more likely to notice schema-consistent, rather than schema inconsistent evidence (Fiske & Taylor, 1984). Swann and Read (1981) demonstrated that subjects tended to seek out, and placed greater value on feedback that confirmed their self-perceived assertiveness and self-perceived emotionality than feedback that disconfirmed these self-schema dimensions. Subjects also indicated that schema-confirmatory feedback was more diagnostic and informative than disconfirmatory feedback. Darley and Gross (1983) told subjects that a particular child was either from a high SES background or a low SES background, and had subjects predict the academic ability of the child. Subjects either saw or did not see a video of a child taking an academic class. The child in the video was the same for both the high and low SES conditions. Subjects who did not see the video rated the child's academic ability to be approximately the class average with no difference between SES conditions. Subjects who saw the video in the high SES condition rated the child's ability above class average, whereas those in the low SES condition who saw the video rated the child's ability below class average. Evidently subjects perceived information from the video in a way that confirmed their schema about the relationship between SES and academic achievement.

Second, it has been demonstrated that schema inconsistent information takes longer to encode than schema consistent information. Brewer, Dull, and Lui (1981) presented subjects with photographs of a young woman, an elderly person, or a grandmother, and then presented them with a number of descriptive statements. The descriptive statements were of three types: 1) consistent with the photograph, 2) neutral (i.e. not directly consistent but not contrasting either), and 3) inconsistent or contrasting with the photograph. Subjects in the inconsistent condition spent longer processing the descriptive statements than subjects in either the consistent or neutral conditions. These authors suggested that people spend longer encoding inconsistent information because they try to generate explanations to resolve the inconsistency. Specifically, one technique people use to reinterpret inconsistent behavioral information is to attribute it to temporary situational causes that are not relevant to one's schema (Crocker, Hannah, & Weber, 1983). A similar attribution process may account for the longer encoding times for inconsistent information found by Brewer et al. (1981).

Third, schemata are found to be fairly resistent to inconsistent information. People will trust their schema rather than heed to disconfirming evidence, and, if possible, will make the data fit their schema rather than adapt the schema (Fiske & Taylor, 1984). Ross, Lepper, and Hubbard (1975) had subjects perform a novel decision making task and presented them with fictitious feedback suggesting either success or failure at the task. After a thorough debriefing, including explanations of how assignment to either the success or failure group was random, subjects rated their actual success and ability at the task. Ratings were higher for those in the success condition than those in the failure condition. Subjects maintained their perceptions or schema despite a total discrediting of the evidence that led to the development of these impressions. Two methods have been suggested by which people deal with inconsistent data so as not to alter an existing schema. As mentioned above people sometimes attribute the inconsistency to factors external to the schema (Crocker et al., 1983). Another method is to discount or give less weight to disconfirming evidence (Anderson & Jacobson, 1965). Anderson and Jacobson had subjects rate the likableness of people described by three adjectives. Results showed that when an adjective was paired with two others that were inconsistent with the first (e.g. gloomy with honest and considerate), the single inconsistent adjective was given less weight in the likableness ratings.

The above findings from covariation assessment research and schema theory suggest that the decision maker's prior theories of dimension redundancy will likely provide a strong influence on assessments of actual redundancy. Specifically, it has been demonstrated that perceptions and judgments are formed more from expectations of covariance (Alloy & Tabachnik, 1984) and social schemata (Fiske & Taylor, 1984) than from the actual data being examined. In addition, when processing data that is inconsistent with expectations, the data tends to be misperceived, requires longer to be encoded, and tends not to reshape one's existing schema or theory.

Interactions Among Environment, Task, and Person

Beach and Mitchell (1978) proposed that three groups of factors, the decision environment, the decision task, and characteristics of the decision maker, all influence the decision process and strategy selection. However, little indication was given to how these factors combine. Beach and Mitchell provided a tentative suggestion that variables combine in a weighted sum, but asserted that this suggestion may require modification. Clearly an important issue for research to address is the interaction among different factors (Ford et al., 1989).

To date, only one study has systematically examined the combined effects of environment, task and person on decision behavior (Klayman, 1985). The variables examined were task importance/significance (environment), number of alternatives and number of dimensions (task), and memory ability and dimension importance rankings (person). The only significant interaction on the proportion of information searched measure was a three-way interaction between task importance, number of alternatives, and memory ability. In the high-memory ability group a task importance by number of alternatives interaction was found, such that greater search was observed with important decisions than unimportant decisions only when the task contained many alternatives. When the task contained few alternatives, this importance effect was not seen. A task importance by number of alternatives interaction was not found in the low-memory ability group. Although this is only one study, the findings demonstrate that environment, task, and person factors may not simply combine in an additive fashion as suggested by Beach and Mitchell (1978). Investigation of such interactions clearly offers insight into individual decision behavior and may help to clarify the contingency decision model.

Hypotheses

The goal of this study was to examine three variables thought to influence information search in a decision making task. First, time constraints were manipulated such that subjects were asked to make decisions under either high time constraints or no time constraints. Second, the effects of information redundancy was examined through manipulation of both actual and expected (schematic) dimension redundancy. Third, the effects of inconsistent information was examined by testing the conflict between schematic and actual redundancy. An additional independent variable in this study was repeated measures with the decision task. Three tasks were completed to ensure subjects had adequate opportunity to observe actual redundancy in the data. Therefore, effects of actual redundancy should be qualified by interactions with repetitions. With regard to the additional interactions between independent variables, this study was exploratory as prior theory and research does not provide a basis for any predictions.

The three primary variables in this study, time constraints, actual redundancy, and expected redundancy, were chosen for investigation for a number of reasons. First, none of these variables have received much research attention using process tracing methods. Second, all of these variables have real world relevance. As previously mentioned, dimension redundancy is often found in nonexperimental decision situations (Abelson & Levi, 1985). Time constraints and other costs that limit the amount of information that can be accessed and the thoroughness with which it can be integrated are also prevalent in real world decisions. A third and related reason for the choice of variables is their relevance to the decision task in this study. Subjects completed job choice tasks in which they chose one job from a number of job offers. Information redundancy is likely an issue with job choice because information about a job often comes from a variety of sources, including written job descriptions, interviews, and informal sources. Fourth, the three variables examined in this study were sampled from the three groups of decision making influences outlined in the contingency model (Beach & Mitchell, 1978). Thus, a test of the ability of contingency theory to provide a framework for organizing decision research is provided. Finally, the variables chosen should demonstrate interesting interactions. Both the predicted interaction between expected redundancy, actual redundancy, and repetitions; and the exploratory interactions between time constraints, redundancy, and repetitions were be investigated. The investigation of interactions is both interesting in and of itself and theoretically useful for extending contingency theory.

This process tracing study used a computerized information board format. An information board was used instead of verbal protocol analyses because it is less obtrusive (subjects can work on their own without explaining their steps) and may provide a closer approximation of actual decision making behavior. A computerized information board was used because it is more accurate and efficient to use than a manual information board. The dependent variables collected in this study were four measures of search behavior.

Dependent Variables

In previous process tracing research a number of variables have been used to describe search behavior. These include: Depth of search, pattern of search, latency of search, and content of search. Depth of search refers to the total number of cells in the decision matrix accessed. Many studies have used depth of search and the related measures, proportion of search and variability of search as dependent variables (e.g. Jacoby et al., 1978; Payne, 1976). Proportion of search is simply the amount of information searched divided by the total amount of information available. A common finding has been that as a task becomes more complex a smaller proportion of information is searched (Payne, 1976). This finding indicates that one method a decision maker uses to simplify a decision task is to reduce search behavior. Variability of search refers to the variance, across alternatives, in amount of information searched. A variable search pattern is often used as an indication of a nonlinear (i.e. noncompensatory) search strategy (Payne, 1976).

Pattern or sequence of search refers to the degree to which search proceeds primarily across dimensions, within an alternative (interdimensional), or across alternatives, within a dimension (intradimensional). Operationally, pattern of search is defined by a comparison of the *n*th + 1 with the *n*th piece of information searched. One instance of interdimensional search is observed when the *n*th + 1 piece of information is from the same alternative but a different dimension than the *n*th piece of information. An instance of intradimensional search occurs when the *n*th + 1 piece of information is in the same dimension but a different alternative than the *n*th piece of information. If the two pieces of information differ in both alternative and dimension then a shift in pattern of search is said to have occurred (Payne, 1976). Pattern of search has been used to distinguish search strategies: Interdimensional search indicates linear or conjunctive strategy use and intradimensional search indicates additive difference or elimination by aspects strategy use (Billings & Marcus, 1983). Findings have been inconclusive with respect to the factors that lead to inter vs. intradimensional search. For example, some research suggests that as the number of alternatives in the decision task increases, search becomes more intradimensional (Payne & Braunstein, 1978) and other research fails to support this relationship (Payne, 1976).

Latency of search refers to the amount of time a decision maker spends accessing a piece of information or making their final decision. For example, Payne and Braunstein (1978) found that as the decision task became more complex, subjects spent less time examining each piece of information. Similarly, Payne et al. (1987) found that people spent less time accessing each piece of information when the decision task was constrained by time. Consistent with cognitive research, latency of search can be used as an indication of the extent of cognitive processing on a given piece of information (Brewer et al., 1981).

The final variable, content of search, has been of primary interest to those investigating consumer decision making (Capon & Burke, 1980; Jacoby et al., 1978). Content refers to the specific items of information accessed. As content of search is not a variable of interest in this study, specific research utilizing this measure will not be addressed.

An additional dependent measure reported in a number of process tracing studies is decision strategy. While not directly measurable, strategy often is inferred from measures such as variability of search and pattern of search. For this study, search strategy was limited to the linear/nonlinear distinction rather than further distinguishing strategies based on pattern of search. The reason for this limitation was as follows. Expected information redundancy was manipulated as a within-subjects, within-task variable. That is, the decision task contained some dimensions with labels that suggest redundancy with each other and some dimensions with labels suggesting orthogonality. Hypotheses regarding the effects of expected redundancy differentiated the set of redundant dimensions from the set of orthogonal dimensions within the decision task. However, decision strategies have typically been used to label a pattern of processing behavior across an entire decision task. It makes little sense to label search on one set of dimensions with one strategy and search on another set of dimensions, in the same decision task, with a different strategy.

One decision strategy distinction that can be applied to within task subsets of dimensions is degree of linearity/nonlinearity. Doherty and Schmitt (1988) describe an index of linearity that provides additional information over the variability of search measure. Essentially, all alternatives are compared against the alternative that was accessed the most (the "standard"). The degree of similarity between the standard and the other alternatives, in terms of specific dimensions accessed, serves as the index of linearity. Thus, perfectly linear search would be indicated by access of the same dimensions across all alternatives. On the other hand, the variability of search measure provides an indication of variance without attention to the specific dimensions accessed. Lack of variance is thought to indicate linear strategy use, even though different dimensions could be accessed in different alternatives. As the Doherty and Schmitt (1988) index of linearity produces a continuous variable rather than an overall strategy type, there should be utility in trying to differentiate the redundant from orthogonal dimensions on this measure. Additionally, this classification system maintains Beach and Mitchell's continuum of resource requirements and strategy accuracy. Linear strategies require high resource allocations and produce accurate decisions, whereas nonlinear strategies require fewer resources but produce less accurate decisions.

In summary, the following dependent measures were collected: Depth of search, pattern of search, latency of search, and linearity of search. The following hypotheses relate these dependent variables to each of the manipulated variables in this study.

Time Constraints

Previous research has demonstrated that on simple decision tasks, a short time constraint (e.g. 15 seconds), compared to an unconstrained time condition, leads to less information accessed, greater variability of access, shorter latencies of search, and marginally more intradimensional search (Payne et al., 1987). On a more complex decision task, with more distant time constraints, the Beach and Mitchell (1978) cost/benefits model leads to similar predictions. As time constraints limit information access, the decision maker will likely adopt techniques to simplify the decision process with the least possible sacrifice to decision accuracy. These techniques include, accessing less information, accessing the information for a shorter period of time, and increasing the use of nonlinear decision strategies. The following hypotheses were tested with respect to time constraints:

Hypothesis 1: Depth of search will be less when decision makers are required to make decisions within time constraints in comparison to unconstrained decisions.

Hypothesis 2: Latency of search will be shorter in the time constrained condition than in the unconstrained condition.

Hypothesis 3: Decision makers should exhibit greater nonlinearity in their search behavior in the time constrained condition than in the unconstrained condition.

Hypothesis 4: Pattern of search will be more intradimensional in the time constrained condition than in the unconstrained condition.

<u>Expected Redundancy</u>

Both the literature on covariation detection (Alloy & Tabachnik, 1984) and the schema literature (Fiske & Taylor, 1984) suggest that prior expectations prevail over subsequent data. A main effect was therefore predicted for expected redundancy but not for actual redundancy. In terms of the cost/benefit model, redundant information provides less benefit to a decision maker than does orthogonal information. Since the costs are the same for accessing both redundant and orthogonal information, simplifying techniques ought to be observed when redundant information is accessed. The following predictions were formed with respect to information redundancy:

> Hypothesis 5: Depth of search will be greater for dimensions that are expected to be orthogonal than those expected to be redundant.
>
> Hypothesis 6: Latency of search will be shorter for dimensions that are expected to be redundant than those expected to be orthogonal.
>
> Hypothesis 7: Decision makers should demonstrate greater nonlinearity in their search of redundant dimensions than in their search of orthogonal dimensions.

No hypothesis was generated with respect to redundancy and pattern of search because neither past research nor the cost/benefit model provide a basis for this prediction. However, this study investigated the possibility of an effect of information redundancy on sequence of search.

<u>Actual Redundancy</u>

As previously stated, no main effect was predicted for actual redundancy because of the dominance of expected redundancy. Subjects should only notice actual redundancy on the dimensions that are expected to be redundant. Any main effect that is observed for actual redundancy should be a result of information inconsistency found in the interaction between expected and actual redundancy.

Information Inconsistency

As both expected and actual dimension redundancy were manipulated, a significant interaction between these variables would indicate an effect for inconsistent information. Additionally, as subjects should be more likely to notice actual dimension redundancy in later decision tasks, the interaction of expected and actual redundancy was hypothesized to be embedded in a three-way interaction with repetitions. If subjects expected the dimensions to be redundant but in fact the data provided was orthogonal, this data should be perceived as inconsistent with prior expectations or theory. If subjects expected the dimensions to be redundant and they actually were redundant the information would be consistent with prior theory. Likewise, if subjects expected orthogonal dimensions and the data was orthogonal the information would be consistent with prior theory. If subjects expected orthogonal information and the data was actually redundant they should not perceive this situation as inconsistent. This condition would therefore be the same as the consistent, expected orthogonal condition. Several lines of research support this last prediction. First, subjects tend to underestimate or be conservative in their estimates of covariation (Crocker, 1981). Second, prior theories tend to weigh more heavily in people's judgments of covariation than do actual data (Alloy & Tabachnik, 1984). Finally, subjects could easily explain away the inconsistency by the fact that the sample size was small and that the covariation was a chance occurrence.

In terms of predicting effects, schema theory suggests two predictions about the effects of inconsistent information. First, subjects tend to seek information that confirms their schema (Swann & Read, 1981). Therefore, when faced with inconsistent information, subjects would likely search additional information in an effort to find confirmatory evidence. Search should be of greater depth and more linear for inconsistent information. Second, inconsistent information takes longer to encode than consistent information (Brewer et al., 1981). Latencies of search should therefore be longer for inconsistent information. The effects of information inconsistency are counter to those predicted for information redundancy. It is unclear how these effects may combine. Therefore, it can only be predicted that redundant inconsistent information should be accessed more often, more linearly, and for longer periods than redundant consistent information. No prediction can be made comparing the access of redundant inconsistent information to the access of orthogonal information. For the redundant, consistent information and orthogonal information, predicted effects are the same as the previous set of hypotheses with regard to information redundancy. The hypothesized interaction is graphically displayed in Figure 1 and the following hypotheses were tested:

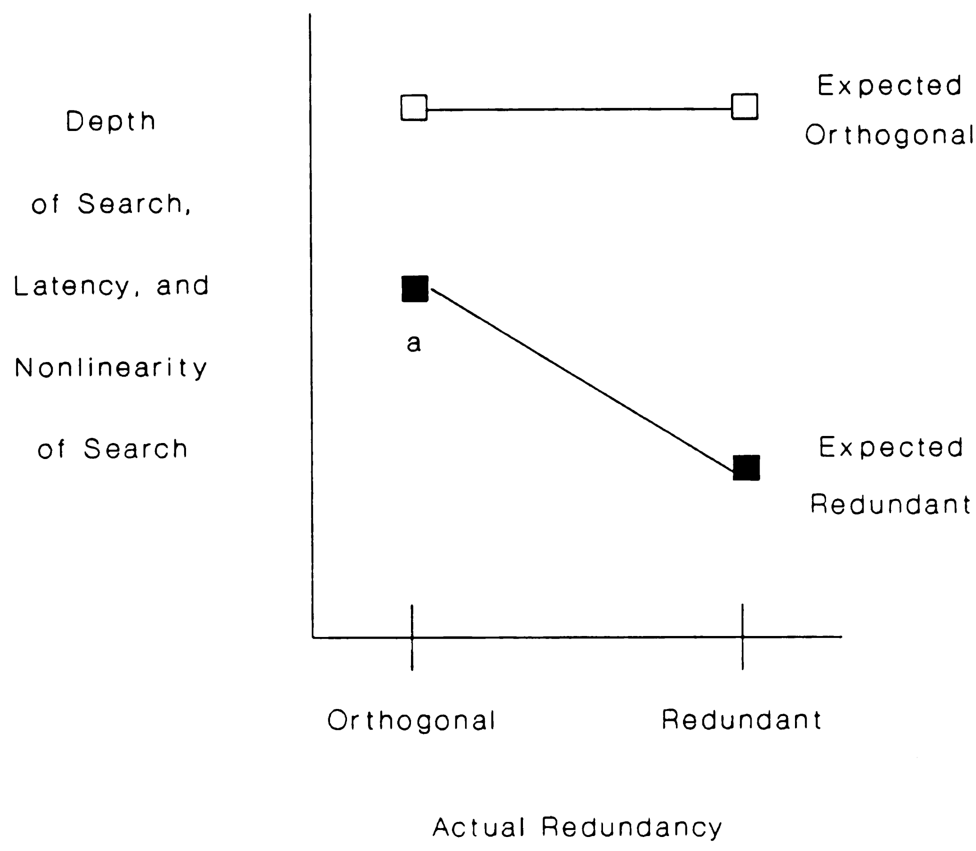
> Hypothesis 8: An interaction between expected and actual redundancy will be observed for depth of search. Specifically, an effect of actual redundancy will be observed for the expected redundant dimensions, such that greater search will be observed in the actually orthogonal (inconsistent) condition than in the actually redundant (consistent) condition. No effect of actual redundancy will be observed on the dimensions that subjects expect to be orthogonal.

