A PROCESS-TRACING STUDY OF EXTERNAL INFORMATION SEARCH IN MULTIPLE ITEM PURCHASE DECISIONS

by

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ABSTRACT

This dissertation reports the results of an experimental study that examined the extent to which information acquisition strategies differ between choosing one alternative (single item decision) and choosing more than one from the same set of available alternatives (multiple item decisions). It also examined information acquisition differences in multiple item decisions when different subset sizes are to be chosen. Subjects were 125 students, mostly pursuing undergraduate courses in business administration at three Norwegian institutions. A single factorial between-subjects experimental design was used in which the between subject factor was varied at 4 levels. Selection of cities to visit during a vacation was used as experimental stimulus. The same profile of ten Asian cities described along 10 attributes, was presented to all subjects in each of the four experimental groups. Subjects in Group 1 were then asked to choose one city ("Choose 1" condition), those in Group 2 were asked to choose three ("Choose 3" condition), subjects in group 4 selected 5 ("Choose 5" condition), whilst those in Group 4 selected seven ("Choose 7" condition). The decision tasks were presented in interactive computer sessions in which the software presented subjects with available information, and monitored what information (and in what order) was requested by subjects.

Information acquisition differences among the four experimental groups were then analyzed in two sets of comparisons. In the first comparison, information acquisition variables for the Choose 1 condition were compared with those of the aggregate of the Choose 3, Choose 5, and Choose 7 conditions. This set of comparisons investigated information acquisition differences between single and multiple item decisions. In the second set of comparisons, the same information search variables for the Choose 3, Choose 5, and Choose 7 groups were compared. Thus, this set of comparisons investigated the effects of size of subset to be selected on information acquisition behavior.

With regards to the first comparison, the results showed that subjects who were asked to select more than one alternative (Multiple Item group) engaged in more extensive information search with less variable search patterns than those who were asked to select only one alternative (Single Item group). They also tended to use more alternative-based search patterns and to spend more time on their decisions than those asked to select only one alternative.

Regarding the second set of comparison, remarkable similarities were found in information acquisition variables for the Choose 3 and Choose 7 groups. Furthermore, differences in information acquisition variables were found between these two groups on one hand, and the Choose 5 group on the other. Subjects in the Choose 3 and Choose 7 groups searched more information with less variability in search per attribute, used more alternative-based search patterns, and reported lower levels of task difficulty than subjects in the Choose 5 group.

In short, the results show that the number of alternatives to be selected in a decision has an impact on strategies used by consumers to acquire and integrate decision-relevant information. Specifically, subjects in the Multiple Item group tended to use more compensatory processes than those in the Single Item group. However, this was true only when the number of alternatives to be selected by the Multiple Item group was less than or greater than half the number of available alternatives. When the number of alternatives to be selected equalled exactly half the number of available alternatives, subjects tended to adopt more noncompensatory processes, albeit to a limited extent than those in the Single Item group. Implications of these findings for decision research are presented and discussed.

PREFACE

"Doktor - eg?" (Doctor - me?) is the question beneath the graduation picture of one of the former Ph.D candidates at the institute to which this dissertation is submitted. It has taken me four years of academic training to realize that there is more to that question than meets the eye. During those years a number of people have both directly and indirectly supported and encouraged me in the work with my dissertation. The idea of a Ph.D in Marketing was first suggested to me by Andreas W. Falkenberg at a time when I was considering Finance and Accounting as an alternative. I still admire the great marketing skills with which he presented the Ph.D program in Marketing at N.H.H. I am greatly indebted to him for luring me into this exciting field of academic endeavour.

I wish to thank my dissertation committee members, Professors Kjell Grønhaug, Sigurd V. Troye, and Gilles Laurent for their encouragement and support. Professors Kjell Grønhaug and Sigurd V. Troye were also my academic supervisors during the period of work on this dissertation. Throughout this period, they have given me exceptional support and encouragement. I wish to thank Kjell for the swiftness with which he read the drafts I submitted to him, and the useful comments he gave me. His constant demands for structure and clarity have contributed immensely to the final structure of this dissertation.

It is difficult for any Ph.D student to have Sigurd as supervisor without admiring the spontaneous manner in which he comes up with ideas that often dramatically change one's own narrow perspective on an issue. I have been very fortunate to have had the benefit of Sigurd's ideas and comments, and I wish to thank him for all the support and encouragement. I first met Professor Gilles Laurent during the 6th Annual Colloquium for Doctoral Students in Marketing in Barcelona in May, 1993. His comments on my research problem were probably the first external encouragement I got during the period prior to starting the data collection. I wish to thank him for that, and for agreeing to be on my dissertation committee.

Frank Indome deserves "a thousand thanks" for showing undoubted programming skills in developing the software used for the data collection. My colleagues at the Institute of Marketing have provided me with an exceptional working environment and a forum for useful

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PART I

INTRODUCTION

This part of the dissertation consists of the introductory chapter which presents the background for the study conducted as part of this dissertation, as well as the specific research questions addressed by the empirical study.

CHAPTER 1

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INTRODUCTION

1.1 Background

Understanding how consumers acquire and integrate product-related information in their purchase decisions has for a long time been one of the major concerns of marketers, consumer rights groups, public policy makers, and consumer behavior researchers. Marketers' interest in understanding consumers' use of product-related information stems largely from a desire to better communicate their product offerings so as to achieve competitive advantage in the marketplace. Policy makers and consumer rights groups have been interested in consumers' use of product-related information so as to enable them effectively design rules for, and regulation of marketing activities (specifically marketing communication) to protect consumers' rights. Consumer behavior researchers have had an interest in the cognitive processes underlying consumers' acquisition and integration of decision-relevant information largely for the purpose of theory-building, but also, to enable them effectively advise marketers, consumer rights groups, and public policy makers.

Over the years, this concern has resulted in a variety of research efforts directed towards unravelling the complexities of consumer decision making. One stream of research in this effort, has been concerned with identifying the *strategies* used by consumers to acquire product information, evaluate alternative product offerings, and make choices among evaluated alternatives. The consumer behavior literature is now rich in both normative and descriptive models of these strategies. The literature has also come a long way in identifying context and individual-related factors that affect how consumers relate to product information when they make purchase decisions, as well as methodologies for researching consumer decision making in general.

There is, however, one deficiency in the current literature that needs redressing. Almost all

available models of the decision process apply to decision situations in which the consumer chooses a *single* alternative from the set of available alternatives (hereafter referred to as single item selection decisions or SISDs). These models are often based on an implicit assumption that the consumer evaluates available alternatives independently. There are, however a myriad of decision situations where this assumption of independent evaluation is not appealing, because consumers ordinarily select more than one of the available alternatives. How consumers acquire and integrate information in these decisions has received little attention in the literature.

Table 1.1 shows examples of decisions in which the decision maker needs to select a portfolio of items rather than a single item as has been emphasized in studies of consumer decision making. Although not all of the decision situations outlined in Table 1.1 are relevant within the context of consumer decision making, some of them are. For example, under "Management Applications", selection of magazine subscription packages, television packages, and combinations of meals at a restaurant are all decisions that are also made by ordinary consumers. The same can be said of purchases from a record club, selection of telephone services, and stocking of liquor for a home bar (under "Other Applications"). One common feature of all these decisions is that, they often involve selection of a portfolio of items rather than a single item. For example, it is not uncommon for consumers to subscribe to more than one type of magazine at a time, select different brands of liquor (soft drinks) for a home bar, or subscribe to different television channels. Similarly, in their travel decisions, it is quite common for holiday makers to travel to more than one country, or more than one location in a country during the same vacation.

In these decisions, independent evaluation of available alternatives is not an intuitively appealing assumption. Rather, it is more likely that a consumer's preference for each of the available alternatives would be influenced either by his/her current collection of items from the particular product class, or the specific nature of the total set of available alternatives. Stated differently, preferences for individual alternatives are not formed exclusively on the basis of the attribute configurations of the individual alternatives, but their attribute configurations with respect to other alternatives in the available set, or other alternatives already chosen by the consumer.

Table 1.1
Examples of Decision Situations in which Multiple Items are Chosen

A. Management Applications	B. Academic Applications	C. Other Applications
1. Selection of a portfolio of stocks	1. Selection of an entering class in a college	1. Choosing an all-star sports team
2. Purchase of food for an institution	2. Selection of faculty for a school or department	2. Picking candidates for political tickets
3. Magazine subscription package	3. Selection of elective courses by students	3. Medical testing and case selection
4. Television program scheduling	4. University course offerings and resource allocation	4. Selection of new car options by buyer
5. Menu Selection	5. Acquisitions of material by a library	5. Purchases from a record club
6. Packaging of an assortment of products such as cereals	6. Document storage and retrieval	6. Services selection by a telephone subscriber
7. Selection of car models for a rental agency	7. Selection of counseling services	7. Stocking of liquor in a home bar
8. Acquisition of equipment by a firm		8. Selection of tools for a workshop
9. Design of new products		9. Choice of playground equipment
10. Selecting a task force for a management problem		10. Selection of scientific experiments to include in NASA space missions

Source: Farquhar and Rao (1976), p. 528

Decision situations involving the selection of portfolios of items from a product class have been studied in other fields like economics, finance, and the decision sciences. In economics for example, the idea of satisfaction being derived from the consumption of a "basket of goods" rather than a single good, is well documented. In business finance, portfolio theory and the Capital Asset Pricing Model (CAPM) are the cornerstones of normative investment behavior. These theories address the normative issue of how best to select a portfolio of investments to maximize the expected return on the entire portfolio. In the decision sciences, multiple criteria decision making (MCDM) is becoming an increasingly popular area of

research. MCDM is concerned largely with the study of decisions in which different conflicting objectives have to be satisfied at the same time. Among others, MCDM addresses the issue of how different individual items can be chosen to meet these conflicting objectives. The approach here has been to apply linear programming and network modelling to determine optimal solutions to these subset decision problems.

In the field of marketing, however, comparatively few attempts have been made at studying consumer decision situations in which item collections are chosen. Research in consumer behavior still emphasizes the study of single item purchase decisions, although there are some exceptions, e.g. Green, Wind and Jain (1972), Green and Devita (1974), McAllister (1979; 1982), Simonson (1990), and McClelland et. al (1987). Even then, the first three studies adopted a mathematical modelling approach in which the researchers sought to identify the optimal subset that should be chosen given an *a priori* choice objective.[1] It turns out that the models available so far are more suitable for understanding how consumers evaluate already assembled subsets of items than for describing the process by which the consumer him/herself assembles the subset.[2]

To my knowledge the only studies that have adopted some kind of descriptive approach to studying this process within a marketing context are Simonson (1990) and McClelland et. al (1987). But here again, there are some deficiencies in these two studies that make additional research necessary. Simonson's study was more concerned with the effect of making multiple purchases on consumers' variety-seeking behavior. Studying information acquisition strategies was only a secondary objective, and so did not receive the attention it deserves. In McClelland et al's study, the stimuli were constructed in such a way that these could have biased their results. These studies will be reviewed in chapter 3, and the deficiencies discussed in more detail. For now, however, we note that even in the absence of these deficiencies, there is still a need for further research because, in general, we still have a very limited knowledge of how consumers make their purchase decisions when the decision

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[1] For example, in McAllister's model the consumer is assumed to have a variety-seeking objective.

[2] In these studies, consumers have ordinarily been presented with subsets of items for which they are then asked to express preferences for the different subset combinations. In none of the studies have consumers been asked to group items into a preferred subset.

situation requires selection of more than one item from a set of available alternatives. Table 1.2 which summarizes our state of knowledge about consumer decision making, puts this need in a very clear perspective.

Table 1.2
Current State of Knowledge About Consumer Decision Making

	DECISION SITUATION	
	Single Item Selection	*Multiple Item Selection*
Normative Mathematical Models of Choice	Extensive	Limited
Descriptive Studies of Decision Process	Extensive	Limited

As can be seen from the table, there is an extensive wealth of studies that have adopted both mathematical modelling and descriptive approaches to studying single item selection decisions. For multiple item decisions, however, there is only a limited number of studies. There is therefore, a need for further research on consumer decision making as it relates to selection of multiple items from a product class. This need applies both for mathematical models and descriptive studies of the decision process. The purpose of this dissertation is to contribute in addressing this need by carrying out a descriptive study of consumer decision making process for multiple item selections. In other words, the dissertation seeks to study *how* consumers actually make choices when the decision situation requires selection of more than one item from the same product class. Because of its emphasis on describing the process leading to the decision, the study will adopt an information processing perspective, and so will draw on the process-tracing paradigm of contemporary decision research. Consequently, in the next section, central tenets of this paradigm are briefly reviewed as a prelude to formally presenting the research questions to be answered by this dissertation.

1.2 The Information Processing Paradigm of Consumer Decision Making

As indicated in the previous section, the consumer behavior literature is rich in mathematical models and descriptive studies of consumer decision strategies within the realm of single item selection decisions. These models and studies are generally based on the fundamental assumption that the consumer engages in conscious search and evaluation of information prior to arriving at a decision. Consequently, consumers' information acquisition patterns have formed the basis for formulating models of their decision processes as well as empirically investigating how they actually make decisions (Einhorn and Hogarth, 1981). For example, the basic distinction between compensatory and noncompensatory decision models centers around the extent to which all or some of the available information is utilized by the consumer prior to arriving at a decision. Specific models under each of these broad categories are then distinguished by examining the specific order in which information is acquired (i.e. whether intra- or interdimensional) as well as the manner in which the acquired information is combined (integrated) to arrive at a decision (Wright, 1975; Bettman, 1979). In his classification scheme for consumer decision strategies, Bettman (1979) employs three criteria - form of information processing, evaluation process, and choice criterion. The first two relate respectively to the order in which information is acquired and the manner in which the acquired information is integrated.[3]

Descriptive process studies of consumer decision making (Payne, 1976; Svenson, 1979) have also employed a strategy of examining information search statistics as a means of describing consumers' decision processes. Techniques used in such process tracing studies have included verbal protocols (Payne, 1976; Biggs et. al, 1985), eye movement studies (Russo and Dosher, 1983) and the information board technique (Payne, 1976; Klayman, 1985). In a pioneering attempt to identify underlying dimensions in the numerous information search statistics suggested by studies adopting these methodologies, Chestnut and Jacoby (1976; cited in Jacoby, Chestnut, and Fisher, 1978) performed a principal components analysis on a sample of 28 information acquisition variables and found three main factors which they labelled measures of *depth, content,* and *sequence,* of information search.

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[3] A more detailed review of the role of information acquisition in consumer decision making is presented in chapter 2.

Briefly stated, depth of search refers to the proportion of available information that a consumer utilizes before making a decision, content of search refers to the specific type of information searched, e.g. which specific attributes are searched for which alternatives, and sequence of search is concerned with the specific order in which various bits of information are searched. Typical acquisition sequences are alternativewise (where an alternative is selected and attributes searched for that alternative) and attributewise (in which case an attribute is selected and alternatives are searched for that attribute).

In addition to depth, content and sequence of search, Payne (1976) suggested examination of variability of information searched per alternative, arguing that this variable differs for compensatory (low variability) and noncompensatory (high variability) strategies. Klayman (1985) argued for examination of variability in information searched across *dimensions (or attributes)*, pointing out that the distinction between variability across alternatives and variability across attributes would help isolate the sources of variability, e.g. whether variability in information searched is attributable to unsearched alternatives or unsearched attributes.

It is evident from this short review of the decision literature that there exists a clear link between decision strategies and information processing (acquisition). In fact, any informed consumer decision involves the acquisition and integration of information about available alternatives, and it is generally accepted conventional wisdom that without information there can be no informed decisions. It is therefore, not surprising that researchers have resorted to studying information acquisition (search) patterns as a means of inferring the strategies used by consumers in their purchase decisions. The established link between decision strategies and information acquisition in the literature is a theoretical basis upon which the research questions for this dissertation will be formulated. It will also be the framework guiding choice of research methodology to answer the research questions. Stated generally, in line with the information acquisition paradigm of contemporary decision research, this dissertation will adopt an information acquisition perspective as a basis for studying consumers' decision strategies within the realm of multiple item decision making. The next section formally outlines the research questions to be answered in this regard.

1.3 Research Questions

As stated in section 1.1, the main objective of this dissertation is to study how consumers make decisions when they select more than one item from a product class. Within the context of the information processing paradigm briefly presented above, this objective can be achieved by answering the following general research question:

RQ1 **How do consumers acquire and integrate decision-relevant information when faced with decisions in which more than one alternative needs to be selected from the same product class?**

However, since most of the available studies of consumer decision making are within the domain of single item selection decisions, a useful approach to answering the above research question would be to examine the extent to which information acquisition and integration in multiple item selection decisions differs from what we already know from the single item selection domain. In other words, with the benefit of an existing wealth of knowledge about single item decisions, a comparative approach to answering RQ1 would be the most appropriate. In addition to this, a comprehensive answer to RQ1 also requires identifying some specific intricacies of multiple item decisions (e.g. the size of subset to be selected), and examining any differences therein. Consequently, our research question (RQ1) can be understood in terms of the following more specific research questions:

RQ2 **How do information acquisition and integration strategies used in selecting more than one item from the same product class differ from strategies used in selecting a single item?**

RQ3 **How does the exact number of items to be selected in multiple item selection decisions (i.e. size of subset to be selected) impact on information acquisition and integration strategies used in making the selections?**

Together, these three research questions will guide review of the appropriate literature, formulation of our research hypotheses, and design of the empirical study.

1.4 Significance of Topic

There are both theoretical and practical reasons why the study of decision strategies in multiple item purchase situations is important. From a theoretical point of view, such a study would provide a broader and more complete understanding of the robustness or otherwise, of current descriptive models of information acquisition and integration strategies in consumer decision making. As stated earlier in this chapter, existing models of consumer decision making either explicitly or implicitly assume that consumers evaluate available alternatives independently because of their desire to choose only one of the available alternatives. To what extent these models are applicable to multiple item choices in which independent evaluation is not an appealing assumption, is definitely an important theoretical question that needs to be answered. As Maddox et. al (1978) rightly assert,

"our confidence in the generality of a theory is heightened if its descriptions of a process are found to be accurate in a wide range of settings" (p. 167).

Stated differently, a scientific theory or model should be capable of being reproduced in a wide variety of empirical settings in order to ascertain its validity across a broad spectrum of relevant settings Troye (1989). Therefore, given the importance of understanding consumer decision making as outlined in the introduction to this chapter, it is equally important to understand this behavior across different types of decision situations. Thus, there is a need to understand the strategies consumers use in selecting item collections in multiple item decision situations.

From a practical point of view, an understanding of the strategies used in multiple item decision making would be useful for marketing practitioners in their choice of marketing strategies. As the examples in Table 1.1 illustrate, there are a number of situations in which products are often sold in packages consisting of assortments of different elements from the product class. For example, cable companies sell packages of TV subscriptions, travel agencies sell vacation packages, and some soft drink manufacturers sell six- or twelve-item packs consisting of assortments of different flavors. For most of these products, the marketing manager may be responsible for assembling the packages. Clearly, if such a manager knows how different consumer segments would themselves have assembled the packages, s/he would

be able to do a better job in assembling the packages to meet the needs of these consumers.

1.5 Organization of the Dissertation

The dissertation is organized into five main parts (Parts I to V). Part I consists mainly of this introductory chapter. Part II is devoted to a review of existing literature and consists of three chapters (chapters 2-4). Chapter 2 reviews the literature on consumer decision making for single item selection decisions. In this chapter, the theoretical link between information acquisition and consumer decision strategies is formally examined. Contingent decision behavior is also reviewed. In chapter 3, the limited available studies of multiple item selection decisions are reviewed and implications for this dissertation outlined. Chapter 4 reviews the consideration set and categorization literatures to identify useful parallels to multiple item selection decisions.

Part III of the dissertation consists of chapters 5 and 6. In chapter 5, a conceptual model of the relationships to be studied in the empirical study is presented. Hypotheses are then formulated on the basis of the model. Chapter 6 discusses methodological issues as they relate to the empirical study. Part IV also consists of two chapters (chapters 7 & 8). In chapter 7, results of preliminary analyses conducted to determine quality of the collected data are presented. Chapter 8 presented detailed results of the actual hypothesis testing. Part V, which includes the last two chapters is devoted to overall discussion of the results and their implications for theory and practice of marketing (chapter 9). This part also includes a discussion of some limitations of the present study and some suggestions for future research (chapter 10).

PART II

LITERATURE REVIEW

This part of the dissertation consists of 3 chapters. Chapter 2 formally examines the theoretical link between information processing and consumer decision making. In chapter 3, the limited available studies of multiple item selection decisions are reviewed and a classification scheme for these decisions is presented. Chapter 4 reviews theories and empirical studies of categorization and consideration set formation, two areas of academic enquiry with relevance for understanding multiple item decision making.

CHAPTER 2

DECISION STRATEGIES AND INFORMATION ACQUISITION

This chapter is organized as follows. Section 2.1 reviews current models of consumer decision strategies commonly discussed in the literature and discusses the theoretical link between these strategies and information acquisition. Section 2.2 is devoted to reviewing empirical studies of information acquisition in consumer decision making. The objective here is to identify the methodologies that have been used in studying consumer decision strategies as well as how variables relevant for studying decision strategies have been operationalized. In section 2.3, contingent decision behavior is discussed. This section reviews some of the factors that have been found to affect consumers' preferences for, and their ability to use various strategies identified in the literature. Theoretical frameworks for explaining contingent decision behavior are also briefly reviewed.

2.1 Information Processing and Consumer Decision Research

One of the main concerns in consumer decision research has been identifying the strategies consumers use when they make choices among multiattributed product alternatives. Over the years considerable research effort has been devoted to this issue and the consumer behavior literature is now rich in mathematical models and findings from empirical studies of decision strategies commonly used by consumers in such choices[4]. In this research effort, studying information acquisition has played a central role, and descriptions of decision strategies identified in the literature are often made in terms of the information acquisition implied by each of the strategies. For example, in an early attempt to provide a much needed taxonomy

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[4] For an introductory description of decision strategies see Bettman (1979).

of decision strategies, Wright (1975) used a two-dimensional framework based on two criteria - *evaluation process* and *choice criterion*. Wright (1975) defined the evaluation process in terms of the process by which a value is assigned to each alternative. This process can either be "compensatory" in which case the decision maker averages data so that positive and negative data have a balancing impact on the overall product impression, or "non-compensatory" in which the presence (absence) of one attribute may not compensate for the absence (presence) of other attributes. Choice criterion, refers to the rule by which the consumer decides which of the evaluated alternatives is finally chosen. Most commonly used rules identified by Wright's (1975) review are "choose the best" and "choose the first alternative that is satisfactory".

Bettman (1979) argued that the two aspects of a choice strategy outlined by Wright (1975) are not sufficient to fully characterize all choice processes, because requiring that a decision strategy specifies *"a process by which single multi-attributed options are evaluated"* (Wright, 1975; emphasis in original) suggests that the strategy must necessarily involve alternative-based information processing. He therefore proposed a third dimension along which choice strategies can be classified - the specific *form of information processing* used in examining alternatives when making a choice. Bettman (1979) suggested two types of processing - Choice by Processing Brands (CPB) and Choice by Processing Attributes (CPA). In CPB, all relevant information for a particular alternative is obtained before the consumer searches for information on another alternative. Thus, each alternative is processed and evaluated as a whole, and then a choice is made on the basis of these overall evaluations. On the other hand, in CPA all alternatives are compared on the basis of a single attribute, followed by a second attribute, and so on. This classification corresponds respectively to alternative-based and attribute-based evaluation strategies (Hogarth, 1989).

It is therefore, a generally accepted paradigm in contemporary consumer decision research that the manner in which available information is acquired and integrated, is a useful basis upon which various decision strategies can be distinguished. Table 2.1 shows an adaptation of

Bettman's (1979) classification of 10 distinct choice strategies[5] on the basis of their information processing implications.

Table 2.1
Information Processing Implications of Decision Strategies

CHOICE STRATEGY	EVALUATION PROCESS	CHOICE CRITERION	FORM OF PROCESSING
COMPENSATORY			
Affect referral	Holistic	Choose the best	Indeterminate
Linear Compensatory	Weighted sum	Choose the best	Brand
General Info. Integration	General function	Choose the best	Brand
Additive Difference	Relative	Choose the best	Attribute
NONCOMPENSATORY			
Conjunctive	Derived	Unspecified	Brand
Disjunctive	Derived	Unspecified	Brand
Lexicographic	Derived	Unspecified	Attribute
Sequential Elimination	Derived	Unspecified	Attribute
Elimination by Aspects	Derived	Unspecified	Attribute
Lexicographic Semiorder	Derived	Unspecified	Attribute

Source: Adapted from Bettman (1979), p. 184

A more formal theoretical basis for employing an information processing paradigm in the study and/or classification of consumer decision strategies is provided by Einhorn and Hogarth's Decision Process Components (DPC) framework (Einhorn and Hogarth, 1981).

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[5] We have chosen to present Bettman's (1979) classification because the 15 strategies described by Wright (1975) can be diffused into 8 distinct strategies. The remaining 7 are merely variations of some of these 8. For example Wright's classification includes both a conjunctive strategy with a "choose the first alternative that is satisfactory" rule, and a conjunctive strategy with an unspecified choice rule as two different choice strategies.

According to the DPC perspective, processes of judgement and choice consist of three interrelated components - information acquisition, evaluation/action, and feedback/learning - which form a sequence of related activities. The *information acquisition* component refers to the process by which the consumer seeks information about decision alternatives. This includes the sources used (e.g. external search and retrieval from memory), what pieces of information are acquired, the pattern in which information is acquired, etc. This component of the DPC framework corresponds to the form of processing suggested by Bettman (ibid). As indicated in Table 2.1, each of the strategies identified in the literature implies a specific form of information acquisition. For example, strategies like the linear compensatory, general information integration, conjunctive and disjunctive strategies all imply an essentially alternative-based processing, whilst additive difference, lexicographic and elimination-by-aspects all imply an attribute-based form of information acquisition (processing).

The *evaluation/action* component in the DPC framework is concerned with the manner in which acquired information is combined to make judgements and choices. This combination process corresponds to the evaluation process suggested by Wright (1975) and outlined in Table 2.1. It also probably includes the criterion used to make the final selection. As indicated earlier, using the evaluation process as a basis for classifying decision strategies, the distinction is between strategies that imply a compensatory evaluation process and those that imply a noncompensatory evaluation process. Finally, the *learning/feedback* component of the DPC framework is concerned with the extent to which evaluation strategies are tested and maintained (or discarded) in the face of experience, under what conditions decision makers fail to learn about the qualities of the strategies, and the extent to which decision makers are aware of their own rules.

The strategies outlined in Table 2.1 can be described as generic decision strategies in the sense that, numerous studies have documented that in any particular decision, a consumer may combine one or more of these strategies prior to reaching a decision. Consequently, there has also been distinctions between single stage and multistage (or phased) strategies as well as between strategies that use attribute weights and those that do not. A related issue has been the extent to which consumers actually have repertoires of decision strategies which they bring to bear on their consumption decision problems. In a rather insightful article, Bettman

and Zinns (1977) suggested that, contrary to the general assumption that consumers have predetermined strategies from which to choose from for any particular decision (the stored-rule hypothesis), in practice consumers may construct their decision strategies *only during* the actual decision process (the constructive-process hypothesis). Bettman and Zinns (1977) provided empirical evidence in support of this hypothesis. The next section discusses how researchers have studied consumers' decision strategies.

2.2 The Process-Tracing Paradigm of Consumer Decision Research

Earlier studies of consumer decision strategies often employed a policy capturing approach in which the strategy used in making a decision was inferred from the relationship between cues provided in a choice task and the final choice made by the respondent (e.g. Einhorn, 1971; Bernado and Blin, 1977). Typically, this approach involved fitting different mathematical decision models to a subject's choice/judgement outcome, and selecting the model with the greatest amount of explained variance as the one underlying the decision process. Following the pioneering work by Payne (1976) and Jacoby and his colleagues (e.g Jacoby, Speller, and Kohn (1974), consumer decision research has shifted from a policy-capturing to a process-tracing paradigm. Under the latter, researchers have become more interested in describing the actual process leading to a decision rather than the particular mathematical model that best accounts for the final decision outcome. This shift in paradigm has been accompanied by a corresponding shift in methodology from an emphasis on model-building and refinement to the use of various process-tracing research techniques like verbal protocols (e.g. Payne, 1976; Bettman and Zinns, 1977), eye movement studies (e.g. Russo and Rosen, 1975) and the information board technique (e.g. Payne, 1976; Jacoby, Szybillo, and Busato-Schach, 1977; Klayman, 1985).[6]

A typical information board as described in Payne (1976), consists of a number of envelopes attached to a large piece of cardboard (20 inches X 6 3/4 inches was used by Payne, 1976).

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[6] For a review of studies within this process-tracing paradigm see Svenson (1979), Bettman (1979) and quite recently Ford et al. (1989).

The board is divided into the same number of columns as there are available alternatives for the decision. Thus each column represents an alternative. The envelopes contain information cards which are labeled with the name of a dimension of information, e.g "price". For each alternative, its value on the dimension is written on a piece of paper and placed inside the envelope. In order to obtain this information, a subject has to pull the card out of the envelope, turn it around, and place it back in the envelope. The information is then displayed for the rest of the experiment. The experimenter him/herself has to be present to monitor the order in which information is examined by each subject. This way it is possible to determine the sequence of information acquisition and processing.

However, in view of the obtrusive nature of this approach (the experimenter has to keep track of the order of information search), some researchers (Klayman, 1985; Olshavsky, 1979) have adopted a version of the information board in which the envelopes do not contain only one sheet of paper, but rather more than one sheet (typically ten sheets) with exactly the same information on the value of an attribute for a given alternative. The envelopes are then attached to the alternative-by-attribute information board. If a subject needs information on the value of an attribute for an alternative, the subject still has to open the envelope in order to take out the piece of paper. However, in this modified version, the information is not displayed throughout the experiment. Rather, the piece of paper is put face down into a waste paper basket. If at a later time the subject needs this same information then he/she has to go back to the envelope and take out one of the remaining pieces in the envelope. This way the researcher is able to unobtrusively monitor which pieces of information were searched during the course of the decision because the waste paper basket provides an unobtrusive record of the order in which items of information were searched.

With the proliferation of personal computers, computer versions of the information board have also been developed. Examples of studies that have used such computerized versions are Payne, Bettman, and Johnson (1988) who used a software called *Mouselab,* Cook's *ISLab* (Cook, 1987) and Brucks' *Search Monitor* (Brucks, 1985; 1988).

A further consequence of this shift in methodology has been a shift in emphasis from one of examining decision outcomes to examining information search statistics (many of which have

been suggested in the consumer decision literature) in order to determine the strategies used by consumers in decision making. In this regard, consumer behavior researchers have made tremendous advances in operationalizing information acquisition and integration variables relevant for inferring various decision strategies. Several such variables have been suggested in the literature. In an early review of this literature, Chestnut and Jacoby (1976), cited in Jacoby, Chestnut and Fisher (1978) found 28 measures of information acquisition variables. A principal components analysis of these revealed three distinct factors which they labeled depth, content, and sequence of information search. Depth of search refers to the proportion of available information a consumer searches before making a decision. Content of search refers to the specific type of information searched, e.g. which specific attributes are searched for which alternatives, whilst sequence of search is concerned with the specific order in which various information values are searched. Typical acquisition sequences are alternativewise (where an alternative is selected and attributes searched for that alternative) and attributewise (in which case an attribute is selected and alternatives are searched for that attribute).

* In addition to depth, content, and sequence of search, consumer decision researchers have also operationalized information acquisition patterns in terms of the extent to which the same or unequal amounts of information are searched for all available alternatives/attributes, i.e. variability in information the amount of information searched per alternative/attribute. Payne (1976) argued that the level of variability in amount of information searched per alternative can help distinguish between compensatory and noncompensatory decision strategies. For compensatory strategies, a constant and equal amount of information will be searched for each alternative (thereby leading to low variability in search), whilst for noncompensatory strategies a variable pattern of information search across alternatives will be observed. Klayman (1985) suggested that in addition to variability in search per alternative, researchers should also examine the extent of variability in amount of information searched per *dimension (or attributes)*, arguing that a distinction between variability in search per alternative and variability in search per attribute would help isolate the sources of total variability, e.g. whether this is attributable to unsearched alternatives or unsearched attributes. Table 2.2 shows the information processing measures discussed above, and how they can be used to classify some of the decision models presented in Table 2.1.

As can be seen from Table 2.2, a strategy like the linear additive compensatory model may be implied if a consumer searches all or a high proportion of the available information, uses an alternativewise sequence of information search (i.e. Choice by Processing Brands), and searches approximately the same amount of information for each alternative and attribute. Similarly, an elimination-by-aspects strategy is implied if the consumer's decision is based on limited information search, high variability in the amount of information searched per alternative and per attribute, and an attributewise search pattern (Choice by Processing Attributes).

Table 2.2
Classification of Decision Strategies on the Criteria of Depth, Variability, and Sequence of Information Search

CHOICE STRATEGY	DEPENDENT VARIABLES			
	Proportion of Info. Searched	Variability in Search per Alternative	Variability in Search per Attribute	Search Sequence
Compensatory				
Additive (Linear)	High	Low	Low	Alternativewise
Additive Difference	High	Low	Low	Attributewise
Noncompensatory				
Conjunctive	Low	High	High	Alternativewise
Disjunctive	Low	Low	Low	Attributewise
Elimination-by-Aspects	Low	High	High	Attributewise
Lexicographic	Low	High	High	Attributewise

Source: Adapted from Cook (1987) p. 54.

Before closing the discussion in this section, it is necessary to state that the variables specified in Table 2.2 would be used as building blocks in designing our study to investigate

information acquisition differences between single item and multiple item selection decisions. Consequently, these variables would be used in developing the conceptual model for our hypotheses. We would therefore, return to Table 2.2 in chapter 5 when we discuss our research hypotheses.

2.3 Contingent Decision Behavior

One of the enduring findings in studies of consumer decision making has been the contingent nature of consumers' decision processes. Several researchers have documented that consumers' preferences for, and their ability to use particular decision strategies is contingent on a number of factors, which for the purposes of this review, can broadly be classified into three categories - individual, context and task factors.[7] Individual factors refer to stable characteristics of the consumer that have a potential to affect the way s/he acquires and integrate information in a decision situation. Examples of such factors that have been investigated in the literature are the consumer's product class knowledge (sometimes operationalized as past purchase experience), his/her cognitive abilities and decision making skills, and his/her perceptions of the risk associated with making a wrong decision.

The effect of product class knowledge was investigated in a study of purchase decisions for breakfast cereals by Jacoby, Chestnut and Fisher (1978) who found a positive relationship between degree of past purchasing experience and amount of information searched. In contrast, Bettman and Park (1980) and Johnson and Russo (1984) found an inverted U-shaped relationship, with external search greatest for consumers with low and high product class knowledge than those with moderate knowledge. Distinguishing between objective and subjective product class knowledge, Brucks (1985) reported results that show that only objective knowledge is positively related to amount of external search for information. Distinctions among various aspects of product class knowledge have also been made by Alba and Hutchinson (1987), Selnes (1986), Selnes and Grønhaug (1986) and Selnes and Troye (1988; 1989). In general, however, studies examining the specific direction in which product

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[7] The distinction between context and task factors is based on Payne (1982).

class knowledge affects information search have not provided conclusive findings. This notwithstanding, these studies do at least show that product class knowledge affects consumers' decision strategies.

Other individual-related factors that have been found to affect consumers use of product information is socioeconomic status (SES) and consumers' perceptions of risk associated with the product class. Using steam irons, microwave and toaster ovens as experimental stimuli, Capon and Burke (1980) found that consumers with medium to high SES tended to use more information in purchase decisions than those with low SES. They also found a positive relationship between perceived risk and amount of information acquired prior to making a decision, in contrast to Jacoby, Chestnut and Fisher (1978) who found no effect for perceived risk. In a subsequent study, Capon and Davis (1984) established a link between subjects' performance on basic cognitive ability measures and their information acquisition behavior in decision tasks.

Payne (1982) defines *context factors* as "those factors associated with the particular values of the objects in the decision set under consideration" (p. 386). These include the degree of similarity of available alternatives (Shugan, 1980; Tversky and Sattath, 1979; Biggs et al., 1985), and the quality of the option set (Payne, Laughhunn, and Crum, 1980; 1981). With regards to similarity, both Shugan (1980) and Tversky and Sattath (1979) used this variable in theoretical discussions of how similarity can impact on evaluation processes. For example, Shugan (1980) suggested that similarity would affect the ease or difficulty with which the consumer can make comparisons among available alternatives. Quality of the option set refers to the extent to which clearly dominating alternatives are present or absent in the set of available alternatives. Under this line of research, a number of studies (e.g. Huber and Puto, 1983; Huber, Payne, and Puto, 1982; Simonson, 1989; Pan and Lehmann, 1993) have investigated and found enduring effects on consumers' evaluation processes of changing the option set by adding assymetrically dominated alternatives to an existing option set.[8]

As defined by Payne (1982) *task factors* refer to "those factors associated with the general

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[8] An assymetrically dominated alternative is one that is dominated by one item in the set of available alternatives but not by another (Huber, Payne, and Puto, 1982).

structural characteristics of the decision problem". These include inter alia, the format used to present information, i.e. whether information is arranged by brands or by attributes (Bettman and Kakkar, 1977; Russo, 1977), the response mode used in experiments, i.e. whether consumers are required to make judgements or choices (Lichtenstein & Slovic, 1971; Lindman, 1971), and the complexity of the decision task. The effects of task factors on consumers' evaluation processes are of particular relevance for this dissertation. As such, these would be considered in more detail in the discussions that follow.

- Recapitulating on the research questions posed in chapter 1, we note that this dissertation is specifically concerned with how information processing strategies differ for consumers who make multiple selections as opposed to those who select only a single item from the same product class, as well as the impact of size of subset to be selected on information processing. Clearly, the relevant dimension along which single and multiple item selection decisions differ is the number of alternatives to be selected. The same applies to selection of different subset sizes in multiple item selection decisions.

Following Payne's (1982) distinction between context and tasks factors, number of alternatives to be selected may appropriately be described as a task factor since this variable is more related to the "structural characteristics" of the decision task, than to factors associated with available alternatives. Specifically, it is plausible to assume that asking subjects in an experimental situation to select one or more of the available alternatives, represents a response mode manipulation, albeit along a different operationalization as has been ordinarily used in the literature. With support from Green, Wind, and Jain (1972) and Simonson (1990),[9] there is also reason to conclude that differences in the number of alternatives to be selected in a decision situation has some impact on complexity of the decision task, i.e. the ease or difficulty with which the task can be completed. Consequently, in the sections that follow, theoretical and empirical perspectives on the effects of task complexity and response mode on consumers decision strategies would be reviewed in more detail. Implications of each factor for this dissertation will then be outlined, and fully developed in chapter 5 when these factors are used as a point of departure for the research

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[9] These studies would be reviewed in chapter 3.

hypotheses upon which the subsequent empirical study will be based.