> Hypothesis 9: An interaction between expected and actual redundancy will be observed for latency of search, such that latencies will be shorter for the expected redundant/actually redundant dimensions than for the expected redundant/actually orthogonal dimensions. Latencies will be the same in both expected orthogonal conditions.

Figure 1

The Hypothesized Interaction between

Actual and Expected Redundancy



Note. The relative position of point [a] is uncertain due to the competing effects of redundancy and inconsistency.

> Hypothesis 10: An interaction between expected and actual redundancy will be observed for linearity of search behavior, such that linearity will be greater for the expected redundant/actually orthogonal dimensions than for the expected redundant/actually redundant dimensions. Linearity of search will be the same in both expected orthogonal conditions.

As previously stated, the predicted interaction of expected and actual redundancy should be imbedded within a three-way interaction with repetitions. If this is the case, the predicted two-way interaction should be most obvious in the final decision task, where actual redundancy was most likely to be observed. As with the previous set of hypotheses, insufficient evidence existed to make predictions about the pattern of search and so this study was exploratory with respect to an expected/actual redundancy interaction on this measure. This study was also be exploratory with respect to any interactions between time constraints and redundancy.

METHOD

Subjects

Subjects included 140 undergraduate psychology students (43 males and 97 females) who received nominal course credit in exchange for their participation. A power analysis with the assumption of a medium effect size suggested this sample size would provide statistical power at the .80 level (Cohen, 1988). The mean age of subjects was 19.42 years with a range from 17 to 53 years. Subjects were randomly assigned to the experimental conditions.

Design

This experiment was a 2 (time constraints vs. no time constraints) x 2 (highly intercorrelated information dimensions vs. orthogonal information dimensions) x 2 (expected redundant dimensions vs. expected orthogonal dimensions) x 3 (task repetitions) mixed model design. Time constraints and actual redundancy were manipulated as between-subjects facets while expected redundancy and decision task repetitions were within-subjects facets.

Stimuli

The decision tasks in this experiment involved choosing the most preferred job from among 10 job offers. Each subject completed three decision tasks in order to maximize the exposure to the actual redundancy of the dimension information. On each of these decision tasks, subjects were allowed to access both expected redundant and orthogonal information in order to make a job offer decision. A computer controlled information board was used to present the decision tasks and collect measures of search behavior. The information board consisted of 10 jobs (labeled Job A to Job J) and 10 information dimensions that described those jobs. The computer presented subjects with a randomized list of jobs (the job labels appeared in alphabetical order) and a randomized list of the job dimensions. By specifying the job and dimension of interest, subjects were able to examine the data matrix one piece at a time. Subjects had a pencil and paper with which to take notes to assist their decision making. Subjects were also allowed to reaccess previously accessed information. Upon completion of the information search, the computer collected the final decision with regard to which job the subject preferred.

Time constraints. Time constraints were manipulated by placing a limit on the amount of time the subject was able to spend searching the data matrix. A digital clock was presented in the upper right hand corner of the computer monitor. Subjects in the time constrained condition were given 8 minutes to examine job information and make their decision. The length of the time constraint was determined during pilot testing of the information board and was half the average amount of time spent by pilot subjects in the unconstrained conditions. Subjects in the unconstrained time condition also had the clock present on the computer monitor but were able to spend as much time and access as much information as they choose. During the actual experiment, subjects in the unconstrained condition spent an average of 12.5 minutes on each task whereas subjects in the constrained condition spent an average of

6.9 minutes on each task.

Expected redundancy. The ten job dimensions were selected such that five were thought to be highly redundant; and five were thought to be relatively orthogonal, with both the redundant dimensions and the other orthogonal dimensions. The redundant and orthogonal dimensions were controlled with respect to importance. That is, for each redundant dimension there was a matched orthogonal dimension of equal importance. This control was necessary because perceived dimension importance has been shown to be related to search behavior (Ben Zur & Breznitz, 1981; Klayman, 1985). Two pilot procedures were utilized to develop the set of job dimensions. The first involved collecting importance ratings on a number of job characteristics. A subset of these job characteristics were then rated for informational similarity.

1. Importance ratings. A list of 45 job characteristics were developed from 7 general dimensions. The dimensions included work characteristics, advancement opportunities, salary, benefits, coworkers, supervision, and location of the company. Each dimension contained six or seven job characteristics. Additionally, two job characteristics were added that were thought to represent separate job dimensions: Job security and reputation of the company. One hundred and seventy two undergraduate psychology students rated each job characteristic on a seven point scale ranging from (1) "Not very important" to (7) "Very important". See Appendix A for a copy of the questionnaire. Table 1 presents a complete list of the 47 job characteristics and the mean importance rating for each characteristic.

A principal components analysis was conducted on the 47 job characteristics. Seven factors were extracted and rotated using the

Table 1

Job Characteristics and Importance Ratings

	Importance
A. Work Characteristics:	
1. How enjoyable the work is	6.40
2. How challenging the work is	5.68
3. How interesting the work is	6.31
4. How satisfying the work is	6.30
5. Work offers a variety of activities	5.58
6. Opportunity to learn from work experiences	6.03
7. Opportunity to use abilities at work	6.06
B. Advancement Opportunities:	
1. Number of career paths in organization	5.61
2. Potential for advancement to a supervisory/ management position	6.36
3. Likelihood of transfer to a more desirable department	5.56
4. Average rate of advancement	5.81
5. Average length of time in entry position	4.85
6. Average length of periods without job movement	5.20
C. Salary:	
1. Starting salary	5.84
2. Average salary after five years	5.46
3. Average performance based salary increases	5.69
4. Maximum salary after five years	5.12
5. Maximum performance based salary increases	5.38
6. Frequency of salary increases	5.65
D. Benefits:	
1. Maximum medical coverage in benefits package	5.38
2. Percent co-pay with medical coverage benefits	4.69
3. Percent co-pay with dental coverage benefits	4.59
4. Annual company pension contributions	4.78
5. Company financed life insurance coverage	4.93
6. Company stock sharing options	3.74
7. Expense account	4.22

Table 1 (cont'd.)

E. Coworkers:	
1. Competence of coworkers	5.67
2. Sociability of coworkers	5.16
3. Supportiveness of coworkers	5.21
4. Opportunities for work interactions with coworkers	5.17
5. Opportunities for non-work interactions with coworkers	4.51
6. Cohesiveness of work group	5.15
F. Supervision:	
1. Ease of working for supervisor	5.53
2. Supervisory acknowledgement of good performance	5.35
3. Amount of work performed with supervisor	3.91
4. Degree of autonomy	4.89
5. Closeness of supervision	4.29
6. Fairness of supervisor	5.95
G. Location of Company:	
1. Desirability of geographic location	5.39
2. Metropolitan population of work location	4.37
3. Desirability of metropolitan center where work is located	4.51
4. Average distance from residential areas to work	4.90
5. Average commuter time to work	4.56
6. Quality of public transportation to work	3.43
7. Average cost of living	5.52
Additional orthogonal job dimensions:	
1. Job security	6.15
2. Reputation of company	5.70

varimax method. The choice of seven factors was based on prior theory and supported through examination of the eigenvalues using the scree criterion. See Appendix B for the prerotation eigenvalues and the rotated factor loadings. Items loading on those dimensions that were most clearly identified in the factor analysis (as evidenced by factor loadings) were chosen as the most redundant items. Items on work characteristics, advancement opportunities, benefits, and coworkers dimensions were most clearly identified with single factors. Of these, work characteristics was eliminated from further consideration because of high average importance ratings ($\underline{M}$ = 6.05), and benefits was eliminated because of low average importance ratings ($\underline{M}$ = 4.62). While these mean ratings are not particularly extreme, it was impossible to find a sample of orthogonal dimensions that could be matched on importance ratings. Of the remaining two dimensions, advancement opportunities and coworkers, advancement opportunities was chosen on the basis of ease of incorporating the dimensions into a plausible decision task.

A set of seven orthogonal job characteristics was composed by selecting items from the remaining six dimensions and two additional characteristics. Importance ratings for these orthogonal dimensions were matched as closely as possible with those from the advancement opportunities dimension. Mean correlations between the orthogonal characteristics and the advancement opportunities characteristics ranged from .058 to .208 (see Table 2). Thus, the orthogonal characteristics were not highly correlated with the redundant characteristics. The full set of intercorrelations between the 13 job characteristics are presented in Table 3. It is evident that on average the correlations

Table 2

Mean Correlation of Selected Orthogonal Job Characteristics with

Redundant Job Characteristics

Dimension	Correlation
1. How interesting the work is	.058
2. Starting salary	.200
3. Reputation of company	.198
4. Average cost of living	.208
5. Desirability of geographic location	.077
6. Sociability of coworkers	.123
7. Degree of autonomy	.115

Table 3

Intercorrelations of Redundant and Orthogonal Job Characteristics

	1	2	3	4	5	6	7	8	9	10	11	12	13
Redundant													
1. Advancement to management	-												
2. Rate of advancement	.42	-											
3. Number of career paths	.26	.35	-										
4. Transfer to a better dept.	.30	.38	.35	-									
5. Period without job movement	.27	.26	.31	.39	-								
6. Time in entry position	.29	.23	.26	.10	.19	-							
Orthogonal													
7. How interesting work is	-.04	.16	.11	.12	.06	-.06	-						
8. Starting salary	.17	.34	.20	.22	.12	.15	-.04	-					
9. Reputation of company	.19	.28	.22	.25	.14	.11	.10	.25	-				
10. Average cost of living	.12	.40	.18	.27	.16	.12	-.02	.23	.21	-			
11. Geographic location	.06	.10	.15	.03	.09	.03	.03	.30	.16	.04	-		
12. Sociability of coworkers	.07	.20	.12	.21	.13	.01	.15	.05	.28	.16	.11	-	
13. Degree of autonomy	.12	.12	.08	.20	.04	.13	.15	.02	.14	.05	.05	.17	-

were highest among the advancement opportunities characteristics. Although some of the correlations between redundant characteristics were quite low (e.g. r = .10) and some of the correlations between orthogonal characteristics quite high (e.g. r = .40), it was not possible to find a set of characteristics with better intercorrelations that met the above criteria. These results are not particularly worrisome because the purpose of this set of analyses was only to obtain a set of job characteristics to be used in a later similarity rating analysis.

2. Similarity ratings. In a second pilot study, subjects were asked to compare the 13 job characteristics for similarity in a pairwise fashion. All possible comparisons of the 13 job characteristics resulted in 78 pairwise comparisons, 15 of which were between characteristics hypothesized to be redundant. Each comparison was rated on an 11-point rating scale on the basis of similarity of information conveyed. Zero represented "no similarity at all (0% similarity)" and 10 represented "virtually identical (100% similarity)". In addition, subjects were asked to imagine that they had to make a decision among a number of job offers and to make their ratings based on the similarity of information that each characteristic would provide when making that job choice. See Appendix C for the complete questionnaire. A sample of 71 undergraduate psychology students completed the questionnaire in return for nominal course credits.

The mean ratings across subjects are presented in Table 4. For the redundant characteristics pairings, average similarity ratings ranged from 6.4 to 8.7 with a mean of 7.4 (average SD = 2.06). Pairings of nonredundant with other nonredundant and with redundant characteristics (orthogonal comparisons) produced similarity ratings that ranged from

Table 4

Average Similarity Ratings of Redundant and Orthogonal Job Characteristics

	1	2	3	4	5	6	7	8	9	10	11	12
Redundant												
1. Advancement to management	-											
2. Rate of advancement	8.3	-										
3. Number of career paths	6.7	6.7	-									
4. Transfer to a better dept.	7.0	7.5	6.9	-								
5. Period without job movement	7.4	8.5	6.4	7.5	-							
6. Time in entry position	7.4	8.2	6.5	7.7	8.7	-						
Orthogonal												
7. How interesting work is	3.8	4.0	4.7	6.1	5.7	5.5	-					
8. Starting salary	4.3	4.8	4.7	4.6	4.8	6.6	3.7	-				
9. Reputation of company	4.3	4.7	5.7	4.8	4.5	4.4	5.4	5.7	-			
10. Average cost of living	2.9	3.5	3.4	3.1	4.2	4.4	1.3	7.8	2.4	-		
11. Geographic location	2.3	2.1	4.2	3.6	3.2	3.2	4.1	3.6	3.8	4.8	-	
12. Sociability of coworkers	3.1	2.6	2.3	4.5	3.6	3.1	5.8	1.3	5.4	1.5	3.2	-
13. Degree of autonomy	4.8	4.4	4.4	4.7	3.8	4.1	5.2	3.1	3.9	2.2	2.9	5.7

1.3 to 7.8 with a mean of 4.1 (average *SD* = 2.81). A statistical comparison of the average redundant ratings with the average orthogonal comparisons demonstrated a significant difference, $t(70) = 17.04$, $p < .05$. More important was the fact that the difference in the means (7.4 - 4.1) was more than 1 1/2 standard deviations.

One redundant and two orthogonal characteristics were eliminated to reduce the set to 10 job characteristics. The redundant characteristic "Number of career paths" was eliminated because it exhibited the lowest similarity ratings with the other redundant characteristics. Two orthogonal characteristics "Reputation of the company" and "Average cost of living" were eliminated on the basis of importance ratings. The remaining five orthogonal characteristics matched the redundant characteristics fairly closely on importance ratings.

Table 5 presents the average similarity and importance ratings of the 10 job characteristics that were used as dimensions in the decision tasks. For the redundant characteristics, the average similarity ratings ranged from 7.0 to 8.7 with a mean of 7.8 (average *SD* = 1.82) and for the orthogonal comparisons, the average similarity ratings ranged from 1.3 to 6.6 with a mean of 4.1 (average *SD* = 2.89). The difference between redundant and orthogonal average similarity comparisons was highly significant, $t(70) = 16.75$, $p < .05$.

Actual redundancy. In order to standardize the format of cue information across job dimensions, all cues were presented as points on a seven-point scale. The anchors of each scale were tailored to the specific job dimensions. Table 6 presents the 10 rating scales that correspond to the 10 job dimensions. Subjects received a printed copy of these dimensions and were able to refer to this copy at any time

Table 5

Average Similarity and Importance Ratings of the 10 Selected Job Characteristics

	1	2	3	4	5	6	7	8	9	Importance
<u>Redundant</u>										
1. Advancement to management	-									6.36
2. Rate of advancement	8.3	-								5.81
3. Transfer to a better dept.	7.0	7.5	-							5.56
4. Period without job movement	7.4	8.5	7.5	-						5.20
5. Time in entry position	7.4	8.2	7.7	8.7	-					4.85
<u>Orthogonal</u>										
6. How interesting work is	3.8	4.0	6.1	5.7	5.5	-				6.31
7. Starting salary	4.3	4.8	4.6	4.8	6.6	3.7	-			5.84
8. Geographic location	2.3	2.1	3.6	3.2	3.2	4.1	3.6	-		5.39
9. Sociability of coworkers	3.1	2.6	4.5	3.6	3.1	5.8	1.3	3.2	-	5.16
10. Degree of autonomy	4.8	4.4	4.7	3.8	4.1	5.2	3.1	2.9	5.7	4.89

Table 6

Job Dimension Definitions and Rating Scales

1. ADVANCEMENT TO MANAGEMENT. Potential for advancement to a supervisory/management position within the company.

1	2	3	4	5	6	7
No chance of advancement						Advancement almost certain

2. RATE OF ADVANCEMENT. Average rate of advancement within the company.

1	2	3	4	5	6	7
Very slow advancement						Very rapid advancement

3. TRANSFER TO A BETTER DEPT. Likelihood of a future transfer to a more desirable department within the company.

1	2	3	4	5	6	7
No chance of transfer						Transfer almost certain

4. PERIOD WITHOUT JOB MOVEMENT. The average length of periods without job movement (either advancement or transfer).

1	2	3	4	5	6	7
10 years or more						2 or 3 years at maximum

5. TIME IN ENTRY POSITION. The average length of time in the position at which you enter the company.

1	2	3	4	5	6	7
10 years or more						Maximum of 1 year

Table 6 (cont'd)

6. HOW INTERESTING WORK IS. On average, how interesting the work is that you will perform.

1	2	3	4	5	6	7
Not at all interesting						Very interesting

7. STARTING SALARY. The salary that you will initially receive with this job.

1	2	3	4	5	6	7
$18,000/ year						$42,000/ year

8. GEOGRAPHIC LOCATION. The desirability of the geographic location of the job.

1	2	3	4	5	6	7
Very undesirable location						Very desirable location

9. SOCIABILITY OF COWORKERS. On average, how sociable or easy to get along with your coworkers are.

1	2	3	4	5	6	7
Not at all sociable						Very sociable

10. DEGREE OF AUTONOMY. The degree of autonomy that the job offers.

1	2	3	4	5	6	7
Not at all autonomous						Very autonomous

during the experimental session. A second reason for presenting information along standardized scales was to maximize the likelihood of subjects noticing the actual redundancy (intercorrelations) among job dimensions.