2.3.1 *Response Mode and Contingent Decision Behavior*

Response mode (or task instruction), as operationalized in consumer decision research, refers to the explicit instructions given to subjects in a decision task, and which often have implications for the actions they are required to take to complete the task. Discussing response mode effects under the heading "effects of motivation and task instruction", Troye (1983; p. 49-52) provides a selected review of studies that have manipulated task instruction in decision research. The overwhelming evidence from these studies is that response mode manipulations do have enduring effects on the strategies used by subjects in acquiring information for decision making. This led Troye to conclude that:

> "There is empirical evidence that the purpose for which information will be used can be successfully manipulated and that it affects the way information is processed (Bettman, 1979)" (p. 51).

In his own study, Troye (1983) manipulated the operational definition of evoked set by instructing one group of subjects to identify apartments they find "acceptable" whilst another was instructed to list apartments they would "consider" in a decision. The results indicated that those asked to list acceptable alternatives generally listed fewer alternatives than those asked to list apartments they would consider.

Whilst several manipulations of response mode have been used in decision research, the effects of two types of manipulations are of interest to this dissertation. These are:

1.   Response effects attributable to instructions requiring judgement vrs. those requiring choice.

2.   Effects attributable to instructions requiring subjects to choose versus reject alternatives from a fixed set of available alternatives.

In what follows, we review these effects in greater detail, and outline their implications for this dissertation.

2.3.1.1 Judgement vrs. Choice

As used in studies of consumer decision making, the distinction between judgement and choice tasks is based on the extent to which consumers in an experimental task are required to make a single choice from a set of available alternatives (choice) or express different degrees of preference for all alternatives without selecting one (judgement). In studies employing a choice task manipulation, respondents are typically asked to select only one alternative (and by implication reject the remaining) from a set of available alternatives. In judgement tasks, however, they are explicitly asked to evaluate each alternative using some form of continuous or multilevel scale. Extant research has demonstrated that when explicitly asked to make judgements about alternatives, respondents adopt cognitive evaluation processes that differ from those used when they are asked to choose one of the alternatives. Moreover, the different response modes have differing impacts on certain post-evaluation outcomes such as learning new information (Johnson and Russo, 1984).

In one of the studies that explicitly distinguished between choice and judgement tasks, Billings and Scherer (1988) instructed one group of students to rate each of 8 hypothetical candidates on how they would perform as resident advisor (a Judgement Condition). Another group was asked to choose only one of the candidates as resident advisor (a Choice Condition). The results showed that subjects in the Judgement condition acquired more information than those in the Choice condition. Billings and Scherer (1988) also found that subjects in the Judgement condition used a much more constant amount of information (low variability of search) than those in the Choice condition, and they tended to use an interdimensional (or alternativewise) search pattern.

These findings are consistent with the suggestion by Einhorn, Kleinmuntz, and Kleinmuntz (1979) that in general, compensatory strategies would be more prevalent in judgement tasks than in choice tasks where noncompensatory strategies are more likely to be used. Similarly,

in a study in which apartments were used as experimental stimuli, Billings and Marcus (1983) could not find convergence between rating and choice tasks using three alternative measures of compensatory and noncompensatory decision processes. In discussing their results, the authors suggested that this lack of convergence could be explained by the fact that the rating and choice tasks required different cognitive processes. They therefore concluded that whilst the distinction between judgement and choice tasks is often blurred in decision research, the results of their study indicated that "decision making behavior is affected by the response required by the task" (p. 350).

In sum, evidence from studies that distinguish between judgement and choice tasks suggest a tendency for consumers to adopt more heuristic, noncompensatory strategies in choice tasks and compensatory strategies in judgement tasks. Similar patterns of processing differences have been observed in studies of gambling decisions where the distinction has been between bidding for, and expressing preferences for gambles (e.g. Grether and Plott, 1979; Lichtenstein and Slovic, 1971; Lidman, 1971). Commonly known as the preference reversal phenomenon, these studies found dramatic preference reversals in subjects' responses to the same pairs of gambles depending on whether the gambles were presented in a bidding or preference task. For example, a subject will express a higher preference for a particular gamble in the preference task and then turn to price it lower in a bidding task. In the literature, it has been suggested that the reason for this preference reversal is that the bidding task is essentially a choice task because it requires the decision maker to select one of the gambles to play in. On the other hand the preference task is mainly a judgement task requiring the subject to express overall preference for each gamble without explicitly selecting one of them. Therefore, in order to explain the preference reversal phenomenon, one needs to understand why judgement and choice tasks lead to different decision outcomes (thereby suggesting different cognitive processes).

Slovic, Fischoff and Lichtenstein (1988) offered a justification explanation for this. According to the authors, because of the inevitability of conflict in decision making, in choice tasks (where only one alternative is to be selected and the rest rejected) people seek a set of coherent reasons to justify both to themselves and to others why a particular alternative is selected. Such a justification is easier when alternatives are compared to each other along

specific dimensions. Elimination by Aspects (Tversky, 1972) is a particularly useful strategy in this regard because it

"permits a choice to be resolved in a clear-cut fashion, without reliance on relative weights, trade-off functions, or other numerical computations, and eases demands on the decision maker's limited capacity for intuitive calculation" (p. 159).

On the other hand, judgement tasks require people to make holistic evaluations (based on overall worth) of each alternative. According to Slovic, Fischoff and Lichtenstein, this triggers off an anchoring and adjustment process in which, for each alternative, a starting point is determined as a first approximation or anchor. This is then adjusted to accommodate additional information about the alternative. Because the anchor serves as a first approximation to the overall worth of the alternative, additional information used in adjustment must necessarily pertain to the specific alternative, thereby leading to an interdimensional search pattern.

Payne (1982) has offered a complementary explanation based on Tversky's (1977) distinction between common and distinctive attributes and their role in similarity and dissimilarity judgements (i.e. judgements of how two or more alternatives are respectively similar or dissimilar to one another). According to this distinction, situations requiring judgements of similarity trigger a comparison process in which attention is focused on attributes held in common by the alternatives. In dissimilarity judgements, however, attention tends to be focused on the distinctive features of each alternative. Payne (1982) suggests that choice seems to be more related to a dissimilarity response in the sense that "what determines a choice between a and b is the distinctive features of a and b, not the features held in common" (p.389). As such in a choice task, common features are edited out of the decision problem and comparisons are then made using the distinctive features. In contrast, a judgement task requires integrating all available information about each alternative to determine its overall worth.

Summing up the discussion so far, the following propositions have empirical support in the decision making literature:

1. Response mode (i.e. whether a judgement or choice has or be made) affects the cognitive processes employed in completing a decision task.

2. The effects attributable to response mode can be explained in terms of a justification hypothesis (for choice tasks) and an anchoring and adjustment explanation (for judgement tasks).

3. Other types of response mode manipulations (e.g. bidding vs preference), though not explicitly framed as a distinction between judgement and choice, may lead subjects to adopt evaluation processes that are consistent with what obtains under a judgement-choice distinction.

The last point is particularly relevant for establishing whether such a judgement/choice distinction can be used to predict information processing differences between single and multiple item selection decisions. This is because it suggests that, even in decision tasks where there is no explicit reference to either judgement or choice, some types of response mode manipulations can lead to cognitive responses that follow patterns similar to those observed for judgement or choice tasks. It might well be that requiring that subjects to select more than one of the available alternatives will, under certain conditions, trigger off cognitive processes consistent with what obtains under a judgement task. Why this may, or may not be so will be discussed in chapter 5 when the research hypotheses of this dissertation are formally presented. For now however, the discussion turns to another response mode effect which has relevance for the third research question (RQ3) in chapter 1.

2.3.1.2 Choosing vrs. Rejecting

One other response mode effect that has been studied in the decision making literature is the distinction between choosing and rejecting. Following from the predictions of classical decision theory, given a set of *n* available alternatives it should make no difference whether a decision maker is asked to select one alternative or to reject *n-1* alternatives. The two tasks are identical from a logical point of view. However, empirical evidence suggests that

cognitive processes underlying these decision tasks are not identical. In a study of personnel selection decisions, Huber, Neale and Northcraft (1987) investigated the effect of instructing subjects to either choose or reject applicants for a job interview, on the number of candidates accepted, decision-processing time, and acceptance thresholds, among other things. In their experiment, subjects were presented with actual letters of application and resumés received by a large computer retailer in response to newspaper advertisements for computer technician's assistants. They were then asked to either list the names of applicants they would accept for the job interview (an "Acceptance" condition) or list the names of those they would reject (a "Rejection" condition). The results showed that subjects in the Acceptance condition listed significantly fewer names, and had significantly higher acceptance thresholds than those in the Rejection condition, especially when decision-related costs were made salient. No significant differences in decision-processing time was found in the absence of decision-related costs.

In a series of experiments involving binary problems which varied in context from child-custody award to vacation selection decisions, Shafir (1993) investigated the effect of asking subjects to choose vrs. reject on the relative frequencies with which an impoverished and enriched alternative would be chosen.[10] Drawing on the argument that when asked to choose (reject) people often focus on reasons for choosing (rejecting) an alternative, Shafir predicted that by virtue of its possession of many good and many bad attributes, an enriched alternative will be both chosen and rejected more frequently than an impoverished alternative. This hypothesis was supported across experimental tasks. For all tasks, the impoverished alternative was chosen by a majority of those asked to choose, whilst at the same time it was rejected by a majority of those asked to reject one alternative.

Extending the study to nonbinary problems, Shafir (1993) presented 139 subjects with three lotteries consisting of one enriched lottery and two impoverished ones.[11] Half of the subjects were asked to choose their most preferred lottery whilst the other half was asked to

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[10] An enriched alternative was defined as one that possesses more positive and more negative features with respect to another alternative (an impoverished alternative).

[11] The enriched lottery offered the largest gain whilst at the same it was the only one for which there was a probability of loosing an amount of money.

reject one lottery and then to reject a second from the remaining two. The enriched lottery was chosen by 61% of those asked to choose their preferred lottery, whilst at the same time it was rejected by 56% of those asked to reject their two least preferred lotteries. Again the results indicated a tendency for the enriched option to be both chosen and rejected by a majority of subjects depending on whether they were asked to respectively choose or reject.

In a further extension within the realm of nonbinary problems, Shafir (1993) presented four groups of subjects with a set of six lotteries. Three of these offered a modest gain (impoverished lotteries), whilst three offered substantial gains as well as a probability of loosing an amount of money (enriched lotteries). One group was asked to choose their most preferred lottery, the other was asked to reject their least preferred; a third group was asked to choose their five most preferred lotteries, whilst a fourth group was asked to reject their five least preferred lotteries. Again, the dependent variable was the frequencies with which the enriched and impoverished lotteries were chosen (rejected) in each of the four groups. The results were similar to his earlier findings, i.e. a majority of subjects chose (rejected) an enriched lottery as their most preferred (least preferred). But more importantly, the results also indicated a high positive correlation between rankings of subjects in the Choose 1 and Reject 5 instruction groups on the one hand (rank correlation coefficient of 1.0), and between the Reject 1 and Choose 5 instruction groups on the other (rank correlation coefficient of 0.9). Commenting on these results Shafir wrote:

> "The data suggest that having to choose five out of six options is converted by subjects into the simpler task of rejecting a single option. Conversely, the task of rejecting five out of six options is converted into the more natural task of choosing one alternative. .... When a majority of options need to be chosen, the task is naturally seen as involving the rejection of the weakest; when a majority are to be rejected, the task is seen as involving the choice of a select few" (p. 553).

In a general discussion of his findings, Shafir (1993) noted further that:

> "...the size of the set under consideration may .. determine whether we end up choosing or rejecting. The need to recommend 2 applicants from a pool of 10 is likely to be seen as requiring the selection of 2, whereas having to recommend 8 applicants from the same pool will most likely be framed as requiring the rejection of 2" (p. 554)

A major implication of the Huber, Neale and Northcraft (1987) and Shafir (1993) findings is that within the realm of multiple item selection decisions, tasks requiring the selection of different subset sizes will be associated with both different decision outcomes and different information acquisition strategies. To the specific directions of these differences we return in chapter 5 when we formally present our research hypotheses. For now, however, we review the other task factor along which single item and multiple item selection decisions may be distinguished, i.e., task complexity.

2.3.2 Task Complexity and Contingent Decision Behavior

In the consumer decision literature, task complexity has ordinarily been defined in terms of the information overload paradigm (Jacoby, Speller, and Kohn, 1974; Jacoby, 1984; Malhotra, 1984). As such, any structural characteristic of a decision task that has a potential to increase the amount of information available to the decision maker has been construed of as representing a relevant complexity factor. On the basis of this paradigm, consumer decision researchers define task complexity in terms of:

a)   the number of alternatives available to the decision maker (e.g., Olshavsky, 1979; Payne, 1976; Payne & Braunstein, 1978),

b)   the number of attributes used to describe available alternatives (e.g. Einhorn, 1971; Jacoby, Speller, & Kohn, 1974; Payne, 1976; Payne and Braunstein, 1978), and

c)   the interaction between number of alternatives and number of attributes.

Using these operationalizations, studies investigating the effects of task complexity on consumers' information search patterns have produced reasonably consistent findings. In general, it has been found that an increase in task complexity results in

(a)   a decrease in proportion of available information searched,

(b)   an increase in variability of search patterns, and

(c)   a decrease in mean search time.

For example, Payne (1976) found that an increase in the number of available apartments induced subjects to search a lower proportion of the available information, and a variable amount of information per alternative (indicating use of an elimination-by-aspects strategy). He also found that increasing the number of attributes (or dimensions) resulted in a decrease in the proportion of total information searched. Payne and Braunstein (1978) replicated the findings in a study involving gambles whilst Olshavsky (1979) provided further supporting evidence in a comparative study of condominiums and stereo receivers. Biggs et. al. (1985) replicated the findings in a study of bank loan officers' decision behavior, and Shields (1980; 1983) found the same results in a study of accountants' analysis of performance reports.

In terms of the decision strategies outlined in the previous section these findings suggest that an increase in task complexity results in an increase in the likelihood that consumers will use simplifying non-linear strategies like the conjunctive rule and elimination-by-aspects (Payne, 1976; Payne and Braunstein, 1978; Olshavsky, 1979; Lussier and Olshavsky, 1979). Clearly, on the basis of contemporary operationalizations of task complexity in consumer decision research, it would be difficult to see how this factor can be used directly to explain information processing differences between single and multiple item selection decisions. However, whilst consumer decision researchers have ordinarily defined task complexity in terms of the number of available alternatives and attributes, these are by no means the only factors that affect the complexity of a decision task. In the organization sciences for example, several perspectives on task complexity have been suggested by task design researchers. In a review of various operationalizations of the construct in this literature, Campbell (1988) identifies three main views of what constitutes complexity in a decision task. These are:

a)   Complexity as a subjective psychological experience of the decision maker. This perspective emphasizes the psychological dimension of task performance, and addresses subjective reactions of the decision maker to the task, e.g. whether the task is perceived as stimulating and difficult or boring and easy.

b)   Complexity as a person-task interaction. This perspective defines task complexity in terms of the capabilities of the individual who performs the task. According to Campbell (1988), this view of task complexity stems from findings in the job design

literature that a particular task that is high in core job dimensions can be experienced as both interesting and boring depending on the person performing it.

c) Complexity as an objective task characteristic. According to this perspective, the complexity of a decision task can be objectively determined independently of the individual performing the task. Thus, complexity is a structural property of the decision task, and can therefore be manipulated through appropriate task design.

Complexity as an objective task characteristic is perhaps the one perspective that is congruent with consumer decision researchers' view of task complexity. However, even within this view, Campbell's (1988) review suggests that besides the sheer amount of available information (indexed by number of available alternatives and attributes), other structural properties of the decision task also have a potential to increase decision task complexity. For example, Campbell (ibid) cites March and Simon's (1958) definition of a complex task as one in which three specific characteristics are embedded: a) the existence of unknown or uncertain alternatives, b) the presence of inexact or unknown means-ends connections, and c) the existence of a number of subtasks which may not consist of independent parts. Furthermore, the review suggests that a decision task can be complex either because there are multiple path-goals that can be applied to its solution, or there are several interrelated and conflicting elements that have to be satisfied in the decision.

Consistent with the information overload paradigm in consumer behavior research, Campbell's (1988) review concludes that, in general, any structural property of a decision task that has a potential to put *high cognitive demands* on the decision maker can be construed of as representing a relevant complexity dimension. Clearly, there are other characteristics besides the amount of available information, that have the potential to increase decision task complexity. Chapter 5 discusses specific dimensions of multiple item selection decisions that have the potential to affect task complexity in a manner that is different from what obtains for single item selections decisions. This discussion has been reserved for chapter 5 because the arguments would be better appreciated after the discussion in chapter 3, where a distinction between different classes of multiple item selection decisions is presented along with identification of the specific class(es) that are relevant for the present study.

2.3.3 Explaining Contingent Decision Behavior

In discussing response mode and task complexity effects on consumers decision strategies, reference was made to explanations that have been offered in the literature for the specific effects observed. In this section, some frameworks for explaining general contingent decision behavior are briefly reviewed. At appropriate places, references are made to parallels between these and the specific explanations offered for response mode and task complexity effects. The discussion in this section is based largely on Payne (1982) who suggested three theoretical frameworks for explaining contingent decision behavior. These are cost/benefit principles, perceptual processes, and production systems.

Cost/benefit principles posit that decision strategies have associated costs (e.g information acquisition requirement, computational effort, etc.),[12] and associated benefits (e.g likelihood of making a correct decision, speed of making a decision, and the justifiability for using the strategy).[13] When faced with a purchase decision involving evaluation of two or more alternatives, the consumer weighs the benefits of using any particular strategy against its associated costs, and chooses the strategy that maximizes the expected net benefit. Moreover, because of cognitive limitations in consumers' information processing capabilities (March and Simon, 1958), the cost/benefit framework posits that they will deal with task complexity by employing various simplifying strategies, or what has come to be generally known as decision heuristics. Since these "heuristics function by disregarding some of the available information" (Bettman, Johnson, and Payne, 1991; p. 55), the result is a reduction in the amount of cognitive processing. Indeed, the cost-benefit framework has often been invoked to explain observed effects of task complexity on consumers' decision strategies.

The *perceptual processes framework* seeks to explain contingent decision behavior by resorting to basic principles governing human perception. The argument here is that perceptual/decision responses are "hardwired" into the human organism by evolutionary processes, thereby making people predisposed to respond to stimuli (in our case decision

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[12] Shugan (1980) has proposed a methodology for measuring these information processing costs.

[13] Payne, Bettman, and Johnson (1988) have suggested an effort/accuracy framework for explaining adaptive strategy selection which bears a striking resemblance to cost/benefit principles.

situations) in specific preidentified ways. This line of argument has been pioneered by the works of Tversky and Kahnemann (e.g., Tversky, 1979; Tversky and Kahnemann, 1974; 1981; Kahnemann and Tversky, 1979) in which they have systematically demonstrated invariance in human choice behavior, especially in the realm of decision making under risk. In particular, Tversky and Kahnemann have discussed perceptual processes in terms of framing effects, which incidentally have been advanced as alternative explanations for findings of the preference reversal studies discussed earlier under response mode effects.

The *production systems framework* adopts a strategy of modeling choice behavior as a production system in which a condition-action pair similar to the stimulus-response pair is in operation. Each individual decision maker is presumed to have a set of production systems that are stored in long term memory. When faced with a decision situation, the systems are automatically tested against the data elements, and as soon as the conditions are satisfied, an action is taken. In the concluding remarks to his rather insightful review Payne (1982) notes that,

> "the theoretical frameworks,..., are best viewed as differing more in terms of emphasis than of predictions. Each framework should be evaluated in terms of its usefulness in handling particular kinds of task and context effects" (p. 385).

However, whilst cost-benefit and perceptual principles have been invoked in the literature to explain various aspects of contingent decision behavior, the production systems framework has not been equally suitable.

2.4 Implications for the Present Study

This chapter has reviewed the role of information acquisition in studies of consumers' decision strategies, how information acquisition has been operationalized in the literature, and the methodologies that have been used in contemporary decision research. It has also reviewed contingent decision behavior with special emphasis on response mode and task complexity effects, and how the contingent nature of consumer decision making has been explained in the literature. The role of information acquisition in decision strategy research,

operationalizations of information acquisition variables, and methodologies used in studying consumer decision behavior all have a direct relevance for our choice of variables to study, as well as the research methodology to use in an attempt to better understand consumer decision making for multiple item selection decisions.

Response mode and task complexity effects would enable a better understanding of the direction in which changes in the number of alternatives to be selected in a decision would impact on strategies used by consumers to accomplish the decision task. Furthermore, the review in this chapter would enable us better appreciate limitations in the few studies of multiple item selection decisions that have been published in the consumer behavior and related literature. To a review of this literature the discussion turns in chapter 3.

CHAPTER 3

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STUDIES OF MULTIPLE ITEM SELECTION DECISIONS

This chapter reviews the existing literature on multiple item selection decisions (MISDs), and presents a conceptual framework for classifying this class of decisions. It is organized as follows. Section 3.1 provides a general background for the review. In section 3.2, studies that have addressed selection of multiple items from different generic product classes are reviewed. Section 3.3 reviews studies that have investigated selection of multiple items from the same generic product class. Based on the reviews in sections 3.2 and 3.3, a framework for classifying multiple item selection decisions is presented in section 3.4. This framework also serves as a reference point for positioning the specific class of decisions to be studied in this dissertation. Section 3.5 briefly outlines issues arising from the review and discusses their implications for the present study.

3.1 Introduction

Researchers' interest in multiple item selection decisions (MISDs) is not entirely new. Three decades ago Coombs (1964) criticized normative models of decision making for their undue emphasis on decision situations where all preferences are assumed to be "first choices", in the sense that each successive choice is presumed to be a first choice given the absence of previously chosen alternatives. As an illustration of the inadequacy of this assumption, Coombs presented the following example of preference choices of graduate students of psychology:

> "Suppose ten fields are available at a given university and each student is required (or permitted) to choose four for his preliminary. We might wish to use such data to seek a joint space to find out what graduate

students perceive as the dimensions of the fields of psychology. We might suspect, however, that some students would survey the ten fields with the view of seeking balance and breadth, and successive choices of such students would not reflect alternative first choices. ... A student's choice of learning as a major and mathematical and physiological psychology as minors does not necessarily mean that if learning were not available to him he would pick one of the others as his choice. He might regard mathematical and physiological psychology as two scientific languages or levels of description in psychology and prefer to substitute motivation or perception as a major" (p. 206).

The central idea in Coombs' (1964) example is that in decisions involving selection of multiple items, available alternatives will not be evaluated independently and so existing models of choice which assume independent evaluation, may be inappropriate in explaining decision making in these situations. Coombs (1964) therefore, called for research in what he called "second choices"[14], i.e. the choice that will be made from a set of dependent alternatives given that the decision maker already possesses the most preferred alternative, and therefore it is absent from the offered set. Since Coombs' admonition, two broad streams of MISD research have emerged, viz, the study of MISDs involving selections from generically different product classes (or across-product category choices) and the study of MISDs involving selections from the same generic product class (or within-product category choices). The next two sections review the limited studies in these two streams of research, and tries to single out the important implications for the present work.

3.2 Studies Addressing Selection of Multiple Items From Generically Different Product Classes

Consumers often face decisions where they have to make comparisons among alternatives from generically different product classes (i.e. choice among noncomparable alternatives, cf. Johnson, 1984; 1986; 1988; 1989; Bettman & Sujan, 1987; Corfman, 1991). Some of these decisions require selection of only one of the competing alternatives. In other situations, however, multiple items from the different generic product classes need to be selected because

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[14] Ratchford (1980) examined the expected benefits of searching second, third, and fourth brands of various household appliances.

they are congruent with each other, and therefore, together they contribute to the achievement of a given objective (Green, Wind, and Jain, 1972). For example, in a particular decision context a consumer may have to purchase a pair of trousers, a pair of shoes, a shirt, and a tie; a marketing manager may have to select a television personality to "match" a product to be advertised, or a type of package design to match a particular brand name.[15] In all these cases, the items chosen are functionally related with one another insofar as they contribute to a particular objective. In other words, they conform to what economists call complementary products.

Green, Wind, and Jain (1972) demonstrate how conjoint measurement techniques can be applied to the determination of consumer preferences for such item collections. As stimuli for an experimental study, Green, Wind, and Jain (1972) formed various alternative combinations of entrées and desserts for an evening meal. They then asked a group of subjects to express preferences for each of the combinations, and the resulting preference rankings were used as input for the conjoint measurement. In a discussion of the management implications of their suggested procedure, Green, Wind, and Jain (1972) distinguished between the three classes of decisions involving selection of multiple items:

1. Decisions in which item collections are *purchased or consumed as a sequence,* either during the same consumption occasion (e.g., the purchase/consumption of an entrée followed by a dessert) or over different consumption occasions (e.g. subscribing to a Book-of-the-Month Club).

2. Decisions in which item collections are *purchased or consumed without attention to sequence.* In this case, consumers may acquire a set of products with no specific regard to the sequence of acquisition or intended usage. The items are simply stocked in inventory and used as and when desired. Examples mentioned by Green, Wind, and Jain (1972) include the purchase of different types of soups, assortments of cold cuts, or collections of magazines or records.

3. *Congruence decisions,* in which case the decision maker is interested in the congruence of various components of a collection of items, e.g. how well do the components of an advertisement convey the intended "message", or how well does a

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[15] The managerial examples are taken from Green et. al. (1972).

television personality "match" the product being promoted.

Building on the work of Green, Wind and Jain (1972), Green and Devita (1974) proposed what the authors call a complementarity model for evaluating a consumer's utility for item collections. The model addresses the issue of interactions (both ordinal and disordinal) among the chosen items in these decision situations. It combines two models for portraying preference data for item collections - the additive model (based on perfectly additive utilities of the different items) and the vector model (used in representing complementarities in situations where the utilities of different items have a multiplicative relationship). According to Green and Devita (1974) it is reasonable to start an analysis of preferences for item collections by first fitting an additive model (after monotonic rescaling of the data) to determine if resulting preference functions are essentially parallel. If they are not, then residuals are computed by subtracting out additive main effects. The interaction component can then be analyzed by fitting a vector model. Green and Devita's model thus complements the popular additive model and is in essence a vector model with the important exception that it is fitted to residuals after first fitting an additive model. Empirical test of the complementarity model was carried out by fitting the model to preference data for various dessert combinations. They found, contrary to expectations, that most respondents did not exhibit highly interactive utilities as regards to their stimulus set. In other words, subjects preferences for different entree-dessert combinations could simply have been investigated using the additive model. In spite of this, however, their model is still a significant contribution to the study of preferences for item collections which exhibit highly interactive utilities.

3.3 Studies Addressing Selection of Multiple Items From the Same Generic Product Class

Choices of multiple items are also often made among alternatives from the same generic product class, or what economists prefer to call substitute products. A number of reasons may account for this. Among others, consumers may purchase multiple items from the same product class as a consequence of their desire for variety. McAllister and Pessemier (1982), citing Laurent (1978), propose that one of the derived causes of such explicable variety-seeking behavior[16] of consumers is their desire to satisfy *multiple needs,* a concept that can further be broken down into three components - multiple users, multiple uses, and multiple usage situations. According to McAllister and Pessemier (1982) a purchase is made for *multiple users* when the consumption unit consists of a household. In this case it is likely that different members of the household would prefer different brands of the same product type. This heterogeneity of preferences leads to a selection of multiple brands even though each member uses only one of the brands. A purchase is made for *multiple situations* when usage of the product is conditioned by the demands of the situation such as the social context of consumption, the location of consumption, time constraints on consumption, usage convenience, etc. Thus, behavior changes as the situation changes, and a brand/product variant that is consumed in one situation may not be consumed in another. Finally, *multiple uses* describes the situation in which the same product is used in more than one way. For example a particular type of baking soda may be used as a cooking ingredient and a different type as a cleaning agent.

Given the variety of reasons why consumers may select multiple brands/variants of the same product type, an important research issue has been how to model the process(es) underlying consumers' decision behavior in these decisions. Here again, a number of researchers have made limited contributions. Farquhar and Rao (1976) proposed a balance model for evaluating subsets of multiattributed items when a decision maker has to select multiple items from the same product class. According to the authors, for this class of decisions, decision makers select the individual items so as to achieve balance in attributes relevant for evaluating

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[16] Variety-seeking behavior implies that consumers sometimes purchase different brands of a particular product rather than multiple replicates of their most preferred brand.

alternatives from the product class. Balance in this case is defined as the degree of homogeneity of items in the chosen subset with respect to some attributes, and the degree of heterogeneity of these same items with respect to some other attributes. Each individual is presumed to use the concept of balance in his/her preference judgements, resulting in a classification of the relevant attributes describing alternatives into nonessential and essential attributes. *Nonessential attributes* are irrelevant to a consumer's judgement of the balance of a subset and therefore do not enter into the evaluation process. On the other hand, *essential attributes*, are used in the judgement/choice process and can be classified into four subcategories:

1. *Equibalancing attributes,* i.e. those attributes for which the decision maker prefers homogeneity of item scores on the attributes (irrespective of the particular score of each item), if the objective is to achieve balance. For these attributes, a low dispersion of item scores is an indication of high balance.

2. *Counterbalancing attributes,* i.e., attributes for which a large diversity of scores increases the decision maker's preference for the subset (or increases balance of the subset). In this case heterogeneity of item scores on relevant attributes is preferred.

3. *Desirable attributes,* i.e., attributes whose values the decision maker seeks to maximize.

4. *Undesirable attributes,* i.e. attributes whose values the decision maker seeks to minimize.[17]

The balance model itself describes a decision maker's value function for a collection of items based on the person's rankings of different combinations of item collections from a given set of alternatives. It also provides a methodology for assessing the weights of a decision maker's essential attributes, and consequently the contributions of each attribute to the total value of the selected subset. In testing the balance model Farquhar and Rao (1976) presented subjects with packages of television shows, each of which was described by scores on six different attributes. Subjects were then asked to make preference judgements of various TV show triples, and the results used to estimate the parameters of the model. The authors found that given the objective of achieving balance in the set of chosen items, the classification of

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[17] Equibalancing and counterbalancing attributes together form a category of "balancing" attributes whilst undesirable and desirable attributes belong to a "nonbalancing" category.

attributes into the four categories mentioned above is a useful one. The balance model was able to predict the three subsets which subjects explicitly considered as the most balanced.

In contrast to Farquhar and Rao's (1976) balance model, other models of multiple item choices from the same generic product class have been concerned with explaining the tendency of consumers to select variety in these purchase situations. McAllister (1979), proposes an Attribute Satiation Model (ASM) for determining a consumer's preferences for groups of generically similar items based on the tenet that consumers become satiated after consumption of high levels of a given attribute, and therefore seek alternatives that offer higher levels of other attributes. Stated differently, attribute satiation implies that successive units of an attribute give less utility than earlier ones, a phenomenon that is well documented in studies of brand loyalty and variety-seeking behavior (McAllister, 1982; Lattin, 1987; Bawa, 1990). Combining this with a second assumption that attributes are cumulative over successive consumption occasions, the ASM tries to ascertain the impact of differential levels of relevant attributes of a product class on consumers' preferences for combinations of alternatives from the product class. Using the methodology of LINMAP (Srinivasan and Shocker, 1973), with the important modification that the input to the linear program is a rank-ordering of *groups of items* rather than single items, the model specifies a consumer's utility for a subset of items as a quadratic function of the sum across items in the subset, of the values of individual attributes that describe the alternatives.

In testing her ASM, McAllister (1979) asked her subjects to rank-order packages/portfolios of magazine subscriptions each consisting of five different magazines. The rank-ordered data were used to test the predictive ability of the ASM, and to compare its performance with three other models of subset evaluation: a random choice model, an independent choices model, and Farquhar and Rao's (1976) balance model. The main findings were that the ASM confirmed the hypothesis that in situations where multiple choices are made from a single product class, consumers do not evaluate available alternatives independent of one another. McAllister's model was also found to perform better than each of the three models with which it was compared. McAllister (1982) introduced a dynamic aspect to the attribute satiation model, thus incorporating the effects of time in the choice process.

From the foregone discussion it is evident that in terms of mathematical modelling, the study of multiple item purchase decisions has received some research attention. However, descriptive studies of these class of decisions are still comparatively lacking. An important exception is Simonson (1990) and McClelland et. al (1987). Simonson (1990) used think-aloud protocols to investigate the "*strategies* consumers use when making multiple purchases in a product category for future consumption" (p.150; emphasis added). The main objective of this study was to examine the effect of making multiple purchases of items from the same product category on consumer's tendency to select variety rather than multiple replicates of their most preferred alternative. Studying decision strategies was only a secondary objective even though Simonson (1990) rightly established the need for such a study by charging that:

"much of the work on consumers' choice strategies has pertained to selections of a single alternative from a choice set (Bettman, 1979). However, consumers often choose several alternatives in a category simultaneously. A relevant question is whether the decision rules employed in making a single choice are also used in making multiple choices" (p.160).

Despite its limitation, the results from Simonson's (1990) study are relevant to this dissertation for two reasons. The first is that his study demonstrated a structural difference in decision outcomes between selecting multiple items *sequentially* (i.e., over different purchase occasions) and selecting them *simultaneously* (during the same shopping trip). Simonson (1990) hypothesized that consumers who simultaneously choose multiple items in a category for sequential consumption, are more likely to choose different items than those who sequentially make the same number of choices. This is because, those who make simultaneous choices are more likely to be uncertain about their future preferences for alternatives. Moreover, they have to make multiple decisions at the same time, some of which involve a consideration of future developments in preferences. The combined effects of these two factors is that the choice task becomes more demanding. Variety may, therefore, be selected to reduce risk conditioned by the possibility of a future change in preferences, to simplify the decision task by saving time and effort needed to resolve decision conflict which may arise out of this situation, or simply to satisfy the desire for variety itself.

Simonson's hypothesis was supported by his empirical studies. He found in his first study that subjects who made simultaneous choices for sequential consumption tended to select variety,

whilst those who made sequential choices tended to select multiple replicates of their most preferred alternative. In a second study, a third condition was added to the first two, namely making simultaneous choices for immediate consumption. The results indicated that subjects who made simultaneous choices for immediate consumption were even more likely to select variety than either those who made sequential choices or those who made simultaneous choices for sequential consumption. It seems, therefore, that whilst the need to make simultaneous choices itself increases the tendency to select variety, this tendency is reinforced when a temporal dimension is added to the consumption sequence.

The second relevance of Simonson's study lies in his finding that strategies used by consumers for selecting a single alternative are modified when they make multiple selections from a choice set. In particular, his subjects tended to use a modified version of a phased decision strategy (Bettman, 1979). They first went through an initial elimination phase, followed by the selection of all of the remaining noneliminated alternatives. The modification here is that, unlike in the phased decision strategy for single item choices, in multiple choices subjects did not face the problem of having to choose only one of the remaining alternatives. Consequently, phase two did not put any demands on their information processing capabilities. In discussing the implications of his findings for future research, Simonson (1990) concluded that:

> "in making multiple purchases for future consumption, consumers' decision strategies are not mere extensions of those used in selecting a single item. Much more research is needed to improve our understanding of the impact of temporal separation between purchase and consumption and of making multiple decisions simultaneously on consumers' purchase behavior" (p. 161).

In a similar study that directly compared information processing differences between decision tasks requiring selection of one, and those requiring selection of more than one alternative from the same set of available alternatives, McClelland et. al (1987) found patterns that support Simonson's conclusion. Their experimental study was conducted within the context of automobile choice. In one experiment of the study, McClelland et. al (1987) presented two groups of subjects with descriptions of 15 hypothetical cars in terms of three "major" and eight "minor" attributes. One group was required to choose one car out of the set of 15

(Choose 1 condition) whilst the other was required to choose 3. The experimental stimuli were constructed such that three of the cars were good on all three major attributes, whereas the remaining were deficient in at least one of the major attributes. After making their choices, subjects were presented with descriptions of the cars and asked to indicate for each of the eight minor attributes, whether or not the car possessed that feature.

The hypothesis was that, since there were three alternatives that clearly dominated the rest on the three major attributes, subjects in the Choose 3 condition could make their choice by processing only the major attributes. Therefore, they would have little memory for the minor attributes which they did not have to process to make their choices. On the other hand, after eliminating the dominated cars, those in the Choose 1 condition still had to decide which of the three dominating alternatives to choose. These subjects were therefore more likely to also process the minor attributes, and consequently have better memory for these. This hypothesis was supported and the results were replicated in a second experiment in which the number of dominating alternatives was also varied at two levels (one vrs. three dominating alternatives). However, in this second experiment, subjects in the Choose 3 condition who were presented with a set containing only one dominating alternative, also had a high memory for minor attributes, although this was not as high as for those in the Choose 1 condition with three dominating alternatives.

In general, these results indicate that the extent of information processing would be affected by the number of alternatives to be selected (in the terminology of McClelland et. al, 1987, Choice Task condition) as well as the number of dominating alternatives in (or quality of) the option set. Specifically, McClelland et al. (1987) found greater depth of processing for single item choices in a situation three with dominating alternatives. Under the same conditions, they also found lower depth of search for multiple item choices involving selection of the same number of alternatives as the number of dominating alternatives in the option set. However, it is not clear from these results, how information processing would be affected in both choice task conditions in the absence of any dominating alternative. This issue will be addressed in our empirical study.

In a similar effort, Crow, Olshavsky, and Summers (1980) used a process tracing

methodology to study the strategies used by industrial buyers' in selecting vendors from whom to request quotations for the supply of electrical components. In the study, subjects were free to determine the exact number of quotations they would request. The results indicated that none of the buyers requested fewer than 3 quotations. Half of the subjects specified in advance either a minimum number, or an exact number of quotations they would request, whilst the other half simply requested quotes from those passing an initial screening test. In terms of strategies used, 12 out of their 14 subjects used a conjunctive strategy in the initial screening process. Those who specified either a minimum or exact number of quotations then went on to relax (tighten) the minimum acceptable if too few (many) alternatives remained after this initial screening. This finding is similar to the one reported by Simonson (1990).

Table 3.1 summarizes the studies of multiple item selection decisions that have been reviewed so far. As can be seen from the Table, a majority of these studies have been concerned with mathematical models of preference formation. Exceptions are the studies by Crow, Olshavsky, and Summers (1980), Simonson (1990), and McClelland et. al (1987) which are descriptive studies of the decision process and fall within the same category as this dissertation. There are, however, a number of reasons why the present study is still deemed necessary. First, as briefly discussed above, describing the decision process for MISDs was only a secondary objective in Simonson's (1990) study. Moreover, both Crow, Olshavsky, and Summers (1980) and Simonson (1990) used verbal protocols as the main process tracing methodology. A number of researchers have raised serious doubts about the validity of this technique in decision strategy research (e.g., Nisbett and Wilson, 1977). These include, among others, the obtrusive effects of the technique and the subjective nature of the data analysis. To obtain a more complete understanding of strategies used in these types of decisions, we need a study focusing exclusively on identifying these strategies, and employing a process tracing methodology that eliminates the shortcomings of verbal protocols.

McClelland et. al's study directly compared SISDs with MISDs in terms of information processing. However, by using experimental stimuli in which there were 3 clearly superior alternatives, the authors created a bias in favor of greater depth of processing by subjects in the Choose 1 condition. Consequently there is still room for a study in which information

processing differences between SISDs and MISDs are investigated for experimental stimuli with no obviously superior alternative.

Table 3.1
Summary of Studies of Multiple Item Selection Decisions

Study	Decision Task	Objective	Sample	Method	Findings
Green, Wind, and Jain (1972)	Preference ratings of combinations of entrées and desserts	To determine: 1. the effects of adding 2 new desserts on individual and group preferences for entree-dessert combinations. Effects were defined in terms of similarity in entree and dessert scales, as well as reliability of the scales at the individual level 2. whether there are individual differences in the entree and dessert scales, and if so whether the differences are related to certain background factors.	52 young adults of whom 1/3 were University students. Sample consisted of both men and women with an average age of 26 years	Conjoint scaling of individual and group preferences for 30 combinations of 5 entrees and 12 desserts (Phase I). In Phase II, a similar scaling of 40 combinations of 5 entrees and 14 desserts (original 12 from phase I plus 2 new desserts).	1. High scale reliability at the group level 2. Intersubject similarities in preferences across the two phases 3. Preference heterogeneity across subjects 4. Entrees were more important contributors to utility. Addition of 2 new desserts had little impact on similarity of judgements and stability of scales.
Green and Devita (1974)	Preference rankings of combinations of entrees and desserts	To determine: 1. how many subjects exhibit non-additive utility models for combinations of entrees and desserts 2. the importance of entree-dessert interaction in accounting for response variance in subjects' utility values 3. the nature of the space obtained by application of a complementarity model to the utilities of subjects who exhibit non-additivity in preferences	30 Wharton MBA students	Subjects were asked to rank order all (45) combinations of 5 entrees and 9 desserts on a 9-point preference scale. Then after an hour subjects ranked 15 replicate menus randomly selected from the original 45. Additive MONANOVA analysis were performed. The complementarity model was also tested.	1. Most respondents did not exhibit high interactive utilities. 2. Of the few who did, their interaction numbers were small. 3. The complementarity model portrayed the complementarities reasonably well.

Farquhar and Rao (1976)	Preference ratings of combinations of TV shows	To test the authors' Balance model for evaluation of subsets of multiattributed items by examining whether subjects use their notion of balance when faced with situations where they have to choose subsets of items	Convenience sample of 35 graduate students in business administration	A profile of 6 TV shows was developed, then twenty subsets of 3 shows each were constructed. Subjects were asked to rank the subsets in terms of how balanced they were. The actual rankings were then compared with rankings predicted by the authors' balance model	1. The balance model predicted subjects' rankings reasonably well
McAllister (1979)	**Study 1: Choosing Multiple Items and Consuming All of Them** Rank-ordering of 35 magazine subscription packages (composed of all possible subsets of 5 magazines).	**Study 1:** To compare the performance of the author's Attribute Satiation Model (ASM) against 3 other models: a) Random Choice Model (RCM) b) Independent Choices Model (ICM) c) Farquhar and Rao's (1976) Balance Model (BM)	**Study 1:** 20 spouses of entering MBA students at Stanford University	**Study 1:** Subjects were asked to rank-order 32 packages of 2 magazines each in order of preference. 6 randomly selected packages were held out for validation and the remaining used to parametrize the 4 models under investigation, i.e. the RCM, ICM, BM and ASM	**Study 1:** 1. The ASM exhibited better predictive ability than the RCM 2. Multiple choices from some product classes are dependent on one another 3. The ASM is a better model of this dependence than the BM
	Study 2: Choosing Multiple Items and Consuming Only One Rank-ordering of 6 groups of 3 schools each based on which group subjects will most likely apply to for admission. Selection of 3 schools from a set of 5 schools to which subjects will apply.	**Study 2:** To compare the author's Lottery Model (LM) against 2 other models: a) Random Choice Model (RCM) b) Independent Choices Model (ICM)	**Study 2:** 53 high school juniors from 3 high schools in California	**Study 2:** Subjects first rank-ordered 32 hypothetical colleges in terms of preference. Then they rank-ordered 6 groups of 3 schools each, and finally selected 3 schools from 5 to which they would apply for admission	**Study 2:** 1. The LM is a better model than the RCM in predicting subjects' preferences. 2. The LM was not found to have better predictive ability than the ICM.
Crow, Olshavsky, and Summers (1980)	Selection of vendors from whom to receive quotations for supply of electrical components	1. To develop detailed models of industrial buyers' choice strategies for quotation requests and for final supplier choice. 2. To investigate the effects of time pressure and number of potential vendors on choice strategies	Convenience sample of 14 industrial buyers	Verbal protocol analysis of information acquisition in a 2 (time pressure) X 2 (no. of potential vendors) design	No buyer requested less than 3 quotations. Some specified in advance the no. of quotations to be requested. Most buyers used initial screening (conjunctive) followed by relaxing or tightening minimum criteria until required no. of quotations is achieved. No signif. differences due to time pressure and/or no. of potential vendors

Simonson (1990)

Study 1: Choosing multiple items simultaneously vrs. choosing them sequentially Selections from 7 product categories: yogurt, bread, soft drinks, canned vegetables, milk, snacks fruit, and canned soup	**Study 1:** To determine the extent to which subjects in the two conditions (simultaneous and sequential) would exhibit variety-seeking behavior.	**Study 1:** 67 undergraduate students of introductory marketing.	**Study 1:** Subjects in simultaneous choice condition were asked to assume they were going to the supermarket to do their shopping for the next 3 days and intended to buy 3 items from each product category for the next 3 days. Subjects in the sequential choices condition were asked to assume they were going to do their daily shopping, and intended to buy only one item from each product category.	**Study 1:** In all 7 product categories, subjects who made sequential choices selected less variety than those who made simultaneous choices.
Study 2: Selection of snacks	**Study 2:** To find out if the findings of Study 1 will be replicated in a study involving actual products.	**Study 2:** 392 undergraduate students of marketing, accounting, and organizational behavior.	**Study 2:** *a) Sequential Choices Condition:* Subjects made one choice each week for 3 weeks during class sessions. *b) Simultaneous Choices for Sequential Consumption:* Subjects made all 3 choices during the same class session, but received only one item each week. *c) Simultaneous Choices for Immediate Consumption:* Subjects made 3 choices during the same class session and received all selections at the end of that session.	**Study 2:** 1. Subjects who made sequential choices selected less variety than those who made simultaneous choices both for sequential and immediate consumption. 2. Subjects who made simultaneous choices for sequential consumption selected less variety than those who made simultaneous choices for immediate consumption. 3. Overall ratings of alternatives were a stronger predictor of choice in the sequential choices condition than in the two simultaneous choices conditions.
Study 3: Selection of snacks	**Study 3:** To determine the effects on choice strategies of having to make prediction of future preferences when choices are made for future consumption.	**Study 3:** 46 undergraduate students of psychology.	**Study 3:** Two groups of subjects: *Group 1* made simultaneous choices for sequential consumption, and then made simultaneous choices for immediate consumption. *Group 2* made a single selection, and then predicted their choices for the next 2 weeks. Think-aloud protocols were used to determine subjects'	**Study 3:** *Group 1:* Elimination of unattractive snacks followed by determination of most preferred from remaining. *Group 2:* Subjects used their current preferences to predict future preferences. Subjects who selected variety in the simultaneous choice condition had more difficulty making choices for later weeks.

nd et.	Choice of automobiles	To investigate differences in depth of information processing between choosing one and choosing 3 alternatives.	**Study 1:** 34 students of introductory psychology	**Study 1:** Subjects were presented with 15 hypothetical cars described on 3 major and 8 minor attributes. Three cars dominated the rest on the major attributes (dense choice set). Half of the subjects were to recommend one car to the president of a rental car agency (Choose 1 condition) and the other half were to recommend 3 cars (Choose 3 condition). Memory for minor attributes was measured after subjects' choices.	**Study 1:** Subjects in the Choose 1 condition had better memory for minor attributes (suggesting further processing of these) than those in the Choose 3 condition.
			Study 2: 40 subjects; background not specified.	**Study 2:** A new experimental stimulus was added to that from study one - a choice set in which only one alternative dominated the rest on the major attributes (sparse choice set).	**Study 2:** The results of study 1 were replicated for the dense choice set. For the sparse choice set, subjects in the Choose 3 condition also had better than average memory for minor attributes (though still lower than those in the Choose 1 condition).

3.4 Classifying Multiple Item Selection Decisions

In this dissertation, the concern is with examining the extent to which the decision strategies identified in the literature (and briefly reviewed in chapter 2) are used (or modified) when the task structure of the decision changes from selecting one to selecting more than one of the available alternatives. As noted in chapter 1, these class of decisions have been relatively neglected in the literature. Consequently, it is necessary to specify a classification scheme for these decisions in order to enable us appropriately position this dissertation. This will be particularly useful for the empirical study where we have to decide what product class to use. In this section, such a classification scheme is presented. The scheme is based on two variables that characterize consumers' interaction with multiple products - the sequence in which individual product items are purchased, and the sequence in which they are consumed. These variables have earlier been suggested by Green, Wind, and Jain (1972) and Simonson (1990). However, none of them has gone further to classify consumers' consumption decisions using both the purchase sequence and the consumption sequence.

In the present conceptualization, purchase sequence can be operationally defined as the temporal separation between multiple purchases of items from a set of available alternatives. Two types of purchase (or selection) sequences can be identified - sequential purchase over different time periods and simultaneous purchase during the same time period. For sequential purchases, a single item is purchased at time t_1, a single item at time t_2, a single item at time t_n. Over a given time period, the consumer would then have purchased items 1, 2,..., n from the same product class. The resulting collection of items may consist of multiple replicates of the most preferred brand, or it may consist of a collection of different brands. The specific content of brands that have been selected up to a given point in time has been the focus of brand loyalty and variety-seeking behavior studies.

In the simultaneous purchase situation, several items from the same product class are selected during one and the same purchase occasion. Here, in contrast to the sequential purchase condition, items 1, 2, ...,n are all purchased together at time t_1. Simonson's (1990) study showed that when consumers make such multiple purchases during the same shopping occasion, they tend to select a variety of brands/product items rather than multiple replicates of their preferred brand.

Consumption sequence is similarly defined as the temporal separation between consumption of individual items purchased from a product class. In our conceptualization, four separate consumption sequences can be identified:

1)   sequential consumption during the same consumption occasion,

2)   sequential consumption over different consumption occasions,

3)   simultaneous consumption during the same consumption occasion, and

4)   simultaneous consumption over different consumption occasions.

When these four consumption sequences are crossed with the two purchase sequences discussed above, an eight-cell purchase-by-consumption matrix of decision situations can be obtained. This is illustrated in Table 3.2. The Table is self-explanatory and as such a detailed presentation of each of the cells will be redundant. Note however, that a ninth cell has been added to the 8 cells resulting from crossing the two purchase sequences with the four consumption sequences. This last cell considers the case where multiple items are "selected" as a first step to eventually choosing one for consumption. This class of multiple item decisions falls within the realm of the consideration set phenomenon in consumer decision making.

In the empirical part of this dissertation, stimulus products used would be those that can be classified in cell V, i.e. decisions in which multiple items are selected during the same purchase occasion (simultaneous selection) to be consumed simultaneously during the same consumption occasion. However, as the research questions in chapter 1 indicate, the main focus of the present study is the purchase aspect. Put differently, although the decision scenario selected for the empirical study would be one in which the multiple items selected are to be consumed during the same occasion, the emphasis would be on the selection process. Consequently, a stimulus product and decision scenario for which the multiple items are to be consumed sequentially, or simultaneously over different consumption occasions would still have met the objectives of the study.

Table 3.2.
Purchase and Consumption Sequences in Consumer Decision Making

Purchase Sequence

	Sequential	*Simultaneous*
Consumption Sequence		
Sequential Consumption during the same consumption occasion	**I** Unspecified	**VI** Items are purchase simultaneously and consumed sequentially during the same consumption occasion. E.g. Green et. al's entrée-dessert study.
Sequential consumption over different consumption occasions	**II** Items are purchased and consumed sequentially over different consumption occasions. Typically, each consumption takes place in the same time period as the purchase (choice). Switching behavior over the different time periods is addressed in studies of brand loyalty and variety seeking behavior. Most studies of consumer decision making relate to these types of decisions.	**IV** Items are purchased simultaneously during the same purchase occasion, but they are consume one at a time over different consumption occasions. Often the items are non-perishable and a consumer may buy a week's or month's supply during one shopping trip. The items ar stocked in inventory and consumed as and when desired. Studies of these types of decisions include Simonson (1990).
Simultaneous consumption during the same consumption occasion	**III** Items are purchased sequentially during different purchase occasions, but they are consumed simultaneously during one and the same consumption occasion. Sequential purchase may be due to budgetary constraints. Consumption starts only after the entire collection has been assembled. For example, purchase of drinks for a birthday party may be done sequentially during several shopping trips. However, consumption takes place during the party (same consumption occasion).	**V** Items are purchased simultaneously during th same purchase occasion and are consumed *together* during the same consumption occasi Simultaneous consumption may be conditione by the situation (e.g. drinks purchased for a party, multiple destinations to be visited durir a vacation trip) or perishability of the product Studies of these types of decisions include Green et. al. (1972) and Simonson (1990, stu 2).

	IV	VI
Simultaneous consumption over different consumption occasions	Items are purchased sequentially during different purchase occasions, and are consumed together over more than one consumption occasion. This applies mostly for durable products like clothing. As for III, sequential purchase may be conditioned by budgetary limitations.	Items are purchased simultaneously and consumed together over more than one time period. Examples here are the same as for category III.

Multiple items are chosen but only one is consumed

IX

Multiple items are "chosen" as a first step to eventually selecting one item for consumption. Selection of multiple items is used as a strategy to reduce cognitive processing when there are several alternatives to be evaluated. This class of MISDS coincides with studies of consideration set formation. Examples include McAllister (1979), study 3.

3.5 Summary and Implications

Almost all the studies reviewed in this chapter started out with the central hypothesis that there are structural differences between single item and multiple item selection decisions. McAllister (1979) discussed these differences in terms of dependence among selected alternatives in MISDs (Coombs' 1964) whilst Simonson (1990) referred to the need to select variety rather than multiple replicates of the most preferred alternative so as to counteract uncertainties in future preferences. Similarly, Farquhar and Rao (1976) introduced the idea of balancing the subset of items selected, whilst Green, Wind and Jain (1972) called attention to the need to select an ideal assortment of items whose components are suitable for a variety of problem-solving situations anticipated by the consumer. Contributions that adopted a mathematical modelling approach (Farquhar and Rao, 1976; Green, Wind and Jain, 1972; McAllister, 1979) then went on to suggest alternative models of the decision process for MISDs whilst those that employed a policy-tracing approach either described the decision process (Crow, Olshavsky and Summers, 1980) or in addition investigated differences in decision outcomes between single item selection and multiple item selection decisions (McClelland et. al, 1987; Simonson, 1990).

The general thrust of all these studies is that multiple item selection decisions have structural properties that distinguishes them from single item decisions. This further suggests that consumers employ different cognitive processes in evaluating alternatives depending on whether the purpose of information processing is for selecting one or more than one alternative. Indeed, some of the studies (e.g. Mclelland et al., 1987 and Simonson, 1990) investigated and found differences. This led Simonson to conclude that consumers' decision strategies when making multiple purchases are not mere extensions of those used in selecting a single item. The major implication for the present study is this finding that cognitive processes required to complete multiple item selection decisions are different from those required to complete single item selection decisions. It will be the central proposition around which discussion of hypothesized cognitive differences for this dissertation would be based.

CHAPTER 4

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· RELATED THEORIES AND EMPIRICAL STUDIES

This chapter reviews theories and empirical studies from other areas of consumer decision making that can contribute to a better understanding of the specific ways in which information may be processed in multiple item selection decisions. Section 4.1 outlines the two areas of consumer decision making that are deemed relevant and the reasons for this. Sections 4.2 and 4.3 then reviews the theories and empirical studies in these areas whilst section 4.4 discusses the specific implications for the present study.

4.1 Introduction

Given the relative lack of descriptive studies of information processing in multiple item selection decisions, we find it useful in this dissertation, to draw on research in other areas of consumer behavior research that address issues conceptually similar to selection of multiple items from a product class. In this regard, we find theories and empirical work from the consideration set formation and categorization literatures relevant. Theories of consideration set formation are useful as a point of departure because both consideration set formation and multiple item selection are concerned with the selection and maintenance of more than one of the available alternatives as part of a favored set, although in consideration set formation, maintenance of multiple items in a favored set serves as a prelude to eventually selecting only one. Similarities between consideration set processes and those of multiple item selection decisions are especially evident in situations where the entire consideration set is constructed in response to a specific purchase occasion, thereby invoking evaluation of available alternatives at the same point in time.

Categorization theory is concerned with understanding the principles people use in grouping objects and events into semantic categories, and the way information about objects and events is combined to arrive at categorization judgements. Ideas from categorization theory, and especially ad hoc categorization, would be useful for the present work because conceptually, items that are chosen together as part of a subset can be thought of as belonging to the same category, and therefore having properties that distinguish them from items that have not been selected. This categorization perspective is consistent with other studies of consumer decision making processes. For example, Lockheed (1980; cited in Troye, 1983) views the entire consumer decision making process as a categorization process, Troye (1983; 1984) has shown that consideration set formation can be viewed as a categorization process whilst Svenson (1979) quoting Hogarth (1974) explicitly states that "sometimes when heuristics are applicable, a decision problem may be more fruitfully viewed as a problem of categorization" p.93. Indeed, most decisions involving the evaluation of more than one alternative can usefully be studied using ideas from categorization theory.

In the next two sections, theories and empirical studies of information processing in consideration set formation and categorization are discussed. Section 4.3 considers implications of this discussion for our empirical work on multiple item selection decisions.

4.2 Information Processing in Consideration Set Formation

The concept of a consideration set refers to the subset of the available brands on the market which a consumer would consider evaluating in a purchase decision. It was first introduced into the consumer behavior and marketing literature by Howard (1963) in his text on consumer behavior, and later explicated in Howard and Sheth (1969). Campbell (1969) first empirically demonstrated its existence by operationalizing it as the subset of the brands of which a consumer is aware. Since then there has been an increasing interest among consumer behavior researchers in studying consideration sets. Researchers have tried to provide theoretical frameworks for studying consideration sets (e.g. May, 1979; Roberts, 1989), identify the average size of this set for different product categories (e.g. Grønhaug and Troye, 1983), identify correlates of the set size (e.g. Grønhaug, 1973-74, Maddox et. al., 1978; Reilly

and Parkinson, 1985), and develop mathematical models to explain the formation and composition of consideration sets (e.g. Roberts, 1989; Roberts and Lattin, 1991).

Of particular interest to this dissertation, however, is research that has adopted an information processing perspective to understanding consideration set formation. Among these include the work of Parkinson (1979), Parkinson and Reilly (1979) and Brisoux and Laroche (1981). Parkinson and Reilly (1979) drew upon Narayana & Markin's (1975) suggestion that consideration set formation is a cognitive process that is amenable to study from an information processing perspective, to investigate which of five decision heuristics closely approximate actual consideration set decision processes. The five heuristics studied were the unweighted linear compensatory, the weighted linear compensatory, the conjunctive, the disjunctive, and the lexicographic heuristics. They found that the unweighted linear compensatory and the lexicographic heuristics performed best in terms of the percentage of successful consideration set determination.[18] The weighted linear compensatory heuristic performed fairly well, whilst the conjunctive and disjunctive heuristics were the worst performers. In contrast to the Parkinson and Reilly findings, Brisoux and Laroche (1981) found that the conjunctive cutoff and lexicographic models to be the best representations of the process of evoked set formation, leading them to conclude that:

> "A similar reasoning with the three compensatory models reinforces the conclusion that the process of evoked set formulation is, in our case, one of inclusion based on cutoff points for all three major dimensions of the product space. This conclusion is consistent with Myers (1979) expectations, as well as those by Pras and Summers (1977).[19] It is also consistent with the findings of Best (1976). On the other hand, our findings do not confirm those of Parkinson and Reilly (1979)" (p.359).

In a discussion of the Parkinson and Reilly (1979) findings, Myers (1979) suggested that the temporal dimension in consideration set formation may account for the different performances of the five processing models examined by Parkison and Reilly. He argued that if consideration sets are formed by evaluating alternatives one at a time over a period of time,

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[18] Successful evoked set determination was defined in two ways: (a) as the highest percentage of matches between actual and simulated evoked sets, and (b) as a 100% match between actual and simulated evoked sets. The results were the same for both operationalizations.

[19] Note: The actual citation for this reference is Pras and Summers (1975).

then the conjunctive and disjunctive models may be more appropriate for evaluating the alternatives. However, if consideration sets are formed by considering all brands in the awareness set at the same point in time, then the weighted/unweighted linear compensatory and the lexicographic models may be the appropriate evaluation criteria.

The search for information processing strategies has also been extended to include mathematical models of the consideration set formation process. Roberts (1989) proposed a model of the process that is based on a phased decision heuristic. He argues that consideration set formation can be decomposed into a conjunctive and a compensatory element. During the initial stage of the process the consumer uses a conjunctive rule to decide a brand's acceptability on the basis of whether or not the brand meets minimum thresholds on the relevant attributes. This screening procedure results in an "acceptable set" of alternatives which are then further evaluated using a compensatory rule. In this latter phase, a minimum utility threshold is set for the evaluation, and only acceptable alternatives which have utilities greater than or equal to the minimum threshold will be included in the consideration set. The model itself uses ideas from the economics of information to posit that a brand will be included in the consideration set only if "the increase in expected category utility that it causes more than offsets the associated mental and physical transaction costs" associated with including the brand. In contrast to the two-stage model developed by Roberts (1989), Roberts and Lattin (1991) developed and tested a model of consideration set formation and composition that is based exclusively on a compensatory decision heuristic. Their rationale for using a compensatory model is captured in their argument that:

"though the consumer behavior literature argues for noncompensatory screening processes on theoretical grounds, a substantial literature suggests that under a wide range of situations, compensatory models provide reasonably accurate approximation to noncompensatory processes" (p.431).

A final group of consideration set research that is relevant for this dissertation is work on the relationship between consumers' evaluation strategies and the sizes of their consideration sets. We refer specifically here to the work of Belonax (1979) who found in an experimental setting, that subjects who employed a large number of evaluative criteria tended to perceive the decision task as more difficult. They also tended to construct smaller evoked sets than

those who employed a smaller number of criteria. This finding is not entirely surprising because, intuitively, if a consumer uses many evaluation criteria there is a much higher likelihood of finding unacceptable alternatives than if a smaller number of criteria are used to evaluate the same set of alternatives. However, what makes the finding interesting for this dissertation is the possibility of hypothesizing the opposite effect, i.e., that if subjects are asked to use a fixed number of criteria to construct a consideration set consisting of a fixed number of alternatives, then those asked to construct smaller sets are more likely to use a larger number of criteria than those asked to construct larger sets. The intuitive explanation advanced above is still relevant for such a hypothesis. Furthermore, Belonax (1979) did not suggest a causal relationship of the form "number of criteria causes set size". He merely hypothesized and found a correlational relationship. If these arguments are tenable, then there is reason to expect differential use of evaluative criteria as the number of alternatives to select in a multiple item selection decision increases or decreases.

4.3 Information Processing in Categorization

Categorization theory is concerned with the way individuals classify objects in their environment into semantic groups in order to make meaning out of their numerous everyday encounters with these objects. In the words of Rosch (1978),

> "The world consists of an infinite number of potentially different stimuli. Thus a basic task of all organisms.... is a segmentation of the environment into classifications by means of which nonidentical stimuli can be treated as equivalent" (p.1).

This general predisposition of people towards categorizing objects in their environment, stems from limitations in their cognitive capabilities, and the consequent need to reduce information to manageable proportions. Smith and Medin (1981) discuss three models that have been advanced by researchers to explain the process by which categorization of objects takes place - the *classical, prototype,* and *exemplar* views of categorization. Each of these models has a distinct view of the processes by which objects are grouped into already existing or new semantic categories, and the way newly encountered objects are accordingly classified into

existing categories.

In a rather insightful review of the information processing implications of each of the three models of categorization, Cohen and Basu (1987) suggest two main classifying criteria - the nature of the comparison process and the degree of automaticity associated with the comparison process. The comparison process itself can either be analytic (feature-by-feature comparison) or nonanalytic (holistic comparison), whilst in terms of automaticity the process can be automatic or deliberative. For the sake of simplicity, however, we consider only the first criterion since the degree of automaticity merely specifies whether or not the categorization rule is retrieved from memory or constructed in response to the task at hand. Table 4.1 (adapted from Cohen and Basu, 1987) summarizes the main information processing implications. Note that analytic comparison corresponds to a noncompensatory evaluation model whilst nonanalytic comparison corresponds to compensatory decision process.

The *classical view* of categorization can rightly be described as the oldest psychological theory about how humans use abstract concepts to represent occurrences in their everyday life. According to Lakoff (1987), the classical view had for a long time been held as an unquestionable definitional truth and was not even thought of as a theory. It was simply considered as the way to view the categorization process. As can be seen from Table 4.1, the classical view models the categorization process solely in terms of an analytic, noncompensatory evaluation process. The idea is that, for any particular category concept, individuals define necessary and sufficient attributes which a target object must possess if it is to be classified into the category. In the words of Smith and Medin (1981), the target object will be classified into the category

> "only when every feature of the target has matched a feature of the" ...[category, and the target will not be classified into the category]... as soon as any feature of the target mismatches a feature of the category" (p.36).

It is easy to appreciate that this specification implies the use of a conjunctive rule, in the sense that a target must possess *all* the relevant attributes to be classified into the category. The classical view of categorization in its formulation and representational assumptions, does

Table 4.1

Information Processing Implications of Alternative Categorization Models

	THE CLASSICAL VIEW	THE PROTOTYPE VIEW	THE EXEMPLAR VIEW
COMPARISON PROCESS			
	I	II	III
Analytic Processing **or** **Feature-by-feature Comparison**	Target is analyzed on a feature-by-feature basis. Features are compared to a hierarchically organized memory representation of the category, or to a specific category-defining rule (which may have been constructed from prior learning and experience) until a perfect match is found. Much of the work in this area assumes a conscious deliberative mechanism.	Target is compared to either a probabilistic rule, or an ideal category member on a feature-by-feature basis. The larger the number of "successful" matches, the closer the target is to the centroid of the category. The processing mechanism may be deliberative or automatic (in which case prior learning and experience is important).	Target is compared to a number of "good" examples of specific instances of the category on a feature-by-feature basis. The larger the number of "successful" matches, the closer the target is to the category exemplar(s). Automatic processing mechanisms have not been specified. Rather processing is assumed to be deliberative.
	IV	V	VI
Nonanalytic Processing **or** **Holistic Comparison**	Target is compared with a configural or template representation of the category on the basis of overall fit (e.g pattern matching). Processing mechanism may be deliberate or automatic. This type of processing is not implied by any of the available models under the classical view.	Target is compared with "ideal" category member on a more "holistic" basis. The closer the target is to the "ideal", the greater the family resemblance. Both deliberative (or "top down") and automatic comparison processes have been suggested.	Target is compared to an overall representation of an exemplar (or subset of exemplars) of the category. Significant similarity establishes category membership. Significant dissimilarity leads to search for better exemplars. Processing may be deliberative or automatic, bur no specific model exists for either.

Source: Adapted from Cohen and Basu (1987), p. 457

not make room for nonanalytic information processing. In particular, the main assumption that requires the specification of necessary and defining category features, explicitly excludes the possibility of holistic comparison of the target with a "template" of the category. Consequently, Table 4.1 states that no model is specified for nonanalytic compensatory processing under the classical view.

In *prototype theory*, emphasis is placed on "goodness of category membership" rather than the search for necessary and sufficient distinguishing attributes. All members of a category are placed on a continuum of category membership on the basis of how representative they are of the category. A prototype of a category would then be a highly representative category member[20] possessing a set of attributes commonly associated with members of the category, with each attribute assigned a weight according to its degree of association with the category (Rosch and Mervis, 1975). Under the prototype view of categorization, both analytic and nonanalytic processes have been specified.

In analytic processing, the category prototype is held to be the central tendency, defined as the mean value of a set of actual category members on a set of relevant features/attributes (Posner and Keele, 1968; cited in Cohen and Basu, 1987). Target objects are compared to this category prototype (which need not be an actual category member) on the basis of the deviations of their scores on the relevant attributes from those of the prototype. This comparison is done on a *feature-by-feature* basis. In non-analytic processing, the prototype is seen in terms of some overall criterion of fit rather than the application of a fixed set of defining features. Wyer and Srull (1981; cited in Cohen and Basu, 1987), report empirical findings that suggest that an instance may be categorized on the basis of a comparison of the total configuration of its features with the total configuration of a prototype's features without prior encoding of the individual features comprising the configurations. Under this view, when faced with a target object that requires categorization, an individual will construct a category prototype (or bring to mind an existing one), and make the categorization judgement on the

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[20] The requirement of representativeness does not imply that the prototype need be an actual member of the category. On the contrary, it is possible to construct a hypothetical category object to represent a category's prototype. This hypothetical member can often be an abstract representation obtained through a process of computation resulting in the idea of an ideal category member (Cohen and Basu, 1987).

basis of overall similarity between the prototype and the target. Both linear compensatory and affect referral processing models are plausible in this context. In this case, the linear compensatory model may be used for deliberative processing whilst affect referral may be applicable when processing is automatic.

The *exemplar view* of categorization is based on a central thesis that certain members of a category function as exemplars of the category much in the same way as prototypes serve as cognitive reference points in the prototype model. However, in the exemplar view, exemplars are not formed on the basis of their possession of specific critical attributes. Rather exemplars just happen to be category members that are accessible in memory and can easily be recalled during a categorization process. This necessarily implies that the representation of a category consists of separate descriptions of some of its exemplars, and so for a given category, there may be more than one exemplar of the category. In that case the representation of the category may consist either of other exemplars, or of a description of the relevant properties of the subset of exemplars, or both.

Unlike the prototype view, however, discussions under the exemplar view suggest the use of only one type of information processing, namely, an analytic comparison process. Based on this, a target object is compared with a number of "good" examples (or one "good" example) of the category on a feature-by-feature basis. These examples (or examples) are often specific concrete instances of the category. The analytic comparison process itself may be deliberative, in which case exemplar retrieval is consciously activated in response to the given task, or automatic in which case exemplar retrieval is automatically activated without much deliberation. No specific model exists for the study of these automatic exemplar retrieval processes.

A growing number of studies have adopted categorization theory in an attempt to explain a wide variety of marketing-related phenomena. Troye (1983) used categorization theory in his study of consumers' consideration set formation processes. In developing a framework for his study, Troye (1983) outlined four basic ways in which categorization theory may predict how consumers form categories of "acceptable alternatives". These are:

a)   Evaluating each alternative separately on the basis of a conjunctive cut-off rule. Troye (1983) cites studies by Brisoux and Laroche (1980), Pras and Summers (1975), Park (1976) and Lussier and Olshavsky (1979) as empirical support for this strategy.

b)   Comparing each of the available alternatives to some "ideal" alternative in a manner similar to the prototype model of categorization;

c)   Comparing each alternative to a specific exemplar of the product class which the consumer considers desirable (cf. the exemplar model of categorization); and

d)   A "free classification" strategy based on overall similarity of the alternatives on one or more dimensions.

Ozanne, Brucks, and Grewal (1992) employed principles of categorization in their attempt to explain how consumers integrate new products into their existing knowledge structures. Categorization theory has also been used to study consumers' general cognitive representation of products and their attributes (Johnson and Fornell, 1987), what consequences this has for comparative advertising (Sujan and Dekleva, 1987; Goldstein, 1993), and how consumers evaluate franchise extensions (Hartman, Price, and Duncan, 1990). Using categorization theory as a point of departure, Sujan (1985) suggested "category-based" processes as an alternative to the "piece-meal" Fishbein-type models commonly used in studies of consumer evaluation processes. John and Sujan (1990) examined the impact of age on consumers ability to effectively categorize products, and quite recently, Ratneshwar and Shocker (1991) explained product substitutability and its consequences for product-market structures in terms of ad hoc categorization.

The studies cited above demonstrate the tremendous potential that lies in using categorization theory to explain important consumer behavior phenomena. Most of these studies used principles derived from the literature on what may be called "conventional categories". However, as rightly pointed out by Ratneshwar and Shocker (1991; p. 283), one special class of categorization theory with special relevance for consumer behavior research is goal-derived or ad hoc categories. These class of categories also have special relevance for this

dissertation, and so will be reviewed in more detail in the next section.

4.3.1 Ad Hoc Categorization

The term "ad hoc categories" can be attributed to Barsalou (1983). It refers to categories that are created spontaneously for use in specialized situations where an immediate response is required. Such categories, e.g. things to take from one's home during a fire, what to buy for a birthday present, what to do for entertainment on a weekend, what collection of drinks to purchase for a daughter's birthday party or what destinations to visit during a vacation, are not conventional fixed categories but are temporary and formed on the spur of the moment. Ad hoc categories are a special case of a the general class of "goal-derived categories" (Barsalou, 1982; Bettman and Sujan, 1987; Alba and Hutchinson, 1987), which are categories that are structured around a particular goal.

Barsalou (1983) found that such categories (both goal-derived and ad hoc categories), even though not fixed, do exhibit some of the characteristics of conventional categories. His research results showed that just like conventional fixed categories, ad hoc categories exhibit graded structure, in the sense that some particular members of the category are more representative of category membership than others). In a series of experiments, Barsalou (1983) found that subjects showed excellent agreement about which of stimulus alternatives constitute "things to inventory at a department store", "ways to make friends", "things that conquerors take as plunder", "nouns", "ways to escape being killed by the mafia", "things that babies do", "times to write a term paper", and "things that can fall on your head". Barsalou (1983) also found evidence of the existence of unclear cases in ad hoc categories, i.e his subjects were divided about whether certain items are members of the ad hoc categories they were presented with.

These findings imply that goal-derived and ad hoc categories can be studied in the same way as conventional fixed categories. Furthermore, Barsalou (1983) suggests that inspite of the fact that ad hoc categories cut across the correlational structure of the environment, people still perceive them as categories because they "are instrumental to achieving goals" (p.214). In a marketing-related application of Barsalou's (1983; 1985) findings, Ratneshwar and Shocker

(1991) provide some evidence of the role of consumption goals in determining product category membership.

In their study, Ratneshwar and Shocker (1991) employed product usage context as an anchor in studying how consumers categorize different types of snack foods. In one of the studies reported in this article, fourteen usage contexts were presented to subjects along with lists of food snacks. Examples of contexts used in the study were "a snack you might eat when you don't have enough time for a regular breakfast" or "a snack that you might eat regularly just before going to bed". The list of snacks included items like apple, chocolate chip cookie, popcorn, etc. Subjects were first asked to judge on a 9-point scale how good an example each product was of the snack food category. Then some of the subjects judged how appropriate each snack was for the 14 usage occasions. Distinguishing between snacks with common and those with distinctive usages, the results showed that inter-product similarity between pairs of snacks correlated positively with the number of common usages shared by the pair. However, contrary to expectations, although similarity correlated negatively with the number of distinct usages between pairs of snacks, the correlation was not statistically significant. Overall implications of these findings and those reviewed earlier in this chapter for the present study, are taken up in the next section.

4.4 Summary and Implications

In this chapter we have reviewed theoretical models and empirical studies of information processing in consideration set formation and categorization - two areas of academic enquiry which bear a structural resemblance to the decision situations of interest to this dissertation. A number of relevant implications for the present work can be identified from the review. With respect to information processing in consideration set formation, both compensatory (e.g. linear compensatory, Parkinson and Reilly, 1979) and noncompensatory models (e.g. lexicographic) seem to provide adequate representations of the set formation process, although there also seems to be a general consensus that a conjunctive decision heuristic best represents cognitive processes underlying decisions in this sphere.

As regards categorization, the review indicates that both the classical and exemplar views model the categorization process in terms of an exclusively analytic noncompensatory evaluation processes whilst the prototype view makes room for nonanalytic compensatory processes. More specifically, both the classical and exemplar views seem to favor a conjunctive evaluation process, whilst the prototype view suggests either a disjunctive process (if the evaluation is analytic) or a linear compensatory process (if evaluation is holistic).

A number of observations can be made from the review which have relevance from the present study:

1.   Except in situations where prototypical (or exemplar) members of a product category can be brought to mind, product categorization is best seen in terms of an essentially analytic feature-by-feature comparison process. More specifically, by virtue of available empirical evidence, a conjunctive cut-off rule is seen as the most appropriate.

2.   Whilst categorization is traditionally seen in terms of grouping together products that share certain attributes in common, Barsalou's (1983; 1985) work suggests that even products that don't share common attributes may be perceived as belonging to the same category if they contribute to attainment of a particular goal.

3.   Following from 1) & 2), multiple item selection decisions can be studied within an ad hoc categorization perspective. In these decisions, groups of product items often need to be selected to achieve a given consumption objective. Therefore, evaluation processes that have been found to be relevant for categorization tasks should be relevant for selecting multiple items from the same product class.

Implications of the review in this chapter would be returned to in chapter 5 when hypothesized differences in information acquisition between single and multiple item decisions are considered.

PART III

HYPOTHESES AND METHODOLOGY

This part of the dissertation consists of 2 chapters. In chapter 5, a formal model of relationships to be investigated in the empirical study is presented. Hypotheses based on this model are also outlined and discussed. Chapter 6 discusses methodological choices made to effectively carry out the empirical study.

CHAPTER 5

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CONCEPTUAL MODEL AND RESEARCH HYPOTHESES

This chapter is organized as follows. First, a model of the relationships to be investigated in the empirical study is presented in section 5.1. This model specifies the dependent variables to be used, and how these relate to the research questions posed in chapter 1. It also provides a framework around which presentation of the research hypotheses is organized. Next, the hypotheses and underlying arguments are presented in section 5.2.

5.1 Conceptual Model

Based on the research questions specified in chapter 1, and the literature review in the last three chapters, a formal model of the relationships to be investigated in the empirical study is presented in this section. To put the model and related hypotheses in perspective, it will be useful to recall from chapter 1 that the main objective of this dissertation is to investigate how consumers acquire and integrate information when they select more than one alternative from the same product class. In section 1.3 of chapter 1, it was argued that this objective can best be achieved by examining:

a)   how information acquisition in these decisions differ from those in decisions where only a single item is to be selected,

b)   how the size of subset to be selected impacts on information acquisition and integration strategies in multiple item decisions.