Actual redundancy was manipulated by varying the intercorrelations among the dimensions. A generator of pseudorandom numbers from a standard normal distribution (IMSL, 1987), with constraints on the intercorrelations among the dimensions generated, was used to develop two sets of data. Each data set was comprised of 10 dimensions with 10 data points in each dimension. One data set had high intercorrelations among the dimensions with correlations ranging from .64 to .95 ($\underline{M}$ = .82). This data set was used in the redundant information dimensions condition. The data are presented in Table 7 along with dimension means and standard deviations. Table 8 presents the intercorrelations among the dimensions. The second data set was generated for use in the orthogonal information dimensions condition. This data set is presented in Table 9 and intercorrelations are presented in Table 10. The intercorrelations among the dimensions in this set ranged from -.47 to .56 ($\underline{M}$ = .04). The range of correlations is considerably greater in the orthogonal condition because of limits on the ability to generate a data set with uniformly low intercorrelations.

The same set of data (either redundant or orthogonal) was used for all three repetitions of the decision task. The dimension labels attached to the data was varied across the replication to minimize the chance of subjects realizing they were examining the same data matrix. The redundant and orthogonal sets of data with the dimension labels attached are presented in Appendix D.

Table 7

Redundant Dimension Data

	Job Dimensions											
Jobs	1	2	3	4	5	6	7	8	9	10	Mean	S.D.
1	6	5	5	7	5	5	5	6	6	4	5.4	0.84
2	5	5	6	3	5	4	6	5	5	5	4.9	0.88
3	3	5	5	5	6	5	4	5	5	6	4.9	0.88
4	6	6	5	4	4	5	5	6	6	5	5.2	0.79
5	6	5	5	6	6	5	6	5	6	6	5.6	0.52
6	5	4	5	4	5	4	6	4	3	6	4.6	0.97
7	1	2	2	2	2	2	2	2	2	3	2.0	0.47
8	3	3	4	4	3	4	4	4	3	4	3.6	0.52
9	4	3	4	3	3	4	4	4	5	4	3.8	0.63
10	1	1	1	1	1	1	1	2	1	1	1.1	0.32
Mean	4.0	3.9	4.2	3.9	4.0	3.9	4.3	4.3	4.2	4.4	4.11	
S.D.	1.9	1.6	1.5	1.8	1.7	1.4	1.7	1.4	1.8	1.6		1.59

Table 8

Intercorrelations of Redundant Dimension Data

Job Dimensions

	1	2	3	4	5	6	7	8	9	10
1	-									
2	.86	-								
3	.85	.91	-							
4	.73	.73	.69	-						
5	.74	.86	.89	.80	-					
6	.83	.91	.90	.86	.86	-				
7	.91	.83	.94	.67	.84	.82	-			
8	.89	.95	.88	.80	.78	.93	.79	-		
9	.85	.89	.81	.76	.76	.90	.73	.92	-	
10	.69	.81	.87	.64	.91	.84	.86	.69	.67	-

Table 9

Orthogonal Dimension Data

Jobs	Job Dimensions 1	2	3	4	5	6	7	8	9	10	Mean	S.D.
1	7	4	3	4	2	2	4	5	4	7	4.2	1.75
2	4	4	2	3	3	2	2	5	4	2	3.1	1.10
3	7	5	4	5	4	4	5	4	3	3	4.4	1.17
4	3	5	4	2	3	7	5	2	5	6	4.2	1.69
5	5	4	5	4	3	7	4	6	3	6	4.7	1.34
6	5	5	5	5	4	1	3	2	1	4	3.5	1.65
7	3	3	3	5	2	3	4	2	3	1	2.9	1.10
8	6	4	2	5	5	4	3	2	5	3	3.9	1.37
9	4	4	7	5	3	3	3	6	4	2	4.1	1.52
10	4	2	3	4	5	4	5	4	3	4	3.8	0.92
Mean	4.8	4.0	3.8	4.2	3.4	3.7	3.8	3.8	3.5	3.8	3.88	
S.D.	1.5	0.9	1.5	1.0	1.1	2.0	1.0	1.7	1.2	2.0		1.43

Table 10

Intercorrelations of Orthogonal Dimension Data

	Job Dimensions									
	1	2	3	4	5	6	7	8	9	10
1	-									
2	.32	-								
3	-.12	.30	-							
4	.39	-.11	.24	-						
5	.20	-.11	-.15	.22	-					
6	-.21	.06	.12	-.45	.06	-				
7	.04	-.11	.04	-.17	.08	.56	-			
8	.21	-.14	.37	-.04	-.26	.05	-.15	-		
9	-.06	.00	-.30	-.46	-.09	.40	.00	.06	-	
10	.33	.24	.06	-.47	-.11	.40	.41	.15	.09	-

Dependent Measures

Four dependent measures were assessed in this study: Depth of search, latency of search, nonlinearity of search, and pattern of search. Each dependent measure was calculated six times for each subject; once for redundant dimensions and once for orthogonal dimensions on each of the three trials.

Depth of search. The computer program recorded the specific elements of the decision matrix accessed by the subject. The number of elements accessed was summed across dimensions, for the redundant and orthogonal dimensions separately. The number of elements accessed indicated depth of search.

Latency of search. The computer program recorded the amount of time each cue was accessed. This was the time from when the information cue was presented on the screen until the subject entered the command to continue with the task. The mean access time was calculated separately across redundant and orthogonal dimensions and was used to indicate latency of search.

Nonlinearity of search. Development of the nonlinearity of search variable was an adaptation of that used by Doherty and Schmitt (1988). The first step in calculating nonlinearity was to select the alternative that was accessed along the most dimensions. This alternative and the dimensions accessed along it was used as a standard to which other alternative were compared. If a tie existed among two or more alternatives in terms of the number of dimensions accessed, the standard was the alternative that was accessed first. Once the standard was obtained, all other alternatives, that were accessed on at least one dimension of the standard, were compared to the standard. When comparing alternatives to the standard, if a dimension of the standard was not accessed along the alternative a score of one was assigned to that element of the decision matrix. Following comparisons, the scores of the elements were summed. The sum was divided by the following denominator: ((the number of dimensions accessed in the standard x the number of alternatives used in the comparisons, including the standard) - (the number of dimensions in the standard + the number of alternatives used in the comparisons, including the standard - 1)). The nonlinearity index produced coefficients between zero and one, with zero indicating perfect linearity and one indicating perfect nonlinearity. Appendix E presents a summary of the formula and examples of calculations of the nonlinearity index. A seperate nonlinearity index was calculated for redundant and orthogonal dimensions.

Pattern of search. As previously stated, pattern of search referred to the extent to which search proceeded along or across dimensions and was assessed by comparing the nth + 1 piece of information accessed to the nth piece of information accessed. Instances of interdimensional search, intradimensional search, and shifts were summed separately for redundant and orthogonal dimensions. Each instance of search referred to the nth + 1 dimension. For example, if a subject accessed an orthogonal dimension for a particular job and then a redundant dimension for that same job, it was counted as an instance of interdimensional search for the redundant dimensions. An index of inter vs. intradimensional search (Payne, 1976) was computed for each set of dimensions by subtracting the number of interdimensional search instances from the number of intradimensional search instances and dividing by the sum of inter and intradimensional search instances.

Procedure

Subjects participated in this experiment in small groups of one to three individuals. Upon arrival to the experimental session, subjects read and signed a consent form to ensure they understand the voluntary nature of their participation. The experimenter explained the decision task to the subject and asked the subject to try to imagine that they were making a choice between a number of job offers. In the time constrained condition, subjects were informed of the time limit and were asked to monitor their time using the clock displayed on the computer monitor. Subjects also had a piece of paper upon which they recorded their start time. The experimenter monitored subjects compliance with the time constraints and provided a reminder to those who exceeded the time limit.

Subjects were situated individually in front of a computer and proceeded through the interactive computer program at their own rate. Prior to the first decision task, the computer presented subjects with instructions on how to access information and make the final decision. A practice decision task followed and was comprised of four jobs described along four dimensions. None of the dimensions appearing in the experimental decision tasks appeared in the practice decision task. Upon completion of the practice task, subjects entered the first experimental decision task. The computer lead the subject through three decision tasks that were identical except for the data that was assigned to dimension labels and the order of dimensions. The order of dimensions was be randomized for each decision task.

Information was accessed by entering the number of the job and the job dimension for which information is requested. Examples of information cues for each dimension appear in Appendix F. Subjects had a printed page with descriptions on how to interpret the scales used in the information cues. When subjects accessed sufficient information to make their decision or reached their time limit, they entered the job number of their final decision. The experimenter then restarted the computer program for the next decision tasks. See Appendix G for a transcription of the computer instructions and programs.

Upon completion of the final decision task, subjects completed a short questionnaire that included manipulation checks for time constraints, actual redundancy, and expected redundancy. Appendix H contains a copy of the manipulation checks questionnaire. Also collected at this time was the subject's age and sex, for sample demographic purposes. Subjects were debriefed as to the purpose of the research and questions were answered.

RESULTS

Manipulation Checks

Manipulation checks were collected with a questionnaire that was administered following the computer tasks. The questionnaire was comprised of 13 questions: two dealing with perceptions of time constraints, two with perceptions of actual redundancy or similarity in the data, and nine with opinions of the similarity between pairs of job dimensions.

The two questions regarding "time limiting ability to make optimal decisions" and "constraints in ability to access information" demonstrated a significant intercorrelation ($\underline{r}$ = .390) and were summed to produce a scale with a possible range from 2 to 14. This variable was examined with a 2 (unconstrained vs. constrained) x 2 (actually redundant vs. actually orthogonal) ANOVA. As expected the only effect observed was a main effect for constraints ($\underline{F}(1,136) = 31.887$, $\underline{p} < .05$, $eta^2 = .189$) with subjects in the unconstrained condition indicating less constraint ($\underline{M}$ = 4.16) than individuals in the constrained condition ($\underline{M}$ = 6.66). Given that eight represents a midpoint rating on this composite variable, subjects in neither condition felt particularly constrained.

Two questions regarding the similarity or intercorrelations observed among the job dimensions were moderately correlated ($\underline{r}$ = .360) and were summed to form a "similarity" composite ranging from 2 (low similarity) to 14 (high similarity). A 2 (unconstrained vs. constrained) x 2 (actually redundant vs. actually orthogonal) ANOVA indicated a main effect for actual redundancy ($F(1,136) = 42.39$, $p < .05$, $eta^2 = .237$). Mean ratings in the actually redundant condition were higher ($M = 9.21$) than in the actually orthogonal condition ($M = 7.06$). Results indicate that subjects were sensitive to the actual intercorrelations in the data.

The final set of manipulation check questions referred to the similarity among expected redundant and expected orthogonal dimension labels. Three questions probed the similarity between pairs of expected redundant dimensions (RR), three the similarity between pairs of expected orthogonal dimensions (OO), and three the similarity between pairs of an expected redundant and an expected orthogonal dimension (RO). It is important to note that in this context, expected redundancy and expected orthogonality are being used as labels for sets of dimensions. There was no anticipated differences in similarity between the OO pairings and the RO pairings, because in both cases the pairs of dimensions should be orthogonal with each other. All similarity ratings were made on a seven-point scale anchored with 1 (not at all similar) and 7 (virtually identical). The three questions were summed to produce a composite for each of the pairings RR, OO, and RO, with a possible range from 3 to 21. These composites were analyzed with a 2 (actually redundant vs. actually orthogonal) x 3 (RR, OO, RO) ANOVA with the dimension pairings as a within-subject variable. Main effects were found for both actual redundancy ($F(1,132) = 5.99$, $p < .05$, $eta^2 = .012$) and dimension pairings ($F(2,264) = 106.59$, $p < .05$, $eta^2 = .316$).

Subjects in the actually redundant condition gave higher ratings ($\underline{M}$ = 10.97) than those in the actually orthogonal condition ($\underline{M}$ = 10.04). While this effect is not very large, this set of questions was not constructed to test for perceptions of actual redundancy. It does, nonetheless, give further indication that subjects were sensitive to actual redundancy.

The main effect for dimension pairings supported the pilot work and found higher similarity ratings for RR pairings (M = 13.75) than for OO pairings (M = 9.58) or RO pairings (M = 8.24). Comparisons using Tukey's HSD revealed significant differences between all three means. It was expected that the RR pairings would be higher than the other two pairings, but the finding that the RO pairing was significantly different from the OO pairing was unexpected. Upon examination of the means of each of the six RO and OO pairings (for actual questions not composites) it is apparent that one OO pairing was perceived to be moderately similar (see Table 11). Question number 11, which paired "Degree of autonomy" with "How interesting the work is", received an average rating of 3.79 whereas the ratings from the other OO and RO pairings ranged from 2.41 to 3.11.

In summary, the manipulation check questions indicate that subjects perceived the time constraints, the actual redundancy of the information, and the similarity of job dimension labels. While mean differences in ratings were not as large as might have been expected, all were highly significant with fairly large effect sizes.

Search Behavior

The four measures of search behavior, depth of search, latency of search, nonlinearity of search, and pattern of search were calculated

Table 11

Summary Statistics for the Dimension Similarity Questions

Quest	Pairing	Dimensions	Mean	S.D.
1	RR	Advancement to management & Period without job movement	4.07	1.38
2	OO	Geographic location & Sociability of coworkers	2.73	1.48
3	RO	Transfer to a better dept. & How interesting work is	3.11	1.51
8.	OO	Starting salary & Degree of autonomy	3.07	1.54
9.	RR	Period without job movement & Rate of advancement	4.94	1.61
10.	RO	Time in entry position & Geographic location	2.41	1.67
11.	OO	Degree of autonomy & How interesting work is	3.79	1.56
12.	RO	Rate of advancement & Sociability of coworkers	2.71	1.67
13.	RR	Transfer to a better dept. & Time in entry position	4.75	1.50

across both redundant and orthogonal dimensions. For presentation ofintercorrelations, the depth of search measure was averaged across trials and summed across dimensions in order to reflect the total amount of search for the decision task as a whole. The other three measures were averaged across dimensions and across trials for each subject. The means, standard deviations, and intercorrelations are presented in Table 12. On average, subjects looked at half the information in the decision matrix, spending roughly five seconds examining each item. Search tended to be somewhat nonlinear and slightly interdimensional. The correlation between depth of search and nonlinearity of search is quite large, indicating that these measures may be statistically redundant. The remaining correlations between dependent variables are small, which suggests different dimension of search behavior were measured.

The remainder of the results section will be divided into four sections corresponding to the four search behavior variables. Although the hypotheses were grouped by effects and not by variables, the results can be more clearly presented one variable at a time. The four search variables were analyzed with separate 2 X 2 X 2 X 3 analyses of variance with the first two facets (time constraints and actual redundancy) as between-subject variables and the last two facets (expected redundancy and repetitions) as within-subject variables. Tests for homogeneity of variance and sphericity (of effects involving repetitions) were conducted and in many cases these assumptions appeared to be violated. Unfortunately, these tests are very sensitive to departures from normality in the distribution so it is unclear to what extent these violations were serious (i.e. how they affected the tests of significance). To compensate for this uncertainty, a conservative

Table 12

Means and Intercorrelations of Independent and Dependent Variables

			Correlations				
Variable	Mean	S.D.	1	2	3	4	5
1. Actual Redundancy[1]	1.50	.50					
2. Time constraints[2]	.50	.50	.000				
3. Depth of search	49.53	22.40	-.117	-.438*			
4. Latency of search	5.13	2.52	.110	-.259*	-.281*		
5. Nonlinearity search	.438	.215	.095	.252*	-.729*	.195*	
6. Pattern of search[3]	-.126	.691	.095	.042	-.274*	.150*	.123

[1] The actual redundancy variable was coded 1 = redundant, 2 = orthogonal.

[2] The time constraints variable was coded 0 = unconstrained, 1 = time constrained.

[3] For the pattern of search variable, negative numbers indicate greater interdimensional search and positive numbers indicate greater intradimensional search.

* $p < .05$

probability level ($p < .01$) was adopted on three of the four search variables. The nonlinearity of search index did not appear to violate the assumptions so the standard probability level ($p < .05$) was maintained on this variable.

Depth of search. The results of the ANOVA on depth of search are presented in Table 13. The first hypothesis stated that depth of search would be less in the time constrained condition than in the unconstrained condition. This hypothesis was confirmed ($F(1,136) = 33.30$, $p < .01$, $eta^2 = .102$) as subjects in the constrained condition examined an average of 39.76 pieces of information (summed across redundant and orthogonal dimensions) compared to 59.30 pieces in the unconstrained condition. Subjects looked at less information when they were constrained by time.

The fifth hypothesis, that depth of search would be greater on those dimensions expected to be orthogonal than those expected to be redundant, was also confirmed ($F(1,136) = 135.22$, $p < .01$, $eta^2 = .104$). Subjects searched 29.69 items from the orthogonal dimensions and 19.85 items from the redundant dimensions. No main effect was predicted for actual redundancy because of the dominating effect of expected redundancy. As can be observed in Table 13, no effect was found for actual redundancy ($F(1,36) = 2.39$, $p > .01$).