Stated differently, the suggested approach is to make comparisons between information acquisition in single and multiple item decisions on one hand, and among different multiple item selection decisions on the other. In order to effectively make such comparisons, there is the need for a set of dimensions along which any differences can be examined. The literature review in section 2.2 of chapter 2 is useful in this regard. In that section, variables used to study consumers' information acquisition processes within the process-tracing paradigm were presented and discussed. These were identified as proportion of available information searched, variability in amount of information searched per alternative, variability in amount of information searched per attribute, and sequence of information search. Examining these variables does not only enable classification of decision strategies into the broad categories of compensatory and noncompensatory, they also enable determination of specific strategies under each of these broad categories.

The central role played by these variables in process-tracing research suggests that, in order to enable comparison of findings from the present study with those of contemporary decision researchers, it would be imperative to use them as dependent variables in the study. In addition to these four variables, decision time, although not included in Table 2.2, is also one variable that is normally used as a dependent variable in decision research. Decision time serves as an indirect measure of the amount of effort and deliberation required to make the decision. In all, five main dependent variables form the basis of the conceptual model shown in figure 5.1. This model specifies the relationship between the dependent variables and two independent variables, and serves as a point of departure for the hypothesized differences that will be discussed later in this chapter.

Figure 5.1 should be read as follows. The variables to the right of the figure are the main dependent variables that will be used in the study. Differences along these variables will be investigated for two sets of decision situations. The first set concerns differences between selecting a single item and selecting more than one item, whilst the second set addresses differences among decisions involving selecting more than one item, but for which different subset sizes are to be selected. In figure 5.1, the set of relationships denoted by non-bold arrows specifies that proportion of information searched, variability in search per alternative/attribute, sequence of information search, and time taken to arrive at a decision

Figure 5.1 Model of Relationships to be Investigated in the Empirical Study
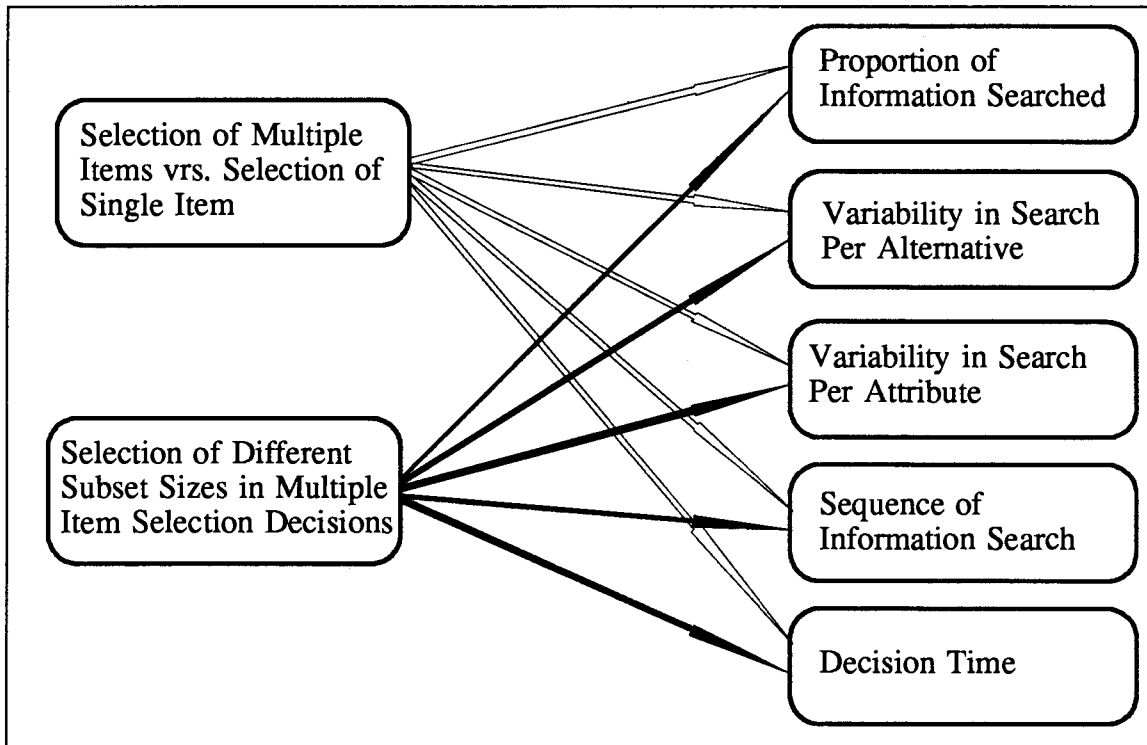
would be different for multiple and single item selection decisions. Similarly, the relationships denoted by bold arrows specify that within the realm of decisions for which more than one alternative is to be selected, proportion of information searched, variability in search per alternative/attribute, sequence of information search, and time taken to arrive at a decision would differ as the specific number of alternatives to be selected (subset size) changes. Specific directions for these sets of differences cannot be visually displayed in the figure and so are contained in the hypotheses that follow this section.

5.2 Research Hypotheses

The conceptual model (figure 5.1.) shows two sets of relationships that need to be investigated in order to achieve the main objective of this dissertation. These sets of relationships also form the basis upon which discussion of the research hypotheses will proceed. Consequently, the discussion in this section is broken down into two parts. First, expected differences in the dependent variables for single and multiple item selection decisions are discussed. Then in section 5.2.2, discussion of the impact of size of subset to be selected on expected differences in the dependent variables is taken up.

5.2.1 *Information Acquisition Differences Between Single and Multiple Item Decisions*

Figure 5.2 shows that part of the conceptual model (figure 5.1) relevant for this discussion. Again, figure 5.2 should be interpreted as predicting that proportion of information searched, variability in search per alternative/attribute, sequence of information search, and decision time would all be different for single and multiple item selection decisions. Specific directions of these differences would be discussed at appropriate places in this section. For now, however, we note that the basis for these expected differences are the studies by McClelland et al. (1987), Crow, Olshavsky and Summers (1980) and Simonson (1990) reviewed in chapter 3. These studies directly investigated and found differences in decision-relevant variables between single and multiple item selection decisions. However, none of them specifically examined these differences along the dependent variables specified for this study. The purpose of this section is to predict the specific nature and direction of the differences with respect to proportion of information searched, variability in search per alternative/attribute, sequence of search and decision time.

As suggested in the discussion of contingent decision behavior in chapter 2, discussion of the expected differences will be based on response mode and task complexity arguments.[21] The

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[21] Task complexity and task difficulty will be used interchangeably in the discussions in this chapter. We note, however, that although all difficult tasks are complex, not all complex tasks are difficult (Kaufman, 1988).

discussion will begin with response mode arguments, and then turn to task difficulty arguments.

Figure 5.2   Conceptual Model Relevant for Differences in Information Acquisition Between MISDs and SISDs
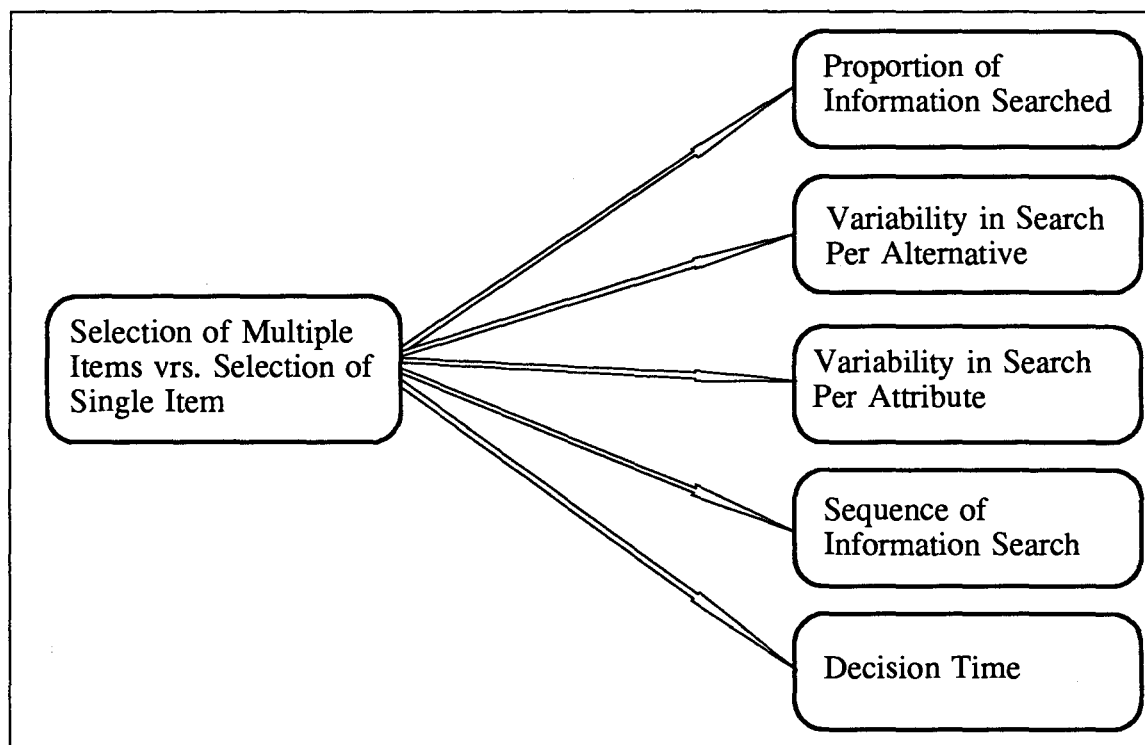
In all types of decisions, whether they are single or multiple item selection decisions, consumers need to apply a rule (or decision criterion) by which a selection (or selections) can be made among the evaluated alternatives (Wright, 1975). In single item selection decisions (SISDs), Wright (1975) suggested "choosing the best alternative" or "choosing the most satisfactory alternative" as the most likely decision rules. For multiple item decisions (MISDs), these rules could translate to "choose the best subset of alternatives" or "choose the most satisfactory subset of alternatives". The best or most satisfactory subset in this case could be the "x top candidates" (as in the McClelland et. al, 1987 study and most other studies in the consideration set line of research). However, for the MISDs of interest to this

dissertation, Coombs (1964) suggests that what constitutes the best subset of alternatives will be determined by the consumer's objective of "covering his/her bets". Similarly, Green, Wind and Jain (1972) posit that the best (or most satisfactory) subset will be the one consisting of some ideal *assortment* of the alternatives whose components are suitable for a variety of anticipated problem-solving situations. The same basic idea is conveyed by Farquhar and Rao's (1976) proposition that in MISDs consumers will select the individual items in the collection so as to achieve balance in the attributes that define the selected alternatives.

An important implication of this notion of "rounding out" or balancing the choice set as a whole is that alternatives often cannot be evaluated independently of each other (McAllister, 1979). Rather, each alternative has to be evaluated in terms of its contribution to overall utility of an eventually selected subset, thereby requiring that the consumer determines the overall worth of each alternative. Consequently, as opposed to selection of a single item where winnowing processes can be employed, when multiple items are to be chosen such that the entire subset is balanced, global evaluations may prevail in the decision process. This suggests that cognitive evaluation processes employed in these decisions may well resemble those that obtain under judgement tasks. Now, as the review in chapter 2 showed, when asked to make overall judgements about available alternatives, consumers often use strategies consistent with a compensatory model in the sense that they engage in extensive information search, low variability in search patterns, and compensatory evaluation processes (Billings and Scherer, 1988). Therefore, on the basis of response mode predictions, we expect consumers who select multiple items from a product class to search a higher proportion of the available information with lower variability in search per alternative/attribute, alternative-wise search patterns and longer decision times, compared to those who select only a single item from the same product class.

With regards to differences in task difficulty between single and multiple item decisions, we note that, in their studies of multiple item selection decisions, both Green, Wind and Jain (1972) and Simonson (1990) found these class of decisions to be inherently complex. Simonson (1990) contends that this complexity arises because, in MISDs multiple sub-decisions have to be made in order to achieve the desired decision outcome. Put differently, in a multiple item decision, the consumer has to make more than one selection (decision) at

the same point in time and

"the fact that multiple decisions must be made simultaneously, rather than a single decision at a time, tends
to make [the] task more demanding, *especially if no alternative is perceived as far superior to all others*
[emphasis added]" (Simonson, 1990; p. 150).

In addition to this increase in difficulty attributable to the sheer fact of having to make
multiple decisions, Simonson (1990) suggests that in MISDs, future preferences often have
to be incorporated in a current decision, especially when the products selected are to be
consumed over different consumption occasions. Paraphrasing Green, Wind, and Jain (1972),
in such decisions ".... the consumer is (conceptually) committing herself to some type of
future behavioral pattern ..." (p. 376). Now since future preferences are at best difficult to
predict, incorporating their prediction into a current decision clearly increases the difficulty
of the decision task. Moreover, there is reason to expect that the need to balance the subset
of selected alternatives would increase complexity of MISD tasks. This is because, as already
alluded to under the discussion of response mode effects, alternatives have to be evaluated
relative to each other rather than independently as is possible in SISDs. It may seem logical
then, to assume that task difficulty will increase as a function of the number of decisions to
be made (alternatives to be chosen), even though there is no reason to expect a direct
monotonic relationship. But what implications will such an increase in difficulty have for the
dependent variables in our empirical study?

As discussed in chapter 2, empirical studies of the effects of task complexity have found a
tendency for consumers to use simplifying heuristics when complexity of a task increases.
These heuristics are generally associated with incomplete information search and variable
search patterns. It appears then that if, as suggested by Simonson (1990) and Green, Wind and
Jain (1972) MISDs are more difficult to make than SISDs, then the former should be
associated with increased use of simplifying heuristics. Since these heuristics involve
noncompensatory processes, information search will be more incomplete, and consumers who
select multiple items will exhibit higher variability in search patterns than those who select
a single item. Such a hypothesis is consistent with current conceptions in the contingent
decision literature reviewed in chapter 2. It is also consistent with evidence from the

categorization and consideration set formation literatures reviewed in chapter 4 that suggests a kind of conjunctive evaluation process in both consideration set formation and categorization.[22]

However, there are a number of reasons why despite the greater complexity of MISDs consumers may not use simplifying heuristics to the same extent as they do for SISDs. First, our brief review in chapter 2 (section 2.3.2) of alternative conceptualizations of task complexity in the organizational sciences revealed that there are other aspects of a decision task besides the sheer amount of available information that have the potential to increase task complexity. In particular, recall that March and Simon (1958) suggested that one task may be more complex than another if it embodies unknown and uncertain alternatives, inexact means-ends connections, and a number of subtasks which may not consist of independent parts. The last requirement (existence of multiple subtasks) is particularly relevant for describing the nature of task complexity differences between single and multiple item decisions.

By virtue of the need to balance the assortment of items selected in MISDs, these types of decisions will involve the performance of more subtasks than will be the case for SISDs. For example, in a MISD, the consumer may have to first select one of the available alternatives, and then use this as an anchor against which the remaining alternatives will be evaluated. This opens for the possibility that preferences will be revised as the decision progresses, with alternatives entering and leaving the preferred subset as additional information is obtained. The need to perform more multiple subtasks in MISDs implies that given the same level of information overload conditions for the two decision tasks (call this structural complexity), MISDs may be more complex than SISDs because of the additional procedural (or performance) complexity.

Second, although task complexity has generally been found to be associated with increased use of simplifying heuristics, consumers motivation to use these heuristics for all types of

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[22] From Table 2.2 (chapter 2), we note that the conjunctive evaluation heuristic is associated with a low proportion of information searched, high variability in search across alternatives and attributes, and an alternativewise search pattern.

complex tasks would depend on the extent to which heuristic processes would lead to the desired decision outcome. Although heuristics are generally cost-effective in the sense that they reduce cognitive processing costs, the cost/benefit framework suggests that they will not be used if the reduction in processing costs is not compensated for by an associated benefit (Shugan, 1980; Payne, 1982). For MISDs, application of heuristics could result in a suboptimal performance of the subtasks (evaluating each alternative in terms of its compatibility with other alternatives in the chosen subset) that are required to achieve the desired decision outcome (selection of an ideal assortment of alternatives that together form a balanced subset). Therefore, even though complexity is expected to be higher for MISDs, there may be little motivation to employ simplifying heuristics in these decisions. In that case, complexity would result in greater effort on the part of the consumer to cope with the requirements of the task. This would imply a greater amount of deliberation, increased information search and lower variability in search. Furthermore, the need to perform the subtasks of evaluating each alternative to determine its compatibility with others in an eventually chosen subset will encourage a greater use of compensatory decision processes.

The above arguments are consistent with the predictions made on the basis of response mode differences between single and multiple item selection decisions. If the task difficulty arguments are valid, and we believe they are, then one might expect the same predicted differences between single and multiple item decisions with respect to our dependent variables as derived under the response mode arguments. In that case, consumers in the multiple item selection situation would use information acquisition strategies that are consistent with the compensatory decision model. The specific effects on our dependent variables can be deduced from Table 2.2, and are formally presented in the hypotheses that follow.

5.2.1.1 Proportion of Information Searched

We have argued above that in multiple item selection decisions, the need to evaluate available alternatives in terms of their contribution to overall utility of an eventually selected subset would lead to evaluation processes that resemble what obtains under judgement tasks, viz compensatory processes. We further argued for the possibility that higher complexity for these

decisions will lead to increased deliberation by the consumer rather than the use of simplifying heuristics as would be predicted on the basis of current findings from contingent decision research. These arguments lead us to the direct conclusion that when they select multiple items from a product class, consumers are likely to engage in more complete information search than when they select only a single item. Our formal hypothesis then becomes:

H1 **Consumers who need to select more than one alternative will acquire a higher proportion of available information than those who need to select a single item from the same product class.**

It should be noted that this hypothesis is in direct conflict with results from the McClelland et. al (1987) study reviewed in chapter 3. In that study, they reported evidence of lower depth of information search for subjects who were asked to choose three cars compared to those asked to choose one. However, their study consisted of a product profile in which three alternatives dominated the rest, thereby internally inducing less search for the group that selected three. We believe that when no alternative dominates all others in the choice set, consumers who choose more than one alternative will search a higher amount of the available information.

5.2.1.2 *Variability in Amount of Information Searched Per Alternative*

Variability in amount of information searched per alternative is an indication of the extent to which the same or unequal amounts of information are searched for each of the available alternatives in a decision. Low variability implies that fairly equal amounts of information were searched for each available alternative, and may indicate use of compensatory or conjunctive decision strategies. On the other hand, high variability in search per alternative implies that the consumer searched unequal amounts of information for each available alternative, and is an indication that the consumer is using noncompensatory or sequential decision processes. In earlier discussions in this chapter, we expressed skepticism at the feasibility of using such noncompensatory strategies in selecting multiple items, largely

because of the need for holistic evaluations to fulfil the requirement of balancing the selected subset. Clearly, if holistic evaluations have to be made, the consumer would not only need to acquire as much information about each alternative as possible, s/he may also have to acquire the information on the same set of attributes for each alternative (i.e., the same amount for each alternative, and therefore, low variability). Therefore, there is reason to expect that the following hypothesis holds:

H2   Variability in amount of information searched per alternative will be lower for consumers who need to select multiple items from a product class than for those who need to select a single item from the same product class.

4.2.1.3 Variability in Amount of Information Searched Per Attribute

Variability in amount of information searched per attribute is an indication of the extent to which some alternatives are not searched for any particular attribute relevant to the evaluation. There are two main factors that could lead to high variability in number of alternatives searched per attribute:

1.   Prior product knowledge. Where the consumer already knows the value of an alternative on a particular attribute s/he may not need to search that alternative for the attribute.[23]

2.   Heuristic evaluation strategies. Where a strategy like Elimination-by-Aspects (EBA) is used in evaluating alternatives, a variable pattern of search per attribute may be observed because some alternatives may be eliminated after they have been searched on only the first attribute. Consequently, they would not be searched on subsequent attributes.

Clearly, the knowledge effect would be relevant in a research employing brand name as an attribute. In the absence of brand names, there is no reason to expect high variability other than as results from the use of simplifying heuristics. Since these are expected to be used

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[23] Jacoby, Szybillo, and Busato-Schach (1977) report that some of their subjects made selection of breakfast cereal entirely on the basis of brand name, even though other attributes were provided in the study.

more in SISDs than in MISDs, we are in a position to hypothesize that:

H3 **Variability in amount of information searched per attribute will be lower for consumers who need to select multiple items from the same product class than for those who need to select a single item from the same product class.**

5.2.1.4 Sequence of Information Search

As defined earlier, sequence of information search refers to the particular order in which a consumer searches information in a decision task. The distinction here is between attribute-based (where the consumer selects an attribute, compares alternatives on that attribute, then selects a second attribute, then a third, etc. until all relevant attributes are considered) and alternative-based processing (where the consumer selects an alternative and evaluates it on all relevant attributes before processing information about another alternative). Referring to Table 2.2, we note that both attribute-based and alternative-based search sequences are plausible irrespective of whether the consumer uses a compensatory or noncompensatory evaluation process. In other words, it is not possible to predict differences in information search sequence between MISDs and SISDs based exclusively on the possibility for more compensatory evaluation in MISDs compared to SISDs. This problem is further underscored by the fact that most process-tracing studies often find both types of processing in the same experimental task. It would seem then, that sequence of information processing is affected more by individual differences in preferences for either of the two processing modes.

However, we know from empirical studies that there are other factors that might facilitate use of one or other of the two processing modes. For example, Bettman and Kakkar (1977) found that when information is arranged by alternatives consumers tend to employ alternative-based processing, whilst attribute-based processing is favored when information is arranged by attributes. This evidence is corroborated by Russo (1977) who found that when information was displayed in a sorted list with available brands ranked according to increasing unit price, consumers tended to use more unit price information in their shopping decisions. By the same token, the purpose for which information is searched would be expected to influence

consumers preferences for processing mode. For example, we know from the decision literature (e.g. Payne, 1976) that when consumers are searching for information in order to help them eliminate some options from further consideration they tend to adopt an attribute-based mode of processing. We also know from the judgement versus choice literature that when the purpose of information acquisition is to make holistic judgements about all available alternatives, consumers tend to adopt an alternative-based mode.

Now, there is reason to believe that the purpose of information acquisition differs for MISDs and SISDs. Specifically, information acquisition in MISDs would have the objective of identifying a set of alternatives that *together* contribute to the attainment of a particular consumption objective. The need for holistic evaluations to enable such an identification naturally speaks in favor of alternative-based processing, especially when seen within the context of the justification explanation discussed in chapter 2 (Slovic, Fischhoff, and Lichtenstein, 1988). Therefore, even though some subjects in a SISD will also use alternative-based processing, in general we would expect a greater percentage of those selecting multiple items to use this mode than for those selecting a single item. Hypothesis H4 follows from this argument.

H4   **Compared to those who need to select a single item, consumers who need to select more than one item from the same product class are more likely to use alternative-based information acquisition strategies.**

5.2.1.5 Decision Time

The need for increased deliberation in MISDs and related need to search a greater proportion of available information implies that, in general, decision time in a multiple item selection decision will be higher than the corresponding time in a single item selection decision of equal structural characteristics. This argument is further strengthened by the fact that trade-offs are more difficult to make when more than one alternative is to be selected than when a single item is to be selected. In the former situation, each alternative does not just have to be evaluated in its own right. It has to be evaluated in relation to other alternatives in the

available set or alternatives already selected in an earlier part of the decision process. Consumers should, therefore, be expected to spend more time deliberating over any particular alternative in order to determine its compatibility with the objective of selecting an ideal assortment of alternatives. This gives as sufficient grounds to hypothesize that:

H5   Compared to those who need to select a single item, consumers who need to select more than one item from the same product class will to spend more time prior to making a decision.

5.2.1.6 Perceptions of Task Difficulty

Though not included in our conceptual model, we also seek a set of hypotheses about the impact of number of alternatives to be selected on perceptions of task difficulty. If our arguments about differences in task complexity between single and multiple item selection decisions are correct, then we should expect consumers in MISDs to report higher levels of task difficulty than those in SISDs. In effect, H6 is a direct test of the Simonson (1990) and Green, Wind, and Jain (1972) position that MISDs are more complex (difficult) to make. It states that:

H6   Compared to those who select a single item, consumers who select multiple items from the same product class will report higher levels of task difficulty.

5.2.2 Effects of Selecting Different Subset Sizes in MISDs

As specified in our conceptual model (figure 5.1.), the second set of information acquisition differences that would be investigated in an attempt to answer the main research question of this dissertation, relates to selection of different subset sizes in multiple item decisions. Up to now, we have discussed multiple item decisions as a single class of decisions, arguing for differences in information acquisition between these and decisions in which only one item is selected. For example, we have argued that, given a set of 10 available alternatives, different information acquisition strategies would be used to select one alternative than would be used to select more than one, irrespective of whether in the latter decision the consumer is to select 2, 3, or 9 of the available alternatives. Clearly, if these differences are expected between single and multiple item decisions only because the number of items to be selected changes from one in single item decisions to more than one in multiple item decisions, then by a logical deduction, we should expect to observe changes in information acquisition strategies for multiple item decisions as a function of the exact number of items to be selected. In other words, in the example above, we should expect to observe differences in acquisition strategies depending on whether 2, 3, or 9 alternatives are to be selected.

In the rest of this dissertation, the exact number of items to be selected in a multiple item decision will be referred to as the size of subset to be selected. In this regard, the purpose of this section is to examine the impact of changes in size of subset to be selected on information acquisition in multiple item decisions, and to formulate hypotheses of these differences. Figure 5.3 shows the portion of our conceptual framework (Figure 5.1) that is relevant for this exercise.

As usual, figure 5.3 should be interpreted as predicting that proportion of information searched, variability in search per alternative, variability in search per attribute, sequence of information search, and decision time would be different for multiple item decisions that differ with respect to the size of subset to be selected. The specific direction of these differences would then be discussed at appropriate places in this chapter.

To put discussion of the expected differences into perspective, we begin with the following illustration. Suppose there are 10 alternatives available in a particular decision situation. Let

**Figure 5.3   Conceptual Model Relevant for Differences in Information
Acquisition as a Function of Subset Size in MISDs**
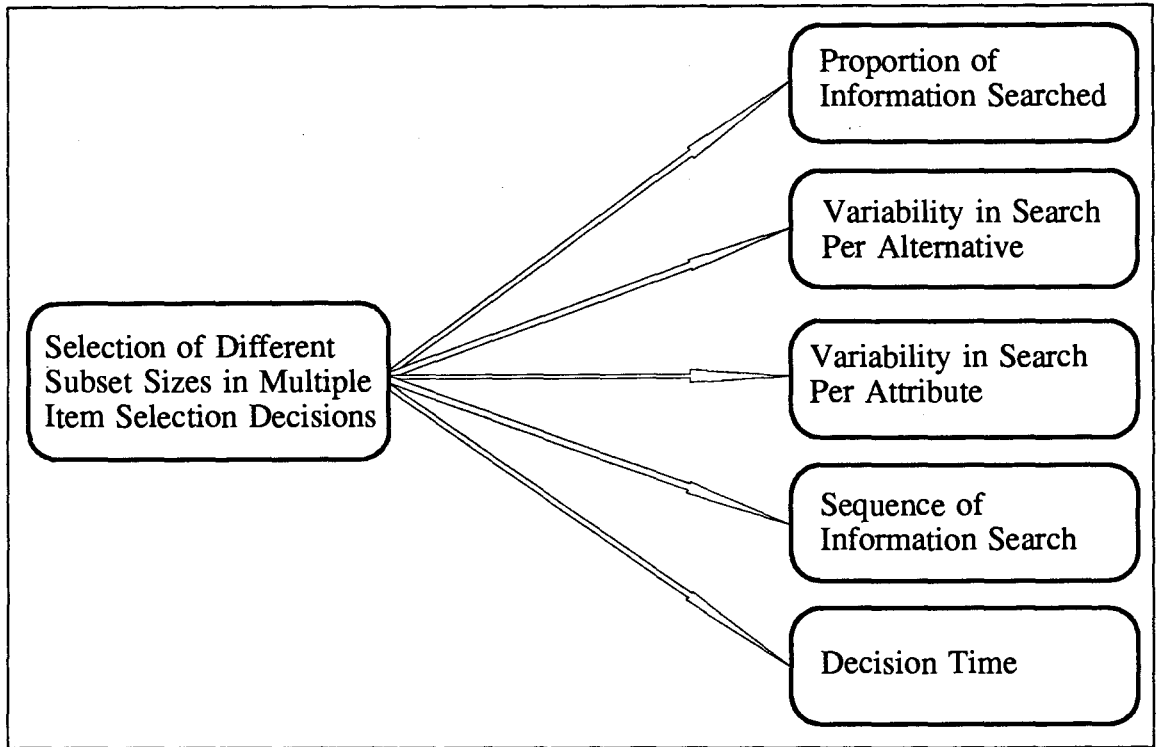
us define two decision scenaria, one in which a particular consumer is to select zero
alternatives from the set of 10, and the other in which another consumer is to select all 10
alternatives. Let us denote the former as Scenario A and the latter as Scenario B. Clearly,
both consumers are faced with extremely easy decision tasks. Without much deliberation, the
consumer in Scenario A (call him/her C1 for Consumer 1) simply makes no selection, whilst
the one in Scenario B (call him/her C2 for Consumer 2) simply selects all 10. In fact,
following from a basic characteristic of decision making that requires the availability of more
than one course of action (French, 1988), we may logically say that in these two scenaria
there is actually no decision to be made.

Let us now increase the number of alternatives to be selected from zero to one for C1, and
decrease the number to be selected from 10 to 9 for C2. Now the difficulty of the decision
has increased for both consumers. C1 must now select one of the available alternatives (and
by implication reject 9) whilst C2 must now select 9 (and by implication reject one). Let us
further increase the number of alternatives to be selected by C1 from one to 2, 3, 4 and 5,
and decrease the number to be selected by C2 from nine to 8, 7, 6, and 5. We seek

hypotheses about the impact such increases (for C1) and decreases (for C2) will have on the dependent variables of interest to this dissertation. Consistent with arguments advanced for our hypothesized differences between single and multiple item selection decisions, relevant distinguishing characteristics in this regard, would be task difficulty and response mode. The former is relevant in addressing the impact of changes in size of subset to be selected on task difficulty whilst response mode effects are relevant in determining the extent to which the objective of information acquisition changes when the size of subset to be selected increases or decreases.

We consider first the situation described in Scenario A, and examine the extent to which changes in size of subset to be selected by C1 will impact on task difficulty. Returning to the arguments advanced in Section 5.2.2, sympathy was expressed for the proposition that for the same level of structural complexity, multiple item decisions are more difficult than single item tasks mainly because the former involve an additional performance difficulty. If this argument is valid, then for C1, the task requiring selection of 2 alternatives will be more difficult than that requiring selection of one alternative because the former involves performance of more subtasks than the latter.[24] By a similar reasoning a task that requires selection of three alternatives would be more difficult than that requiring selection of two alternatives, and so on. In general, extending our arguments derived from the distinction between structural complexity (which has to do with the sheer amount of information to be processed - cf. the information overload paradigm) and performance complexity (which describes the number of independent subtasks to be performed), we may deduce that, any increase in the number of items to be selected in a decision task, would lead to an increase in task difficulty. However, this increase is not expected to be monotonic. Rather, on the basis of Shafir's (1993) findings reviewed in chapter 2, we expect difficulty to peak at the point where the number of alternatives to be selected equals half the number of available alternatives.

In his study of risky decision making, Shafir (1993) found, among other things, that when subjects were asked to select five out of six lotteries to play in, they converted the task into the "simpler task of rejecting a single" lottery. On the other hand, subjects who were asked

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[24] The task requiring selection of one alternative is definitely more difficult than that requiring selection of zero alternatives by virtue of the fact that, strictly speaking, the latter requires no decision at all.

to reject five out of six lotteries converted the task into "the more natural task of choosing one" of the gambles. This led him to conclude that:

> "...the size of the set under consideration may .. determine whether we end up choosing or rejecting. The need to recommend 2 applicants from a pool of 10 is likely to be seen as requiring the selection of 2, whereas having to recommend 8 applicants from the same pool will most likely be framed as requiring the rejection of 2" (p. 554)

If the above conclusion is correct, then it is natural to expect that if C2 is required to select 8 out of 10 alternatives, s/he will convert the task into the simpler task of selecting two alternatives for rejection. In that case C2 will be confronted with a decision task, which under certain assumptions, is diametrically similar to that faced by C1 when the latter selects 2 alternatives from 10.[25] Both consumers have to identify 2 alternatives from a set of 10. Extending this argument to other subset sizes, we should then expect that when required to select 9, 8, 7, and 6 from a set of 10, C2 would convert these decision tasks to rejecting respectively 1, 2, 3, and 4. Again, under the assumption of similar information acquisition strategies for choosing and rejecting decisions, these decision tasks would be diametrically similar to those faced by C1 in respectively selecting 1, 2, 3, and 4 out of 10. Clearly, both consumers face the same decision task when increases for C1, and decreases for C2 result in both consumers selecting 5 out of 10 alternatives. At this point task difficulty is at its peak for both consumers. If these arguments are plausible, then, as illustrated in figure 5.4, an inverted U-shaped relationship exists between the number of alternatives to be selected from a *fixed* set of available alternatives and the difficulty of the decision task.

It is interesting to note that according to the arguments advanced above, whether an increase in size of subset to be selected would lead to an increase or decrease in task difficulty depends on which scenario we are considering. When the initial size of subset to be selected is less than half the available alternatives an increase in subset size leads to an increase in task difficulty. On the other hand, if the initial subset size is greater than half the number of available alternatives, then an increase will lead to a decrease in complexity of the task. Put

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[25] For example, an assumption of similarity in information acquisition patterns across selection and rejection decisions.

differently, the inverted U-shaped relationship between size of selected subset and task difficulty implies that for very small and very large subset sizes, task difficulty would be lower than for moderate subset sizes.[26]

Figure 5.4   **Hypothesized Relationship Between Size of Subset Selected and Task Difficulty in MISDs**
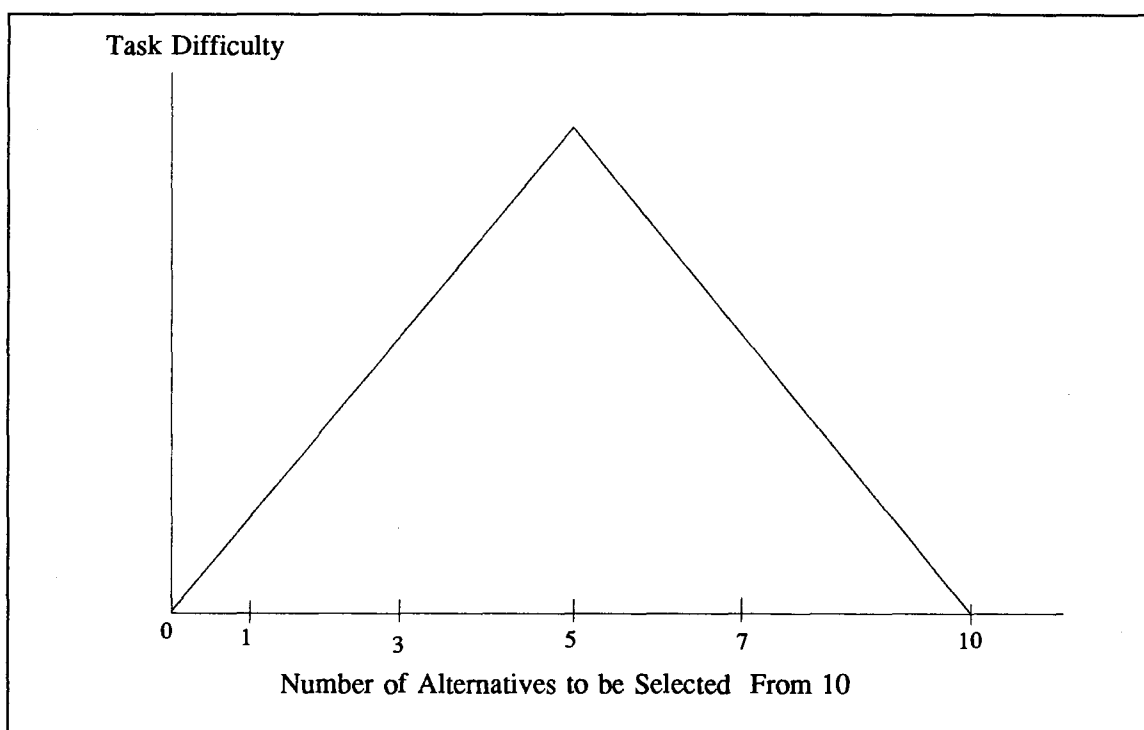
In the sections that follow, we discuss the implications of this inverted U-shaped relationship for information acquisition behavior in multiple item decisions. More specifically, we discuss the effects these changes in task difficulty are expected to have on proportion of information searched, variability in search per alternative and per attribute, sequence of search, decision time, and consumers' perceptions of task difficulty.

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[26] Where the terms "very large", "very small", and "moderate" are defined with respect to the number of available alternatives.

5.2.2.1 Proportion of Information Searched

In the discussion leading to hypothesis H1 (Section 5.2.1.1), we argued that the higher level of performance difficulty in multiple item selection decisions would lead to more deliberation on the part of the consumer. Specifically, it was argued that this increased deliberation arises out of the need to evaluate available alternatives relative to each other, in order to determine the compatibility of each alternative in an eventually chosen subset. Extending this argument to the present discussion, we would logically expect that since selection of very small and very large subset sizes are associated with lower task performance difficulty than selection of moderate subset sizes, the former would also be associated with less deliberation on the part of the consumer than the former. If therefore, as argued earlier, increased deliberation leads to greater information search, then a natural implication of the inverted U-shaped relationship between size of subset selected and task difficulty would be an inverted U-shaped relationship between size of subset to be selected and proportion of information searched. In other words, for selection of very small and very large subset sizes a smaller amount of information would be searched compared to moderate subset sizes.[27] Therefore, if this extension of our earlier arguments is valid, the following hypothesis should hold:

H7   **Given a fixed set of available alternatives, an inverted U-shaped relationship exists between the size of subset to be selected and proportion of available information searched.**

It should be noted that H7 does not contradict the predictions in H1. Even though in H7 we expect proportion of information searched to be lower for small and large subset sizes than for moderate subset sizes, proportion searched for small, moderate, and lower subset sizes are still expected to be generally higher than when a single item is to be selected. Put differently, H7 hypothesizes that proportion of information searched would be lower for small and large subset sizes only in relation to proportion searched for moderate subset sizes.

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[27] Small, moderate, and large refer to the size of the selected in relation to the number of available alternatives.

5.2.2.2 Variability in Amount of Information Searched Per Alternative

With respect to variability in amount of information searched per alternative, we hypothesized in H2 that this variable would be lower for multiple item decisions than for single item decisions. The main argument in support of this hypothesis was that in multiple item selection decisions, because of the need to make holistic evaluations of available alternatives, not only will more information be needed, but also fairly the same amount of information will need to be acquired on each alternative. This implies that for all multiple item decisions, variability in search per alternative will generally be lower, and so significant differences may not be expected for selection of different subset sizes.

However, if as argued above, different levels of task difficulty lead to different amounts of deliberation, and consequently proportion of information searched, then we might expect some differences in variability of search per alternative. In particular, we note that in general, searching a high proportion of available information also increases the likelihood that variability in search would be lower. For example, we note from Table 2.2, that no decision strategy logically implies both a high amount of search and high variability in search. Indeed, at the very extreme, when all available information is searched, variability in search must logically be zero. Therefore, if our arguments relating to proportion of information searched are tenable, then an inverted U-shaped relationship between subset size and proportion of information searched should naturally imply a regular U-shaped relationship between subset size and variability in search per alternative.

H8   Given a fixed set of available alternatives, a regular U-shaped relationship exists between the size of subset to be selected variability in amount of information searched per alternative.

5.2.2.3 Variability in Amount of Information Searched Per Attribute

The arguments relating to variability in search per attribute follow the same logic as those for variability in search per alternative. Again, even though variability in search per attribute will generally be higher for multiple item decisions than for single item decisions, the greater likelihood of observing less variability in search as proportion of information searched increases implies that we may expect subset size to have an effect on variability in search largely due to the predictions of H7. In that case, the hypothesized inverted U-shaped relationship between size of subset selected and proportion of information searched should naturally imply a regular U-shaped relationship between size of subset and variability in search per attribute. We may therefore, formally hypothesize that:

H9   Given a fixed set of available alternatives, a regular U-shaped relationship exists between the size of subset to be selected and variability in amount of information searched per attribute.

5.2.2.4 Decision Time

As noted in the discussion leading to presentation of our general conceptual model (figure 5.1), decision time is an indirect measure of the extent of deliberation involved in arriving at a final decision. The extent of deliberation may in turn be determined by the level of difficulty of the decision task. Specifically, it was argued in Section 5.2.1, that for multiple item decisions, as task difficulty increases, consumers will engage in increased deliberation rather than resort to use of simplifying heuristics. This will lead them to search a higher proportion of information and thereby spend more time in the process. In addition, the need to evaluate each alternative to determine its congruence with other alternatives in an eventually chosen subset, would itself lead to increased decision time. Based on these arguments, we established a positive relationship between task difficulty in multiple item decisions and decision time. If this relationship is valid, then a natural implication of the inverted U-shaped relationship between subset size and task difficulty is the expectation of a similar inverted U-shaped relationship between subset size and decision time. Stated differently, we expect consumers who select very small or very large subset sizes to spend

longer times deliberating over their choices compared to those who select moderate subset sizes.[28] The following hypothesis formalizes this argument.

H10   Given a fixed set of available alternatives, an inverted U-shaped relationship exists between the size of subset to be selected and time spent prior to making a decision.

5.2.2.5 Perceptions of Task Difficulty

Our hypothesis on the effect of subset size on consumers' perceptions of task difficulty is simply an empirical test of the relationship hypothesized in figure 5.4 which formed the basis for much of the discussion leading to the hypotheses in this section. Therefore, without further formal discussion, we formulate the following hypothesis which captures the essence of figure 5.4:

H11   Given a fixed set of available alternatives, an inverted U-shaped relationship exists between the size of subset to be selected and consumers' perceptions of task difficulty.

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[28] Again, the distinction between very small and very large on the one hand, and moderate on the other, is in relation to the number of available alternatives.

CHAPTER 6

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METHODOLOGY

This chapter is organized as follows. In section 6.1, considerations in the choice of research design are discussed. Section 6.2 presents a general outline of the experimental design used in the empirical study. Sections 6.3 and 6.4 describe the stimulus products and sample of respondents used for the data collection. In section 6.5, the data collection instrument used in the empirical study is described whilst issues related to the actual data collection are outlined in section 6.6. Finally, section 6.7 discusses how the variables specified in the hypotheses of chapter 5 were measured.

6.1 Research Design

"Science is concerned with understanding variability in nature, statistics is concerned with making decisions about nature in the presence of variability, and experimental design is concerned with reducing and controlling variability in ways which make statistical theory applicable to decisions made about nature." (Winer, Brown, and Michels, 1991; p.1)

As is evident from the introductory and literature review chapters of this dissertation, there are relatively few descriptive studies of how consumers process information in decisions involving the selection of more than one alternative from a product class. The research problem is relatively new to the extent that there is a weak theoretical frame of reference that specifically addresses information processing in multiple item selection decisions. In spite of this, it was deemed appropriate to use an experimental design for a number of reasons.

First, a substantial part of this dissertation has been devoted to structuring the problem by integrating empirical findings from general decision research with theories and empirical research in other areas that are conceptually similar to multiple item selection decisions, i.e categorization and consideration set formation. Consequently, it has been possible to formulate hypotheses regarding likely differences in information processing between single and multiple item decisions. These hypotheses are well structured with a clear distinction between independent variables (the number of items to select in a decision) and dependent variables (proportion of information searched, variability in search across alternatives and attributes, sequence of information search, and decision times). We are not only concerned with investigating the correlation between the number of items respondents are required to select and their information search behavior; we are also concerned with attributing any observed differences in this behavior to the fact that respondents had to select different numbers of items in their decision tasks. Certainly, an experimental design would provide a much stronger test of these differences.

Second, the variables under consideration, and the specific form of the hypotheses make it possible for the study to meet most of the requirements for using an experimental design viz:[29]

a)   the ability to *control* either the situation in which the experiment is conducted, which experimental units receive a particular treatment at a particular time, or the extraneous variables that can be a threat to valid inference,

b)   the ability to *manipulate* the treatment (or independent) variable, and

c)   the possibility of making *comparisons* between treatment conditions.

For example, the independent variable (number of items to select) can be manipulated in an experimental setting by appropriate task instructions, thus creating different treatment conditions. Observations on the dependent variables can then be made and comparisons made

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[29] See for example, Cook and Campbell (1979), Churchill (1991).

across treatment conditions. Moreover, control can easily be achieved by random assignment of subjects to the different task instructions.

Third, in this early phase of research in multiple item decisions, a major concern is on theory application as opposed to effects applications (Calder, Phillips, and Tybout, 1981). Following suggestions by Calder and his colleagues in the article cited above, it was deemed appropriate to strive for maximum internal validity through the use of an experimental setting. Since, as discussed above, the nature of the proposed study permitted manipulation of the independent variable, there is sufficient grounds to opt for an experimental design in the study.

Finally, multiple item decisions may be viewed as a special class of decisions, the study of which may be deemed to fall within the general class of decision research. As is evident from the discussion in chapter 3, decision researchers have made tremendous advances in terms of concept development, methodology, identification of factors that affect strategy use, etc. In particular, it is crystal clear which variables are relevant for classifying decision strategies and what methodologies are available for researching the variables. Previous research in decision making has guided identification of the independent variables. Research on the effects of task complexity and response mode on decision strategy use has been very helpful in shaping the formulating the hypotheses. In contemporary decision research, especially research using a process-tracing methodology, researchers ordinarily use experimental designs. Therefore, in order to enable us position the present study within the broad stream of decision research, it is imperative to use a similar methodology as that commonly used in the area.

6.2. Outline of Experimental Design

To test the hypotheses advanced in the previous chapter, an experiment was conducted in which the number of items subjects were required to select was varied at four levels. Subjects in Group 1 were asked to select one alternative out of a total of 10 described on 10 attributes. Group 2 subjects were asked to select 3 out of the same set of 10 alternatives, subjects in Group 3 selected 5, whilst those in Group 4 were asked to select 7 alternatives. Using number of items to select as the independent variable, this resulted in a four-level single-factorial

experimental design. In terms of product class, number of available alternatives, number of attributes, and ratings of alternatives on attributes (i.e. product profiles), the decision situation was the same for all experimental groups. In other words, subjects in all experimental groups were required to make their selections from the same set of alternatives. An outline of the experimental design is depicted in Table 6.1.

Table 6.1
Outline of Experimental Design Used in the Empirical Study

	Group 1	Group 2	Group 3	Group 4
No. of Items to Select	1	3	5	7
Size of Matrix (Alternatives X Attributes)	10 x 10	10 x 10	10 x 10	10 x 10

The following considerations guided determination of the number of items subjects in each experimental group were required to select. Group 1 represented a single item selection task intended to be used as an active control group (Sternthal, Tybout and Calder, 1987) and a benchmark in testing hypotheses H1 to H6. Groups 2-4 were all multiple item selection decisions in which the number of items subjects were required to select represented increasing proportions of the number of available alternatives. The specific number to be selected by subjects in each of these groups was determined according to the following principles. Subjects in Group 3 selected half the number of available alternatives (i.e. 5 out of 10 available alternatives). For Groups 2 and 4, the number of items to be selected was determined such that subjects in each of these groups could form theoretically equal *combinations* of choice subsets. For example, if the task in Group 2 required the selection of two items, then that in Group 4 would require the selection of 8 items, since according to combinatorial principles there is an equal number of combinations of two items as there combinations of 8 out of 10 (i.e., $^{2}C_{10} = {}^{8}C_{10} = 45$). Furthermore, such a configuration would have a potential to reflect the symmetry between choosing 2 items and rejecting 2 items. In

the experiment, subjects in Group 2 were required to select 3 items whilst those in Group 4 selected 7 items.[30] Comparisons among the information search statistics for Groups 2-4 could then be used to test hypotheses H7 to H11. In subsequent discussions we will refer to Groups 1, 2, 3, and 4 the Choose 1, Choose 3, Choose 5, and Choose 7 conditions respectively.

Subjects were randomly assigned to each of the four experimental groups, and were required to perform only the task to which they were assigned. In experimental design terminology, we used a single-factor between-subjects design (Keppel, 1982). Inspite of the fact that an alternative within-subjects design would have required fewer subjects and would be more sensitive in detecting treatment effects (Keppel, ibid; p. 19) we opted for a between-subjects design because of a number of limitations associated with within-subjects designs (ibid; pp. 370-380).[31]

First, in a within-subjects design, to be able to attribute any differences in information search to differences in the number of alternatives selected we would need to keep the task structure similar across all treatments, not only in terms of the number of available alternatives and attributes, but also in terms of values of alternatives on attributes (i.e., profiles of experimental stimuli would have to be the same across tasks). Clearly, there is the danger that respondents will detect the similarities in product profiles across treatments, and may simply not search for information in subsequent tasks. Moreover, there is the risk of *practice effects* (i.e, general improvements in subjects' ability over the course of the experiment) that later confound the effects of subsequent experimental treatments. Even if we vary the product profiles across decision tasks, there is still the possibility that respondents, after going through the first task, will learn certain context-specific ways of dealing with the decision situation. This may affect their subsequent performance on the last two tasks in ways that will confound the effects attributable to the number of alternatives required to be selected. Alternatively, repeated performance of similar tasks may create boredom and/or fatigue for the respondent

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[30] Since $^3C_{10} = {}^7C_{10} = 120$.

[31] In a within-subjects design, each respondent serves in all of the treatment conditions. This means that each of our respondents will be required to perform all the tasks involving the selection of 1, 3, 5, and 7 alternatives in a particular sequence.

and therefore adversely affect performance on subsequent tasks.

Finally, a within-subjects design could have created problems of *differential carry-over effects*, i.e., earlier administrations of a treatment condition may affect subsequent treatment conditions differently. For example, in the empirical study there were four treatment conditions. If a within-subjects design was used, there would be a danger that performance of the first three tasks will all have different effects on the way subjects perform the final task. Although there are ways to solve some of these problems, e.g. by counterbalancing to eliminate the practice effect, using a within-subjects design had a potential to place excessive demands on subjects, and this may compromise reliability of the results.[32]

Although a between-subjects design was preferred for testing the hypotheses, specific requirements of the data collection procedure necessitated that a within-subject aspect be built into the general design. As discussed in more detail later in this chapter, a computer software was used in the data collection. As such there was the need to include a practice decision to familiarize respondents with the operation of the software before they proceeded to the main decision. This practice decision had the same structure as the main decision, except that all subjects in all experimental groups were required to select 3 alternatives from a set of six described along six attributes. In other words, the decision task consisted of a 6 X 6 decision matrix, and all subjects were required to select three alternatives. In the rest of the discussion that follows, the practice decisions will be referred to as the Practice Session, and to the main decision as the Main Session of the experiment.

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[32] Subjects in each experimental group used an average of 30 mins to complete the experimental task. If each subject were required to perform all 4 tasks the average decision time would be around 2 hours, assuming they performed all tasks with the same level of motivation. Clearly, we would be asking too much of each respondent.

6.3 Stimulus Products

A suitable product for the Main Session of our empirical study had to meet a number of requirements. First, the product had to be such that consumers/decision makers *ordinarily* choose more than one alternative from the product class, and at the same time there is still the possibility for making single item choices. This would ensure that any instruction requiring subjects to select more than one of the available alternatives would not be unrealistic. Second, since the main objective in this study is to investigate information search strategies, a suitable product class for the study would be one for which subjects are sufficiently motivated to search for information prior to making a decision. Finally, it was considered desirable to select a product class with which the sample selected is relatively familiar. This is particularly useful since the effects of product familiarity (or product class knowledge) are not of interest in the dissertation.

Based on these considerations, selection of vacation destinations was used as the stimulus product. First, in terms of the first criterion, we note that in vacation selection decisions, the idea of a package tour is well established both in academia and in the practical world of the tourism industry. Such package tours often consist of a collection of destinations designed to give the buyer a memorable total experience during his/her vacation. Also, for tourists who plan their own vacations, it is common for the consumer to plan visiting more than one destination during the vacation trip. It is therefore, not be unrealistic to ask respondents in an experimental task to select more than one destination for a vacation.

To meet the requirement of sufficient product class interest and necessary motivation to seek information, vacationing in Asia was specifically identified as a scenario for the decisions. This was deemed appropriate because this region is becoming increasingly popular for Norwegian holiday-makers, as they seek alternatives to the increasingly congested traditional holiday regions of southern Europe. Finally, in terms of product class familiarity, Norwegians are probably one of the most travelled people in the world, and informal discussions with colleagues indicated that, in general, they normally seek a reasonable amount of information when planning their annual vacations.

With regards to the Practice Session, it was considered desirable to use a different product

class than that used in the Main Study. However, the same basic requirements as for the Main Session had to be met. In particular, it was considered appropriate to select a product class that would introduce respondents to the idea of selecting more than one of the available alternatives. Inspired by the Crow, Olshavsky, and Summers (1980) study, the decision scenario used in this session involved selection of suppliers from whom to request quotations for supply of computer network equipment. Experimental instructions, attributes used, and product profiles for both the Practice and Main Sessions will be discussed in the sections that follow.

6.3.1 Attributes Used in Constructing Product Profiles

To determine which attributes to use in constructing the experimental stimuli for the Main Session, a combination of literature review and free attribute-elicitation procedures were employed. We first went through the tourism literature to identify attributes that have been found to be relevant for vacation destination selection. Specific references consulted were Scott, Schewe, and Frederick (1978), Walter and Tong (1977), Crompton (1979), Goodrich (1978), Haati (1986), and Ritchie and Zinns (1978). From this literature, a set of 15 distinct attributes were first identified. These were further narrowed down to a list of 10 that had direct relevance for evaluating cities (not countries), which were then used as part of a questionnaire in an exploratory study to determine their importance for selection of cities in Asia. This questionnaire is reproduced in Appendix A.

In addition to the list of 10 attributes provided, the questionnaire also included open-ended questions designed to elicit additional attributes from the respondents. These questions asked the respondents, among other things, to state why in their opinion Asia has become popular as a vacation destination for many Norwegian tourists, and what factors they would consider important if they ever decided to visit Asia on vacation. Care was taken to ensure that the list of provided attributes, was placed on a separate page, and after subjects had responded to the open-ended questions. This was deemed necessary so as to avoid a situation where, in their responses to the open-ended questions, respondents simply write attributes from the list provided. The questionnaire was administered to a student sample at the Norwegian School

of Economics and Business Administration during a Business Strategy class. In all, 120 questionnaires were handed and 75 usable ones were returned.

Answers to the open-ended questions were content-analyzed after using the *List* procedure in SPSSX statistical package to obtain a listing of the responses. Since the answers were often short and precise, it was deemed unnecessary to employ any specific coding process. The results of this exploratory study provided a number of interesting insights. First, with regards to the reasons why Asia has become popular as a vacation destination, the answers were surprisingly identical. Factors mentioned by almost all respondents included Norwegians' desire to experience a culture quite different from their own, the need to get away from the mass tourism in traditional destinations like southern Europe, and the need to experience something new, exciting and quite distant. 95% of the respondents explicitly used the terms "exotic", "exciting", or "nontraditional" to describe Asia.

In contrast to the identical responses to why Asia has become popular as a vacation destination, responses to the question that asked for factors that will be important in deciding which cities in Asia to visit were quite varied. Most respondents simply mentioned specific countries or cities in Asia which they would like to visit, and then gave reasons for their selections. However, some respondents did mention a number of factors which had not been identified from review of the tourism literature. These were:

1)   Security for foreign tourists in the city

2)   Crime level in the city

3)   Possibilities for making oneself understood in the city (i.e. the ability to use English in the city/country)

4)   Access to attractions outside the city

5)   Possibility of getting away from the tourist mass.

These factors were included in the main study because they were judged to be both interesting and relevant for evaluation of Asian cities to visit. Moreover, since they were suggested by respondents belonging to the population from which the sample for the main study would eventually be drawn, it was considered appropriate to include them. Importance ratings for

the 10 attributes included in the final part of the questionnaire were also analyzed using the *Descriptives* procedure in the SPSSX package. Mean importance ratings (Table 6.2) for each attribute were used to rank them in terms of overall importance. Using these rankings, five attributes were then selected to be added to those explicitly mentioned by the respondents.

Table 6.2
Importance of Selected Attributes for Evaluating Asian Cities
(*Scale:* 1 = Not Important   5 = Very Important)

	ATTRIBUTE	MEAN	STD. DEV.	N
1.	Cultural Attractions	3.83	1.02	75
2.	Historic Attractions	3.75	0.95	75
3.	Natural Beauty	3.65	0.95	75
4.	Friendliness of the People	3.52	0.92	75
5.	Accessibility	3.39	0.91	75
6.	Quality of Accommodation	3.27	0.95	75
7.	Level of Prices in the City	3.27	0.96	75
8.	Cleanliness of the Environment	3.16	1.00	75
9.	Nightlife and Entertainment	3.03	1.15	75
10.	Possibilities for Shopping	2.88	0.97	75
11.	Standard of Parks	2.42	0.98	74
12.	Possibilities for Camping	1.75	0.90	75

In selecting the five attributes from the list of provided attributes, it was considered desirable to include attributes with high, medium and low mean importance ratings. The following attributes were finally selected:

1.   Quality of cultural attractions (High importance rating)

2.   Quality of historical attractions (High)

3.   Friendliness of people (Medium)

4.   Quality of accommodation (Medium)

5.   Nightlife and Entertainment (Low)

These, together with the 5 attributes obtained through free elicitation, represented the attribute pool that was used to construct the stimuli for the experimental task. The final list of attributes used in the Main Session is available for reference in Appendix B2. This appendix also contains information about profiles of the cities used in this session of our experiment. With regards to the Practice Session, the attributes used in the Crow, Olshavsky, and Summers (1980) were adapted to the specific needs of our study. For this session, Appendix B1 shows the final list of attributes used, as well as profiles for each of the suppliers used in the study.

6.3.2 Construction of Product Profiles

The ten attributes identified from the exploratory study were used to construct profiles of fictitious cities to be presented as experimental stimuli in the Main Study. The cities were then identified by alphabets and each city was rated on a 7-point scale (1 indicated a rating of "very bad" and 7 "Excellent") using the 10 attributes. There are a number of reasons why it was considered appropriate to use fictitious cities and to identify them by alphabets. *First,* the decision making literature suggests that brand name often represents an "information chunk" (Jacoby, Szybillo, and Busato-Schach, 1977), thereby reducing the amount of additional information the consumer searches. For example, Jacoby et al. (ibid) found that when brand name was available it was the most frequently used attribute (41 of their 42 subjects used this attribute). Furthermore, the authors found that respondents who had access to brand name used fewer other information dimensions compared to those who did not have brand name available to them.

Second, in order to use actual destination names we would have to seek actual information about the destinations on the relevant attributes. In addition to the extra work load this would imply, there is the problem of finding actual and reliable evaluations of various Asian cities on the attributes selected for the study. Furthermore, there is the risk of presenting information that conflicts with respondents prior knowledge of the cities which could have been arrived at either through personal experience or word-of-mouth communication with persons who have visited those places.

Third, the objective of the study is to investigate information integration strategies and not the actual Asian destinations that would be preferred by respondents. In other words our purpose is not to generalize to actual Asian destination selection. Rather we use destination selection in general and Asia in particular, just as a means to achieve an objective. *Finally,* it was felt that using fictitious destination names will allow us to manipulate the destination profiles in a manner that will facilitate testing of our hypotheses. Using actual Asian cities would imply that values in the destination by attribute matrix would be predetermined. The result could be that some destinations will clearly dominate the rest because they have superior scores either on all attributes or on attributes considered important by any respondent.

Overcoming this last problem was a major objective we sought to achieve in constructing the product profiles. Recall from chapter 2 that we expressed reservations about generalizability of the McClelland et. al (1987) study mainly because they had product profiles in which there were dominating alternatives. To ensure that no alternative clearly dominated all others, a modified version of the technique of cyclic hyper-graeco-latin square design for creating Pareto-optimal subsets suggested by Wiley (1978) was adopted in creating the product profiles. The modification in this case was necessary because, in our study, there were 10 alternatives and 10 attributes, but the ratings of alternatives were based on a 7-point Likert scale. Creating a perfect cyclic hyper-graeco-latin square design would require a 10-point rating scale. Therefore, we first created a Pareto-optimal 7 x 7 design and adjusted the matrix to 10 x 10. This resulted in some alternatives having a particular score on two attributes (e.g. scoring 7 on two attributes). On the whole, however, the total set of available cities was reasonably Pareto-optimal to the extent that no city was superior to others on more than two attributes. Appendix B2 shows profiles of the cities presented as ratings on the relevant attributes. Subjects in all experimental groups made their selections from this same product profile.

The same basic approach as described above, was used in constructing profiles of suppliers for the task in the Practice Session of the experiment. Here too, a 7 x 7 Pareto-optimal design was first created. This was then adjusted to cater for the fact that a 6 x 6 matrix was used in the Practice Session, with alternatives evaluated on a 7-point Likert scale. Appendix B1 shows profiles of the suppliers used in the Practice Session. This appendix also includes the specific

attributes used in this session of the experiment.

6.4 Sample

The sample used for the study consisted of 125 students recruited from three educational institutions in Norway - the Norwegian School of Economics and Business Administration (Norges Handelshøyskole, NHH) , the National Teachers College for Business Education (Statens Lærerhøyskole i Handels- og Kontorfag, SLHK), and the District Business Education College in Hardanger (Høyskoleundervisningen i Hardanger, HiH). Distribution of students from each of these institutions in the sample was as follows: NHH - 71, SLHK - 35, HiH - 13. Of the NHH students, 12 were graduate students taking a Masters course in International Business, three were doctoral students, and the remaining 56 were undergraduate students. Of the SLHK students, 18 were enrolled in full-time courses at the college whilst the remaining 17 were participants at an intensive adult education programme for the unemployed. Respondents from HiH were full-time participants in a similar adult education programme.

All SLHK students and the Masters students at NHH were recruited with the help of professors who taught courses in which the students were participants. The author himself taught a Marketing Research course to the students at HiH, and so used one of the class sessions for the data collection. As regards the undergraduate students at NHH, part of this group of respondents was recruited from the exploratory study described in section 6.3. At the beginning of the questionnaire used in that study, students were told that their responses would be used in planning a larger experimental study, and a request was made for them to also volunteer to participate in the main experiment. Space was provided in the questionnaire for respondents to indicate whether or not they were willing to participate in the main experiment, and if so to provide their names and addresses or phone numbers so that they could subsequently be contacted. Out of the 75 who returned the questionnaire, 23 volunteered to participate in the main experiment. The remaining 33 were recruited during class sessions for other courses at the school.

The total of 125 respondents were assigned to each of the experimental groups randomly.

Some of the subjects performed the decisions in group sessions at a computer terminal room, whilst others were ran individually at the author's office. For subjects who performed the tasks in group sessions, the number of subjects required for each group was first determined. Then the appropriate number of diskettes were created and randomly distributed to respondents. For those who were ran individually, these were asked to specify what date and time would be appropriate for them. So they showed up for the experiment at their own convenience. The procedure then was to assign the first respondent to Group 1, the second to Group 2, the third to Group 3, and the fourth to Group 4, the fifth to Group 1, sixth to Group 2, etc.[33] The entire sample of 125 respondents was finally distributed among the experimental groups as follows: Choose 1 condition - 46, Choose 3 condition - 27, Choose 5 condition - 26, Choose 7 condition - 26. The larger number of subjects in the Choose 1 condition was deliberate because of the need to compare information acquisition variables of this group with those of the aggregate of the last three groups in order to test hypotheses H1 to H6.

6.5 Data Collection Instrument

The data collection instrument used in our study was a computer version of the information board technique. As discussed earlier in chapter 2, a number of such computerized information boards have been used in previous research. Although any of these softwares could have been procured for the present study, they were deemed inappropriate for several reasons. First, Cook's (1987) *ISLab* software is designed specifically for investigating information overload effects on decision strategies. Therefore, even though the researcher can redefine the alternative by attribute matrix to suit his/her requirements, the subject still has to go through three overload conditions before getting out of the program. Second, all the software packages of which we are aware, are designed for single item selections, and we were not exactly sure whether or not the copyright holders would permit us to modify the

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[33] The only exception is the 17 participants at the intensive adult education course at SLHK who were all assigned to Group 1 (the Choose 1 condition). This was the last group of subjects used in the experiment, and so it was deemed desirable to assign them all to the Choose 1 condition to increase the size of this group for subsequent comparison with the aggregate of the Choose 3, Choose 5, and Choose 7 conditions - a comparison necessary for testing H1-H6.

structural properties of their softwares by adapting them to cater for multiple item selections. Moreover, the cost (in terms of time and effort) associated with such a modification might be high. This, in addition to the cost of procuring the software, would have exceeded the costs associated with developing our own software. Therefore, we opted for the latter.

A software called IASM (for Information Acquisition Monitoring Software) was, therefore, developed for the data collection. IASM consists of two main interfaces - a researcher interface and a decision maker interface. The researcher interface allows the experimenter to control the decision environment by specifying the number and names (descriptions) of available alternatives and attributes, the values of alternatives on attributes, the number of items subjects are required to select in the decision, and the instructions presented to subjects for the experiment. This provides a degree of versatility in terms of number of alternatives and attributes provided, decision type (i.e. whether single or multiple item decision), as well as manipulation of task instructions. The researcher interface also contains results of the experimental session, which include the information values accessed by the decision maker, the order in which these were accessed, time spent on each information value, time spent looking at the list of attributes and alternatives, total decision time, and the alternative(s) selected by the decision maker.

The decision maker interface (DMI) is the part of IASM with which the respondent interacts. This interface presents the respondent with information about the decision environment, instructions about the decision task, and guidelines as to how to work through the program. It also provides relevant information (list of available alternatives, description of attributes, and ratings of alternatives on attributes) when this is requested by the respondent. The DMI is divided into two experimental sessions - a Practice Session and a Main Session.[34] Specific features of the DMI (i.e, both practice and main sessions) are:

1. IASM is menu-driven so that subjects can decide for themselves what part of this interface they wish to access at any point during the decision process.

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[34] The researcher can also use the Practice Session actively in a within-subjects design. All that needs to be done is to change the instructions for this session. Alternatively, the researcher may omit the Practice Session altogether if it is not deemed relevant for any particular decision task.

Upon starting the program, the respondent is first presented with a general information screen welcoming him/her to the experiment and telling him/her what s/he is expected to do in the experiment. If desired, the information screen also informs the respondent that there is a practice session which s/he can go through to become familiar with the experimental task. In our study, all subjects were encouraged to go through this session and to take it as seriously as they would take the main session. After the subject has finished reading the instruction screen s/he presses 'Enter', and is then shown a menu with options for accessing the Practice Session, Main Session, previous instruction screen, or exiting the software. When the subject chooses either the Practice or main session, s/he is then presented with an information screen describing the decision scenario for the particular session, and instructed to select the required number of alternatives for the particular session. When s/he has finished reading this screen and pressed 'Enter', s/he is taken to the menu for the particular session where s/he can choose among the following options: 1) Ask for a list of the available alternatives, 2) Ask for a list of the attributes along which alternatives are described, (3) search for the values of alternatives on attributes, (4) Record his/her selections. At any point during the decision, the subject can return to the menu for the particular session in which s/he is, or to the main menu of the entire experiment.

2.   In IASM, information about alternatives is not displayed in matrix format.

When the subject requires information about the value of an alternative on a particular attribute, s/he has to first type in the name of the alternative at a prompt, press 'Enter', and type in a number associated with the relevant attribute. After pressing 'Enter' the second time, the value of the alternative on the attribute is then displayed on the screen. This introduces an element of information search costs in terms of effort required to access any information value. Moreover, by not presenting information in matrix format, subjects are free to form their own structural representations of the decision problem.

A more detailed description of the basic features of IAMS is presented in Appendix C. The software was first pretested among a number of doctoral students and professors at the author's institute. These were asked to go through the decision tasks, with a view to answering questions about the user-friendliness of the software, and to make suggestions for

improving aspects of it which they felt needed improvement. Overall, the software was judged user-friendly, and the respondents reported no problems at all with how it works. In fact, when we finally started the data collection, some subjects did not complete the Practice Session, and later reported on a post-decision questionnaire that they didn't complete this session because it was quite easy to understand how the software works, and so they didn't bother to go through the entire Practice Session.

6.6 Experimental Procedure

Of the 125 students who participated in the experiments, all participants from SLHK, HiH, and the Masters students at NHH (altogether 60 respondents) were ran in group sessions, usually at the central computer terminal room of the relevant institution. The undergraduate students at NHH (altogether 62) were ran individually at the author's institute over a 3-month period from October 1993 to January 1994. The three doctoral students performed the decision tasks at their own convenience in their offices. Description of the experimental procedure that follows uses respondents who were ran in group sessions as a point of departure. However, the basic procedure was the same also for those who were ran individually. It is worth mentioning that all experiments were conducted by the author himself, and efforts were made to conduct all sessions in as much the same way as possible.

Upon arrival at the computer terminal room, subjects were reminded that they were going to participate in an experiment in decision making. They were then told that, in order to avoid subsequent atypical behavior, they would be informed about the purpose of the study only after they had completed the decision tasks. They were told that all they needed to know was that they would be performing two decision tasks, and it was important for the study that they went through both tasks. The experimenter then briefly explained to them the structure of the computer software, and which keyboard functions they will be using most often. Special emphasis was placed on the interactive nature of the software, and the importance of reading instructions on the screen at all times. Subjects were then handed a list of the attributes used in constructing the stimuli and told that they could also request a display of the attribute-list from the software. The list on paper was to help them make easy reference to the attribute-list

without having to request a display from the software anytime they wanted to take a second look.[35] In addition to the attribute-list on paper, subjects were provided with extra sheets of paper on which to take notes if they decided to organize their thoughts on paper.[36] They were then told that they could spend as much time on the decision as they desired, but that once they start the process, it was of utmost importance that they concentrate on the decision and not do any other thing alongside. The experimenter was then always around to ensure that subjects do not pause during the decision to talk to each other, since this could result in bias in time taken to make a decision (one of the dependent variable of the study).

After this brief introduction, the experimenter showed subjects how to start the program. As indicated earlier, each subject made two decisions. The first was intended to familiarize subjects with the software, and so was initially described as a Practice Session, and subjects were encouraged to work through the entire practice session. After running the first 21 subjects, a preliminary analysis of their performances revealed that seven of them did not complete practice session. Some of them indicated on the post-decision questionnaire (discussed later in this section), that after going briefly through the practice session they easily understood how the software works, so they decided to go straight to the Main Session. Since the software was designed to keep track of relevant information search statistics also for the Practice Session, it was deemed necessary to re-label this session as "Part 1" and the Main Session as "Part 2" for subsequent subjects. This ensured that they took both parts equally seriously. Thus, in the rest of this dissertation the Practice Session will be referred to as "Session 1" and the Main Session as "Session 2".

As mentioned earlier, Session 1 involved selection of 3 suppliers from whom to request quotations for the supply of a computer network system, and was inspired by Crow, Olshavsky, and Summers (1980). In this session respondents were asked to assume that they were purchasing officers responsible for procuring a new computer network system for a large

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[35] This was deemed necessary because the software is designed to display only information requested by the respondent. Thus at any point in time, the screen display is the current information asked for. See Appendix C for a detailed description of how the software works.

[36] This was judged as desirable because it would be unrealistic to expect that subjects keep in memory all the information searched earlier when there is so much information available. Moreover, in real life decisions consumers have the choice of organizing their thoughts on paper.

Norwegian company. They were required to select 3 suppliers out of a list of 6 from whom to request quotations. They were further informed that each of the 6 suppliers have been evaluated by a group of experts using a set of 6 attributes and the evaluations were to be used in making their selections (See Appendix D2 for the full instructions). For this session, subjects in all experimental groups received the same set of stimuli and they selected the same number of suppliers.

Session 2 contained the experimental manipulations of interest to this dissertation. As indicated earlier, this session involved selection of cities to visit during a vacation in Asia. Here respondents were asked to assume that they had won a competition organized by their local travel agency and had been offered a vacation to Asia. The length of vacation period varied across experimental groups. Depending on experimental group they were then asked to select 1, 3, 5, or 7 cities to visit during the vacation. For the full instructions given in the Session 2, see Appendix D3.

After subjects completed their decisions, they were asked to fill out a questionnaire of which they had not been told in advance. In the questionnaire they were asked, among other things to report how they processed information prior to making a decision, the decision rule used in making their selections, and the importance of each attribute for their decision. Single-item questions were also used to measure how satisfied they were with the decisions they had made, their perceptions of decision accuracy, and task difficulty. The same set of questions were used for the decisions in both sessions. This questionnaire is reproduced in Appendices E1 and E2.

6.7 Measurement

6.7.1 Independent Variable

The main independent variable in the study was the number of items subjects are required to select in a decision task. Through appropriate task instructions (see appendix....), this variable was manipulated in the experiments by asking subjects in each of the groups to select a different number of the available alternatives. A check for the potency of this manipulation is very simple in this case. To determine whether or not the manipulation was successful, one only needs to look at the number of items actually selected by subjects in each group. Results of this manipulation check are presented in chapter 7.

6.7.2 Dependent Variables

In this section, procedures used in measuring each of the dependent variables specified in the hypotheses are outlined and discussed.

6.7.2.1 Proportion of Information Searched

Proportion of information searched was measured by dividing the total number of information pieces a respondent requests by the total number of available pieces of information. In Session 2 of our empirical study where we used a 10 alternative by 10 attributes matrix, there are 100 cells containing different pieces of information that can be requested. Investigation of a subject's search matrix can easily reveal whether all or only a portion of these 100 pieces of information were actually searched. The proportion searched can then be calculated as the number of cells examined divided by 100. Typically, this statistic is expected to vary between zero (for no information searched) and one (for all information searched). However, it is possible for a respondent to request the same piece of information more than once. If in addition to this such a respondent also searches the entire alternative by attribute matrix, then his/her score on this variable would be greater than 1. Furthermore, where a respondent requests for some pieces of information more than once but does not search the entire matrix, his/her score on this variable may be quite high in spite of the fact that s/he has engaged in

incomplete information search. For example, a subject may request information from 90 cells out of the total of 100 in the alternative by attribute matrix. If for 10 of these 90 cells the subject also requested information more than once s/he will have requested 100 pieces of information altogether. An examination of this figure alone would give the impression that the subject searched the entire matrix whilst in actual fact only 90% of the matrix was searched. To overcome the possibility of such a wrong conclusion we calculated proportion of information searched in two ways:

1) the number of unique pieces of information searched (i.e., disregarding the second, third, etc. request for any particular piece of information) divided by total number of information pieces available. This statistic is labelled "Proportion of Information Searched - Unique" and varies from zero to one.

2) the total number of information searched (including second, third, etc. requests for any particular piece of information) divided by the total number of information pieces available. This statistics was labelled "Proportion of Information Searched - Total". It has a lower value of zero (for no information searched) but no upper limit, even though it will typically not exceed 1.5.

In the present study, tests of differences among experimental groups gave the same results irrespective of whether unique or total information was used as the dependent variable. Consequently, in the hypothesis testing, we decided to use proportion of unique information searched.

6.7.2.2 Variability in Amount of Search Per Alternative/Attribute

Variability in amount of information searched per alternative/attribute was measured as the standard deviation of the proportion of information searched per alternative/attribute across the total set of available alternatives/attributes. As is the case for proportion of information searched, these variables were also calculated in two ways - by reference to the unique pieces of information searched (i.e., excluding subsequent requests for the same piece of information and by using the total number of information pieces searched (including multiple requests for the same piece of information). Consequently, two statistics were calculated for each of these

variables viz:

1) Variability in amount of information searched per alternative/attribute - unique.

2) Variability in amount of information searched per alternative/attribute - total.

As for proportion of information searched, tests of differences among experimental groups gave the same results irrespective of whether variability was calculated with respect to unique or total information searched. As such, in the hypothesis testing, variability used as dependent variable was that based on unique information searched.

6.7.2.3 Sequence of Information Search

Following Bettman and Jacoby (1976) and Payne (1976), sequence of information search was measured by the technique of "analysis of transitions" (Jacoby, et al., 1976; p. 310). This technique works by conceptualizing the movement from one acquired value of information (n) to the next (n+1) as a transition. Since any information value in an alternative by attribute matrix can be described as a row-column (alternative-attribute) coordinate, the transition from any nth to $n+1$th value can be one of four types - same alternative, same attribute; same alternative, different attribute; different alternative, same attribute; different alternative, different attribute. This results in four transition types labelled in the literature as follows:[37]

a) Type 1 transition - same alternative, same attribute

b) Type 2 transition - same alternative different attribute

c) Type 3 transition - different alternative, same attribute

d) Type 4 transition - different alternative, different attribute

If a subject requests N information values before making a decision, there are a total of $N-1$ transitions in the subject's search matrix. For each subject, these $N-1$ transitions were classified into each of the four categories above in order to determine the total number of each transition type in the matrix. This figure was then divided by $N-1$ to determine the

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[37] An alternative classification has been suggested by Hofacker (1984).

proportion of each transition type.[38] By examining the proportion of each transition type in a subject's search matrix, one can determine whether the subject used an alternativewise, attributewise or random search pattern. Specifically, the proportion of Type 2 transitions is a crude measure of the extent of alternativewise processing or, paraphrasing Bettman (1979), Choice by Processing Brands (CPB). Similarly, the proportion of Type 3 transitions is a crude measure of the extent of attributewise processing or Choice by Processing Attributes (CPA), whilst proportion of Type 4 transitions captures the extent of random processing *and* "shifts" necessary to execute an alternativewise or attributewise processing strategy.[39] A number of approaches to determining the search pattern more accurately have been suggested in the literature.