The eighth hypothesis predicted an interaction between expected and actual redundancy. Greater search was predicted in the expected redundant, actually orthogonal condition than in the expected redundant, actually redundant condition. Equal search was predicted on the two expected orthogonal conditions. An interaction was found between expected and actual redundancy ($F(1,136) = 15.46$, $p < .01$, $eta^2 = .012$).

Table 13

Analysis of Variance Summary for Depth of Search

Variable	*df*	*MS*	*F*
Time Constraints (T)	1	20050.97	33.30**
Actual Redundancy (A)	1	1440.48	2.39
T x A	1	1200.02	1.99
Within (*S*/TA)	136	602.16	
Expected Redundancy (E)	1	20345.19	135.22**
T x E	1	267.47	1.78
A x E	1	2326.67	15.46**
T x A x E	1	11.43	.08
Within (E*S*/TA)	136	150.46	
Repetitions (R)	2	173.41	1.35
T x R	2	505.53	3.92*
A x R	2	59.57	.46
T x A x R	2	1.75	.01
Within (R*S*/TA)	272	128.83	
E x R	2	48.93	1.16
T x E x R	2	30.58	.73
A x E x R	2	9.02	.21
T x A x E x R	2	83.74	1.99
Within (ER*S*/TA)	272	42.11	

* $p < .05$
** $p < .01$

The means for this interaction are presented numerically in Table 14 and graphically in Figure 2. Tests of simple effects demonstrate effects for expected redundancy in both the actually orthogonal ($\underline{t}(69) = 10.58$, $\underline{p} < .01$) and actually redundant ($\underline{t}(69) = 5.68$, $\underline{p} < .01$) conditions. As predicted, no effect was found for actual redundancy in the expected orthogonal condition ($\underline{t}(138) = .36$, n.s.). An effect was found in the expected redundant condition ($\underline{t}(138) = 2.73$, $\underline{p} < .01$), however, the means were in the opposite direction from what was predicted. Subjects in the actually orthogonal condition examined 22.82 items from the redundant dimensions whereas subjects in the actually redundant condition examined only 16.87 redundant items. Possible reasons for this reversal in the predicted effect will be discussed later.

The only other effect for depth of search was a time constraints by repetitions interaction ($\underline{F}(2,272) = 3.92$, $\underline{p} < .05$). Given the adoption of a conservative probability level this effect would have to be considered marginal. Examination of the means for this effect suggests that subjects in the unconstrained condition may have examined less information as they proceeded through the task ($\underline{M}_1 = 63.89$, $\underline{M}_2 = 56.33$, $\underline{M}_3 = 57.70$), whereas subjects in the constrained condition may have examined more information as they proceeded through the task ($\underline{M}_1 = 38.16$, $\underline{M}_2 = 39.44$, $\underline{M}_3 = 41.69$). Nothing else will be said of this effect as it was not of interest and was only marginally significant. All other main effects and interactions were not significant.

Latency of search. The analysis of the latency of search variable is summarized in Table 15. The second hypothesis suggested that less time would be spent looking at each item of information in the time constrained condition than in the unconstrained condition. This

Table 14

Means and Standard Deviations for Expected by

Actual Redundancy Interactions

Dependent Measure	Expected Redundancy	Actual Redundancy: Orthogonal	Actual Redundancy: Redundant
Depth of Search*	Orthogonal	30.04[a] (11.49)	29.33[a] (11.55)
	Redundant	16.87[b] (12.36)	22.82[c] (13.43)
Latency of Search	Orthogonal	4.87 (2.20)	4.66 (2.16)
	Redundant	5.95 (3.61)	5.05 (2.83)
Pattern of Search*	Orthogonal	.159[a] (.682)	-.092[b] (.747)
	Redundant	-.282[c] (.699)	-.292[c] (.757)

Note. Numbers in parentheses represent standard deviations.

* Means sharing common letters are not significantly different ($p > .05$).

Figure 2

The Interaction between Actual and Expected Redundancy

on Depth of Search

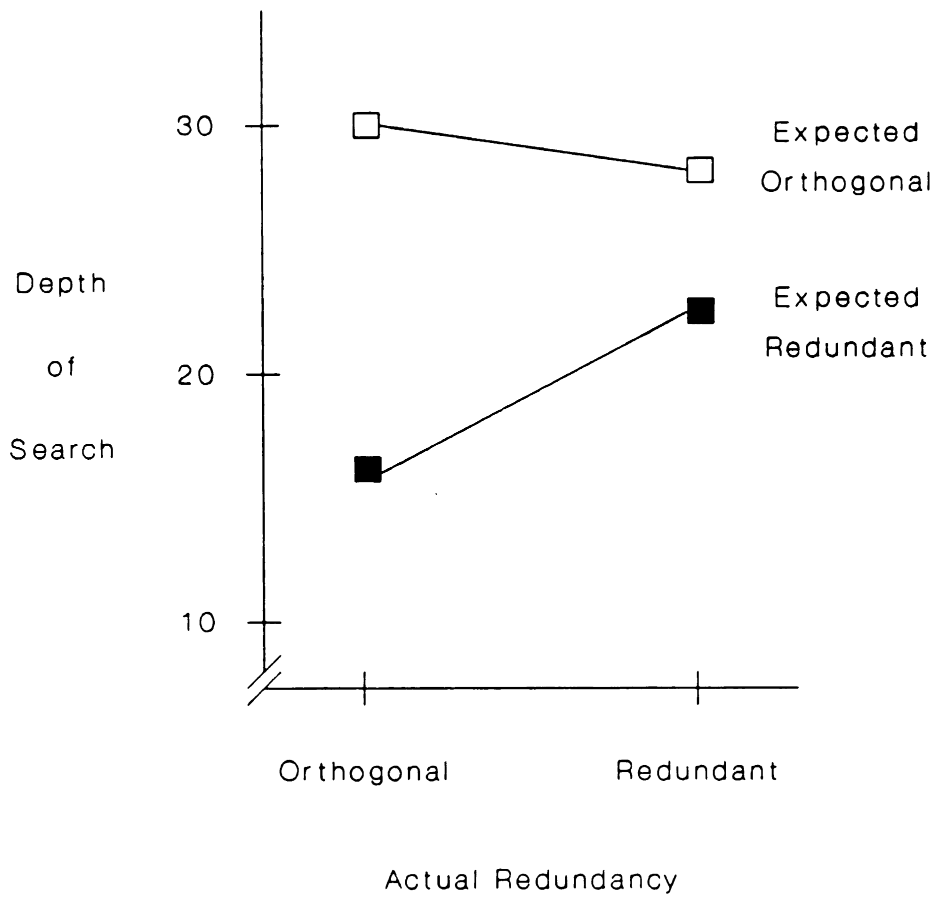


Table 15

Analysis of Variance Summary for Latency of Search

Variable	df	MS	F
Time Constraints (T)	1	354.86	10.01**
Actual Redundancy (A)	1	63.97	1.80
T x A	1	56.88	1.60
Within (S/TA)	136	35.45	
Expected Redundancy (E)	1	112.72	14.13**
T x E	1	5.35	.67
A x E	1	25.52	3.20
T x A x E	1	13.32	1.67
Within (ES/TA)	136	7.98	
Repetitions (R)	2	116.47	15.93**
T x R	2	17.39	2.38
A x R	2	6.37	.87
T x A x R	2	15.54	2.13
Within (RS/TA)	272	7.31	
E x R	2	.39	.10
T x E x R	2	1.54	.41
A x E x R	2	3.28	.87
T x A x E x R	2	2.11	.56
Within (ERS/TA)	272	3.76	

** $p < .01$

hypothesis was confirmed ($F(1,136) = 10.01$, $p < .01$, eta$^2 = .036$). Search latency was 4.48 seconds in the constrained condition and 5.78 seconds in the unconstrained condition. When subjects had less time to do the task, they spent less time looking at each piece of information.

Hypothesis six stated that the latency of search would be shorter for expected redundant dimensions than for expected orthogonal dimensions. A significant effect for expected redundancy was found ($F(1,136) = 14.13$, $p < .01$, eta$^2 = .011$), however the observed means were in the opposite direction to the predictions. Subjects examined information from the redundant dimensions for 5.50 second and information from the orthogonal dimensions for 4.76 seconds. As expected, latency of search was not influenced by actual redundancy ($F(1,136) = 1.80$, $p > .01$).

The ninth hypothesis suggested an interaction between expected and actual redundancy on the latency of search variable. Latencies were predicted to be shorter for the expected redundant/actually redundant dimensions than for the expected redundant/actually orthogonal dimensions. Latencies were predicted to be the same in both of the expected orthogonal conditions. Only a marginal interaction was found between expected and actual redundancy ($F(1,136) = 3.20$, $p < .10$). While this effect was not significant, the means were in the predicted direction (see Table 14).

A main effect for repetitions was found on the search latency measure ($F(2,272) = 15.93$, $p < .01$, eta$^2 = .024$). Although not specifically hypothesized, this effect is hardly surprising. The means suggest that subjects spent more time looking at information during the first task (Task 1 $M = 5.85$) than during the later tasks (Task 2 $M =$

4.95, Task 3 $\underline{M}$ = 4.59). This effect is easily attributed to practice or familiarity with the decision task. No other effects were found with the latency of search measure.

Nonlinearity of search. The nonlinearity of search index yielded few significant results (see Table 16). As more than one dimension had to be accessed by the decision maker in order to calculate an index of nonlinearity, there was considerable missing data with this variable. In total, 59 subjects were removed from the analysis because of missing data on one or more of the three task. Of the remaining 81 subjects, 26 were from the unconstrained actually redundant condition, 23 from the unconstrained actually orthogonal condition, 18 from the time constrained actually redundant condition, and 14 from the time constrained actually orthogonal condition.

The third hypothesis stated that decision makers in the time constrained condition would exhibit greater nonlinearity in their search than would those in the unconstrained condition. An effect for time constraints was found on the nonlinearity index ($\underline{F}(1,77) = 5.12$, $\underline{p} < .05$, $eta^2 = .027$). As hypothesized, decision making was more nonlinear in the time constrained condition ($\underline{M} = .505$) than in the unconstrained condition ($\underline{M} = .394$). This finding suggests that decision makers adopt a different decision strategy when faced with time constraints.

Hypothesis seven suggested greater use of nonlinear decision making during search of dimensions expected to be redundant than search of orthogonal dimensions. Hypothesis ten predicted an interaction between actual and expected redundancy. Neither of these hypotheses were supported ($\underline{F}$s < 1), nor were any other main effects or interactions observed. Thus, in spite of the high correlation between depth of

Table 16

Analysis of Variance Summary for Nonlinearity of Search

Variable	df	MS	F
Time Constraints (T)	1	1.37	5.12*
Actual Redundancy (A)	1	.17	.63
T x A	1	.08	.31
Within (S/TA)	77	.27	
Expected Redundancy (E)	1	.02	.16
T x E	1	.04	.28
A x E	1	.00	.01
T x A x E	1	.06	.42
Within (ES/TA)	77	.13	
Repetitions (R)	2	.02	.25
T x R	2	.07	.83
A x R	2	.21	2.66
T x A x R	2	.01	.14
Within (RS/TA)	154	.08	
E x R	2	.01	.44
T x E x R	2	.02	.73
A x E x R	2	.01	.33
T x A x E x R	2	.02	.60
Within (ERS/TA)	154	.03	

* $p < .05$
** $p < .01$

search and the nonlinearity index, the redundancy variables accounted for little of the variation in this measure.

Pattern of Search. Pattern of search was calculated from the instances of intra and interdimensional search. If there were no instances of intra or interdimensional search on a set of dimensions (expected redundant or expected orthogonal) then a pattern of search coefficient could not be calculated. For 13 subjects, pattern of search could not be calculated on one or more of the decision tasks. The remaining 127 subjects were distributed as follows: 33 in each of the unconstrained cells, 30 in the time constrained actually redundant cell, and 31 in the time constrained actually orthogonal cell. The summary of the ANOVA on the pattern of search variable is presented in Table 17.

Hypothesis four predicted that decision makers' pattern of search would be more intradimensional in the time constrained condition than in the unconstrained condition. The results failed to support this hypothesis ($F(1,123) = .60$, n.s.). Search pattern was not influenced by the presence of time constraints.

No other hypotheses were generated for the pattern of search variable because there was no prior theory or research to support such hypotheses. However, as stated in the hypotheses section, the possibility of expected and actual redundancy influencing pattern of search was investigated. An effect of expected redundancy was found for search pattern ($F(1,123) = 73.77$, $p < .01$, $eta^2 = .036$). Search sequence was more interdimensional within the expected redundant dimensions ($M = -.287$) than within the orthogonal dimensions ($M = .035$). That is, decision makers tended to search more by alternative (across dimensions) with the redundant dimensions, and tended to search just as

Table 17

Analysis of Variance Summary for Pattern of Search

Variable	df	MS	F
Time Constraints (T)	1	.60	.21
Actual Redundancy (A)	1	3.29	1.13
T x A	1	.40	.14
Within (S/TA)	123	2.90	
Expected Redundancy (E)	1	19.53	73.77**
T x E	1	.00	.00
A x E	1	2.67	10.08**
T x A x E	1	.31	1.17
Within (ES/TA)	123	.26	
Repetitions (R)	2	3.36	8.75**
T x R	2	.24	.61
A x R	2	.29	.76
T x A x R	2	.28	.74
Within (RS/TA)	246	.38	
E x R	2	.02	.20
T x E x R	2	.05	.41
A x E x R	2	.24	2.10
T x A x E x R	2	.31	2.67
Within (ERS/TA)	246	.11	

** $p < .01$

often by alternative as by dimension with the orthogonal dimensions.

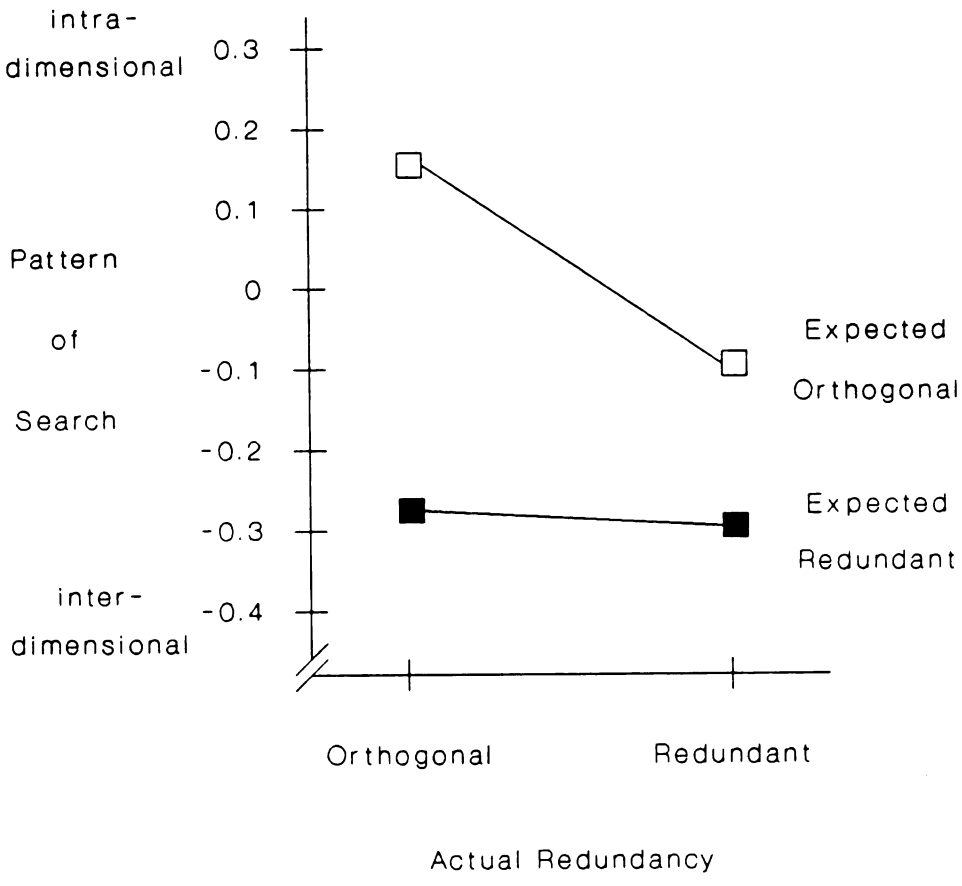
An expected redundancy by actual redundancy interaction was also found on the pattern of search variable ($F(1,123) = 10.06$, $p < .01$, eta^2 = .0049). The means of this interaction are presented in Table 14 and plotted in Figure 3. Tests of simple effects demonstrated significant effects for expected redundancy in both the actually orthogonal condition ($t(63) = 7.45$, $p < .01$) and in the actually redundant condition ($t(62) = 4.46$, $p < .01$). A significant effect for actual redundancy was demonstrated in the expected orthogonal dimensions ($t(125) = 1.97$, $p = .05$) but not in the expected redundant dimensions ($t(125) = .08$, n.s.). That is, actual redundancy affected search behavior such that on orthogonal dimensions search tended to be more intradimensional in the actually orthogonal condition and more interdimensional in the actually redundant condition.

Search pattern was found to vary as a function of repetitions of the decision task ($F(2,246) = 8.75$, $p < .01$, eta^2 = .012). Search pattern became more intradimensional across tasks with a mean of -.254 on task one, a means of -.097 on task two, and a mean of -.028 on task three. This finding suggests that subjects altered their strategy, and search less by alternative as they proceeded from one task to another. No other main effects nor interactions accounted for significant variation in pattern of search.

Figure 3

The Interaction between Actual and Expected Redundancy

on Pattern of Search



DISCUSSION

The discussion chapter of this thesis will be divided into four sections. The first will provide a brief summary of the results, highlighting the main findings with regard to the hypotheses. The next two sections will discuss the findings for time constraints and redundancy in more detail. Implications of confirmed hypotheses will be discussed, and explanations will be generated for results that did not work out as hypothesized. Finally, directions for future research will be suggested.

Summary of Results

In the results section, findings were summarized by dependent measure in order to be concise and consistent with how the data was analyzed. For this section, the more theoretically logical format of grouping results by manipulated variable will be used. That is, results will be discussed in the order in which the hypotheses were presented. Findings with regard to time constraints, expected redundancy, actual redundancy, the interaction between expected and actual redundancy, and repetitions will be reviewed.

Time Constraints. As predicted in hypotheses one, two, and three, time constraints had a significant effect on the amount of information examined, how long each piece of information was examined, and the nonlinearity with which information was searched. When asked to make a decision under moderate time constraints, decision makers tend to examine less information, examine information for a shorter time, and use a more nonlinear search strategy. Contrary to the fourth hypothesis, the pattern of information search was not affected by time constraints.

Expected redundancy. The fifth through seventh hypotheses stated that, compared to redundant dimensions, dimensions thought to be orthogonal would be examined more often, for longer, and in a more linear fashion. The fifth hypothesis was confirmed: Depth of search was greater for the orthogonal dimensions than the redundant dimensions. For the sixth hypothesis, the findings were opposite to predictions. Subjects examined information from redundant dimensions longer than information from orthogonal dimensions. No evidence was found for the seventh hypothesis as nonlinearity of search did not vary as a function of expected redundancy. Though no hypothesis could be generated with regard to the influence of expected redundancy on pattern of search, this relationship was explored. It was found that pattern of search tended to be more interdimensional with the expected redundant dimensions than with the expected orthogonal dimensions.

Actual redundancy. Formal hypotheses were not stated for actual redundancy as no main effects were predicted. Subjects were expected to only realize the benefit of information redundancy from the more salient manipulation of expected redundancy. As expected, no main effects were found with regard to search behavior and actual redundancy.

Interactions between expected and actual redundancy. The eighth through tenth hypotheses predicted an interaction between expected and actual redundancy. Search on the expected redundant dimensions was expected to be in greater depth, for longer durations, and in a more linear fashion for subjects in the actually orthogonal condition than for subjects in the actually redundant condition. It was predicted that no differences between actually orthogonal and actually redundant conditions would be observed on the expected orthogonal dimensions. No evidence was found to confirm any of these hypotheses.

For hypothesis eight, which dealt with depth of search, a significant interaction was observed. As predicted, no differences were observed between the actually orthogonal and actually redundant conditions on the expected orthogonal dimensions. However, contrary to predictions, subjects in the actually orthogonal condition examined <u>less</u> information from the expected redundant dimensions than did subjects in the actually redundant condition. The inconsistency from the expected redundant, actually orthogonal information did not increase subjects depth of search.

The interaction on the latency of search variable, predicted in hypothesis nine, was found to be marginally significant. Given the lack of significance, no simple effects tests were conducted, however means appeared to be in the predicted direction. Latencies on the expected orthogonal dimensions were quite similar in both the actual redundancy conditions. On the expected redundant dimensions, latencies appeared to be much greater in the expected orthogonal condition than in the expected redundant condition. While caution must be exercised when interpreting marginally significant results, these findings suggest that subjects may have been sensitive to the inconsistency between expected and actual redundancy.

The tenth hypothesis predicted an interaction between expected and actual redundancy for nonlinearity of search. No support was found for this prediction. Also related to search strategy is pattern of search. An exploratory analysis indicated a significant interaction between expected and actual redundancy on this measure. However, unlike the other interactions, differences were observed between actual redundancy conditions on the expected orthogonal dimensions but not on the expected redundant dimensions. On expected orthogonal dimensions, subjects tended to be more intradimensional in the actually orthogonal condition than in the actually redundant condition. In both actual redundancy conditions search was more interdimensional on the expected redundant dimensions than on the expected orthogonal dimensions.

Repetitions. No main effects of repetitions were of interest and consequently, no hypotheses were generated with respect to this variable. The hypotheses section did, however, discuss the possibility that the two-way interaction between expected and actual redundancy may be embedded within a three-way interaction with repetitions. This suggestion was based on the assumption that subjects would be more likely to notice the actual redundancy as they became familiar with the decision task. The results failed to support this line of reasoning as no interactions were found between redundancy and repetitions.

Main effects were found with regard to repetitions on both the latency of search and the pattern of search variables. The means suggest that subjects spent longer looking at information, and tended to search for information more interdimensionally in the first task than in later tasks. Latencies decreased and search became less interdimensional in later tasks. Several explanations can account for these findings, including simply familiarity and practice with the decision task and information dimensions. In addition to the main effects, a marginally significant interaction was found between time constraints and repetitions on the depth of search variable.

Summary. Of the ten hypotheses, four were confirmed, one was marginally significant, two were significant but with means in different directions than predicted and three were not supported. In addition, two exploratory effects were found for pattern of search. The inconsistencies in results were related to redundancy and most of the unconfirmed hypotheses were related to the nonlinearity of search index.

Discussion of Time Constraints

Prior research has demonstrated that severe time constraints (15 second vs. no limit - approximately 45 seconds) influenced the amount of information examined, the time spent examining information, and the variability across dimensions in amount of information examined (Payne et al., 1987). The finding for variability was taken to indicate that search was more nonlinear under time constraints. Finally, search was found to be marginally more intradimensional under time constraints.

The current study differs from this earlier research in at least two important ways. First, the decision task was far more complex (10 alternatives by 10 dimensions) in the current study than in the studies by Payne and colleagues (4 alternatives by 4 dimensions). As such, the time constraints in this study were more distant (8 minutes vs. 15 seconds). Second, the time constraints in the present study were not as severe as in previous research. Subjects spent approximately 7 minutes on each task in the time constrained condition and 12.5 minutes in the unconstrained condition. In the study by Payne et al. (1987) subjects in the time constrained condition spent approximately 15 seconds while those in the unconstrained condition spent 44 seconds. These differences between the previous research and the current study provide an important extension to our understanding of the effects of time constraints on decision behavior.

Support for the contention that time constraints were not as severe in the current study comes from the manipulation check questions. While there were significant difference between the time constrained and unconstrained subjects' ratings of how constrained they felt, subjects in the time constrained conditions reported experiencing only low to moderate levels of constraint. In spite of this mild manipulation, time constraints had a large effect on how much information was searched and how long information was examined.

Such firm conclusions cannot be drawn with regard to search strategy. Time constraints did not influence the sequence with which subjects searched information and only a small effect was found in terms of nonlinearity of search. Further, one must be cautious when interpreting the nonlinearity of search findings as this variable was so highly correlated with depth of search ($\underline{r} = -.729$). Given this high correlation and the fact that time constraints was the only variable to account for a significant portion of variance in search nonlinearity, it can be questioned whether the nonlinearity index really captured variability in linearity of search strategy. Before conclusions can be drawn regarding linearity of search in this study, efforts must be made to establish the construct validity of this measure. Such efforts will be further discussed when future research is suggested.

To summarize, this study suggests that when asked to make a decision under mild time constraints, decision makers tend to streamline their search behavior by examining less information for a shorter period of time. No evidence supports the conclusion that actual decision strategies are changed by such time constraints. It may be that decision makers have a series of processes for dealing with time constraints. With mild constraints, processing is sped up and less information is examined. As the severity of time constraints increase, subjects may switch to more nonlinear, intradimensional search strategies.

In terms of Beach and Mitchell's (1978) contingency theory, it appears that the cost/benefit approach has limited applicability in the case of mild time constraints. While the findings do not contradict the cost/benefit model, they also do not support the notion that formal strategy selection is based on a cost/benefit analysis. Contingency theory could be adapted to incorporate a variety of techniques decision makers may use to cope with time constraints. For example, Beach and Mitchell described a continuum of strategies from aided-analytic to nonanalytic; but it is possible that this continuum is multidimensional and includes both informal strategies (e.g. speeding up processing) and formal strategies (unaided-analytic). Future research may address the utility of such modifications to the contingency model.

Discussion of Redundancy

The literature on covariation detection and schema theory has suggested that prior expectations outweigh actual data. People tend to trust their prior theories rather than heed to disconfirming evidence. The results of this study bear out this prediction. No main effects were found for actual redundancy, while expected redundancy was found to be related to three out of four measures of search behavior. For decision makers, the dimension labels have a much greater impact on information search than do the actual intercorrelations among dimensions.

Two of the three main effects for expected redundancy were qualified by actual redundancy by expected redundancy interactions. However, with the significant interactions, tests of simple effects demonstrated significant effects of expected redundancy at both levels actual redundancy. Thus, the main effects for expected redundancy hold throughout the interactions and are therefore, interpretable. Of the three expected redundancy main effects, the depth of search means were in the predicted direction, the latency of search means are opposite to the predicted direction, and the pattern of search measure was exploratory so no predictions were generated. The predicted main effect for nonlinearity of search was not significant, possibly for reasons related to the inadequacies of this index. Given that problems with the nonlinearity index are discussed elsewhere, the lack of effects for this measure will not be discussed here.

Of the interactions between expected and actual redundancy, the interaction on latency of search was in the predicted direction, but not significant; the interaction on depth of search was significant, but the means were different than predicted; the interaction on pattern of search was significant, but no hypotheses were generated for this effect.

The remainder of this section will be divided into three sections: Information access, search strategies, and information processing. While information access (depth of search) is related to search strategies, it is not directly linked to any formal decision strategies.

Further, each of the three categories of measures can be taken to indicate different aspects of decision making. Information access indicates how much information a decision maker needs to make a decision. Search strategy refers to the process or method by which this information is accessed. Information processing is the operation of looking at and interpreting information, and is reflected by latency of search. Such partitioning of the decision making process is consistent with both decision process theories (Einhorn et al., 1979) and information processing theories (Wyer & Srull, 1986).

Information access. Taking a cost/benefit approach, it is suggested that accessing redundant information provides little benefit to the decision process in comparison to orthogonal information. The results of this study support the assertion that decision makers recognized this redundancy and that they examined less information from redundant than from orthogonal labeled dimensions. Given that redundant and orthogonal dimensions were matched on the basis of importance, the difference in access can be attributed to redundancy. This finding has two important implications. First, this study provides evidence that decision makers can use knowledge of redundancy to aid the decision process. Prior research has been unable to document this finding. Second, this study suggests that importance is not the only criteria for deciding what information is examined when making a decision. It is possible to speculate that a number of factors may influence the selection of information. These factors may include, but are not by any means limited to, information importance, information redundancy, reliability of information, and availability of information. Future research could well be directed at examining a number of these factors and how they combine to influence choice of information.

From the schema literature, it was hypothesized that information inconsistency resulting from the interaction between actual and expected redundancy would be a dominating force in terms of influencing information access. Given the observed form of the interaction, this explanation seems unlikely. Decision makers were expected to notice the inconsistency when the actual information presented on the expected redundant dimensions was orthogonal. Information access was predicted to increase in an effort to resolve this inconsistency. Contrary to this prediction, less expected redundant dimension information was accessed when the actual data was orthogonal than when it was redundant. Clearly, factors other than inconsistency influenced information access.

If we turn back to the originally stated costs and benefits associated with information redundancy, an explanation for the depth of search interaction findings can be generated. One of the potential costs of information redundancy is that the number of independent dimensions, upon which the decision can be based, is reduced. That is, if dimensions convey roughly the same information, fine discrimination on the basis of those dimensions is not possible. Consider the decision maker trying to choose between the two best jobs. If information from all dimensions is highly redundant and if the two jobs are similar on most dimensions, then the process of deciding which offer is better is very difficult. The redundant information inhibits discrimination between the two jobs. On the other hand, if the information is orthogonal, then each job will likely be high on some dimensions and low on others. The decision process simply becomes a matter of choosing which job is the highest on those dimensions that are most important.

If this reasoning is correct then the decision task in the actually redundant condition was possibly more difficult than the decision task in the actually orthogonal condition.

Two indirect pieces of evidence support the postulation that actual redundancy made the decision task more difficult. First, if one examines the redundant dimension data in Table 7 with respect to job one and job five, it is apparent that the two jobs are very similar. The data in job one is mostly fives and sixes with one four and one seven and a mean of 5.4. The data in job five is all fives and sixes with a mean of 5.6. Both these jobs have the highest means in terms of the data provided, which suggests that they would likely be perceived as the two most desirable jobs. Given the similarity in the data for each of these jobs, it is quite likely that subjects had problems deciding between the two. Upon examination of the orthogonal dimension data in Table 9, it is clear that a similar problem does not exist. The two jobs with the highest means, job three ($\underline{M}$ = 4.4) and job five ($\underline{M}$ = 4.7), both vary considerably. Dimension data ranges from three to seven for each job, with many instances of dimension differences between the two. Comparisons of the actually redundant and actually orthogonal data indicate that the redundant data may have produced a more difficult decision task.

A second source of evidence supports this idea. Informal subjective reports indicate that some decision tasks were more difficult than others. Subjects were not systematically questioned following completion of the decision tasks so the only verbal feedback available, was that spontaneously generated. One subject in the actually redundant condition commented that the second decision task was particularly tough. When asked what made the task tough, the subject replied that two of the jobs were pretty much the same in terms of the information examined. Although no subjects had the opportunity to complete both a redundant and an orthogonal decision task, the comments from this one subject indicate that high redundancy can make a decision task more difficult. Future research would benefit from systematic assessments of the difficulty of the decision tasks.

If it is accepted that the redundant decision task was more difficult than the orthogonal decision task, the question still remains as to why an interaction with expected redundancy was found rather than a main effect for actual redundancy. A plausible explanation for this question will be stated, and then evidence in support of this explanation will be offered. The interaction may be a result of a ceiling effect in terms of information access on the expected orthogonal dimensions. If decision makers approached the decision task in terms of narrowing down alternatives based on dimension information, it is possible that all orthogonal dimensions were examined. For the easier, actually orthogonal decision task, subjects may have examined all the orthogonal dimensions and one or two of the redundant dimensions. For the more difficult, actually redundant decision task, all the orthogonal dimensions and one or two of the redundant dimensions may have been examined; but, in order to make a decision between two or three similar jobs, additional redundant dimensions may have had to be examined. If this sort of decision behavior occurred, the means from the expected by actual redundancy interaction become understandable.

The above explanation makes several assumptions which need to be supported. First, it is assumed that decision makers used a nonlinear strategy to narrow down alternatives. The imperfect nonlinearity index had a grand mean of .438. This number indicates search behavior midway between perfect linearity and perfect nonlinearity. Past research also indicates that with a complex decision task, such as the one used in this study (10 alternatives by 10 dimensions), decision makers tend to use nonlinear decision strategies (Ford et al., 1989). Second, it is assumed that subjects search all decision relevant information on the orthogonal dimensions. The means in Table 14 indicate that on average approximately 30 items (60%) from the expected orthogonal dimensions were accessed in both actual redundancy conditions. Since most subjects were using somewhat nonlinear decision strategies, 60% access could very likely indicate a thorough examination of orthogonal dimensions on select jobs. Third, it is assumed that the difference in depth of search on the expected redundant dimensions between actually redundant and orthogonal conditions is due to accessing more dimensions rather than more alternatives of the same dimensions. Support for both the second and third assumptions comes from an examination of the number of dimensions accessed.

For each subject, the number of dimensions accessed was counted for both the expected redundant and expected orthogonal dimensions. This measure correlated highly with the depth of search measure ($\underline{r}$ = .603). A 2 X 2 X 2 X 3 analyses of variance with the first two facets (time constraints and actual redundancy) as between-subject variables and the last two facets (expected redundancy and repetitions) as within-subject variables was used to analyze the number of dimensions accessed. In addition to effects for time constraints ($\underline{F}(1,136) = 16.79$, $\underline{p} < .01$, eta^2 = .051), expected redundancy ($\underline{F}(1,136) = 47.23$, $\underline{p} < .01$, eta^2 =

.055), repetitions ($\underline{F}(2,272) = 4.97$, $\underline{p} < .01$, $eta^2 = .008$), and an expected redundancy by repetitions interaction ($\underline{F}(2,272) = 4.26$, $\underline{p} < .05$, $eta^2 = .003$), a significant interaction was found between expected and actual redundancy ($\underline{F}(1,136) = 5.56$, $\underline{p} < .05$, $eta^2 = .007$). The means for this interaction are presented in Table 18. Simple effects tests indicate expected redundancy effects in both the actually orthogonal ($\underline{t}(69) = 6.98$, $\underline{p} < .01$) and actually redundant conditions ($\underline{t}(69) = 3.03$, $\underline{p} < .01$). Effects for actual redundancy were found for neither the orthogonal dimensions ($\underline{t}(138) = .95$, n.s.) nor the redundant dimensions ($\underline{t}(138) = 1.40$, n.s.).

The second assumption was that decision makers were examining all relevant orthogonal dimensions. The means for the number of orthogonal dimensions accessed (4.27 and 4.12) support this assumption. Although these means are not five, they do indicate that decision makers were fairly complete in their examination of redundant dimensions. The third assumption was that differences in depth of search between actual redundancy conditions on the expected redundant dimensions was due to an increase in the number of dimensions accessed. The simple effects tests do not support this assumption, however the means are in the right direction.