Denoting the proportion of Type 2 and Type 3 transitions by respectively SB (Same Brand) and SA (Same Attribute), Payne (1976) suggested an index defined by (SB-SA)/(SB+SA). For a subject following a pure CPB strategy, this index would be +1. By the same token, for a subject following a pure CPA strategy, the index would be -1. Thus Payne's index will typically vary from -1 (for a pure attribute processing strategy) to +1 (for a pure brand processing strategy). Payne (1976) also suggested an index of shifts in the sequence of processing defined by 1-SA-SB. This index is supposed to capture the proportion of Types 1 and 4 transitions in the matrix.

Bettman and Jacoby (1976) argued that Payne's index of transitions does not take into account the fact that the values of SA and SB have different ranges for different numbers of information pieces requested and the total number of attributes and alternatives considered. In particular, given that a subject has requested x pieces of information, considered y

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[38] Since subjects did not search equal amounts of the available information, the only way to make comparisons across subjects is to use the proportion, not the absolute number of each transition type.

[39] The idea of a shift can be illustrated by an example. Given a decision task in which there are 10 alternatives (A...J) and 10 attributes (1...10), a subject who follows a pure CPB strategy may begin search in the following order: A1, A2, A3, ..., A10. Once all attributes have been searched for alternative A, the subject may then move on to say alternative B and search in the following order: B1, B2, ..., B10. Although the transition from A10 to B1 is of type 4, it does not represent a random transition. Rather this transition is necessary to execute the subject's alternativewise processing strategy. If the subject searches the entire matrix, there would be 9 such transitions. In general, where there x alternatives and y attributes, there will x-1 such transitions for a pure CPB strategy and y-1 for a pure CPA strategy.

alternatives and z attributes, Bettman and Jacoby (1976) argue that the maximum values possible for SB and SA are, respectively, $(x-y)/(x-1)$ and $(x-z)/(x-1)$. Dividing each of SB and SA by the maximum possible, one can then arrive at normalized values for SB and SA which they call respectively SBI (Same Brand Index) and SAI (Same Attribute Index). Both will range from 0 to 1.

In our empirical study we measured search patterns using both Payne's (1976) index and Bettman and Jacoby's (1976) SBI and SAI. We then used the criteria suggested by Bettman and Kakkar (1977) to determine if a subject's search pattern should be classified as CPB, CPA, CFP (Choice by Feedback Processing) or other. Bettman and Kakkar's criteria are as follows:

1. For classification into a CPB strategy, SB should be greater than or equal to 0.5, SBI should be greater than or equal to 0.6, and SB-SA should be greater than or equal to 0.3.

2. For classification into a CPA strategy, SA should be equal to or greater than 0.5, SAI should be equal to or greater than 0.6, and SA-SB should be equal to or greater than 0.3.

3. For classification into a CFP strategy, the absolute value of SB-SA (i.e., ISB-SAI) should be less than or equal to 0.2, SB should be greater than or equal to 0.3, SA should be greater than or equal to 0.3, SBI should be greater than or equal to 0.4, and SAI should be greater than or equal to 0.4.

It should be noted that Payne's index does not feature in Bettman and Kakkar's criteria. In analysis of our data, we used Payne's Index, SBI and SAI which are all continuous variables, in ANOVA analysis with experimental group as the independent variable. We then used Bettman and Kakkar's criteria to classify respondents into groups with different processing strategies, and crosstabulated the resulting classification with the experimental groups formed for our study. As discussed in chapter 7, these led to similar conclusions about differences in processing strategies across experimental groups.

6.7.2.4 Decision Time

Decision time was measured unobtrusively by the software used in the data collection (see Appendices F1 and F2). In addition to recording the total spent by each subject on the entire decision, the software also recorded the following:

a)   Time spent examining list of alternatives. Here the software recorded the number of times the list of alternatives was accessed, the stage in the decision process this was done, and the time spent examining the list on each of the times it was accessed. At the end of the decision it also added the different times to arrive at a total time spent on examining the list of alternatives.

b)   Time spent examining the attribute list. The recording system here was the same as for list of alternatives.

c)   Time spent examining each information value. In addition to monitoring the sequence in which information values were requested, the software also monitored the time spent looking at each information value. Then at the end of the decision it automatically calculated the total time spent examining all requested pieces of information.

Total decision time was calculated as the sum of a), b), and c). As illustrated in Appendix F1 and F2, the software also recorded the selections made by each respondent.

6.7.2.5 Perceptions of Task Difficulty

This variable was measured by means of a question included in the post-decision questionnaire (Appendix E1). Subjects were simply asked to indicate on a 7-point Likert scale, how difficult/easy it was for them to decide which of the cities (suppliers for Session 1) to select for their vacation (to request quotations from).

PART IV

DATA DESCRIPTION AND HYPOTHESIS TESTING

This part of the dissertation consists of 2 chapters. In chapter 7, results of preliminary analyses to determine quality of the data collected are presented and discussed. Chapter 8 is devoted to presentation and discussion of results of tests of the hypotheses formulated for the empirical study.

CHAPTER 7

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DESCRIPTION AND EVALUATION OF DATA QUALITY

This chapter presents results of preliminary data analyses that were conducted to determine the quality of the data collected to test the hypotheses put forward in chapter 5. The chapter is organized as follows. In section 7.1, results of a manipulation check to determine effectiveness of task instructions given to each experimental group are presented. Section 7.2 presents descriptive statistics on each of the dependent variables for Session 2 of the experiment. It also presents Pearson correlation coefficients among the variables. In section 7.3, results for tests of the assumptions underlying the analysis technique chosen for the hypothesis testing are presented and discussed. Section 7.4 presents results of initial tests to determine whether the conditions under which subjects performed the decision tasks had any impact on the dependent variables. This was deemed necessary because some subjects performed the decision tasks individually whilst others did so in group sessions at a computer terminal room. Finally, section 7.5 examines group differences on the dependent variables for Session 1 of the experiment.

7.1 ˉ Manipulation Check

As may be recalled from the discussion in chapter 6, the independent variable in the present study was manipulated through task instructions. This was done by asking subjects in each of the experimental groups to select a different number of the available alternatives. As one of the requirements for determining the quality of data collected from each respondent, it was deemed necessary to examine the extent to which task instructions for each group were

followed by each of the subjects assigned to that group. One effective way of doing this is to look at the number of alternatives actually selected by subjects in each group, as well as the content of information searched prior to making the selections. With regards to the latter, if say, a subject selected alternative D, but his/her search protocol shows that no information was collected on D prior to the choice, then there is reason to doubt the quality of data for that respondent. Concerning examination of the number of alternatives actually selected, this is probably the only way to check for potency of the experimental manipulation. The assumption here is that if the experimental instructions were followed by any particular subject s/he would select the appropriate number of items to be selected by subjects in the group to which s/he was assigned.

Examination of the number of alternatives actually selected by subjects revealed that three subjects in the Choose 7 condition selected three instead of the seven alternatives they were required to select. Similarly, two subjects in the Choose 5 condition selected three cities instead of the five they were asked to select. It was first decided to reassign these subjects to the Choose 3 condition for subsequent analysis, on the grounds it could be assumed that they all searched available information with a view to selecting three out of the available alternatives. However, upon second thought it was decided to drop them entirely from the sample, because it can also be argued that these subjects never bothered to read the experimental instructions for Session 2. They simply assumed that the decision task requires selection of three alternatives as was the case for Session 1 where they were required to select 3 out of 6 alternatives.

In addition to these five subjects from the Choose 5 and Choose 7 conditions who were dropped from the sample, one subject in the Choose 3 condition was also dropped because s/he selected the same alternative three times. Here again, the initial decision was to retain him/her for the subsequent analyses. However, in view of the difficulty in deciding why this situation arose, it was decided to also drop this respondent from the final sample. Thus altogether, six subjects were dropped from the initial sample of 125 respondents, leaving a final sample of 119 respondents for subsequent analyses. Distribution of these respondents among the experimental conditions as follows:

Choose 1 condition - 46;

Choose 3 condition - 26;

Choose 5 condition - 24; and

Choose 7 condition - 23.

7.2 Descriptive Statistics

Prior to conducting a more detailed analysis of the data with a view to hypothesis testing, it was also considered appropriate to run simple tabulations of frequencies and descriptive statistics. The objective here was to determine the overall quality of the data by checking for unusual values in the frequency distributions which could arise due to errors in punching in the data. Descriptive statistics (means, standard deviations, skewness, kurtosis, and minimum and maximum values) for each of the relevant dependent variables are shown in Table 7.1 for the entire sample.

Table 7.1
Descriptive Statistics for Entire Sample

Variable	Mean	St. Dev.	Kurtosis	Skewness	Min.	Max.
Proportion of Info. Searched	.660	.287	-1.215	-.278	.02	1.00
Variability in Search per Alt.	1.453	1.374	.312	.896	.00	4.90
Variability in Search per Attrib.	2.030	1.890	-1.615	.271	.00	5.00
Sequence of Search						
Payne's Index	.256	.830	-1.509	-.522	-1.00	1.00
Same Brand Index (SBI)	.599	.405	-1.553	-.457	.00	1.003
Same Attribute Index (SAI)	.357	.406	-1.445	.568	.00	1.01
Decision Time (in Minutes)	25.617	23.376	.863	1.335	1.50	99.05
Perception of Task Difficulty	4.092	1.513	-.289	.080	1	7

n = 119 for all variables

Considering first the minimum and maximum values for each dependent variable, Table 7.1 shows no unusual values that could be attributed to either errors in data-punching or in calculating the indices of search sequence. In particular, note that Payne's Index has a minimum value of -1 and a maximum of 1. This is in accordance with theory. Also both SBI and SAI have minimum values of 0 and maximum values of almost 1. Maximum values are not exactly 1 (according to theory) due to rounding out during some stages in calculation of the indices.

As regards means and standard deviations, we note that standard deviations for most of the variables are quite high, especially in relation to corresponding means. In particular, note the exceptionally high standard deviations for decision time, variability in search per alternative, and variability in search per attribute. Standard deviations for these variables are almost equal to their corresponding means. This suggests that there were significant variations in respondents' scores on the dependent variables used in the study. Put differently, the variables were able to discriminate between subjects in the sample. Finally, distributional aspects of the dependent variables are captured in the values for skewness and kurtosis. For skewness, we note that with the exception of decision time, absolute values of skewness indicators for all variables are less than 1. This indicates that distributions of these variables are fairly symmetrical. With respect to kurtosis, however, most of the variables have distributions that are fairly platykurtic (kurtosis less than zero).

In addition to the descriptive statistics presented in Table 7.1, correlations among the dependent variables were also computed. The reason for this is that, high correlations among the dependent variables will have implications for choice of analysis technique in testing the hypotheses formulated for this dissertation. Results of correlation analysis for the dependent variables are shown in Table 7.2. As can be seen from the Table, a reasonable number of the correlation coefficients are significantly greater than zero at $p \le .05$. Note however, that although 13 out of 27 coefficients are statistically significant, only three of the coefficients are above $\pm .55$. Incidentally, these happen to be correlations among the three alternative measures of sequence of search, i.e., Payne's Index (PI), the Same Brand Index (SBI) and the Same Attribute Index (SAI). These measures are all nearly perfectly correlated with each other (correlations coefficients are .95 or higher). This is an indication that any of these

variables can be used as a measure of sequence of search. In chapter 8, SBI will be used as the principal measure of sequence of search, mainly because it represents an improvement over Payne's Index.[40]

The other coefficients that are significant at $\alpha = 0.01$ for a two-tailed test, are those between proportion of information searched and all other dependent variables except perceptions of task difficulty, as well as those between variability in search per attribute and each of the three measures of search sequence. The correlation between variability in search per alternative and decision time is significant at $\alpha = 0.05$. In conclusion, it is fair to say that whilst proportion of information searched is correlated with the other dependent variables, these other variables do not correlate highly among themselves. The implications of these correlation coefficients for choice of analysis technique will be taken up in chapter 8.

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[40] SAI could also be used, but this measure is simply the complement of SBI, and so it would be redundant to use both. For interested readers, tests of the sequence of search hypotheses using SAI and Payne's Index will also be reported as appendices.

Table 7.2
Pearson Correlation Coefficients for Dependent Variables

	Prop. of Info.	Var./Alt	Var./Attrib.	PI	SBI	SAI	Time	Diff.
Prop. of Info.	1.0000	-	-	-	-	-	-	-
Var./Altern.	-.2180**	1.0000	-	-	-	-	-	-
Var./Attrb.	-.5487**	-.1652	1.0000	-	-	-	-	-
PI	.3755**	.1479	.3988**	1.0000	-	-	-	-
SBI	.3880**	.1518	-.3911**	.9957**	1.0000	-	-	-
SAI	-.3779**	-.1370	.3864**	-.9818**	-.9495**	1.0000	-	-
Time	.3109**	-.2001*	.0499	.0776	.0863	-.1000	1.0000	-
Diff.	.0427	.1077	-.0521	-.0094	.0046	-.0147	.0418	1.0000

** p < .01   * p < .05

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7.3 Tests of ANOVA Assumptions

The research questions formulated for this dissertation call for examination of information acquisition differences between consumers who select one alternative and those who select more than one from the same product, as well as corresponding differences when different subset sizes are to be selected in multiple item selection decisions. As such, the research hypotheses were formulated in terms of group differences on the dependent variables, and a between-subjects design was used in the experiment. Therefore, it was deemed appropriate to use analysis-of-variance (ANOVA) for the hypothesis testing, because this would enable comparison of group means for each of the dependent variables. The next step then involved conducting preliminary tests to determine if the assumptions upon which ANOVA is based were met by the data collected.

Specifically, there are three main assumptions which the data must meet for the classical ANOVA model (and associated analysis-of-covariance, ANCOVA) to be appropriate as a means for testing the hypotheses of this dissertation. These are:[41]

1. the assumption of normally distributed treatment populations;
2. the assumption of equal treatment population variances (or homogeneity of error variance), and
3. the assumption of independence of error components.

In practice, the assumption of independence of error components is achieved by random assignment of subjects to treatment conditions, one of the fundamental principles in experimental design (Keppel, 1982). In this case, since subjects in the present study were randomly assigned to each of the four experimental conditions, independence of error components can reasonably be assumed.

Whilst the assumption of independent error components is directly concerned with design of the experiment, the first two assumptions (i.e. normally distributed treatment populations and

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[41] For a detailed discussion of these assumptions the interested reader should consult Iversen and Norpoth (1987), Keppel (1982), or any other classical statistics text.

homogeneity of population variances) are empirical issues that have to be determined from the data collected. The specific requirements of these assumptions imply that prior to deciding the appropriateness of using ANOVA to test the hypotheses, it is necessary to test for normality in *each of the groups* relevant for testing any particular hypothesis, as well as for equal population variances across the relevant groups. In this regard, it is useful to note that testing hypotheses H1-H6 involves comparing information search statistics for the Choose 1 condition of the study (hereafter called the "Single Item" group) with search statistics for the aggregate of the Choose 3, Choose 5, and Choose 7 conditions (hereafter called the "Multiple Item" group). On the other hand, testing of hypotheses H7-H11 requires making similar comparisons among the Choose 3, Choose 5, and Choose 7 conditions. In the discussion that follows, results of tests for normality and homogeneity-of-variance are presented for each of these two sets of comparisons.

7.3.1 Tests for Normality in Treatment Populations

To test the assumption of normally distributed treatment populations, relevant statistics are skewness and kurtosis values, as well as their corresponding standard errors. In the present study, these statistics were computed for the Single vs. Multiple Item comparison (cf. H1-H6), and for the Choose 3, Choose 5, and Choose 7 comparison (cf. H7-H11). Tables 1a. to 2b of Appendix H show descriptive statistics, which also include skewness and kurtosis indicators, for the two sets of comparison. As shown in these Tables, for both sets of comparisons, skewness and kurtosis values were generally within acceptable ranges for most dependent variables. The only notable exception is decision time for which skewness and kurtosis were abnormally high in the Single Item group. Also for this same variable, kurtosis was greater than 2 in the Choose 7 group. Otherwise, kurtosis for all variables generally had absolute values of less than two, and skewness values were typically less than one.

Although the skewness and kurtosis values suggest some departures from normality, when they were evaluated within the context of reported standard errors associated with each indicator, these departures were not significant enough to warrant too much concern. Moreover, as has been consistently shown in the experimental design literature, the F-statistic in classical ANOVA is fairly robust to violations of the assumption of normally distributed

treatment populations.[42] More specifically, Keppel (1982) notes that:

> "violations of the normality assumption do not constitute a serious problem, except if the violations are severe. Under these circumstances, we need only worry about F's that fall close to the critical value of F defining the start of the rejection region" (p. 86).

In light of the overwhelming evidence on robustness of the F-test to moderate departures from normality, it was finally concluded that the fairly minimal departures found in the present data, do not constitute any serious threat to valid statistical inference based on the ANOVA F-test.

7.3.2 Tests for Homogeneity of Variance

The previous has shown that the F-statistic of classical ANOVA is fairly robust with respect to violations of the assumption of normally distributed treatment populations. However, the same cannot generally be said of violations of the homogeneity of variance assumption. Although some sections of the literature argue that the F-test is fairly robust to this assumption too, others are not entirely convinced. Specifically, Winer, Brown, and Michel (1991) citing Wilcox (1987) admonish that even though:

> "the experimental design literature is prone to emphasize that the analysis of variance F test is robust with regard to this assumption..[usually based upon the work of Box, 1954a; 1954b] ..... the situation regarding violations of the homogeneity of variance is much more complex than is implied by the usual interpretations of the work of Box" (p. 101-3).

These authors suggest that when the homogeneity-of-variance assumption is violated, the experimenter either "should strive for large and equal sample sizes as one way of assuring that the nominal level of significance is approximated" or else consider other alternatives to the analysis of variance F-test (p. 110). Because of this admonition, it was deemed appropriate to take violations of the homogeneity of variance assumption more seriously. Consequently,

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[42] For a useful review of some of the earlier literature on this issue, see Glass, Peckham and Sanders (1972).

this section presents more detailed results of the tests of this assumption.

Although a number of tests of this assumption have been suggested in the literature, the tests used in this dissertation are those based on Cochran's C and Bartlett-Box's F statistics.[43] Preliminary tests for the homogeneity-of-variance assumption were performed using the MANOVA procedure in SPSS-X. Since the test has to be done for the experimental groups used in testing the hypotheses, two sets of tests were performed - one for hypotheses H1-H6 (i.e., for the Single vs. Multiple Item comparison) and the other for H7-H11 (i.e. for the Choose 3, Choose 5, and Choose 7 comparison). Results for the Single vs. Multiple Item comparison are shown in Table 7.3a, whilst those relevant for testing hypotheses H7-H11 are shown in Table 7.3b.

Table 7.3a
Results of Univariate Homogeneity of Variance Tests for H1-H6

VARIABLE	COCHRAN'S C		BARTLETT-BOX'S F	
Proportion of Information Searched	C(59,2) = .51411	p = .829	F(1,35537) = .04394	p = .834
Variab. in Search Per Alternative	C(59,2) = .69669	p = .002	F(1,35537) = 9.83908	p = .002
Variab. in Search Per Attribute	C(59,2) = .51069	p = .870	F(1,35537) = .02503	p = .874
Sequence of Search				
Payne's Index	C(58,2) = .55000	p = .447	F(1,34450) = .55272	p = .457
Bettman & Jacoby's SBI	C(59,2) = .54885	p = .454	F(1,35537) = .53430	p = .465
Bettman & Jacoby's SAI	C(59,2) = .58517	p = .189	F(1,35537) = 1.65956	p = .198
Decision Time	C(59,2) = .60436	p = .106	F(1,35537) = 2.36840	p = .124
Perceptions of Task Difficulty	C(59,2) = .51507	p = .818	F(1,35537) = .05010	p = .823

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[43] The decision to use these two tests is based on their popularity in the literature. Whilst either of the two could be used, it was decided to use both in order to ensure maximum reliability of the conclusions arrived at. As suggested by Winer, Brown, and Michel (1991) the two tests may lead to different conclusions under certain circumstances.

Table 7.3b.
Results of Univariate Homogeneity of Variance Tests for H7-H11

VARIABLE	COCHRAN'S C		BARTLETT-BOX'S F	
Proportion of Information Searched	C(21,3) = .33937	p = 1.000	F(2,8844) = .00440	p = .996
Variab. in Search Per Alternative	C(21,3) = .42759	p = .396	F(2,8844) = .62301	p = .536
Variab. in Search Per Attribute	C(21,3) = .40971	p = .539	F(2,8844) = .56850	p = .566
Sequence of Search				
Payne's Index	C(21,3) = .36835	p = .980	F(2,8844) = .32012	p = .726
Bettman & Jacoby's SBI	C(21,3) = .36164	p = 1.000	F(2,8844) = .17777	p = .837
Bettman & Jacoby's SAI	C(21,3) = .36999	p = .960	F(2,8844) = .33649	p = .714
Decision Time	C(21,3) = .38651	p = .768	F(2,8844) = .36921	p = .691
Perceptions of Task Difficulty	C(21,3) = .35193	p = 1.000	F(2,8900) = .03248	p = .968

Prior to discussing the results and their implications, it is worth noting that both the Cochran and Bartlett-Box tests are based on a null hypothesis that variances in the relevant treatment populations are equal. Therefore, high values of the test statistics, and associated low p-values imply rejection of the homogeneity of variance assumption. With this in mind, it can be seen from Tables 7.3a and 7.3b, that for most of the dependent variables in the two sets of comparisons, homogeneity of treatment population variance can reasonably be assumed. In fact, the only variable for which the null hypothesis is rejected is variability in search per alternative for the Single vs. Multiple Item comparison (Table 7.3a). Both the Bartlett-Box and Cochran tests, show a statistically significant result for this variable ($p < .005$).

The implication of these results is that, for variability in search per alternative, the suggestions by Winer, Brown, and Michel (1991) have to be revisited. Specifically, in order to use the classical ANOVA model to test the hypothesis of differences between the Single and Multiple

Item groups in variability in search per alternative with the current data, we need to make sample sizes in the two groups equal. Otherwise alternative analysis techniques need to be considered.

Clearly, in the present study, it was difficult to achieve equal sample sizes for the analyses of differences between single and multiple item decisions, mainly because the experiment was designed in such a way that differences among the Choose 3, Choose 5, and Choose 7 conditions could also be investigated. As such, even if sample sizes for all four experimental conditions were initially equal, the need to pool the Choose 3, Choose 5, and Choose 7 conditions into a multiple item group for testing H1 to H6 would unavoidably lead to unequal sample sizes. Based on this consideration, in testing for differences in variability of search per alternative between the Single and Multiple Item groups, the option was to follow the second advice and consider using alternative analysis procedures. Specifically, test of the hypothesis for this variable was performed using a nonparametric (or distribution-free) statistical technique.[44] The specific technique used, and results of the analysis will be presented in chapter 8.

7.4 Effects of Data Collection Method

Another set of preliminary analysis performed prior to hypothesis testing involved determining the extent to which method of administering the experiment had an impact on the subjects' scores on the dependent variables. Recall from chapter 6 that subjects used for the experiment were recruited from three different Norwegian institutions (NHH, SLHK, and HiH). Recall also that for each of NHH and SLHK, two groups of subjects were used. Therefore, respondents could be classified into five distinctive groups on the basis of where the data was collected. It was therefore, deemed appropriate to test whether subjects scores on the dependent variables depended on which of these groups they belonged to. Analysis of variance for all dependent variables showed a statistically significant result only for decision time ($F_{1,114} = 9.228$; $p<.001$). Inspection of the group means showed that students from NHH

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[44] For a useful introduction to nonparametric statistics, see Gibbons (1993) or Siegel and Castellan, Jr. (1988). Other useful references are Gibbons and Chakraborti (1992) and Noether (1991).

generally spent more time on their decisions (average of 34.30 minutes) than those from the other institutions (average of 12.80 minutes).

Recall also from chapter 6 that for some of the respondents, the experiments were conducted in group sessions, whilst others performed the tasks individually at the author's institute. A relevant issue that arises is whether these two methods of collecting the data had any impact on the dependent variables. Specifically, there is a possibility that subjects who performed the tasks in group sessions might be influenced in one way or the other, by the presence of other respondents in the room. For example, a subject might feel that s/he is spending unusually more time on the decision when other subjects in the group have completed their decisions. To test for any such effects, group means of subjects who performed the tasks as part of a group (60 in the final sample) were compared with means for subjects who were ran individually (59 in the final sample), irrespective of which experimental group they were assigned to. Comparisons were made for all dependent variables using ANOVA.

Again, the only dependent variable for which a statistically significant result was found was decision time. The results showed that subjects who performed the tasks individually generally spent more time on their decisions (mean, 36.91 minutes) than those who performed them in group sessions (mean for this group was 14.51). The F-value associated with these differences is $F_{1,117} = 35.260$; p<.0001. Implications of these differences and those presented earlier will be addressed at appropriate places in the hypothesis testing.

7.5 Group Differences in Dependent Variables for Session 1

As would be recalled from chapter 6, subjects in each experimental group performed two decision tasks. The first was included to familiarize them with the software, and to put every respondent at fairly the same level of familiarity before they proceeded to the main task. In this task, all subjects selected three alternatives from a set of six described along six attributes. In other words, Session 1 of the experiment did not distinguish between experimental groups. This implies that group membership should not have an effect on information acquisition variables for this session. If this is actually the case, then it would

have two implications for the results of hypothesis testing presented in chapter 8:

1.   It will increase our confidence in any observed group differences on the dependent variables for Session 2 of the experiment.

2.   It could help justify using variables from Session 1 as covariates in the subsequent hypothesis testing.

Consequently, univariate ANOVA for dependent variables from Session 1 of the experiment was performed using experimental group as independent variable. Consistent with the distinction between single and multiple item groups on one hand, and size of subset to be selected on the other, two separate comparisons were made. The first was between the Single and Multiple Item groups, and the other was among the Choose 3, Choose 5, and Choose 7 groups. Tables 7.4a and 7.4b show the results.

Table 7.4a.
Tests for Differences in Information Acquisition for Session 1 (Comparison Between Single and Multiple Item Groups)

			GROUP MEANS	
Variable	F-Value	p	Single	Multiple
Proportion of Information Searched	$F_{1,109} = .002$	.965	.85 (n=44)	.85 (n=67)
Variab. in Search Per Alternative	$F_{1,109} = .054$	.817	.33 (n=44)	.35 (n=67)
Variab. in Search Per Attribute	$F_{1,109} = .002$	.967	.50 (n=44)	.49 (n=67)
Sequence of Search				
Payne's Index	$F_{1,107} = 1.520$	.220	.24 (n=43)	.45 (n=66)
Bettman & Jacoby's SBI	$F_{1,109} = .150$	.699	.56 (n=44)	.44 (n=67)
Bettman & Jacoby's SAI	$F_{1,109} = 2.084$	.152	.38 (n=44)	.26 (n=67
Decision Time (in minutes)	$F_{1,108} = .096$	.757	11.58 (n=43)	12.12 (n=67)
Perceptions of Task Difficulty	$F_{1,108} = .482$	.489	4.34 (n=44)	4.15 (n=66)

* p-values are two-tailed probabilities
** Task difficulty was measured on a 7-point Likert scale anchored at 1 = Very Easy ... 7 = Very Difficult

Table 7.4b.
Tests for Differences in Information Acquisition for Session 1 (Comparison Among Choose 3, Choose 5 and Choose 7 Groups)

Variable	F-Value	p	GROUP MEANS		
			Choose 3	Choose 5	Choose 7
Proportion of Information Searched	$F_{2,64} = .279$	.757	.89 (n=24)	.83 (n=22)	.84 (n=21)
Variab. in Search Per Alternative	$F_{2,64} = .064$	.938	.39 (n=24)	.35 (n=22)	.32 (n=21)
Variab. in Search Per Attribute	$F_{2,64} = .028$	.973	.48 (n=24)	.47 (n=22)	.53 (n=21)
Sequence of Search					
Payne's Index	$F_{2,63} = .952$	.391	.36 (n=24)	.34 (n=21)	.65 (n=21)
Bettman & Jacoby's SBI	$F_{2,64} = .686$	.507	.65 (n=24)	.63 (n=22)	.01 (n=21)
Bettman & Jacoby's SAI	$F_{2,64} = .972$	.384	.29 (n=24)	.31 (n=22)	.16 (n=21)
Decision Time (in minutes)	$F_{2,64} = 3.549$	.035	16.19 (n=24)	10.23 (n=22)	9.45 (n=21)
Perceptions of Task Difficulty	$F_{2,63} = 1.894$	.159	4.57 (n=23)	3.82 (n=22)	4.05 (n=21)

* p-values are two-tailed probabilities

** Task difficulty was measured on a 7-point Likert scale anchored at 1 = Very Easy ... 7 = Very Difficult

As can be seen from Tables 7.4a and 7.4b, for almost all information acquisition variables for Session 1 of the experiment, there were no significant group differences in any of the two sets of comparisons. The only exception is again decision time for the Choose 3, Choose 5, and Choose 7 comparison. For this variable, Table 7.4b shows that the differences are significant at $\alpha=.05$. Again implications of this finding would be discussed at appropriate places in the hypothesis testing. For now, however, we note that the results are entirely in line with expectations. In fact, the results show that mean proportion of information searched by subjects in all four experimental groups was almost equal.

As indicated earlier, these results would go a long way to increase our confidence in any observed group differences on the dependent variables for Session 2 of the experiment. They also suggest that dependent variables for Session 1 can appropriately be used as covariates.

CHAPTER 8

RESULTS OF HYPOTHESIS TESTING

This chapter is organized as follows. In section 8.1, considerations in the choice of statistical technique for testing the hypotheses are outlined. Section 8.2 presents results of the hypothesis testing. Finally, section 8.3 briefly discusses supplementary analyses that were performed to add additional insights into the conclusions drawn from the hypothesis testing.

8.1 Considerations in Choice of Statistical Technique

In deciding which analysis technique to use in testing the hypotheses, the guiding principle was one of selecting the simplest statistical technique that would provide a reasonably valid test of the hypotheses. As discussed earlier in chapter 7, because the research questions call for examination of information acquisition differences between groups of consumers who select different numbers of items from the same available set of alternatives, it was deemed appropriate to use analysis of variance (ANOVA) for the hypotheses testing. With more than one dependent variable investigated in the study, the choice then was between univariate ANOVA, where group differences are investigated for each dependent variable separately, and multivariate ANOVA (or MANOVA), in which the joint effect of all dependent variables are investigated across experimental groups.

The literature often suggests use of MANOVA in situations where the researcher has multiple dependent variables with high inter-variable correlations.[45] In that case, MANOVA would

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[45] See for example, Bray and Maxwell (1985, pp. 10-13) for a discussion of conditions under which MANOVA is more appropriate than ANOVA.

seem to be the appropriate analysis technique in view of the high correlations among some dependent variables in the present study (see Table 7.2 in chapter 7). Moreover, it could be argued that some of the variables jointly determine the strategy used by any particular respondent, thereby presenting a further case for using MANOVA. There are, however, a number of reasons why MANOVA was not deemed appropriate for testing the hypotheses of this dissertation.

First, from Table 7.2 we note that, although Pearson correlation coefficients between proportion of information searched and all other dependent variables were significant at α = 0.01 for a two-tailed test, the highest coefficient was -.5487 (between proportion of information searched and variability in search per attribute), and that all others were lower that $\pm$ 0.4. The only other significant correlation was between variability in search per attribute and sequence of search.[46] Thus, only one of the dependent variable correlates highly with four of the remaining five whilst the latter have insignificant correlation coefficients among themselves.

Second, even though some of the dependent variables jointly enable determination of the decision strategy used by a particular respondent, there is no theoretically predetermined way in which these variables should relate to each other. For example, whilst a combination of high proportion of search and alternative-based processing may lead the researcher to infer a compensatory heuristic, this is not the only theoretically possible combination of the variables. It is also possible to observe low proportion-alternativewise or high proportion-attributewise search patterns. Each of these combinations would lead to a different inference about the strategy used. In terms of the research questions posed for this dissertation, it is also possible to find group differences for some of the dependent variables but not for others. In short, even though MANOVA is to be preferred when the researcher has multiple measures of a construct, the dependent variables in this study do not constitute multiple measures in the sense of being a multi-operationalization of a single construct.

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[46] Correlations among each of the three measures of sequence of search are not relevant for the decision to use univariate or multi-variate ANOVA since only one of the measures would be used in the hypothesis testing.

Finally, since the research questions and corresponding hypotheses were formulated in terms of univariate group differences in the dependent variables, it is only appropriate to test the effects of group membership on each variable separately, thereby providing direct test of the hypotheses. Configurations of the dependent variables for each experimental group could then be subsequently derived, as a means of deducing the dominant decision strategy implied by the average observations.

In light of the above considerations, it was finally decided that the hypotheses would be tested better by univariate ANOVA than by MANOVA. It should be mentioned that in spite of this decision, MANOVA was also performed on the data, and the resulting conclusions were similar to those arrived at through univariate ANOVA. Before turning to the formal hypotheses testing, it is also worth mentioning that, because each subject performed two decision tasks in the experiment, there is also the opportunity of incorporating within-subjects analyses to the tests of group differences on each dependent variable. Therefore, in addition to examining the between-subject effect, for each variable, corresponding scores from Session 1 of the experiment were also used as covariates in an analysis-of-covariance model. For example, proportion of information searched in Session 1 was used a covariate in analyzing group differences in proportion of information searched for Session 2. Consequently, for each dependent variable we also present results of univariate analysis of covariance with the corresponding Session 1 variable as covariate.

8.2 Hypothesis Testing

Recall from chapter 4 that two sets of hypotheses were formulated for the empirical study - one set pertaining to differences between single item and multiple item selection decisions, and the other set addressing differences among multiple item selection decisions in which different subset sizes are to be selected. Recall also from chapter 5 that, in the experimental study, there were four experimental groups - the Choose 1, Choose 3, Choose 5, and Choose 7 conditions. As indicated in chapter 7, in order to test hypotheses H1 to H6, the last three conditions (all of which are multiple item selection decisions) were collapsed together into one group (the "Multiple Items" group) for comparison with the Choose 1 condition (the "Single Item" group). Hypotheses H7 to H12 were tested by comparing the means of the Choose 3, Choose 5, and Choose 7 conditions on each of the dependent variables. The presentation that follows is organized around these two sets of hypotheses. Results of tests for differences between the Single and Multiple Items groups are presented in section 8.3.1 whilst those for differences among the three item groups are reserved for section 8.3.2.

8.2.1 Tests of Differences Between Single and Multiple Item Decisions

In the sections that follow results of the univariate ANOVA between the Single and Multiple Item groups are presented. For each dependent variable, the relevant hypothesis from chapter 5 is stated. Then results of the ANOVA test are presented along with a brief discussion of the results. Detailed discussion of overall results of the empirical study is reserved for chapter 9.

8.2.1.1 Differences in Proportion of Information Searched

The proportion of available information a consumer searches prior making a decision is one of many factors that determine the strategy employed in evaluating available alternatives. In chapter 4 we argued, among other things, that because of the need to "round out" (or balance) the selected subset, multiple item selection decisions may well resemble judgement tasks in the sense that each alternative has to be evaluated as a whole to determine its contribution to overall utility of an eventually selected subset. In contrast, where a single item is to be selected from the same available set, each alternative can be evaluated independently,

thereby leading to the possibility of employing heuristics which function by disregarding some of the available information. We therefore hypothesized that where both groups of consumers face the same set of available alternatives in which no alternative clearly dominates the rest, consumers who select more than one alternative would tend to search a greater amount of the available information than those who select a single alternative. Our formal hypothesis (H1) of these differences is reproduced below:

H1   Consumers who need to select more than one alternative will acquire a higher proportion of available information than those who need to select a single item from the same product class.

Table 7.3a (chapter 7) shows that the assumption of homogeneity of variance between the two treatment populations was met for this variable (p>0.1 for both the Cochran and Bartlett tests). Therefore, H1 was tested using the classical ANOVA model. Analysis of variance was conducted using the ANOVA subroutine in SPSS-X (VAX/VMS Release 4.1).[47] Table 8.1a shows the results of this analysis.

From Table 8.1a, we note that the mean proportion of information searched by the multiple item group is 0.71 (or 71% of the available information) whilst the corresponding figure for the single item group is 0.57 (or 57% of the available information). Under the null hypothesis that there is no difference in proportion of information searched between the groups, the ANOVA test gives an F-value of 7.260 which has a two-tailed probability of 0.008 of occurring when the null hypothesis is true. With a directional hypothesis as specified in H1, the relevant one-tailed probability is 0.004 (i.e. 0.008/2). This p-value is highly statistically significant, indicating that the observed difference in proportion of information searched between the multiple item and single item groups cannot be attributed to sampling error.

Stated differently, the results suggest that the null hypothesis of no differences should be rejected, or alternatively that our data does not provide evidence for rejecting H1. Therefore, there is sufficient evidence from the data to conclude that subjects in the multiple item group

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[47] All subsequent classical analyses of variance were conducted using this statistical package and subroutine.

searched a significantly higher proportion of the available information than those in the single item group, thus providing support for H1.

Table 8.1a
Results of ANOVA for Differences in Proportion of Information Searched Between Single and Multiple Item Groups

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Main Effects	.568	1	.568	7.260	.008[b]
Experimental Group[a]	.568	1	.568	7.260	.008[b]
Explained	.568	1	.568	7.260	.008[b]
Residual	9.158	117	.078		
Total	9.727	118	.082		

[a]Group Means:
     Single Item : 0.57 (n = 46)
     Multiple Items: 0.71 (n = 73)

[b]p=0.004 for one-tailed test

To further ascertain the magnitude of these differences, a power test was performed using the MANOVA procedure in SPSS-X. With this test one can determine the magnitude of the effect size (a measure of the difference between a null hypothesis and a specific alternative hypothesis) and power of the statistical test (i.e., the ability of a statistical test to reject a false null hypothesis, or stated differently, the probability of rejecting the null hypothesis when it is false). Specifying an α-level of 0.05 (the traditional level used in most marketing research studies), eta-square as a measure of effect size was found to be 0.058 and the observed power of the statistical test was 0.759.[48]

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[48] Eta-squared can be interpreted as the proportion of population variance attributable to group membership (Winer, Brown, and Michels, 1991; p. 123-4). Sawyer and Ball (1981) present a summary table in which eta-squared values of 0.01, 0.059, and 0.138 for the F-test can be respectively considered as indicative of small, medium, and large effect sizes (Table 1; p. 276). Similarly, the power value of 0.759 observed for our test is well above the average for medium power of marketing studies reported in the

As indicated in section 8.1, because subjects in each group performed two decision tasks, it is also possible to run analysis of covariance using proportion of information searched in the first decision task (Session 1) as a covariate. This will enable determination of the extent to which individual differences could have contributed to high within-group variance in the results reported in Table 8.1a. In other words, such an analysis would enable us control for that part of the within-group variance which is attributable to systematic individual differences. Results of this analysis of covariance are depicted in Table 8.1b.