When taken all together, a reasonable explanation for the interaction between expected and actual redundancy on the depth of search measure lies within task difficulty. Decision makers found the actually redundant task more difficult than the actually orthogonal task because the dimensions were so highly related that discrimination between alternatives was difficult. The increased difficulty led to greater search of redundant, but not orthogonal dimensions because

Table 18

Means and Standard Deviations for the Expected by Actual Redundancy Interaction on the Number of Dimensions Accessed

Dependent Measure	Expected Redundancy	Actual Redundancy: Orthogonal	Actual Redundancy: Redundant
Number of Dimensions Accessed*	Orthogonal	4.27[a] (.792)	4.12[a] (.980)
	Redundant	3.40[b] (1.131)	3.70[b] (1.386)

Note. Numbers in parentheses represent standard deviations.

* Means sharing common letters are not significantly different ($p > .05$).

orthogonal dimensions were already quite thoroughly searched. The resulting search pattern produced an interaction between actual and expected redundancy.

In summary, redundancy appears to have both helped and hindered the decision process. Expected redundancy of dimensions was acknowledged such that redundant dimensions were accessed less than orthogonal dimensions, presumably because subjects expected that the orthogonal dimension provided more unique information. Actual redundancy may have hindered the decision process by making the decision task more difficult. The effects of actual redundancy were manifested in an actual by expected redundancy interaction because of ceiling effects in the expected orthogonal dimensions. As a number of these explanations are post hoc, clearly more research is needed to examine the effects of expected redundancy and actual redundancy in decision making.

Information Processing. Given the cost/benefit reasoning that generated the predictions for depth of search, similar predictions were generated for latency of search. Although not as obvious, it was suggested that since redundant information provides less of a benefit to the decision process than does orthogonal information, the redundant dimensions would not be examined for as long. The results clearly suggest that the cognitive processes are different during the selection of dimensions to access compared to the actual processing of information cues.

Within the information processing model, longer access durations indicate greater information processing. Two circumstances that would warrant greater information processing are: 1) when information is more complex and therefore requires greater expenditures of processing resources, or 2) when information is inconsistent with prior expectations and the inconsistency has to be resolved. There is no reason to believe that the redundant information dimensions are more complex than the orthogonal dimensions. It is possible that the actual information presented in the redundant dimensions was seen as inconsistent with prior expectations of redundancy. Three lines of evidence support this postulation. First covariation assessment research (Alloy & Tabachnik, 1984) suggests that subjects tend to underestimate true covariation. Thus, even in the actually redundant condition where intercorrelations ranged from .62 to .94 with a mean of .82, decision makers may have perceived less redundancy among dimensions than they came to expect based on the dimension labels. Indeed when you examine the actually redundant data in Table 7, it is apparent that for some jobs the dimension ratings varied from ratings of 3 to ratings of 6. Such range may have contributed to underestimations of true covariation. If this is the case, then information from redundant dimensions may have been perceived as inconsistent by subjects in both the actually redundant and actually orthogonal information conditions. The inconsistency should have been greater in the actually orthogonal condition.

A second factor that may have led to perceptions of inconsistency was the fact that intercorrelations were uniform across both redundant and orthogonal dimensions. Rather than, or in addition to noting actual redundancy, decision makers may have been sensitive to the comparative intercorrelations among the redundant and orthogonal dimensions. The expectation may have been that intercorrelations would be greater for redundant dimensions than for orthogonal dimensions. The fact that intercorrelations were uniform (or at least unsystematically related to expected redundancy) may have led to perceptions of inconsistency. If the intercorrelations among the orthogonal dimensions were taken as a baseline, then the intercorrelations among redundant dimensions would always appear lower than expected.

Examination of the means in the marginally significant interaction between actual and expected redundancy provide a third piece of evidence in support of the inconsistent information explanation (see Table 14). The cell with the longest latency of search is the expected redundant, actually orthogonal cell. This is also the cell with the greatest hypothesized inconsistency. On the expected orthogonal dimensions, actual intercorrelations can be easily interpreted as a chance occurrence, so redundant data does not lead to perceptions of inconsistencies. On the redundant dimensions, inconsistencies may have been perceived in the actually redundant condition and, to a greater extent, in the actually orthogonal condition. To summarize, prior theory, post hoc theory generation, and examination of the marginally significant interaction between actual and expected redundancy all suggest that the main effect for expected redundancy, on the latency of search measure was likely due to perceptions of inconsistency between expected redundancy and actual redundancy.

Search strategy. No predictions were generated for how redundancy would influence pattern of search because no prior theory nor research existed to support such predictions. Results indicate that search pattern was different on those dimensions expected to be redundant than those dimensions expected to be orthogonal. Interdimensional search was more common on redundant than orthogonal dimensions. This effect is congruent with expected redundancy effects found for depth of search and latency of search and similar reasoning can be used to explain the pattern of search effect. It is important to realize that there are many factors that potentially influence whether a decision maker chooses to search interdimensionally or intradimensionally. The explanations given are intended to account for the tendency to see more interdimensional search in one instance than in another.

The depth of search data indicate that information from expected redundant dimensions provided less unique information than did information from orthogonal dimensions and was therefore, examined in less depth. Further, the findings from latency of search indicate that expected redundant dimension information was perceived to be more inconsistent than expected orthogonal dimension information. This inconsistence was evidenced by longer search latencies. Given that the expected redundant dimensions were perceived as highly similar by labels and inconsistent by actual data, one search strategy may be to search by alternative, across dimensions to try and explore the similarity and inconsistency. That is, in order to confirm that the expected redundant dimensions are actually redundant, a good strategy would be to compare across dimensions within a job. Finding inconsistencies in the data would tend to promote this comparative search strategy. The expected orthogonal dimensions provided neither prior expectations of similarity to confirm, nor inconsistencies in the data to resolve. Therefore, less interdimensional search would be expected on the orthogonal dimensions. The findings support this explanation.

The observed interaction between actual and expected redundancy is more problematic. This interaction is unlike the interaction found on depth of search in that an actual redundancy effect was found for expected orthogonal but not expected redundant dimensions. With depth of search the actual redundancy effect was found for redundant but not orthogonal dimensions. This difference in interactions suggests that different processes are leading to the two interactions. No good explanation seems available to account for the pattern of search interaction.

One possible explanation is that actual redundancy tends to encourage comparisons of dimensions in the same way that expected redundancy does. With the expected orthogonal dimensions search was found to be more interdimensional in the actually redundant condition than in the actually orthogonal condition. In the redundant condition, decision makers tend to investigate the redundancy by comparing more across dimensions within an alternative, that is, interdimensionally. The reason an effect for actual redundancy was not found in the expected redundant dimensions is because of information inconsistency. Pattern of search is influenced by expected redundancy, actual redundancy, and information inconsistency (as previously stated, many factors influence pattern of search but at this point we are focussing on the three relevant influences). With the expected orthogonal dimensions, there is no expected redundancy and no inconsistency, so the only influence on pattern of search is actual redundancy. With the expected redundant dimensions, all three factors influence pattern of search. Expected redundancy promotes interdimensional search, as observed by the main effect for expected redundancy. Actual redundancy promotes interdimensional search in the expected redundant, actually redundant condition. Information inconsistency, on the other hand, promotes interdimensional search in the expected redundant, actually orthogonal condition, as that is where the inconsistency is greatest. The result of these influences is that search is just as interdimensional in the expected redundant, actually redundant condition as in the expected redundant, actually orthogonal condition. There is no actual redundancy effect for pattern of search with the expected redundant dimensions.

Although this explanation is very speculative, it is probably the most reasonable account for the particular interaction found with the pattern of search measure. Future research should definitely try to assess some of the suggested mediating influences related to expected and actual redundancy.

Summary of redundancy effects. Many explanations have been put forward to account for the results observed with the redundancy manipulations. At this point these explanations will be summarized in an effort to offer cohesiveness to a somewhat fragmented discussion.

Main effects of expected redundancy were found for depth of search, latency of search, and pattern of search. It was suggested that the expected uniqueness of orthogonal compared to redundant dimensions lead to the differences in depth of search. Observed inconsistencies between dimensions expected to be redundant and the actual redundancy of the data was suggested as an explanation for the effect on latency of search. Finally, it was the decision makers' effort to investigate the relatedness of expected redundant dimensions and to resolve the inconsistencies in the actual data that led to the differences in pattern of search.

For the interactions observed between actual and expected redundancy the explanations became a bit more speculative. For depth of search, task difficulty related to actual redundancy and a ceiling effect with the expected orthogonal dimensions may have led to the interaction. The latency of search interaction was not significant. Perhaps the most speculative explanation came with regard to pattern of search. The explanation offered was that the combined force of three influences, actual redundancy, expected redundancy, and inconsistency, led to the interaction observed for pattern of search.

Future Research Directions

Throughout the discussion, areas in which more research is needed have been suggested. The purpose of this section is to organize and systematically state the issues that need further investigation and methods that could be used to resolve these issues. The main issues that need addressing are: 1) assessment of linearity, 2) isolation of effects of actual redundancy, 3) investigation of expected redundancy and other labeling effects, 4) expansion of the Beach and Mitchell contingency model, 5) process tracing investigation job choice. The order of these five issues roughly corresponds to the order with which future research efforts will likely be directed.

Assessment of linearity. This study tried to introduce a new method of quantifying the linearity of search strategies. The most disappointing results were the high correlation between the index of nonlinearity and depth of search, and the lack of effects of redundancy on search nonlinearity. In addition, the effect of time constraints on nonlinearity was weak in comparison to the other search variables. These findings tend to suggest the nonlinearity index has construct validity problems. Part of the problem may lie with the conceptualization of the index. Definitions of perfect linearity and perfect nonlinearity were developed, and then an index was constructed that varied from zero (indicating perfect linearity) to one (indicating perfect nonlinearity). Given that the definitions of linearity and nonlinearity were accurate, the problem with the index must lie somewhere between the endpoints. It is possible that moderate degrees of nonlinearity are not well differentiated by the index.

Future research, and possibly reanalyses of the data collected in this study, should include efforts to assess the construct validity of the nonlinearity index and to assess other means of quantifying linearity. Previous research has used the variability of search across alternative or across dimensions as an indication of search linearity (Payne, 1976, Payne et al., 1987). One uncertainty in this previous research is how repetitions in access are treated. That is, if a person looks at an information cue more than once, should both accesses be included in the calculation of linearity? The nonlinearity index treated access as a dichotomous (accessed vs. not accessed) variable. Typical variability of search indices appear to treat each access independently. In this study, the number of times a particular dimension was accessed varied between 0 and 46 times. As there were only 10 alternatives, considerable repetition of access took place in the latter case.

Determining how to assess linearity should be a three step process. First, a conceptual investigation should be undertaken to evaluate previous research and theory and arrive at a solid definition of linearity. Given this foundation, one or more measures should be developed to assess linearity and their empirical properties explored. The conceptual validation of a linearity measure should be at least as important as the empirical validation. A final step in the validation of measures of linearity could be to have experts, familiar with the decision strategy literature, independently assess the linearity of various decision makers' search patterns. The correspondence between the experts' evaluations and the linearity measure would provide support for the appropriateness of the measure.

Actual redundancy. A second issue that needs to be addressed in future research is the effects of actual redundancy. The effects of this manipulation were different than predicted and, as such, post hoc explanations were generated to account for the results. It was suggested that actual redundancy may have more than one effect on the decision process. Although not observed in the current experiment, actual redundancy may have the same effect as expected redundancy. That is, decision makers may become aware of actual redundancy and realize they do not have to consider information from all redundant dimensions since it is essentially the same. Redundancy may reduce the complexity of the decision task by reducing the number of independent dimensions. A second effect that actual redundancy may have on the decision process is to make decisions more difficult. Given that decision task difficulty is related to how easily one alternative can be selected from the others, actual redundancy can make difficult decision tasks more difficult by reducing the number of independent dimensions. If more than one alternative is high on all dimensions, the process of selecting the most favorable alternative becomes difficult. One may therefore hypothesize that on easy decision tasks, actual redundancy can facilitate decision making; whereas on difficult tasks, decision making is hindered. This is a testable hypothesis that should be examined in subsequent research.

A number of potential costs and benefits of information redundancy were outlined in the literature review of this paper. Future research could be directed at tapping some of these effects with both actual and expected redundancy. If decision tasks are created in which information is either unreliable or missing, additional benefits of information redundancy may be observed. Redundant information dimensions may be used to substitute or supplement missing or unreliable information.

As mentioned before, more effort should be directed toward identifying mediating steps in the effects that redundancy has on decision making. In this study, it was suggested that actual redundancy affected access of redundant dimensions because the redundancy made the decision task more difficult. Task difficulty could be measured to assess the validity of this hypotheses. Effects attributed to information inconsistency could also be assessed. Whether these mediating processes can be assessed directly through post experiment questionnaires or indirectly with some other means, is an issue for future research to explore. The important point is that the effects of information redundancy on decision making are more complex than initially hypothesized. As such, future research will have to be more concerned with investigating the processes through which redundancy affects decision making.

Expected redundancy. More research is needed to investigate the effects of expected redundancy. The current study examined information labeling effects with highly redundant compared to highly orthogonal dimension labels. Strong labeling effects were found. Future research should examine degrees of redundancy or conceptual similarity. The techniques used to develop dimensions with high and low expected redundancy could be used to investigate other levels of redundancy. For example would information that is negatively redundant (i.e. conceptually negatively correlated) be treated the same as positively redundant information such as was used in this study. Individual differences in terms of perceptions of conceptual similarity could also be examined. Researchers investigating these issues should always be aware of the actual redundancy and the degree to which it is consistent with the expected redundancy. As this study demonstrated, the interaction between actual and expected redundancy can influence decision processes.

It was suggested that many factors, other than information importance, may influence what information is considered when making a decision. This study demonstrated that expectations of information redundancy is one of these factors. Future research should investigate additional factors. For example, information reliability may also be conveyed by dimension labels. In this study it was assumed that all the information presented was highly reliable. By manipulating the source and/or the type of information presented, it may be possible to create dimensions that the decision maker would question in terms of reliability or validity. If other factors are found to influence the selection of information, a model may be developed to predict information access. One possibility would be an expectancy type model. The probability of a particular dimension being accessed may be a function of its importance (valence) and its expected usefulness (expectancy - based on redundancy, reliability, etc.). Such a model may be of use both theoretically and practically.

Contingency theory. The Beach and Mitchell (1978) contingency theory was used to both organize the background literature and generate hypotheses. In terms of organizing the literature and isolating variables for manipulation, contingency theory provides a good framework. The basic idea, that selection of decision strategies is a function of the decision environment, the decision task, and the decision maker, is intuitively appealing and theoretically interesting. However, contingency theory lacks the specificity to generate predictions for complex main effects and interactions.

The cost/benefit model which is part of contingency theory has proven to be somewhat effective for generating hypotheses. For example, the hypotheses with regard to time constraints that were generated with the cost/benefit model were, for the most part, confirmed. Two difficulties did emerge with the cost/benefit model. First, in the case of information redundancy, many potential costs and benefits were identified. Hypotheses were generated by selecting the benefit thought to be most likely to occur. In the process, one potential cost was overlooked. The cost/benefit model provides no way to select which of the various costs and/or benefits may be realized. Future research that utilizes the cost/benefit model should consider the possibility of multiple costs and benefits.

A second difficulty with the cost/benefit model and contingency theory is the vagueness of the decision strategies continuum. As previously suggested, contingency theory may benefit from an expansion of the single strategies continuum to a multidimensional model. That is, decision makers may have both informal techniques and formal strategies for aiding decision making. Informal techniques may include looking at less information (independent of the formal strategy) and speeding up processing. Formal techniques are those defined by the many labels currently available (e.g. linear search, elimination by aspects, etc.). At any time, decision makers may draw on both the formal and informal aspects to facilitate processing. In addition, use of informal techniques may be more a function of the decision environment, whereas formal strategies may be more a function of the individual decision maker. Future research and theorizing is needed to address these issues.

Job choice behavior. A final venue for future research could be to use the process tracing techniques to study job choice behavior. A job choice task was used in this experiment because of its suitability for investigating issues of redundancy and time constraints. Job selection is also a task that is relevant for undergraduate college students. The involvement subjects demonstrated and the interest they informally expressed suggest that the computer controlled information board may be a useful way to study issues of job choice.

Typically, the importance of different job characteristics in making job selection decisions has been examined by directly asking subjects to rate characteristics in terms of importance (Jurgensen, 1978). More recently, policy capturing techniques have been used to address similar issues (Feldman & Arnold, 1978). Differences have been found in the results obtained by rating and policy capturing techniques. Process tracing may provide evidence that helps resolve these differences, as it represents a technique for documenting what information is actually considered when choosing a job. Issues such as sex differences in job choice could also be examined with process tracing methods. The need for process tracing research on job choice can be observed in a recent review of the job choice literature (Schwab, Rynes, & Aldag, 1987). Although the current study used a job choice task to investigate basic decision behavior issues, perhaps future research should be directed toward examining job choice behavior.

Summary. In many ways this study was a successful exploratory investigation. Variables were identified that had not been previously investigated using process tracing methods. A number of interesting results were found, and hypotheses were generated as to why particular findings occurred. As a result, many directions for future research were identified including methodological (assessing linearity of search), empirical (further investigation of redundancy), theoretical (expanding the contingency model), and practical (investigation of job choice) issues.

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APPENDICES

APPENDIX A

Job Characteristics Survey

<u>Instructions</u>: In order to better determine what factors college graduates consider when choosing a job, you will be asked to make ratings of a number of job characteristics. When making the ratings, imagine you have to choose among two or more job offers. Consider the importance of the various factors in terms of how they would influence your choice of jobs.