Table 8.1b
Results of ANOVA for Proportion of Information Searched with Proportion of Information Searched in Session 1 as Covariate

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Covariate	2.842	1	2.842	55.247	.000
Proportion of Info. Searched (Session 1)[a]	2.842	1	2.842	55.247	.000[c]
Main Effects	.721	1	.721	14.024	.000[c]
Experimental Group[b]	.721	1	.721	14.024	.000[c]
Explained	3.563	2	1.782	34.635	.000
Residual	5.504	107	.051		
Total	9.067	109	.083		

[a]Unstandardized Regression Coefficient for Covariate = .618

[b]Group Means:
    Single Item   : 0.57 (n = 44)
    Multiple Items : 0.73 (n = 66)

[c]$p < 0.0001$ for one-tailed test

As can be seen from Table 8.1b, the covariate effect is highly statistically significant ($F_{1,107}$ = 55.247; $p < 0.0001$). The high positive unstandardized regression coefficient (0.618) indicates that in general subjects who searched a high (low) proportion of information in Session 1 tended to search a high (low) proportion in Session 2 of the experiment, irrespective of which

experimental group they belonged to. However, when the effect of these individual differences is controlled for, it becomes even more unlikely to attribute the observed group differences in proportion of information searched to sampling error.

The group effect after controlling for individual differences, is highly statistically significant $(F_{1,107} = 14.024$; one-tailed $p<0.0001)$. Examination of the group means reported in Table 8.1b shows that the differences in mean proportion of information searched are still in the same direction as predicted by H1. Mean proportion searched by the single item group is 0.57 as against 0.73 for the multiple item group.[49] Effect size for the group main effect after controlling for individual differences, is 0.116 and power of the statistical test to detect this difference at $\alpha = 0.05$ is 0.959. Corresponding figures for the covariate effect are 0.341 and 1.000 for effect size and power respectively.

Taken together, the evidence reported in Tables 8.1a and 8.1b lead to the conclusion that there are statistically significant differences in proportion of information searched between the single and multiple item groups. Specifically, mean proportion of information searched by the multiple item group is significantly higher than that for the single item group, and so there is evidence from the data in support of H1.

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[49] Differences between means and sample sizes reported in Table 8.1b and those reported in Table 8.1a are due to the fact that 9 respondents (two in the Single Item group and 7 in the Multiple Items group) did not complete Session 1. With no corresponding measure on the covariate, these were excluded from the analysis reported in Table 8.1b. The same differences occur for subsequent ANOVA and corresponding "ANOVA with covariate" analyses.

8.2.1.2 Differences in Variability in Amount of Information Searched Per Alternative

Variability in amount of information searched per alternative is a measure of the extent to which the same or unequal numbers of attributes are searched for each available alternative. High variability often indicates use of strategies consistent with a noncompensatory heuristic whilst low variability may suggest use of a compensatory strategy. In chapter 4, we hypothesized that, compared with single item decisions, variability in amount of information searched per alternative would be lower in multiple item decisions because in the latter there is a need to make holistic evaluation of alternatives to determine their contribution to overall balance of a selected subset. We reproduce below H2, which addressed this difference:

H2   Variability in amount of information searched per alternative will be lower for consumers who need to select multiple items from a product class than for those who need to select a single item from the same product class.

For variability in information searched per alternative, univariate tests of homogeneity of variance between the Multiple and Single Item groups (Table 7.3a, chapter 7) shows that the ANOVA assumption of homogeneity of variance was not met. Both the Cochran and Bartlett-Box tests rejected the null hypothesis of homogeneity of variance ($p < 0.005$). In view of the serious reservations expressed by Winer, Brown, and Michel (1991; p. 101-3), the decision here was to consider a nonparametric alternative to the ANOVA of classical statistics for testing hypothesis H2. For a two-group analysis of variance, an appropriate nonparametric technique is the Mann-Whitney-Wilcoxon test (Gibbons, 1993). This test is the nonparametric equivalent of the Student's t for two mutually independent samples.[50] However, whilst the Student's t test requires an assumption that the two samples are from normally distributed populations with equal variances, the Mann-Whitney-Wilcoxon test requires only the assumption of a continuous distribution no matter what shape, and data measured on at least an ordinal level. It tests a null hypothesis of no differences in *median* scores for the two groups (in contrast to parametric tests which are based on the *mean* as a measure of central tendency). In SPSS-X, the Mann-Whitney-Wilcoxon test is available under the NPAR subroutine. This was used in testing H2. Table 8.2 shows the results of this test.

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[50] Recall from introductory statistics that the Student t test is a special case of the general F-test in analysis of variance.

Table 8.2
Results of Mann-Whitney- Wilcoxon Test for Variability in Amount of Information Searched Per Alternative[a]

Mann-Whitney U	Wilcoxon W	CORRECTED FOR TIES	
		Z	Two-tailed P
1360.5	3078.5	-1.7486	0.0804[b]

Summary Statistics

Group	Mean Rank	No. of Cases
Single Item	66.92	46
Multiple Items	55.64	73
		119

[a] Group Means:
      Single Item : 1.84 (n=46)
      Multiple Items: 1.21 (n=73)

[b] p=0.0402 for one-tailed test

As shown in Table 8.2 the SPSS-X package calculates two test statistics which form the basis for deciding whether or not to reject the null hypothesis of no differences in median scores between the two groups. These are the Mann-Whitney U and the Wilcoxon W which are calculated by pooling together the scores of the two groups, arranging them in an array from lowest to highest and assigning ranks 1, 2, ... N to the pooled scores.[51] Mann-Whitney U is then calculated as the number of times a score from Group 1 precedes a score from Group 2, whilst Wilcoxon W is calculated as the sum of ranks for the group with fewer cases.[52] The sum of ranks for each group are then divided by the number of cases in each group to

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[51] N = n_1+ n_2 where n_1 = number of cases in Group 1, and n_2 = number of cases in Group 2.

[52] The reader should verify that the value of the Wilcoxon W reported in Table 6.2 equals the sum of ranks for the group with fewer cases, i.e., W = 66.92 x 43 = 3078.5. Because of this, this test is also called the *Wilcoxon Rank Sum Test*.

determine the mean rank. If the median scores for the two groups are equal as suggested by the null hypothesis, then the mean ranks for the two groups would be approximately equal.

Clearly, Table 8.2 shows that this is not the case. Mean rank for the single item group is higher than mean rank for the multiple item group. Moreover, this difference, when corrected for ties has a corresponding Z-value of -1.7486 with a one-tailed probability of 0.0402 (0.0804/2) of occurring under the null hypothesis. The evidence suggests that we reject the null hypothesis of no differences in median scores between the single item and multiple item groups.[53] We therefore conclude that variability in information searched per alternative is higher for the single item group than the multiple item group. Hypothesis H2 is supported by the data.

So far, our results indicate that subjects in the multiple item group not only searched a greater proportion of the available information, but also that they tended to search a fairly equal amount of information for each of the available alternatives, at least when compared with subjects in the single item group. This evidence would suggest greater use of strategies consistent with a compensatory model, especially if we also find in subsequent analyses that subjects in the multiple item group tended to use more alternative-based information processing.

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[53] For the sake of simplifying interpretation of the results for readers who are only familiar with classical hypothesis testing, we note that the mean variability in information searched for the Multiple Item group is 1.21 whilst that for the Single Item group is 1.84.

8.2.1.3 Differences in Variability in Amount of Information Searched Per Attribute

Variability in amount of information searched per attribute is a measure of the extent to which the same or unequal numbers of alternatives are searched for each attribute *provided in the decision task*.[54] High variability for this statistic indicates either selectivity in attribute use (i.e., only a subset of available attributes are used) or further evidence that consumers are using noncompensatory strategies. The hypothesis addressing differences between the single and multiple item groups for this variable is reproduced below.

H3   Variability in amount of information searched per attribute will be lower for consumers who need to select multiple items from the same product class than for those who need to select a single item from the same product class.

Reference to Table 7.3a shows that the preliminary homogeneity of variance test for this variable did not reject the null hypothesis of equal treatment population variances. For both the Cochran and Bartlett-Box tests, $p > 0.1$, implying that the two groups can be assumed to come from treatment populations with equal variances. Therefore, for this variable we used the classical ANOVA model to test H2. The results of the analysis are reported in Table 8.3a.

From Table 8.3a, we note that the F-value associated with the Group Main effect is 0.015 and that this has a one-tailed probability of 0.4515 of occurring under the null hypothesis of no differences in mean variability of information searched between the two groups. Indeed, mean variability for the single item group is 2.06 (n=46) and that for the multiple item group is 2.01 (n=73). This difference is so small, and has such a high probability of occurring under the null hypothesis, that we can only conclude that there is no difference in mean variability per attribute between the two groups. Hypothesis H3 is therefore, not supported by the evidence.

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[54] For subjects who used only a subset of the available attributes variability could be calculated with respect to all available attributes or with respect to only those attributes selected for the evaluations. The emphasis here is meant to stress the fact that our operational definition of variability in this case relates to the entire set of attributes provided for the decision task.

Table 8.3a
ANOVA for Differences in Variability in Amount of Information Searched Per Attribute

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Main Effects	.053	1	.053	.015	.903[b]
Experimental Group[a]	.053	1	.053	.015	.903[b]
Explained	.053	1	.053	.015	.903[b]
Residual	421.412	117	3.602		
Total	421.465	118	3.572		

[a]Group Means:
      Single Item : 2.06 (n = 46)
      Multiple Items: 2.01 (n = 73)

[b] p=0.4515 for one-tailed test

Further evidence in support of this conclusion of no difference is provided by the analysis of effect size and power of the statistical test. For this variable the effect size as measured by eta-squared is a mere 0.001 and observed power of the statistical test to detect such a small difference is 0.046 at a specified α-level of 0.05. These figures are well below what Sawyer and Ball (1981) consider as small effect size and power reported in marketing studies.

As was the case for proportion of information searched, we also performed further analysis of variance for this variable using variability in search per attribute from Session 1 of the experiment as a covariate. The results of this analysis are shown in Table 8.3b. Again we arrive at the same conclusion of no difference in spite of the fact that the covariate effect is statistically significant. For the within-subject effect, $F_{1,107} = 30.715$; p< 0.0001 whilst for the group main effect, $F_{1,107} = 0.082$; p>0.1. This suggests that in general subjects who exhibited high (low) variability in information searched per attribute in Session 1 also exhibited high (low) variability in Session 2, irrespective of which experimental group they belonged to. The high positive unstandardized regression coefficient (1.068) gives credence to this interpretation of the results. However, these individual differences do not account for

the lack of group membership effect observed in Table 8.3a.

Table 8.3b
ANCOVA Results for Variability in Amount of Information Searched Per Attribute
with Variability in Search Per Attribute for Session 1 as Covariate

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Covariates	88.438	1	88.438	30.715	.000
Variab. in Search Per Attribute (Session 1)[a]	88.348	1	88.438	30.715	.000
Main Effects	0.235	1	0.235	0.082	.776[c]
Experimental Group[b]	0.235	1	0.235	0.082	.776[c]
Explained	88.583	2	44.291	15.398	.000
Residual	307.773	107	2.876		
Total	396.356	109	3.356		

[a]Unstandardized Regression Coefficient for Covariate = 1.068

[b]Group Means:
    Single Item   :   2.06 (n = 44)
    Multiple Items: 1.96 (n = 66)

[c] p= 0.388 for a one-tailed test

In conclusion, both the ANOVA with and without Session 1 variability as covariate lead to the conclusion that there is no difference in variability in information searched between the single item and multiple item groups. We note however, that the small differences are in the hypothesized direction (i.e., variability for the multiple item group is lower than that for the single item group in both Table 8.3a and 8.3b), although these differences are not reliable.

It is also interesting to note that for both groups average variability in amount of information searched per attribute was generally higher than the corresponding figure for variability in search per alternative. For example, considering the ANOVA without a covariate effect, variability in search per attribute is 2.01 for the Multiple Item group and 2.06 for the Single Item group. The corresponding figures for variability in search per alternative are 1.21 for multiple item group and 1.84 for single item group. We will return to a detailed discussion of this difference and its implications in chapter 9. For now, however, we note that because

cities (for session 2) and suppliers (for session 1) were identified by alphabets, subjects who engaged in incomplete information search tended to limit the amount of search by selecting only a subset of the provided attributes for use in evaluating alternatives. All available alternatives were then searched for these attributes, or for those who used heuristic processing, all alternatives will first be searched for the most important attribute, and only some selected alternatives searched for the remaining of the selected attributes. Now since we calculated variability in search per attribute with reference to the entire attribute pool instead of with reference to the selected attributes, this resulted in a generally high average value for this variable. For example, a subject who used only 3 attributes but searched all alternatives on these attributes would have a score of 1.37 for variability in search per attribute instead of 0 as would be the case if variability were calculated with reference to the 3 attributes selected.

8.2.1.4 Differences in Sequence of Information Search

The hypothesis addressing differences in sequence of information search between the multiple item and single item groups is reproduced below for recapitulation. It states that:

H4   Compared to those who need to select a single item, consumers who need to select more than one item from the same product class are more likely to use alternative-based information acquisition strategies.

As discussed in chapter 5, two main approaches suggested in the literature, were used as measures of information search sequence. These are Payne's Index (Payne, 1976) and Bettman and Jacoby's (1976) Same Brand Index (SBI) and Same Attribute Index (SAI).[55] Preliminary homogeneity of variance tests between the Single and Multiple Item groups for all three indices supported the null hypotheses of homogeneity of variance (for all indices, $p > 0.1$ for both the Cochran and Bartlett-Box tests). Therefore the classical ANOVA model was used testing H4.

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[55] The interested reader may refer to this chapter for definitions of these indices and how they were calculated in the present study.

As Table 7.3a (chapter 7) indicates, the three measures are highly correlated with each other, suggesting that it would be redundant to use all three in testing hypothesis H4. Consequently, it was decided to test this hypothesis using SBI because, this index represents an improvement over Payne's Index, and for all practical purposes, SAI is simply the complement of SBI. ANOVA results for SBI are presented in Table 8.4a. For the interested reader, corresponding results for SAI and Payne's Index are available for reference in Tables 3a. to 4b (Appendix H).

Table 8.4a
ANOVA for Sequence of Information Search Using Bettman and Jacoby's (1976) Same Brand Index

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Main Effects	.660	1	.660	4.135	.044[b]
Experimental Group[a]	.660	1	.660	4.135	.044[b]
Explained	.660	1	.660	4.135	.044[b]
Residual	18.666	117	.164		
Total	19.326	118	.164		

[a]Group Means:
Single Item : 0.51 (n = 46)
Multiple Items: 0.66 (n = 73)

[b] p=0.022 for a one-tailed test

As regards the SBI which measures the extent of alternativewise (interdimensional) processing in a subject's search matrix, Table 8.4a shows that the average value of this index is higher for subjects in the multiple item group (0.66) compared to those in the single item group (0.51).[56] Under the null hypothesis of no differences in mean scores on the SBI, this difference is associated with an F-value of $F_{1,117}$ = 4.135 and p=0.022 for a one-tailed test.

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[56] Recall that this index varies from 0 (for a subject following a pure attribute processing strategy) to 1 (for subjects using a pure processing by brands strategy).

Clearly, the results show a statistically significant difference between the two groups (p<0.05). The magnitude of effect size for this difference is 0.034 with an observed power of 0.521 at an α level of 0.05. Taken together, the group means, effect size, and level of significance of the F-test indicate that subjects in the multiple item group used more alternative-based processing than those in the single item group.

Results for analysis of covariance with SBI from session 1 of the experiment as covariate are presented in Table 8.4b.

Table 8.4b
ANCOVA for Sequence of Information Search Using Bettman and Jacoby's (1976)
Same Brand Index (SBI) with SBI for Session 1 as Covariate

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Covariates	1.557	1	1.557	11.036	.001
Same Brand Index (Session 1)[a]	1.557	1	1.557	11.036	.001
Main Effects	0.856	1	0.856	6.071	.015[c]
Experimental Group[b]	0.856	1	0.856	6.071	.015[c]
Explained	2.413	2	1.206	8.553	.000
Residual	15.093	107	0.141		
Total	17.056	109	0.161		

[a]Unstandardized Regression Coefficient for Covariate = .074

[b]Group Means:
    Single Item   : 0.51 (n = 44)
    Multiple Items: 0.68 (n = 66)

[c] p=0.0075 for one-tailed test

In addition to corroborating the conclusion drawn from the results in Table 8.4a, Table 8.4b shows a highly significant covariate effect - $F_{1,107}$ = 11.036; p=0.001. When this individual effect is corrected for, the result is an even higher level of statistical significance for the Group Main Effect - $F_{1,107}$ = 6.071; p<0.05 (actual p=0.0075 for a one-tailed test). For this analysis, effect sizes as measured by eta-squared are respectively 0.054 and 0.098 for the

Group and Regression effects with corresponding observed power at α=0.05 of 0.682 and 0.921 respectively.

Thus, taken either singularly or together, the results shown in Tables 8.4a and 8.4b provide evidence in support of our hypothesis that consumers who select multiple items from a product class tend to use more alternative-based information processing than those who select a single item from the same product class. This conclusion can also be drawn by reference to Tables 3a. to 4b. of Appendix H, which show results from similar analyses using the Same Attribute Index (SAI) and Payne's Index.[57]

Recall also from chapter 6, that reference was made to the criteria suggested by Bettman and Kakkar (1977) for classifying subjects' search matrices into Choice By Processing Brands (CPB), Choice by Processing Attributes (CPA), and Choice by Feedback Processing (CFP). Specifically, Bettman and Kakkar suggested the following criteria:[58]

1.   For CPB strategy, SB ≥ 0.5, SBI ≥ 0.6, and SB-SA ≥ 0.3.

2.   For CPA strategy, SA ≥ 0.5, SAI ≥ 0.6, and SA-SB ≥ 0.3, and

3.   For CFP strategy, |SB-SA| ≤ 0.2, SB ≥ 0.3, SA ≥ 0.3, SBI ≥ 0.4, and SAI ≥ 0.4.

where,

      SB = proportion of type 2 transitions

      SA = proportion of type 3 transitions

      SBI = Bettman and Jacoby's (1976) Same Brand Index, and

      SAI = Bettman and Jacoby's (1976) Same Attribute Index

Using these criteria to classify our subjects into each of the three strategies, we also checked for the distribution of strategies across experimental groups using the CROSSTABS procedure in SPSS-X. Results of this analysis are shown in Table 8.4c.

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[57] Note that lower values for SAI indicate more alternative-based processing, or alternatively, higher values indicate more attribute-based processing. For Payne's Index which varies from -1 to 1, a large negative score indicates more attribute-based processing, and a high positive score indicates more alternative-based processing.

[58] CPB and CPA correspond respectively to alternative-based and attribute-based processing.

Table 8.4c
Results of Crosstabulation of Experimental Group by Information Processing Strategy

Count *Exp. Value* *Row Percent* *Column Perc.*	PROCESSING STRATEGY			
	CPB	CPA	CFP	Row Total
SINGLE ITEM	19 25.6 43.2% 29.7%	16 12.4 36.4% 51.6%	9 6.0 20.5% 60.0%	44 40%
MULTIPLE ITEMS	45 38.4 68.2% 70.3%	15 18.6 22.7% 48.4%	6 9.0 9.1% 40.0%	66 60%
Column Total	64 58.2%	31 28.2%	15 13.6%	110 100%

CHI-SQUARE	VALUE	DF	SIGNIF.
Pearson	7.07787	2	0.02904
Likelihood Ratio	7.08063	2	0.02900
Mantel-Haenszel test for linear assoc.	6.65543	1	0.00989

We begin discussion of the results of Table 8.4c by noting that the relevant percentages for investigating differences in processing between the two groups are the row percentages. In this regard, we see that 43.2% of subjects in the Single Item group used a Choice-by-Processing-Brands (CPB) strategy, 36.4% used a Choice-by-Processing-Attributes (CPA) strategy, and 20.5% used a Choice-by-Feedback (CFP) strategy. For the Multiple Item group, the corresponding percentages are 68%, 22%, and 9.1% for CPB, CPA, and CFP respectively. Differences in distribution of strategies in the two groups are statistically significant at α = 0.05 (for both Pearson's chi-square and the likelihood ratio $p < 0.05$). In particular, in the Multiple Item group there is a clear dominance of CPB strategies. On the contrary in the Single Item group, there is an almost even distribution of all 3 processing strategies. Clearly, these results provide further evidence in support of the conclusions drawn from Tables 8.4a

and 8.4b and support the predictions contained in H4.

One interesting feature of the results of Tables 8.4a, 8.4b, and 8.4c is that when they are considered in light of our earlier findings that the Multiple Item group searched a greater proportion of available information with lower variability in search per alternative, there is reason to believe that subjects in this group tended to use strategies consistent with what obtains under a compensatory model. Of course, we recognize that there are other decision strategies which may fit the basic pattern observed above for the Multiple Item group. For example, the high proportion of information searched could be due to the fact that subjects first searched all or nearly all of the available information, used the acquired information to reconstruct the decision matrix, and then went on to use other evaluation strategies in integrating the acquired information.

Indeed, detailed analyses of individual strategies used by our respondents revealed that for some subjects, this was actually the case. Because we provided them with paper to take notes during the decision, some subjects used the opportunity to first construct the decision matrix and then make their decision based on the constructed matrix. Fortunately, however, for most of these subjects, the notes they took alongside the matrix, together with their responses to the questionnaire, enable almost complete identification of their decision strategies. The results of these detailed analyses generally support the conclusions arrived at with respect to greater use of compensatory strategies in the multiple item group.

8.2.1.5 Differences in Decision Time

As a dependent variable in studies of consumer decision making, decision time is an indirect measure of the extent of deliberation a consumer engages in prior to making a decision. In chapter 5, we argued for a greater extent of deliberation in multiple item selection decisions and hypothesized that:

H5   **Compared to those who need to select a single item, consumers who need to select more than one item from the same product class will to spend more time prior**

to making a decision.

Because results of the preliminary analysis shown in Table 7.3a (chapter 7) did not give sufficient basis to reject the hypothesis of equal population variances for the single and multiple item groups with respect to this variable (p>0.1 for both the Cochran and Bartlett-Box tests), hypothesis H5 was tested using the classical ANOVA model.[59] Results from this analysis are shown in Table 8.5a.

Table 8.5a
Results of ANOVA for Differences in Decision Time

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Main Effects	3866.556	1	3866.556	7.464	.007[b]
Experimental Group[a]	3866.556	1	3866.556	7.464	.007[b]
Explained	3866.556	1	3866.556	7.464	.007[b]
Residual	60611.693	117	518.049		
Total	64478.249	118	546.426		

[a]Group Means:
      Single Item   : 18.44 (n = 46)
      Multiple Items: 30.14 (n = 73)
[b] p=0.0035 for one-tailed test

As usual, the null hypothesis states that there is no difference in decision time between the single item and multiple item groups. The alternative hypothesis (H5) argues for differences in the direction of higher decision times for subjects in the multiple item group. Table 8.5a settles the dispute in favor of the alternative hypothesis. As can be seen from the table, average decision time for subjects in the multiple item group is 30.14 minutes as against

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[59] It should be noted, however, that this variable had very high skewness and kurtosis values, and so violations of the assumption of normality may be some threat. In spite of this, ANOVA was used on the raw data (rather than performing logarithmic transformation) because of the general robustness of the F-test to violations of this assumption. Given this situation, it would be imperative to interpret the results with some caution.

18.44 minutes for those in the single item group. Calculated F for the group effect is 7.464 with a one-tailed probability of 0.0035 of occurring if the null hypothesis is true.

Moreover, the effect size is reasonably large (eta-squared = 0.06) and the statistical test has sufficient power to detect any false null hypothesis (observed power at α level of 0.05 equals 0.771). Clearly, there is sufficient evidence to conclude that the observed difference in mean decision time between the single item and multiple item groups cannot be attributed to sampling error. Specifically, average decision time is higher for the multiple item group, providing support for H5.

Table 8.5b shows the analysis of covariance results when decision time in Session 1 is used as a covariate.

Table 8.5b
Results of ANCOVA for Differences in Decision Time Between Single and Multiple Item Groups with Decision Time from Session 1 as Covariate

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Covariates	25349.889	1	25349.889	140.365	.000
Decision Time (Session 1)[a]	25349.889	1	25349.889	140.365	.000
Main Effects	3737.578	1	3737.578	20.695	.000[c]
Experimental Group[b]	3737.578	1	3737.578	20.695	.000[c]
Explained	29087.467	2	14543.734	80.530	.000
Residual	19143.580	106	180.600		
Total	48231.047	108	446.584		

[a]Unstandardized Regression Coefficient for Covariate = 1.714

[b]Group Means:
Single Item : 15.47 (n = 43)
Multiple Item: 28.59 (n = 66)

[c] $p < 0.0001$ for one-tailed test

From Table 8.5b, we see that the covariate effect is highly statistically significant - $F_{1,106} =$ 140.365; p<0.0001. The unstandardized regression coefficient for this variable is 1.714 indicating that subjects who on the average used more (less) time in Session 1 tended to also use more (less) time in Session 2. This result is not entirely surprising in view of the finding in Table 8.1b that subjects who searched a lower (higher) proportion of information in Session 1 also tended to search a lower (higher) proportion in Session 2. The interesting result, however, is that when we control for this individual effect it becomes even more unlikely that the difference in decision times between the Single and Multiple item groups occurred by chance (i.e. due to sampling error). Observed F for the group effect when the effect of individual differences is controlled for is 20.695 (p<0.0001). As regards effect sizes, eta-squared for the group and covariate effects are respectively 0.163 and 0.562. Corresponding observed power at α=0.05 is 0.995 for the group effect and 1.000 for the covariate effect. Clearly, there is enough evidence from the data in support of H5.

Recall from chapter 7 that, preliminary ANOVA for differences between different administrations of the experiment showed that this had a significant effect on decision time. Specifically, it was found that those who performed the tasks in group sessions tended to spend less time on their decisions than those who made their decisions in individual sessions. To determine whether this effect could also be responsible for the results of this section, two-way analysis of variance was performed with experimental group and method of administration as between-subject factors. The results showed a highly significant effect for the method of administration factor ($F_{1,115} = 29.177$; p<.0001), and a significant effect for the experimental group factor ($F_{1,115} = 2.824$; one-tailed p=0.048). The two-way interaction effect was not significant ($F_{1,115} = 0.173$; p=0.678).

These results show that even though the method of administration accounted for a greater proportion of the explained variance for this variable, group membership also had a significant effect on time spent by subjects prior to making a decision. Therefore, on the basis of all the evidence presented in this section, it would be fair to conclude that support was found for hypothesis H5.

8.2.1.6 Differences in Perceptions of Task Difficulty

Although perceptions of task difficulty is not a variable with relevance for classifying a consumer's decision strategy, it was nonetheless included in the hypotheses because task difficulty effects played a central role in the arguments underlying H1 to H5. With respect to this variable, the relevant hypothesis was that:

H6 Compared to those who select a single item, consumers who select multiple items from the same product class will report higher levels of task difficulty.

For this variable, the classical ANOVA model was used in testing H5 since both Cochran and Bartlett-Box tests confirmed our assumption of homogeneity of population variances between the single and multiple item groups. Results from the ANOVA run in SPSS-X are shown in Table 8.6a.

Table 8.6a
ANOVA Results for Differences in Perceived Task Difficulty

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Main Effects	2.127	1	2.127	.929	.337[b]
Experimental Group[a]	2.127	1	2.127	.929	.337[b]
Explained	2.127	1	2.127	.929	.337[b]
Residual	267.856	117	2.289		
Total	269.983	118	2.288		

[a]Group Means:
    Single Item : 4.26 (n = 46))
    Multiple Items: 3.99 (n = 73)) Scale: 1=Very Easy 7=Very Difficult)

[b] p=0.1685 for one-tailed test

As can be seen from Table 8.6a, the results show that there were no statistically significant differences in perceived task difficulty between the single and multiple item groups - $F_{1,117}$

= 0.929; p>0.1 (actual p=0.1685 for a one-tailed test). Furthermore, results of power analysis showed a very small effect size (eta-squared = 0.008) for which at an α level of 0.05, the statistical test had a power of 0.172 of correctly rejecting a false null hypothesis.

Further analysis of covariance controlling for reported task difficulty in Session 1 produced the results depicted in Table 8.6b which only go to further strengthen the conclusion of no significant differences between the groups.

Table 8.6b
ANCOVA Results for Differences in Perceived Task Difficulty with Perceived Difficulty of Session 1 Decision as Covariate

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Covariates	36.003	1	36.003	19.806	.000
Perceived Task Difficulty (Session 1)[a]	36.003	1	36.003	19.806	.000
Main Effects	1.170	1	.644	.644	.424[c]
Experimental Group[b]	1.170	1	.644	.644	.424[c]
Explained	37.173	2	10.225	10.225	.000
Residual	194.499	107	1.818		
Total	231.673	109	2.125		

[a]Unstandardized Regression Coefficient for Covariate = .411

[b]Group Means:
Single Item   :   4.23 (n = 44))
Multiple Items: 3.94 (n = 66)) Scale: 1=Very Easy 7=Very Difficult)

[c] p=0.212 for a one-tailed test

Table 8.6b shows a significant covariate effect - $F_{1,107} = 19.806$; p<0.0001. The positive unstandardized regression coefficient indicates that subjects who reported lower (higher) levels of task difficulty in Session 1 tended to also report lower (higher) difficulty in Session 2. When this individual difference is controlled for it becomes even more unlikely to reject the null hypothesis of no difference between the 2 groups. The probability of obtaining the

observed group means (4.23 and 3.94 for single and multiple item groups respectively) is 0.212 for a one-tailed test under the null hypothesis. Moreover, magnitude of the effect size is only 0.006 as measured by eta-squared with observed power at $\alpha=0.05$ of 0.165. The corresponding figures for the covariate effect are respectively 0.152 and 0.991 for effect size and power.

Clearly, on the basis of the evidence provided by Tables 8.6a and 8.6b, there is sufficient grounds to conclude that H6 is not supported by our data. The untenability of H6 is further aggravated by the direction of differences in group means, albeit unreliable. We note that H6 postulates a higher level of perceived task difficulty for subjects in the multiple item group compared to those in the Single Item group. Observation of the group means suggest, however, that on the average, subjects in the Single Item group reported higher levels of perceived task difficulty than those in the Multiple Item group. Possible explanations for this lack of significant effect will be taken up in chapter 9, because they would better be appreciated within the context of the overall findings of this study. In the next section, we examine results of tests for the second set of hypotheses, i.e., H7-H11.

8.2.2 Tests of Differences Attributable to Size of Subset to be Selected in Multiple Item Decisions

Discussion of the results in this section will be organized in the same manner as was done for testing hypotheses about differences between the single and multiple item groups. To test the effects of varying subset sizes on our dependent variables, comparisons were made among the Choose 3, Choose 5, and Choose 7 conditions of our study. As before, the overriding factors in the decision to use the classical ANOVA model or a nonparametric alternative in testing H7-H11, was whether or not the assumption of homogeneity-of-variance was met for the relevant dependent variable. Table 7.3b (chapter 7) shows that for all variables, this assumption was met. As such, the classical ANOVA model was used in testing the hypotheses pertaining to all the dependent variables in this section. For each of the dependent variables, relevant hypothesis is again presented, then results of the analysis of variance are outlines, and a brief discussion of the results follows. Detailed discussion of implications of the results are reserved for chapter 9.

8.2.2.1 Differences in Proportion of Information Searched

In chapter 5, we argued for an inverted U-shaped relationship between size of subset to be selected in multiple item selection decisions and proportion of information searched. This relationship implies that proportion of information searched would be lower for very small and very large subset sizes compared with moderate subset sizes.[60] The formal specification of this hypothesis is reproduced below for recapitulation.

H7 **Given a fixed set of available alternatives, an inverted U-shaped relationship exists between the size of subset to be selected and proportion of available information searched.**

This hypothesis was tested by comparing the mean proportion of information searched in the

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[60] Small, large, and moderate in relation to the number of available alternatives.

Choose 3, Choose 5, and Choose 7 conditions of our study using the classical ANOVA model. Results of this analysis are shown in Table 8.7a below. The results shown in Table 8.7a indicate that there were no statistically significant differences in mean proportion of information searched among the Choose 3, Choose 5, and Choose 7 conditions. For the group effect, $F_{2,70} = 1.449$; $p > 0.1$, thereby suggesting that we cannot reject the null hypothesis of no differences in mean proportion of information searched. Therefore, H7 has not been supported by the evidence.

Table 8.7a
Results of ANOVA for Differences in Proportion of Information Searched

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Main Effects	.226	2	.113	1.499	.230
Experimental Group[a]	.226	2	.113	1.449	.230
Explained	.226	2	.113	1.449	.230
Residual	5.286	70	.076		
Total	5.513	72	.077		

[a]Group Means:　Choose 3:　0.76 (n = 26)
　　　　　　　　Choose 5:　0.63 (n = 24)
　　　　　　　　Choose 7:　0.75 (n = 23)

We note, however, that effect size for the group main effect, as measured by eta-squared is 0.041. This is well above the level for small effect sizes suggested by Sawyer and ball (1981). It is also quite close to the level for medium effect sizes. However, power of the test at this point is only 0.038 at $\alpha = 0.05$. It seems then, that the lack of statistical significance can be attributed to lack of statistical power of the test to detect the associated level of effect size.

To further ascertain whether individual differences could have accounted for high within-group variance in the results of Table 8.7a, we also performed the analysis of variance with proportion of information searched in Session 1 of the experiment as covariate. As discussed

earlier in this chapter, this kind of analysis allows for the partialling out of the within-subject effect. The results are reported in Table 8.7b. From Table 8.7b we observe a statistically significant effect of individual differences in the proportion of information searched ($F_{1,62}$ = 61.363; p<0.0001 for the covariate effect). The unstandardized regression coefficient for this covariate effect is 0.72, implying that in general, respondents who searched a low (high) amount of information in Session 1 also searched a low (high) amount in Session 2. When this effect is controlled for, the group main effect also becomes highly statistically significant - $F_{2,62}$ = 14.024; p<0.0001. This is in spite of the fact that the group effect size is reduced to 0.032 with observed power of only 0.219 at α = 0.05.[61]

Table 8.7b
Results of ANCOVA for Differences in Proportion of Information Searched with Proportion Searched in Session 1 as Covariate

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Covariate	2.351	1	2.351	61.363	.000
Proportion of Info.					
Searched (Session 1)[a]	2.351	1	2.351	61.363	.000
Main Effects	.078	2	.721	14.024	.000
Experimental Group[b]	.078	2	.721	14.024	.000
Explained	2.429	3	1.782	34.635	.000
Residual	2.375	62	.051		
Total	4.804	65	.083		

[a]Unstandardized Regression Coefficient for Covariate = .720

[b]Group Means:
     Choose 3: 0.78 (n = 24)
     Choose 5: 0.66 (n = 21)
     Choose 7: 0.74 (n = 21)

Thus, we may conclude from the results in Table 8.7b, that individual differences in proportion of information searched, accounts for a large proportion of the variance for this variable, and that when these differences are controlled for there are also statistically

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[61] Corresponding effect size and power for the covariate are respectively 0.487 and 1.000.

significant differences among the Choose 3, Choose 5, and Choose 7 conditions of our study.

Given the level of statistical significance for the group effect after controlling for the covariate effect, we decided to further investigate the nature of these differences through pairwise comparisons of group means. This comparison was done using the PARTITION and CONTRAST subprocedures in the MANOVA subroutine of SPSS-X. Two comparisons of interest were made in this regard. In the first comparison, group means for the Choose 3 and Choose 7 conditions on one hand were contrasted with the group mean for the Choose 5 condition. In the second comparison, the group mean for the Choose 3 condition was contrasted with that for the Choose 7 condition. The results showed a marginally significant difference for the first comparison ($F_{1,62}$ = 1.98; one-tailed p=0.082), and an insignificant difference for the second comparison ($F_{1,62}$ = 0.03; one-tailed p=0.4265). In addition to the earlier significant results reported in Table 8.7b, these results suggest that, when individual differences are controlled for, mean proportion of information searched by subjects in the Choose 5 condition is significantly different from that for both the Choose 3 and Choose 7 conditions. Furthermore, the means for the latter 2 groups do not differ significantly from each other. It would seem then that H7 is supported by the evidence.

However, we note from both Tables 8.7a and 8.7b that the group means in proportion of information searched are **not** in the same direction as predicted by H7. In sharp contrast to the predictions in H7, Tables 8.7a and 8.7b all show that mean proportion of information searched by subjects in the Choose 3 and Choose 7 conditions are all higher than the mean for subjects in the Choose 5 condition.[62] Thus, the results indicate that, even though there are statistically significant differences between the Choose 3 and Choose 7 conditions on the one and the Choose 5 condition on the other, these differences are not in the direction predicted by H7. The obvious conclusion then, is that this hypothesis is not supported by the data.

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[62] Differences between means and sample sizes reported in Table 7.7b and those in Table 7.7a are due to the fact that 7 respondents did not complete Session 1 and so were excluded from the analysis of covariance. The same differences occur for subsequent ANOVA and corresponding "ANOVA with covariate" analyses.

8.2.2.2 Differences in Variability in Amount of Information Searched Per Alternative

With regards to variability in the amount of information searched per alternative, we hypothesized a regular U-shaped relationship between size of subset to be selected and variability in search. In other words, our hypothesis for this variable predicted that for very small and very large subset sizes, variability in search would be higher than for moderate subset sizes. The formal prediction of these differences is reproduced below for recapitulation.

H8   Given a fixed set of available alternatives, a regular U-shaped relationship exists between the size of subset to be selected variability in amount of information searched per alternative.

Results of the analysis of variance to test this hypothesis are reported in Table 8.8a. As can be seen from the Table, these results indicate a statistically significant difference for variability in number of attributes searched per alternative for comparisons among the three experimental conditions of our study ($F_{2,70} = 3.801$; $p<0.05$).