Use the following seven-point scale to make your ratings of importance. One indicates "not very important" and seven indicates "very important". To respond, simply fill in the number corresponding to your rating on the computer scanning sheet.

```
    1         2         3         4         5         6         7
    |---------|---------|---------|---------|---------|---------|
 Not Very                      Moderately                      Very
 Important                      Important                   Important
```

Please begin by writing your student ID number on the scanning sheet and fill in the corresponding circles. Please provide ratings for all of the job characteristics.

1. Average length of time in entry position.
2. Potential for advancement to a supervisory/management position.
3. Job security.
4. How enjoyable the work is.
5. Cohesiveness of work group.
6. Amount of work performed with supervisor.
7. Supportiveness of coworkers.
8. Starting salary.
9. Desirability of geographic location.
10. Maximum medical coverage in benefits package.
11. Average performance-based salary increases.
12. Company stock sharing options.
13. Degree of autonomy

```
1         2         3         4         5         6         7
|---------|---------|---------|---------|---------|---------|
Not Very                  Moderately                    Very
Important                  Important               Important
```

14. Supervisory acknowledgement of good performance.
15. Desirability of metropolitan center where work is located.
16. Maximum performance-based salary increases.
17. Sociability of coworkers.
18. Quality of public transportation to work.
19. Opportunity to use abilities at work.
20. Average cost of living.
21. Likelihood of transfer to a more desirable department
22. Percent co-pay with medical coverage benefits.
23. Expense account.
24. How interesting the work is.
25. Average rate of advancement.
26. Annual company pension contributions.
27. Closeness of supervision.
28. Maximum salary after five years.
29. Average length of periods without job movement.
30. How satisfying the work is.
31. Ease of working for supervisor.
32. Work offers a variety of activities.
33. Frequency of salary increases.
34. Opportunities for non-work interactions with coworkers.
35. Company financed life insurance coverage.

```
 1         2         3         4         5         6         7
 |---------|---------|---------|---------|---------|---------|
Not Very                     Moderately                    Very
Important                     Important                 Important
```

36. Fairness of supervision.

37. Average salary after five years.

38. Average distance from residential areas to work.

39. How challenging the work is.

40. Competence of coworkers.

41. Number of career paths.

42. Opportunity to learn from work experiences.

43. Average commuter time to work.

44. Percent co-pay with dental coverage benefits.

45. Opportunities for work interactions with coworkers.

46. Reputation of company.

47. Metropolitan population of work location.

APPENDIX B

Factor Analysis Eigenvalues and Factor Matrix

Prerotation Eigenvalues

(for factors with eigenvalues greater than 1.0)

Variable	Factor	Eigenvalue
Q1	1	9.90862
Q2	2	3.04028
Q3	3	2.49186
Q4	4	2.25871
Q5	5	2.02349
Q6	6	1.65817
Q7	7	1.48761
Q8	8	1.41317
Q9	9	1.29142
Q10	10	1.28587
Q11	11	1.21813
Q12	12	1.15893
Q13	13	1.08518

Rotated Factor Matrix

	Factors						
Variable	1	2	3	4	5	6	7
Q1	.01582	.15387	.45900	-.11283	.08530	.09791	-.01417
Q2	.09542	.11522	.64847	-.09983	.12337	.05272	.02096
Q3	.51601	.19920	.19406	.07160	-.23311	.25775	.14104
Q4	.03126	.02279	-.15815	.61494	.15483	.16616	-.07369
Q5	.32803	.40785	-.05182	.16828	.22735	-.06473	.27432
Q6	.23051	.40465	.21118	.01492	.44450	.04721	.08102
Q7	.10850	.64832	.16606	.05047	.03462	.07067	.08817
Q8	.19978	-.03857	.21643	.03671	-.00272	.20103	.61174
Q9	-.04472	.14831	.00597	-.04403	.09270	.03574	.73196
Q10	.79060	.11179	.01007	-.01395	.05042	.07004	.13081
Q11	.16250	.03311	.56837	.11535	.15758	.10243	-.06785
Q12	.21996	.01762	.32455	-.06220	.62048	-.17736	.03677
Q13	.04765	.03243	.06977	.25551	.49037	.01617	-.06624
Q14	.09782	.50712	.08716	-.02685	.30247	.08320	.02965
Q15	.00238	.08352	.04550	.16153	.46358	.31106	.25747
Q16	.08627	-.03096	.49169	-.00758	.12597	.19045	.38440
Q17	.08351	.33669	.07915	.17265	.42032	.04920	.12156
Q18	.36893	.23887	-.10512	-.05537	.34254	.14043	.02331
Q19	.09123	.16304	-.06221	.37856	-.09681	.17909	-.29036
Q20	.65419	.09518	.14513	.08324	.03481	.13736	.02600
Q21	.22608	.20674	.42388	.24347	.07935	.32600	-.00014
Q22	.70567	.10459	.27192	.00725	.14426	.09979	-.06972
Q23	.28404	.00831	.35370	.05758	.51743	.00525	.25860
Q24	-.04118	-.01193	.01398	.71535	.11989	.03712	.03451
Q25	.29594	.19023	.57247	.20512	.00175	.22881	.13998
Q26	.69069	.08813	.22507	.17632	.20364	.04321	.01471
Q27	.02185	.28132	.00995	.06221	.31655	.44884	-.28149
Q28	.13172	-.04767	.16373	.08031	.03487	.70677	.18221
Q29	.24151	.16854	.27362	.02918	-.06083	.52561	-.00868
Q30	-.01592	.02743	.22001	.74749	.04178	.05838	.04476
Q31	.09169	.65360	.12447	.12954	.11071	.19182	-.03034
Q32	.01413	.26016	-.06006	.55715	.20317	.00408	.02025
Q33	.06038	-.07111	.51918	.11755	.21232	.39314	.14299
Q34	.15902	.19888	.10572	.06188	.61358	.00590	.01090
Q35	.70429	.16798	.11425	-.02748	.26241	.09088	-.02053
Q36	.17587	.46547	.14828	.29782	-.12884	.26587	-.22875
Q37	.14963	.07358	.36631	.02174	.01848	.67913	.06986
Q38	.37344	.49717	-.04446	-.00925	.02318	.36250	.16265
Q39	.12906	.16115	.15344	.65423	.02838	-.10722	.11863
Q40	.17142	.55788	.23574	.26849	-.03180	-.14335	.02030
Q41	.29799	.18763	.53564	.24445	-.07801	-.09584	.13208
Q42	-.02791	.32879	.31182	.34263	-.09346	-.24391	-.12836
Q43	.31882	.40749	-.13765	-.12864	.04906	.40786	.16270
Q44	.80520	.17033	.12990	-.02862	.21104	.07300	-.00616
Q45	.11481	.56178	.02193	.08476	.26209	-.00309	-.06608
Q46	.25916	.36755	.10608	.21109	.14781	-.06968	.27966
Q47	.06278	.13365	-.15299	.11901	.43245	.28245	.38965

APPENDIX C

Similarity Judgments

<u>Instructions</u>: The purpose of this questionnaire is to determine the similarity or overlap that college students perceive in a number of job characteristics. It should take you about 30 minutes to complete this questionnaire. Your participation is voluntary. You may choose not to participate, or to stop participating at any time while completing the questionnaire. Completing this questionnaire will serve as an indication of your voluntary consent to help with this project. Your responses will be kept anonymous, such that neither your name nor any identification will be associated with the data. Thank you for your cooperation.

The judgments we are asking you to make involve assessing the extent to which a number of job characteristics are similar to each other. When making the ratings imagine that you have to choose among a number of different job offers. Consider the job characteristics with respect to the information that they would provide for you when making an employment decision. Two job characteristics would be considered highly similar if they provide roughly the same information to you in terms of selecting a job offer. For example, you may judge information provided by a characteristic such as the "supportiveness of your coworkers" to be very similar to the characteristic "cohesiveness of your work group." If there is little or no overlap in the information provided by two job characteristics you would provide a judgment of no similarity. For example, the "average commuting time to work" may be judged as not at all similar to the "cohesiveness of your work group."

Use the following scale to make your similarity judgments. Each of the numerical points can be regarded as a percentage of similarity. For example, if the information provided by one job characteristic is virtually identical to the information provided by another characteristic, then a rating of 10 (100% similarity) should be given. Likewise if the two job characteristics are moderately similar, then a rating of 5 would indicate 50% similarity, and so forth.

```
    0      1      2      3      4      5      6      7      8      9      10

    |------|------|------|------|------|------|------|------|------|------|

No similarity              Moderately                    Virtually
   at all                    Similar                      Identical
(0% similarity)          (50% similarity)             (100% similarity)
```

Please begin by turning the page and proceed through the judgments. Please do not skip any judgments as you proceed through the questionnaire. As indicated previously you do <u>not</u> have to put your name or student number on this form.

0	1	2	3	4	5	6	7	8	9	10

|------|------|------|------|------|------|------|------|------|------|

No similarity at all (0% similarity)	Moderately Similar (50% similarity)	Virtually Identical (100% similarity)

To what extent will the information conveyed by:

POTENTIAL FOR ADVANCEMENT TO SUPERVISORY/MANAGEMENT POSITION

be similar to the information provided by each of the following:

REPUTATION OF THE COMPANY ________

AVERAGE RATE OF ADVANCEMENT ________

AVERAGE COST OF LIVING ________

LIKELIHOOD OF TRANSFER TO A MORE DESIRABLE DEPARTMENT ________

DEGREE OF AUTONOMY ________

STARTING SALARY ________

SOCIABILITY OF COWORKERS ________

AVERAGE LENGTH OF PERIOD WITHOUT JOB MOVEMENT ________

AVERAGE LENGTH OF TIME IN ENTRY POSITION ________

HOW INTERESTING THE WORK IS ________

DESIRABILITY OF GEOGRAPHIC LOCATION ________

NUMBER OF CAREER PATHS ________

```
0      1      2      3      4      5      6      7      8      9      10
|------|------|------|------|------|------|------|------|------|------|
```

No similarity at all (0% similarity)	Moderately Similar (50% similarity)	Virtually Identical (100% similarity)

To what extent will the information conveyed by:

REPUTATION OF THE COMPANY

be similar to the information provided by each of the following:

AVERAGE RATE OF ADVANCEMENT ________

AVERAGE COST OF LIVING ________

LIKELIHOOD OF TRANSFER TO A MORE DESIRABLE DEPARTMENT ________

DEGREE OF AUTONOMY ________

STARTING SALARY ________

SOCIABILITY OF COWORKERS ________

AVERAGE LENGTH OF PERIOD WITHOUT JOB MOVEMENT ________

AVERAGE LENGTH OF TIME IN ENTRY POSITION ________

HOW INTERESTING THE WORK IS ________

DESIRABILITY OF GEOGRAPHIC LOCATION ________

NUMBER OF CAREER PATHS ________

0	1	2	3	4	5	6	7	8	9	10

|------|------|------|------|------|------|------|------|------|------|

No similarity at all (0% similarity) — Moderately Similar (50% similarity) — Virtually Identical (100% similarity)

To what extent will the information conveyed by:

AVERAGE RATE OF ADVANCEMENT

be similar to the information provided by each of the following:

AVERAGE COST OF LIVING	________
LIKELIHOOD OF TRANSFER TO A MORE DESIRABLE DEPARTMENT	________
DEGREE OF AUTONOMY	________
STARTING SALARY	________
SOCIABILITY OF COWORKERS	________
AVERAGE LENGTH OF PERIOD WITHOUT JOB MOVEMENT	________
AVERAGE LENGTH OF TIME IN ENTRY POSITION	________
HOW INTERESTING THE WORK IS	________
DESIRABILITY OF GEOGRAPHIC LOCATION	________
NUMBER OF CAREER PATHS	________

0	1	2	3	4	5	6	7	8	9	10

|------|------|------|------|------|------|------|------|------|------|

No similarity at all (0% similarity)	Moderately Similar (50% similarity)	Virtually Identical (100% similarity)

To what extent will the information conveyed by:

AVERAGE COST OF LIVING

be similar to the information provided by each of the following:

LIKELIHOOD OF TRANSFER TO A MORE DESIRABLE DEPARTMENT ________

DEGREE OF AUTONOMY ________

STARTING SALARY ________

SOCIABILITY OF COWORKERS ________

AVERAGE LENGTH OF PERIOD WITHOUT JOB MOVEMENT ________

AVERAGE LENGTH OF TIME IN ENTRY POSITION ________

HOW INTERESTING THE WORK IS ________

DESIRABILITY OF GEOGRAPHIC LOCATION ________

NUMBER OF CAREER PATHS ________

```
  0      1      2      3      4      5      6      7      8      9     10
  |------|------|------|------|------|------|------|------|------|------|
No similarity               Moderately                  Virtually
   at all                     Similar                    Identical
(0% similarity)           (50% similarity)          (100% similarity)
```

To what extent will the information conveyed by:

LIKELIHOOD OF TRANSFER TO A MORE DESIRABLE DEPARTMENT

be similar to the information provided by each of the following:

DEGREE OF AUTONOMY ________

STARTING SALARY ________

SOCIABILITY OF COWORKERS ________

AVERAGE LENGTH OF PERIOD WITHOUT JOB MOVEMENT ________

AVERAGE LENGTH OF TIME IN ENTRY POSITION ________

HOW INTERESTING THE WORK IS ________

DESIRABILITY OF GEOGRAPHIC LOCATION ________

NUMBER OF CAREER PATHS ________

0	1	2	3	4	5	6	7	8	9	10

|------|------|------|------|------|------|------|------|------|------|

No similarity at all (0% similarity)	Moderately Similar (50% similarity)	Virtually Identical (100% similarity)

To what extent will the information conveyed by:

DEGREE OF AUTONOMY

be similar to the information provided by each of the following:

STARTING SALARY ________

SOCIABILITY OF COWORKERS ________

AVERAGE LENGTH OF PERIOD WITHOUT JOB MOVEMENT ________

AVERAGE LENGTH OF TIME IN ENTRY POSITION ________

HOW INTERESTING THE WORK IS ________

DESIRABILITY OF GEOGRAPHIC LOCATION ________

NUMBER OF CAREER PATHS ________

```
   0      1      2      3      4      5      6      7      8      9      10
   |------|------|------|------|------|------|------|------|------|------|
No similarity            Moderately                  Virtually
   at all                 Similar                    Identical
(0% similarity)       (50% similarity)           (100% similarity)
```

To what extent will the information conveyed by:

STARTING SALARY

be similar to the information provided by each of the following:

SOCIABILITY OF COWORKERS	______
AVERAGE LENGTH OF PERIOD WITHOUT JOB MOVEMENT	______
AVERAGE LENGTH OF TIME IN ENTRY POSITION	______
HOW INTERESTING THE WORK IS	______
DESIRABILITY OF GEOGRAPHIC LOCATION	______
NUMBER OF CAREER PATHS	______

```
0      1      2      3      4      5      6      7      8      9      10
|------|------|------|------|------|------|------|------|------|------|
```

No similarity at all (0% similarity)	Moderately Similar (50% similarity)	Virtually Identical (100% similarity)

To what extent will the information conveyed by:

SOCIABILITY OF COWORKERS

be similar to the information provided by each of the following:

AVERAGE LENGTH OF PERIOD WITHOUT JOB MOVEMENT ________

AVERAGE LENGTH OF TIME IN ENTRY POSITION ________

HOW INTERESTING THE WORK IS ________

DESIRABILITY OF GEOGRAPHIC LOCATION ________

NUMBER OF CAREER PATHS ________

To what extent will the information conveyed by:

AVERAGE LENGTH OF PERIOD WITHOUT JOB MOVEMENT

be similar to the information provided by each of the following:

AVERAGE LENGTH OF TIME IN ENTRY POSITION ________

HOW INTERESTING THE WORK IS ________

DESIRABILITY OF GEOGRAPHIC LOCATION ________

NUMBER OF CAREER PATHS ________

```
0      1      2      3      4      5      6      7      8      9      10
|------|------|------|------|------|------|------|------|------|------|
```

No similarity at all (0% similarity)	Moderately Similar (50% similarity)	Virtually Identical (100% similarity)

To what extent will the information conveyed by:

AVERAGE LENGTH OF TIME IN ENTRY POSITION

be similar to the information provided by each of the following:

HOW INTERESTING THE WORK IS ________

DESIRABILITY OF GEOGRAPHIC LOCATION ________

NUMBER OF CAREER PATHS ________

To what extent will the information conveyed by:

HOW INTERESTING THE WORK IS

be similar to the information provided by each of the following:

DESIRABILITY OF GEOGRAPHIC LOCATION ________

NUMBER OF CAREER PATHS ________

To what extent will the information conveyed by:

DESIRABILITY OF GEOGRAPHIC LOCATION

be similar to the information provided by each of the following:

NUMBER OF CAREER PATHS ________

APPENDIX D

Redundant Dimension Data with Labels

	Job Dimensions									
Jobs	1	2	3	4	5	6	7	8	9	10
1	6	5	5	7	5	5	5	6	6	4
2	5	5	6	3	5	4	6	5	5	5
3	3	5	5	5	6	5	4	5	5	6
4	6	6	5	4	4	5	5	6	6	5
5	6	5	5	6	6	5	6	5	6	6
6	5	4	5	4	5	4	6	4	3	6
7	1	2	2	2	2	2	2	2	2	3
8	3	3	4	4	3	4	4	4	3	4
9	4	3	4	3	3	4	4	4	5	4
10	1	1	1	1	1	1	1	2	1	1

	Job Dimension Number		
Label	Set 1	Set 2	Set 3
Advancement to management	4	8	6
Rate of advancement	2	2	5
Transfer to a better dept.	7	4	8
Period without job movement	8	5	9
Time in entry position	10	9	7
How interesting work is	9	10	10
Starting salary	3	3	1
Geographic location	1	6	4
Sociability of coworkers	5	7	3
Degree of autonomy	6	1	2

Orthogonal Dimension Data with Labels

	Job Dimensions									
Jobs	1	2	3	4	5	6	7	8	9	10
1	7	4	3	4	2	2	4	5	4	7
2	4	4	2	3	3	2	2	5	4	2
3	7	5	4	5	4	4	5	4	3	3
4	3	5	4	2	3	7	5	2	5	6
5	5	4	5	4	3	7	4	6	3	6
6	5	5	5	5	4	1	3	2	1	4
7	3	3	3	5	2	3	4	2	3	1
8	6	4	2	5	5	4	3	2	5	3
9	4	4	7	5	3	3	3	6	4	2
10	4	2	3	4	5	4	5	4	3	4

	Job Dimension Number		
Label	Set 1	Set 2	Set 3
Advancement to management	10	9	4
Rate of advancement	4	6	8
Transfer to a better dept.	7	1	2
Period without job movement	3	3	3
Time in entry position	8	8	1
How interesting work is	9	7	7
Starting salary	1	4	5
Geographic location	2	2	10
Sociability of coworkers	6	10	9
Degree of autonomy	5	5	6

APPENDIX E

Index of Nonlinearity Formula and Examples

The following formula will be used to calculate an index of nonlinearity of search:

$$\text{Nonlinearity Index} = \frac{NA}{((DS \times AU) - (DS + AU - 1))}$$

Where:

NA = Number of times a standard dimensions not accessed along those alternatives that were accessed on at least one standard dimension

DS = Number of dimensions accessed in the standard

AU = Number of alternatives used in the comparison, including the standard

The rationale for the components of this equation is as follows:

1. The numerator gives an indication of the degree of dissimilarity between the standard and those alternatives accessed on at least one dimension of the standard. Alternatives are limited to those accessed on at least one dimension of the standard because perfect linearity can exist even when all alternatives are not accessed.

2. The multiplicative component of the denominator gives the size of the matrix examined for linearity.

3. The additive component of the denominator adjusts the denominator for those elements that do not add into the numerator. Specifically, the number of dimensions in the standard are excluded because they never add into the numerator. Additionally, one dimension of each alternative will never add into the numerator because each alternative must be accessed on at least one dimension to be included.

The following are examples of how the index works (note that x indicates an accessed dimension):

1.

		Dimensions				
		1	2	3	4	5
	1	x	x	x	x	x
Alts	2	x	x	x	x	x
	3	x	x	x	x	x
	4	x	x	x	x	x

NA = 0, DS = 5, AU = 4, Nonlinearity index = 0

2.

	1	2	3	4	5
1	x	x	x	x	x
2	x				
3	x				
4	x				

NA = 12, DS = 5, AU = 4, Nonlinearity index = 1

3.

	1	2	3	4	5
1	x				
2		x			
3			x		
4				x	

NA = 0, DS = 1, AU = 1, Nonlinearity index = undefined (denominator is zero)

4.

	1	2	3	4	5
1	x	x	x	x	x
2	x	x			
3	x	x			
4	x	x			

NA = 9, DS = 5, AU = 4, Nonlinearity index = .75

5.

	1	2	3	4	5
1	x	x	x	x	x
2	x		x		
3		x			x
4	x			x	

NA = 9, DS = 5, AU = 4, Nonlinearity index = .75

APPENDIX F

Examples of Information Cue Content

1. The potential for advancement to a supervisory/management position in Job A is a 4.

2. For Job A, the average rate of advancement within the company is a 4.

3. For job A, the likelihood of a future transfer to a more desirable department within the company is a 4.

4. The average length of periods without job movement is a 4.

5. For Job A, the average length of time a person spends in the position at which you will enter the company is a 4.

6. In terms of how interesting the work is, the work that you will perform in Job A is a 4 .

7. The salary that you will initially receive with Job A is a 4.

8. The desirability of the geographic location of Job A is a 4.

9. For Job A, your coworkers are a 4 in terms of sociability.

10. The degree of autonomy that Job A offers is a 4.

APPENDIX G

Example of Computer Instructions and Programs

WELCOME

This exercise provides a simulation of a decision often made by people as they graduate from college. Today, you will be asked to imagine that you are looking for a new job. Further, you are to imagine that you have been offered ten different jobs. Your task is to choose the job you would most prefer from among the job offers.

There are a number of pieces of information you may consider when choosing your job. For example, you may look at starting salary, rate of advancement, and many other attributes of the jobs. Your task will be to examine various attributes of a number of different jobs and then choose the job you prefer.

If you have any questions at this time, please reread this page or ask the experimenter for help. If you do not have any questions, press the RETURN button and you will receive more specific instructions.

To aid you in the search process, you will be presented two lists. One list contains a number of different jobs and the second list contains a number of job attributes you might want to consider in evaluating the different jobs. For example, you might encounter a screen of information such as:

JOB	ATTRIBUTE
1: JOB A	1: COMPANY REPUTATION
2: JOB B	2: JOB SECURITY
3: JOB C	3: HEALTH CARE BENEFITS
4: JOB D	4: COST OF LIVING

As you can see, each job and each attribute are identified by a number. To begin searching for information, you will be asked two questions: (1) the job number about which you would like information and (2) the attribute number about which you would like to receive information. Using the number keys on the row above the typewriter keypad, simply type the number corresponding to the job about which you would like information and then type the number corresponding to attribute you would like.

PRESS THE RETURN BUTTON TO CONTINUE

Let's go through the job choice procedure.

JOB	ATTRIBUTE
1: JOB A	1: COMPANY REPUTATION
2: JOB B	2: JOB SECURITY
3: JOB C	3: HEALTH CARE BENEFITS
4: JOB D	4: COST OF LIVING

To begin the search process, you will choose one job and one attribute of that job. You will continue this procedure until you have enough information to choose the job you would prefer.

PRESS THE RETURN BUTTON TO CONTINUE

To see how this procedure works, let's begin with the following lists:

JOB	ATTRIBUTE
1: JOB A	1: COMPANY REPUTATION
2: JOB B	2: JOB SECURITY
3: JOB C	3: HEALTH CARE BENEFITS
4: JOB D	4: COST OF LIVING

The following message will appear below the jobs and attributes:

ENTER NUMBER OF THE JOB FROM 1 TO 4 THEN RETURN ?
ENTER ATTRIBUTE NUMBER FROM 1 TO 4 THEN RETURN ?

NOTE: TO MAKE YOUR FINAL DECISION TYPE <d> INSTEAD OF A NUMBER

Let's assume that you are interested in the JOB SECURITY of JOB A. You would press -1- for JOB A, the RETURN button, and then -2- for JOB SECURITY and then the RETURN button. The present screen will disappear and the requested information will be shown on the next screen as follows:

PRESS THE RETURN BUTTON TO CONTINUE

The job security in JOB A is a 2.

(Please note that the number (2) refers to a 2 on a scale from 1 to 7. When doing the actual job choice task you will have a handout to which you may refer as a means of interpreting the scale values.)

The computer will also present the following message:

PRESS THE <RETURN> KEY TO CONTINUE

PRESS THE RETURN BUTTON TO CONTINUE

When you press the return key, the computer will take you back to the initial screen.

JOB	ATTRIBUTE
1: JOB A	1: COMPANY REPUTATION
2: JOB B	2: JOB SECURITY
3: JOB C	3: HEALTH CARE BENEFITS
4: JOB D	4: COST OF LIVING

ENTER NUMBER OF THE JOB FROM 1 TO 4 THEN RETURN ?
ENTER ATTRIBUTE NUMBER FROM 1 TO 4 THEN RETURN ?

NOTE: TO MAKE YOUR FINAL DECISION TYPE <d> INSTEAD OF A NUMBER

Let's assume that you have searched all the information you feel you need and that you are ready to make your final decision. You would type a -d- and then the RETURN button, instead of typing a job number or attribute number.

PRESS THE RETURN BUTTON TO CONTINUE

The computer will now reprint the set of jobs as follows:

JOB

1: JOB A
2: JOB B
3: JOB C
4: JOB D

ENTER <N> IF YOU ARE NOT READY TO MAKE A DECISION
ENTER <Y> IF YOU ARE READY TO MAKE A DECISION

Since you are ready to make a decision, you would press the -Y- key. The computer will then ask you to enter your decision in the following manner:

GIVE THE JOB NUMBER OF YOU FINAL DECISION : ?

Let's assume that you have decided to choose JOB C. You would type in a 3 and hit the RETURN button.

PRESS THE RETURN BUTTON TO CONTINUE

Now that you are familiar with the search procedure, you will be given an opportunity to practice prior to conducting the actual job choice tasks. For this practice task, you will be presented with four jobs described by four attributes. You can search as little or as much information as necessary to make your decision. The jobs and attributes are as follows:

JOB	ATTRIBUTE
1: JOB A	1: COMPANY REPUTATION
2: JOB B	2: JOB SECURITY
3: JOB C	3: HEALTH CARE BENEFITS
4: JOB D	4: COST OF LIVING

Remember to choose one job and one attribute at a time. Type in the number corresponding to the job, hit RETURN, and then type the number corresponding to the attribute and hit RETURN. Continue this procedure until you are ready to make the final decision. GOOD LUCK!

PRESS THE RETURN BUTTON TO CONTINUE

Listed below are the scales of the attributes you will be using in the practice session. Notice that (1) always denotes a very poor rating and (7) always denotes a very good rating.

1. COMPANY REPUTATION. The company's reputation within the business world.

1	2	3	4	5	6	7
Very poor reputation						Very good reputation

2. JOB SECURITY. The long term security that the job offers.

1	2	3	4	5	6	7
Very poor security						Very good security

3. HEALTH CARE BENEFITS. The extent of health care benefits offered

1	2	3	4	5	6	7
No benefits						Unlimited coverage

4. COST OF LIVING. The average cost of living where the job is located

1	2	3	4	5	6	7
Very expensive						Very cheap

PRESS THE RETURN BUTTON TO BEGIN THE PRACTICE

JOB	ATTRIBUTE
1: JOB A	1: COMPANY REPUTATION
2: JOB B	2: JOB SECURITY
3: JOB C	3: HEALTH CARE BENEFITS
4: JOB D	4: COST OF LIVING

```
ENTER NUMBER OF THE JOB FROM 1 TO 4 THEN RETURN   ? 1
ENTER ATTRIBUTE NUMBER  FROM 1 TO 4 THEN RETURN   ? 1
```

NOTE: TO MAKE YOUR FINAL DECISION TYPE <d> INSTEAD TO A NUMBER

For JOB A, the company's reputation is a 4.

PRESS THE <RETURN> KEY TO CONTINUE

JOB	ATTRIBUTE
1: JOB A	1: COMPANY REPUTATION
2: JOB B	2: JOB SECURITY
3: JOB C	3: HEALTH CARE BENEFITS
4: JOB D	4: COST OF LIVING

```
ENTER NUMBER OF THE JOB FROM 1 TO 4 THEN RETURN   ? d
ENTER ATTRIBUTE NUMBER  FROM 1 TO 4 THEN RETURN   ?
```

NOTE: TO MAKE YOUR FINAL DECISION TYPE <d> INSTEAD TO A NUMBER

JOB

1: JOB A
2: JOB B
3: JOB C
4: JOB D

ENTER <N> IF YOU ARE NOT READY TO MAKE A DECISION
ENTER <Y> IF YOU ARE READY TO MAKE A DECISION : y

GIVE THE JOB NUMBER OF YOUR FINAL DECISION :

Now that you have done an example, you should be ready to begin the experiment. You will be presented with ten jobs described along ten attributes. You have been given a list of definitions and seven-point scales for the ten attributes on paper. You may refer to this list as often as you like during the course of the experiment. You will be asked to make a choice of the job you would most prefer and may examine as much information as you like before making your decision.

IF YOU HAVE ANY QUESTIONS NOW OR DURING THE EXPERIMENT,

PLEASE ASK THE EXPERIMENTER TO ASSIST YOU

PRESS THE RETURN KEY TO BEGIN THE EXPERIMENT.

PLEASE TYPE YOUR FIRST NAME THEN YOUR LAST NAME, THEN HIT <RETURN>
?

PLEAST TYPE THE LAST FOUR NUMBERS OF YOUR STUDENT NUMBER, THEN HIT <RETURN>
?

IF YOU HAVE ANY QUESTIONS NOW OR DURING THE EXPERIMENT, PLEASE ASK THE EXPERIMENTER TO ASSIST YOU.

PLEASE LOOK AT THE CLOCK IN THE CORNER OF THE SCREEN AND MAKE A NOTE OF WHAT THE TIME WILL BE IN 8 MINUTES. YOU HAVE 8 MINUTES TO COMPLETE THIS TASK.

ENTER THE <RETURN> KEY WHEN YOU ARE READY TO BEGIN

JOB	ATTRIBUTE
1: JOB A	1: PERIOD WITHOUT JOB MOVEMENT
2: JOB B	2: SOCIABILITY OF COWORKERS
3: JOB C	3: GEOGRAPHIC LOCATION
4: JOB D	4: RATE OF ADVANCEMENT
5: JOB E	5: DEGREE OF AUTONOMY
6: JOB F	6: HOW INTERESTING THE WORK IS
7: JOB G	7: STARTING SALARY
8: JOB H	8: TIME IN ENTRY POSITION
9: JOB I	9: ADVANCEMENT TO MANAGEMENT
10: JOB J	10: TRANSFER TO A BETTER DEPT.

ENTER NUMBER OF THE JOB FROM 1 TO 10 THEN RETURN ?3
ENTER ATTRIBUTE NUMBER FROM 1 TO 10 THEN RETURN ?1

NOTE: TO MAKE YOUR FINAL DECISION TYPE <d> INSTEAD OF A NUMBER

The average length of periods without job movement in JOB C is a 4.

PRESS THE <RETURN> KEY TO CONTINUE

JOB	ATTRIBUTE
1: JOB A	1: PERIOD WITHOUT JOB MOVEMENT
2: JOB B	2: SOCIABILITY OF COWORKERS
3: JOB C	3: GEOGRAPHIC LOCATION
4: JOB D	4: RATE OF ADVANCEMENT
5: JOB E	5: DEGREE OF AUTONOMY
6: JOB F	6: HOW INTERESTING THE WORK IS
7: JOB G	7: STARTING SALARY
8: JOB H	8: TIME IN ENTRY POSITION
9: JOB I	9: ADVANCEMENT TO MANAGEMENT
10: JOB J	10: TRANSFER TO A BETTER DEPT.

ENTER NUMBER OF THE JOB FROM 1 TO 10 THEN RETURN ?d
ENTER ATTRIBUTE NUMBER FROM 1 TO 10 THEN RETURN ?

NOTE: TO MAKE YOUR FINAL DECISION TYPE <d> INSTEAD OF A NUMBER

JOB

1: JOB A
2: JOB B
3: JOB C
4: JOB D
5: JOB E
6: JOB F
7: JOB G
8: JOB H
9: JOB I
10: JOB J

ENTER <N> IF YOU ARE NOT READY TO MAKE A DECISION
ENTER <Y> IF YOU ARE READY TO MAKE A DECISION : y

GIVE THE JOB NUMBER OF YOUR FINAL DECISION :

APPENDIX H

Manipulation Check Questionnaire

Age? __________ Student Number ________________________

Sex? Male Female (circle one)

<u>Instructions</u>: Please read each question and indicate your response by circling the number that best represents your opinion.

1. To what extent do you feel that time limited your ability to make optimal decisions?

```
     1       2       3       4       5       6       7
     |-------|-------|-------|-------|-------|-------|
  Not at all                                    Very Limited
Limited by Time                                   by Time
```

2. To what extent were you constrained in your ability to access information when making your decisions?

```
     1       2       3       4       5       6       7
     |-------|-------|-------|-------|-------|-------|
  Not at all                                        Very
 Constrained                                    Constrained
```

3. To what extent did it seem like the information on all attributes about a particular job was the same?

```
     1       2       3       4       5       6       7
     |-------|-------|-------|-------|-------|-------|
 Not at all                                     Virtually
  Similar                                        the Same
```

4. To what extent were the job attributes you examined during the computer task correlated? That is, if jobs that were high on one job attribute were also high on the other attributes, and jobs that were low on one attribute were also low on the other attributes, then the attributes would be labelled as highly correlated. However the attributes would be labelled as not correlated if there was no relation between attributes for each job.

```
     1       2       3       4       5       6       7
     |-------|-------|-------|-------|-------|-------|
  Not at all                                      Highly
  Correlated                                    Correlated
```

For questions 4 to 11 use the following scale and indicate your response by writing the number that best represents your opinion in the space provided. Each question refers to the similarity between job characteristics from the computer task.

```
  1       2       3       4       5       6       7
  |-------|-------|-------|-------|-------|-------|
Not at all            Moderately            Virtually
 Similar               Similar              Identical
```

4. To what extent is information conveyed by "Potential for advancement to management" similar to information provided by "Average length of period without job movement"?

____

5. To what extent is information conveyed by "Desirability of geographic location" similar to information provided by "Sociability of coworkers"?

____

6. To what extent is information conveyed by "Average length of period without job movement" similar to information provided by "How interesting the work is"?

____

7. To what extent is information conveyed by "Likelihood of transfer to a better department" similar to information provided by "Average rate of advancement"?

____

8. To what extent is information conveyed by "Average length of time in entry position" similar to information provided by "Potential for advancement to management"?

____

9. To what extent is information conveyed by "Starting salary" similar to information provided by "Degree of autonomy"?

____

10. To what extent is information conveyed by "Likelihood of transfer to a better department" similar to information provided by "Average length of time in entry position"?

____

11. To what extent is information conveyed by "Average rate of advancement" similar to information provided by "Sociability of coworkers"?

____