Table 8.8a
ANOVA Results for Differences in Variability in Amount of Information Searched Per Alternative

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Main Effects	8.499	2	4.250	3.801	.027
Experimental Group[a]	8.499	2	4.250	3.801	.027
Explained	8.499	2	4.250	3.801	.027
Residual	78.254	70	1.118		
Total	86.753	72	1.205		

[a]Group Means:
     Choose 3: 0.94 (n = 26)
     Choose 5: 1.02 (n = 24)
     Choose 7: 1.71 (n = 23)

Thus, the null hypothesis of no differences among the groups is to be rejected. Further

evidence in support of rejecting the null hypothesis is provided by the analysis of effect size and power of the statistical test. For this variable, the group main effect size as measured by eta-squared is 0.098. This value is well above the 0.059 for medium effect sizes suggested Sawyer and Ball (1981). Consequently, power of the statistical test at this point in our study was observed at 0.674.

Given that the group differences are statistically significant, our next concern was to determine which experimental groups were most responsible for the differences. We therefore, conducted tests of differences for all 3 pairwise group comparisons using the CONTRAST subroutine of the ONEWAY procedure in SPSS-X. Results of this analysis are shown in Table 8.8b.

Table 8.8b
Pairwise Contrasts of Group Means for Variability in Amount of Information Searched Per Alternative

	POOLED VARIANCE ESTIMATES[a]				
CONTRAST	VALUE	S. Error	T-value	d.f	T Prob.
Choose 3 vs. Choose 5	0.0834	0.2993	0.279	70	0.781[b]
Choose 3 vs. Choose 7	0.7708	0.3027	2.547	70	0.013[c]
Choose 5 vs. Choose 7	0.6874	0.3085	2.228	70	0.029[d]

[a] Pooled variance estimates are used because the homogeneity of variance hypothesis could not be rejected.
[b] $p=0.3905$ for a one-tailed test
[c] $p=0.0065$ for a one-tailed test
[d] $p=0.0145$ for a one-tailed test

As can be seen from Table 8.8b, there is a statistically significant difference for two of the three pairwise comparisons. For the Choose 3 vs. Choose 7 comparison, $T = 2.547$; $p<0.05$ whilst for the Choose 5 vs. Choose 7 comparison, $T = 2.228$; $p<0.05$. The difference between the Choose 3 and Choose 5 conditions is not statistically significant ($T = 0.279$; $p>0.1$). The results indicate that variability in amount of information searched per alternative was significantly different between the Choose 3 and Choose 7 groups ($p<0.05$) and between the

Choose 5 and Choose 7 groups (p<0.05). However, there was no significant difference for variability in search between the Choose 3 and Choose 5 groups. The prediction of a U-shaped relationship between subset size and variability in search per attribute is not supported.

The above conclusions confirm what obtains by simple observation of the group means in Table 8.8a. From this table, we see that mean variability in number of attributes searched per alternative for the Choose 3, Choose 5 and Choose 7 groups are respectively 0.94, 1.02, and 1.71. Clearly the levels of these means are not in the direction predicted by H8. In contrast to the regular U-shaped relationship predicted in that hypothesis, the data suggests a monotonic linear relationship, with variability increasing as the size of subset to be selected increases. The obvious conclusion then, is that whilst there are significant differences in variability in search per alternative among the Choose 3, Choose 5 and Choose 7 conditions, these differences do not support hypothesis H8. This conclusion prompted further analysis of the differences using variability in search per alternative from Session 1 as a covariate. Results from this analysis are reported in Table 8.8c.

Table 8.8c
ANOVA for Variability in No. of Attributes Searched Per Alternative with Variability in Session 1 as Covariate

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Covariates	3.118	1	3.118	3.257	.076
Variab. in Search (Session 1)[a]	3.118	1	3.118	3.257	.076
Main Effects	12.403	2	6.201	6.478	.003
Experimental Group[b]	12.403	2	6.201	6.478	.003
Explained	15.521	3	5.174	5.404	.002
Residual	59.356	62	.957		
Total	74.876	65	1.152		

[a]Unstandardized Regression Coefficient for Covariate = .334

[b]Group Means:
  Choose 3: 0.84 (n = 24)
  Choose 5: 0.92 (n = 21)
  Choose 7: 1.78 (n = 21)

The results shown in Table 8.8c indicate that the covariate effect is only marginally significant ($F_{1,62}$ = 3.257; p=0.076). There is a small positive relationship between variability in information searched in Session 1 and the corresponding variability in Session 2 (unstandardized regression coefficient for the covariate is 0.334). However, inspite of the lack of significance for the covariate effect, when this is controlled for, it becomes even more unlikely to attribute the group main effect to sampling error. For the group effect, $F_{2,62}$ = 7.478; p<0.005. The size of this effect, as measured by eta-squared, is as high as 0.173 and power of the test to detect an effect of this magnitude when the null hypothesis is false is 0.892 for α = 0.05.[63] Clearly, these results provide further evidence for rejecting the null hypothesis of no differences. But do these differences conform with the predictions of H8?

Examination of the magnitudes of mean variability in information searched per alternative for each of the 3 groups, as shown in Table 8.8c, suggests that they do not. After controlling for the covariate effect, we still observe a positive linear relationship between subset size and variability in search per alternative, in contrast to the U-shaped relationship predicted by H8. Formal pairwise comparisons of these means using the PARTITION and CONTRAST subprocedures of the MANOVA procedure in SPSS-X show that difference in mean variability in search per alternative between the Choose 3 and Choose 7 conditions is highly statistically significant ($F_{1,62}$ = 10.97; one tailed p=0.001). In contrast, H8 predicts no significant difference between the means for these two groups. Therefore, even though the results of Table 8.8a & Table 8.8c show statistically significant differences among the 3 groups, hypothesis H8 is not supported, because the data suggests a positive linear relationship whilst H8 predicts a U-shaped relationship.

When these findings are seen in light of the U-shaped relationship found for proportion of information searched, the positive linear relationship suggested by Tables 8.8a, 8.8b, and 8.8c is probably the most unexpected finding in our study. One would have expected that if our findings are not in the direction predicted by H8, we should at least have found an inverted U-shaped relationship, not a linear one. This apparent inconsistency in the results for this hypothesis will be discussed in chapter 8 when the overall results of the study are discussed.

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[63] Corresponding effect size and power for the covariate are respectively, 0.059 and 0.489.

8.2.2.3 Differences in Variability in Amount of Information Searched Per Attribute

On the basis of arguments advanced in chapter 5 for the effect of subset size on variability in number of alternatives searched per attribute, the following hypothesis was advanced.

H9 **Given a fixed set of available alternatives, a regular U-shaped relationship exists between the size of subset to be selected and variability in amount of information searched per attribute.**

Stated in other words, H9 predicts that for selection of very small and very large subset sizes in multiple item selection decisions, variability in amount of information searched per attribute would be higher than the corresponding value for selection of moderate subset sizes. Results of ANOVA tests of this prediction are reported in Table 8.9a. From the table, we observe that the effect of group membership on variability in amount of information searched per attribute is only marginally statistically significant at $\alpha = 0.05$ ($F_{2,70} = 3.040$; p=0.054). The size of this effect as measured by eta-squared is 0.80 and power of the F-test to detect an effect size of this magnitude when the null hypothesis is true, is 0.570. We note that even though the effect size is quite high, the statistical test has only satisfactory power to detect the effect.

Table 8.9a
Results of ANOVA for Differences in Variability in Amount of Information Searched Per Attribute

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Main Effects	21.066	2	10.533	3.040	.054
Experimental Group[a]	21.066	2	10.533	3.040	.054
Explained	21.066	2	10.533	3.040	.054
Residual	242.510	70	3.464		
Total	242.510	72	3.661		

[a]Group Means: Choose 3: 1.67 (n = 26)
                Choose 5: 2.78 (n = 24)
                Choose 7: 1.60 (n = 23)

When the lack of adequate statistical power is combined with the closeness of the group differences to statistical significance (p=0.54), there is reason to be skeptical about accepting the null hypothesis of no differences. Consequently, we decided to conduct further pairwise comparisons to find out if any of the pairwise group differences are statistically significant. Results of formal tests of these pairwise contrasts are presented in Table 8.9b. From Table 8.9b, we note that inspite of the lack of statistical significance for the overall effect of group membership on variability in search per attribute, there are statistically significant differences between the Choose 3 and Choose 5 groups on the one hand, and the Choose 5 and Choose 7 groups on the other. For the Choose 3 vs. Choose 5 contrast, T (70 d.f.) = 2.113; p<0.05, whilst for the Choose 5 vs. Choose 7 contrast, T (70 d.f.) = -2.164; p<0.05. For the Choose 3 vs. Choose 7 contrast, T (70 d.f.) = -0.117; p>0.1. Note that the hypothesized U-shaped relationship in H9 implies that there would be significant differences between the Choose 3 and Choose 5 conditions on one hand, and the Choose 7 and Choose 5 conditions on the other, and that there would be no differences between the Choose 3 and Choose 7 conditions.

Table 8.9b
Pairwise Contrasts of Group Means for Variability in Amount of Information Searched Per Attribute

CONTRAST	VALUE	POOLED VARIANCE ESTIMATES[a]			
		S. Error	T-value	d.f	T Prob.
Choose 3 vs. Choose 5	1.1131	0.5269	2.113	70	0.038[b]
Choose 3 vs. Choose 7	-0.0621	0.5328	-0.117	70	0.907[c]
Choose 5 vs. Choose 7	-1.1752	0.5431	-2.164	70	0.034[d]

[a] Pooled variance estimates are used because the homogeneity of variance hypothesis could not be rejected.
[b] p=0.019 for a one-tailed test
[c] p=0.4535 for a one-tailed test
[c] p=0.017 for a one-tailed test

It seems then, that one of the predictions of H9 has been met. The other prediction relates to the specific direction of these differences. H9 predicts that variability in search per attribute would be lower for the Choose 3 and Choose 7 groups than for the Choose 5 group. However, reference to Table 8.9a shows that this is not the case. Mean variability in search

per alternative for the Choose 3, Choose 5, and Choose 7 groups are respectively, 1.67, 2.78, and 1.60, suggesting an inverted U-shaped relationship between size of subset to be selected and variability in search per attribute. Clearly, this contradicts hypothesis H9 which predicts a regular U-shaped relationship. Again, this situation led us to further consider the effects of individual differences on the results.

ANOVA was therefore, conducted with variability in search per attribute in Session 1 as covariate. Results of this analysis are shown in Table 8.9c. These results show a statistically significant effect for the covariate ($F_{1,62}$ = 13.484; p=0.001). The high positive unstandardized regression coefficient for the covariate (0.896) indicates that subjects who searched fairly equal (unequal) amounts of information for each of the provided attributes in Session 1 also tended to search fairly equal (unequal) amounts for the provided attributes in Session 2. Thus, there are significant individual differences on this variable across the 3 experimental groups.

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Table 8.9c
ANOVA Results for Differences in Variability in Amount of Information Searched
Per Attribute with Variability in Session 1 as Covariate

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SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Covariates	39.431	1	39.431	13.484	.001
Variab. in Search Per Attribute (Session 1)[a]	39.431	1	39.431	13.484	.001
Main Effects	19.734	2	9.867	3.374	.041
Experimental Group[b]	19.734	2	9.867	3.374	.041
Explained	59.165	3	19.722	6.744	.001
Residual	181.310	62	2.924		
Total	240.474	65	3.700		

[a]Unstandardized Regression Coefficient for Covariate = .896

[b]Group Means:
        Choose 3: 1.59 (n = 24)
        Choose 5: 2.75 (n = 21)
        Choose 7: 1.59 (n = 21)

Table 8.9c also shows that when these individual differences are partialled out, group

membership has a statistically significant effect on variability in information searched per attribute. For the group main effect, $F_{2,62} = 3.374$; p<0.05, implying that after controlling for individual differences, it is unlikely that the group differences in means for this variable can be attributed to sampling error. Effect size for the group main effect after controlling for the covariate effect, is 0.098 and power of the statistical test at this point of our study is 0.615 for $\alpha = 0.05$.[64]

The nature of the resulting group differences were also further analyzed through pairwise comparisons in which mean for the Choose 5 group was first compared with the Choose 3 and Choose 7 groups, and then the Choose 3 and Choose 7 groups were compared with each other. The first comparison produced a statistically significant difference between the Choose 5 group on one hand and the Choose 3 and Choose 7 groups on the other ($F_{1,62} = 7.75$; one-tailed p=0.006). In contrast, the second comparison showed no significant difference between the Choose 3 and Choose 7 groups ($F_{1,62} = 0.01$; one-tailed p=0.4705). Clearly, there is support for one aspect of the predictions of H9, namely that variability in search per attribute for the Choose 3 and Choose 7 groups would not be different from each other, and that both would be different from variability in search for the Choose 5 group.

However, with respect to the specific directions of these differences the results indicate a lack of support for H9. Examination of the group means in Table 8.9c reveals that mean variability in the Choose 3 group exactly equals that in the Choose 7 group, but also, that variability for these groups is lower than that for the Choose 5 group. This indicates an inverted U-shaped relationship between size of subset to be selected and variability in search per attribute, a result that does not agree with the regular U-shaped relationship predicted in H9. Thus we conclude that even though there are significant group differences in terms of amount of information searched per attribute, these differences are not in the predicted direction, and so H9 has not been supported by the evidence.

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[64] Corresponding figures for the covariate effect are 0.180 and 0.952 for effect size and power respectively.

8.2.2.4 Differences in Decision Time

With respect to differences in decision time for the 3 multiple item selection decisions, the relevant hypothesis from chapter 5 was H10 which stated that:

H10   Given a fixed set of available alternatives, an inverted U-shaped relationship exists between the size of subset to be selected and time spent prior to making a decision.

Again the implication of this hypothesis is that for selection of very small and very large subset sizes in multiple item selection decisions, consumers will generally spend a longer time deliberating over their decision compared to those who select subsets of moderate sizes. Hypothesis H10 was tested using the classical ANOVA model, and the results are reported in Table 8.10a.

Table 8.10a
Results of ANOVA for Group Differences in Decision Time

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Main Effects	1313.173	2	656.587	1.102	.338
Experimental Group[a]	1313.173	2	656.587	1.102	.338
Explained	1313.173	2	656.587	1.102	.338
Residual	41699.660	70	595.709		
Total	43012.833	72	597.400		

[a]Group Means:
    Choose 3: 34.74 (n = 26)
    Choose 5: 30.66 (n = 24)
    Choose 7: 24.41 (n = 23)

From Table 8.10a, we see that the group differences in mean decision time in no way approaches statistical significance ($F_{2,70}$ = 1.102; p>0.1). For this variable, size of the group main effect as measured by eta-squared is 0.031 and power of the F-test to detect a size of

this magnitude under the null hypothesis, is a mere 0.235. We note that the group effect size for this variable is lower than that for medium levels suggested by Sawyer and Ball (1981). Therefore, although we may attribute the lack of statistical significance to inadequate power of the test, for this study we can only conclude that there is not enough evidence to reject the null hypothesis of no differences in mean decision time among the three groups.

In addition to the lack of statistical significance, we also note from Table 8.10a that mean time spent on the decision by subjects in each of the 3 groups decreases as the size of subset to be selected increases. Mean decision time for the Choose 3, Choose 5, and Choose 7 groups are respectively 34.74 minutes, 30.66 minutes, and 24.41 minutes, thereby indicating a negative linear relationship between size of subset to be selected and decision time. This again contrasts sharply with the inverted U-shaped relationship predicted in H10. On the basis of the evidence reported in Table 10a, we can only conclude that H10 has not been supported.

Table 8.10b shows ANOVA analysis with decision time for Session 1 of the experiment as a covariate. As shown in the table, the covariate effect is again highly statistically significant $(F_{1,62} = 119.912; p<0.0001)$.

Table 8.10b
ANOVA Results for Group Differences in Decision Time with Decision Time for Session 1 as Covariate

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Covariates	22734.083	1	22734.083	119.912	.000
Decision Time (Session 1)[a]	22734.083	1	22734.083	119.912	.000
Main Effects	799.099	2	399.550	2.107	.130
Experimental Group[b]	799.099	2	399.550	2.107	.130
Explained	23533.182	3	7844.394	41.376	.000
Residual	11754.518	62	189.589		
Total	35287.701	65	542.888		

[a]Unstandardized Regression Coefficient for Covariate = 1.915

[b]Group Means:
   Choose 3: 34.35 (n = 24)
   Choose 5: 30.32 (n = 21)
   Choose 7: 20.27 (n = 21)

The unstandardized regression coefficient for this effect is high and positive (1.915) indicating that subjects who spent more (less) time deliberating over their decision in Session 1 also tended to spend more (less) time in Session 2. When we control for these individual differences, the effect of group membership on decision time remains statistically insignificant. The size of this effect is 0.064 for eta-squared and power of the test is 0.416. Note that, when compared with the analysis without a covariate effect, both effect size and power have gone up.[65]

Examination of the group means in Table 6.10b show the same relationship between group membership and mean decision time as found earlier in Table 8.10a. For the Choose 3, Choose 5, and Choose 7 conditions, average decision times are respectively 34.35 minutes, 30.32 minutes, and 20.27 minutes, again indicating a negative relationship which sharply contrasts with the predictions of H10. On the basis of the results shown in Tables 8.10a and 8.10b, there is no support for hypothesis H10. Further contrast analyses showed that only the difference between the Choose 3 and Choose 7 conditions approached statistical significance with a one-tailed t-test - $T(70 \text{ d.f.}) = -1.479$; one-tailed $p=0.072$ for a pooled variance test.

8.2.2.5 Differences in Perceptions of Task Difficulty

Just as was done for tests of differences between single and multiple item selection decisions, a hypothesis was specified for the effects of group membership on perceptions of task difficulty among the three multiple item groups, even though this variable does not directly help in determination of decision strategy. Prediction of these differences were contained in hypothesis H11 which stated that:

H11   Given a fixed set of available alternatives, an inverted U-shaped relationship exists between the size of subset to be selected and consumers' perceptions of task difficulty.

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[65] Effect size and power for the covariate are respectively 0.644 and 1.000, again indicating the very strong effect of individual differences on the results.

Hypothesis H11 predicts that for selection of very small and very large subsets in multiple item selection decisions, perceptions of task difficulty would be lower than for selection of moderate subset sizes. This prediction was tested in an ANOVA model in which responses to question 3 of the questionnaire in Appendix E1 was used as dependent variable and comparisons made among the Choose 3, Choose 5, and Choose 7 conditions of our study. The results are reported in Table 8.11a.

As can be seen from Table 8.11a, with $F_{2,70} = 2.154$, the group main effect for perceptions of task difficulty is not significant at $\alpha = 0.05$. However, even though size of this group effect, as measured by eta-squared, is quite high (0.058), power of the statistical test to reject a false null hypothesis for this variable is only 0.427. It seems then, that the lack of statistical significance can be attributed more to lack of power of the test than to absence of a group effect.

Table 8.11a
ANOVA Results for Group Differences in Perceived Task Difficulty

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Main Effects	9.334	2	4.667	2.154	.124
Experimental Group[a]	9.334	2	4.667	2.154	.124
Explained	9.334	2	4.667	2.154	.124
Residual	151.652	70	2.166		
Total	160.986	72	2.236		

[a]Group Means: Choose 3: 3.92 (n = 25)
                Choose 5: 4.44 (n = 25)
                Choose 7: 3.57 (n = 23)

In other words, there is reasonable grounds to not accept the null hypothesis without further investigation. In particular, given the magnitude of effect size, it was considered advisable to further investigate pairwise differences among the groups to determine if additional insights could be gained. Results of such pairwise comparisons are reported in Table 8.11b.

Table 8.11b
Pairwise Contrasts of Group Differences in Perceived Task Difficulty

CONTRAST	VALUE	POOLED VARIANCE ESTIMATES[a]			
		S. Error	T-value	d.f	T Prob.
Choose 3 vs. Choose 5	0.5200	0.4163	1.249	70	0.216[b]
Choose 3 vs. Choose 7	-0.3548	0.4253	-0.834	70	0.407[c]
Choose 5 vs. Choose 7	-0.8748	0.4253	-2.057	70	0.043[d]

[a] Pooled variance estimates are used because the homogeneity of variance hypothesis could not be rejected.
[b] p=0.108 for a one-tailed test
[c] p=0.2035 for a one-tailed test
[d] p=0.0215 for a one-tailed test

From Table 8.11b, we note that the Choose 3 vs. Choose 7 comparison in no way approaches statistical significance (one-tailed p=0.2035), a result which is in line with the prediction of H11. Moreover, the Choose 5 vs. Choose 7 comparison is statistically significant (one-tailed p<0.05) and the Choose 3 vs. Choose 5 comparison approaches significance at $\alpha = 0.1$. All these findings are in line with one aspect of the predictions of H11. Furthermore, we note from Table 8.11a that the group means are in the same direction as predicted by H11. Mean perceived difficulty by subjects in the Choose 5 condition (4.44) is higher than that for both the Choose 3 and Choose 7 conditions (3.92 and 3.57 respectively).[66] These figures suggest an inverted U-shaped relationship between size of subset to be selected and perceived difficulty, as predicted by H11.

In view of the consistent presence of significant individual differences for earlier dependent variables of this study, we also decided to re-run this analysis with perceived task difficulty in Session 1 of the experiment as a covariate. Results of this analysis of covariance are reported in Table 8.11c.

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[66] Perceived difficulty was measured on a 7-point likert scale with 1 = Very Easy and 7 = Very Difficult (see appendix E1).

Table 8.11c
ANOVA for Perceptions of Task Difficulty with Perceptions of Task Difficulty for
Session 1 as Covariate

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Covariates	26.545	1	26.545	18.901	.000
Task Difficulty (Session 1)[a]	26.545	1	26.545	18.901	.000
Main Effects	10.142	2	5.071	3.611	.033
Experimental Group[b]	10.142	2	5.071	3.611	.033
Explained	36.686	3	12.229	8.708	.000
Residual	87.071	62	1.404		
Total	123.758	65	1.904		

[a]Unstandardized Regression Coefficient for Covariate = .477

[b]Group Means:
     Choose 3: 3.96 (n = 23))
     Choose 5: 4.32 (n = 22)) Scale: 1=Very Easy 7=Very Difficult
     Choose 7: 3.52 (n = 21))

From Table 8.11c, we see that the covariate effect is highly statistically significant ($F_{1,62}$ = 18.901; p<0.0001). The unstandardized regression coefficient for this covariate effect is 0.477, suggesting that, in general subjects who reported lower (higher) difficulty for the task in Session 1, tended also to report lower (higher) task difficulty for Session 2. These individual differences seem to have contributed to the high error variance in Table 8.11a because, when these differences are controlled for, the group main effect becomes statistically significant (in Table 8.11c, $F_{2,62}$ = 3.611; p<0.05). Effect size for group differences corrected for the within-subject effect is 0.104 and observed power of the F-test at this point in our study is 0.647.[67]

Combining the results of Tables 8.11a and 8.11b, we can conclude that when the effects of individual differences in perceived task difficulty are controlled for, the data provides evidence in support of H11. This conclusion led us to further examine the pairwise differences between the Choose 5 condition on one hand, and the Choose 3 and Choose 7 conditions on the other, as well as the pairwise comparison between the Choose 3 and Choose 7 conditions.

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[67] Corresponding figures for the covariate effect are 0.256 and 0.995 for effect size and power respectively.

As before, these comparisons were conducted using the PARTITION and CONTRAST subroutines in the MANOVA procedure of SPSS-X. Results of these analysis showed a highly statistically significant difference for the first comparison (Choose 5 vs. Choose 3 and Choose 7 conditions). $F_{1,62} = 7.01$; one-tailed p=0.005 for this comparison. In contrast, for the comparison between the Choose 3 and Choose 7 conditions, $F_{1,62} = 0.20$; p=0.655.

These results indicate that difficulty reported by subjects in the Choose 5 condition was significantly different from that reported by subjects in the Choose 3 and Choose 7 conditions. Moreover, there was no statistically significant difference between the Choose 3 and Choose 7 conditions with regards to reported task difficulty. Examination of the group means for task difficulty (Table 8.11c) reveals the direction of these differences. Reported difficulty by the Choose 5 group is higher than that for both the Choose 3 and Choose 7 groups. This suggests an inverted U-shaped relationship between size of subset to be selected and reported task difficulty, a relationship which confirms the predictions of H11. We can therefore conclude that, at least when individual differences in reported difficulty are controlled for, there is evidence from the data in support of H11.

8.2.2.6 Differences in Sequence of Information Search

Although no specific hypothesis was advanced for differences in sequence of information search, it was considered desirable to examine the data for any differences along this variable since it is an important factor in classifying decision strategies. Table 8.12a shows ANOVA results using Bettman and Jacoby's (1976) Same Brand Index (SBI) as a measure of sequence of search. Recall from chapter 5 and earlier discussions in this chapter that this index measures the extent of alternative-based processing in a subject's search matrix. It varies from zero for a subject using a pure attribute-based processing strategy, to one for a subject using a pure alternative-based strategy. In between these two extremes, a higher value for SBI indicates a higher level of alternative-based processing.

Table 8.12
ANOVA for Sequence of Information Search Using Bettman and Jacoby's (1976)
Same Brand Index

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Main Effects	.479	2	.239	1.655	.198
Experimental Group[a]	.479	2	.239	1.655	.198
Explained	.479	2	.239	1.655	.198
Residual	10.125	70	.145		
Total	10.604	72	.147		

[a]Group Means: Choose 3: 0.70 (n = 26)
                 Choose 5: 0.54 (n = 24)
                 Choose 7: 0.73 (n = 23)

From Table 8.12a, we note that the effect of group differences on SBI is not statistically significant ($F_{2,70}$ = 1.655; p<0.1). Effect size for group membership is 0.045 but power of the test is only 0.337 for α = 0.05. It appears then, that the lack of statistical significance is due to inadequate power of the test to detect the given effect size. In spite of this, it is interesting to note from Table 8.12a that all the group means are above 0.5, thereby suggesting a greater amount of alternative-based processing in all the multiple item selection groups of our study. These figures confirm our conclusion in an earlier section of this chapter that subjects used more alternative-based processing in multiple item decisions than in single item decisions. Furthermore, we note from Table 8.12a that, even though the differences are not statistically reliable, group means for the Choose 3 and Choose 7 conditions are at about the same level, and that both are higher than the mean for the Choose 5 condition.

The obvious conclusion is that, in addition to the general likelihood that there would be greater use of alternative-based processing in multiple item selection decisions, size of subset to be selected affects this likelihood. In particular, for selection of very small and very large subset sizes, there is a tendency for increased used of alternative-based processing over and above what we already expect for multiple item selection decisions in general.

8.3 Supplementary Analysis

In addition to the aggregate group analyses used to test the hypotheses, a number of supplementary analyses were performed to gain further insight into results of the empirical study. These included detailed analyses of individual search protocols, and analyses examination of responses to certain questions in the post-decision questionnaire. These analyses provided very useful insight into the data. Appendix I illustrates the approach used in these analyses. However, the findings from these analyses are not presented because they are not directly relevant for testing the hypotheses. Moreover, as Appendix I indicates, the results are quite detailed, and each individual protocol is so unique, that presentation of the results would cloud the main objective of this results chapter. Consequently, we have decided to incorporate discussion of these results into the general discussion of the overall findings of the study. This implies that, at appropriate places in the general discussion, results of the detailed individual analyses would be brought in to explain some of the findings of this study.

PART V

DISCUSSION

This part of the dissertation consists of 2 chapters. In chapter 9, results of the overall findings from the empirical study are discussed and their implications outlined. Chapter 10 discusses limitations of the present study and suggests directions for future research into consumers' decision strategies when they make decisions involving selection of multiple items from the same product class.

CHAPTER 9

DISCUSSION AND IMPLICATIONS

This chapter is organized into four sections as follows. In section 9.1 a brief summary of the objectives and design of the study reported in this dissertation is presented. Section 9.2 discusses the overall results of tests for differences between single and multiple item selection decisions, whilst section 9.3 presents a similar discussion of results for the three multiple item groups. Finally, in section 9.4, theoretical a practical implications of the overall findings are presented and discussed.

9.1 Summary of Study

The main objective of the study reported in this dissertation was to examine the extent to which information acquisition and integration strategies differ between decisions in which a single item is to be chosen and those in which more than one item is to be selected. To achieve this objective, a single factorial between-subjects experimental design was used in which the between subject factor was varied at 4 levels. This resulted in formation of 4 experimental groups. Selection of cities to visit during a vacation was used as experimental stimulus. The same profile of ten Asian cities described along 10 attributes was presented to all subjects. Subjects in Group 1 were asked to choose one city (Choose 1 condition), those in Group 2 were asked to choose three (Choose 3 condition), subjects in group 4 selected 5 (Choose 5 condition), whilst those in Group 4 selected seven (Choose 7 condition). Information acquisition differences among the groups were then analyzed in two sets of comparisons.

In the first comparison, information acquisition variables for the Choose 1 condition were compared with those of the aggregate of the Choose 3, Choose 5, and Choose 7 conditions. This set of comparisons investigated information acquisition differences between single and multiple item decisions, and was meant to answer RQ2. In the second set of comparisons, the same information search variables for the Choose 3, Choose 5, and Choose 7 groups were compared. Thus, this set of comparisons investigated the effects of size of subset to be selected on information acquisition behavior. It therefore, provided answers to RQ3. In the sections that follow, summaries of findings from these comparisons are presented and discussed.

9.2 Differences Between Single and Multiple Item Decisions

For this part of the empirical analyses, it was hypothesized that, because of the need to make holistic evaluations to determine the contribution of each alternative to an eventually chosen subset, consumers who select more than one item will search a higher proportion of available information with less variable search patterns than those who select only one item from the same product class. Furthermore, those who select more than one item were expected to use more alternative-based processing and to spend more time on their decisions than those who select only one alternative. Table 9.1 summarizes the relevant hypotheses and findings from the empirical study.

It can be seen from Table 9.1 that support was found for hypotheses relating to all but two of the dependent variables used in the study. The two hypotheses for which support was not found, related to variability in search per attribute and perceptions of task difficulty. For variability in search per attribute, differences between the two groups were in the expected direction although they lacked statistical significance. For perceptions of task difficulty, however, the differences were neither significant nor in the direction predicted by the relevant hypothesis. Prior to discussing the overall implications of the findings for this part of the study, it would be imperative to discuss possible explanations for the lack of support for hypotheses about differences for variability in search per attribute and perceptions of task difficulty.

Table 9.1

Summary of Hypotheses and Empirical Findings for Differences Between Single and Multiple Item Decisions

Dependent Variable	Hypothesis	Differences Significant at $\alpha=0.05$?	Differences Significant with Covariate?	Direction of Differences
Proportion of Information Searched	Higher for Multiple Item group	Yes	Yes	Higher for Multiple Item group
Variability in Search per Alternative	Lower for Multiple Item group	Yes	N/A**	Lower for Multiple Item group
Variability in Search Per Attribute	Lower for Multiple Item group	No	No	Lower for Multiple Item group
Sequence of Search	More alternative-based processing in Multiple Item group, more attribute-based in Single Item group	Yes	Yes	More alternative-based processing in Multiple Item group, more attribute-based in Single Item group
Decision Time	Higher for Multiple Item group	Yes	Yes	Higher for Multiple Item group
Perceptions of Task Difficulty	Higher for Multiple Item group	No	No	Lower for Multiple Item group

** Not Applicable. This hypothesis was tested using the Mann-Whitney-Wilcoxon test which does not allow for analysis of covariance.

With regards to variability in search per attribute, the lack of significant differences may be due to the use of alphabets in identifying stimuli used in the study. Recall from chapter 6 that in order to, inter alia, enable effective manipulation of the product profiles, alphabets were used to identify both the suppliers and Asian cities presented as experimental stimuli in Session 1 and 2 of the study respectively. Recall further that variability in amount of information searched per attribute was measured as the standard deviation of amount of search per attribute across all provided attributes. To achieve this, for each subject, the number of alternatives searched per *available* attribute was first determined. The figures for all attributes then formed a vector (or array) of 10 numbers (one for each attribute) for which the mean and standard deviation were calculated. As such, high variability in search per attribute is an indication that unequal numbers of alternatives were searched for each of the provided

attributes, or put differently, that subjects were selective with regards to the *alternatives* for which they searched information.

Given this method of calculating variability in search per attribute, there are two possibilities that could lead to high variability for any particular subject.

1)   Where the subject uses only a *subset* of the provided attributes, and

    a)   for each selected attribute, searches all available alternatives, or

    b)   searches all available alternatives for some of the selected attributes, but only some alternatives for other attributes, i.e. unequal numbers of alternatives are searched for the selected attributes.

Infact, given the operational definition of variability used in this study and most other studies within the process-tracing paradigm, a subject would have high variability in search per attribute as long as s/he uses a subset of the available attributes, irrespective of whether s/he subsequently searches all or only some alternatives for each selected attribute.

2)   Where the subject uses *all* provided attributes, but available alternatives are searched to different degrees on the attributes.

Distinguishing between the above possibilities is important because it helps explain why there were no differences for variability in search per attribute between the single and multiple item groups, as well as why for both groups variability in search per attribute was generally higher than variability in search per alternative.

With regards to the first possibility, i.e., using only a subset of the available attributes, there is no theoretical reason why the distinction between single and multiple item decisions should have implications for whether or not the consumer uses all or only a subset of the provided attributes in his/her evaluations. Rather, this would be determined largely by the amount of information available, and the consumer's need to reduce cognitive processing costs, as well as by the importance to the consumer, of each of the provided attributes. Where a large amount of information is available to be integrated and alternatives are not identified with actual brand names, a desire to reduce processing cost will most likely be achieved by

restricting the number of attributes used in evaluations, rather than restricting the number of alternatives evaluated (since it is not possible to eliminate alternatives solely on the basis of brand name). This may be the case irrespective of the number of alternatives to be selected. Similarly, where all provided attributes are not considered important by the consumer, only a subset of attributes would be used in the evaluations, again irrespective of the number of items to be selected.

With regards to the second point, i.e. where all provided attributes are used in the evaluations, high variability in search per attribute would result only because unequal numbers of alternatives were searched for each attribute. Here there is a theoretical basis to expect more variable search patterns for the Single Item group than for the Multiple Item group. Indeed, the arguments leading to the hypothesized differences for variability in search per attribute were based on the assumption that respondents would use all provided attributes in their evaluations. Those in the Single Item group were then expected to search unequal amounts of information for each attribute mainly because they are more likely to use sequential decision processes whereby some alternatives are eliminated earlier in the decision process, and so would not be searched for subsequent attributes. Put differently, those in the Multiple Item group were expected to search equal amounts of information for each available alternative because of the need for holistic evaluation of alternatives to determine contribution of each to an eventually chosen subset.

It turned out from detailed analysis of individual search protocols that, because stimuli used in the study were identified by alphabets, most respondents who intended to limit the amount of search, did so by limiting the number of attributes used in evaluations rather than by restricting the number of alternatives evaluated. This was so irrespective of which experimental group they belonged to. Consequently, although subjects in the Single Item group used more noncompensatory processes than those in the Multiple Item group, the very fact that variability was calculated by reference to the entire pool of provided attributes resulted in a generally high level of variability for both groups. This also tended to cloud any differences in variability which are a consequence of the greater use of noncompensatory processes in the Single Item group.

With regards to perceptions of task difficulty, the lack of significant differences was especially surprising when considered within the context of observed information acquisition differences between the two groups. In other words, when the lack of differences in perceived difficulty is put within the context of the overall findings for this part of the study, it is tempting to ask the question:

Why were there information acquisition differences between the Single and Multiple Item groups when these two decision tasks were perceived by subjects to be equally difficult (easy)?

This question is especially relevant because differences in task complexity/difficulty was one of the arguments underlying the hypothesized differences in information acquisition. There are a number of possible answers to this question.

The first of these is related to measurement, more specifically, possible inadequate tapping of the domain of the difficulty construct. Even though care was taken to word the single item measure of this construct so as to emphasize perceptions of difficulty in *deciding which alternatives to choose,* it is possible that different respondents reported perceived difficulty of other aspects of the decision task. For example, a respondent who found it difficult to keep track of the acquired information because this was not presented in matrix format, may be reacting to this aspect of difficulty in his/her response to the single item measure of perceived task difficulty. With the benefit of hindsight, it would have been more appropriate to distinguish between difficulty in information acquisition, difficulty in evaluating alternatives, and difficulty in deciding among the evaluated alternatives. A composite measure of difficulty as the aggregate of these three components could then be used in testing for differences between the groups. Such a distinction would have been consistent with the Decision Process Components framework (Einhorn and Hogarth, 1981).

Alternatively, a distinction between pre-decision and post-decision difficulty would have been desirable. In that case, pre-decision difficulty would refer to subjects' perceptions of how difficult they thought the decision would be *prior* to examining any information. This type of difficulty would most likely have an impact on information acquisition. Post-decision

difficulty, on the other hand, would relate to subjects' perceptions of the decision task *after* they have examined available information and made their decisions. This is the type of difficulty measured in the present study. Clearly, this type of difficulty cannot have any impact on information acquisition.[68]

Having said this, it is imperative to add that although measurement of task difficulty may have been inadequate in the study, may not be the only explanation for lack significant differences in perceived difficulty between subjects in the two groups. In particular, even if some subjects responded to difficulty of other aspects of the task than that intended in the single item measure of the construct, these respondents should be randomly distributed across all experimental groups because respondents were initially assigned randomly to each of the groups. Under such an assumption, these random effects should cancel out across groups, and any actual differences should be reflected in the group means. If this is the case, then the observed differences in group means should indicate differences in some aspect of difficulty that is attributable to the different number of alternatives that had to be selected in each of the groups. Therefore, inadequate measurement of task difficulty cannot explain the lack of significant finding for perceptions of task difficulty.

This brings us to the second, and most likely answer to the question posed above, namely that response mode effects accounted more for the differences in information acquisition than task difficulty effects. Recall from chapter 5 that task difficulty was one of two factors hypothesized to have an effect on information acquisition differences between single and multiple item decisions. The other was response mode effects, for which it was argued that, because of the need to select more than one of the available alternatives, multiple item decisions may well resemble judgement tasks whilst single item decisions are unequivocally choice tasks. Both task difficulty and response mode effects were predicted to lead to differences in information acquisition in the same direction as contained in the relevant

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[68]It should however, be noted that, although with the benefit of hindsight a multi-item measure of perceived difficulty would have been desirable, a single item measure was initially deemed appropriate because, perceived difficulty was only of supplementary interest as a dependent variable. Moreover, it was considered desirable to limit the length of the post-decision questionnaire because we anticipated that after spending much time on the decision, subjects might react negatively to a very long questionnaire.

hypotheses. Now, since the results show that task difficulty effects cannot explain the differences in information acquisition behavior, the most plausible conclusion is that response mode effects accounted for these differences. This conclusion is especially viable since, in the arguments leading to the hypotheses, the implicit assumption was that the two factors would have an additive (as opposed to interactive) effect on information acquisition differences between single and multiple item decisions.

Despite the lack of significant differences for two dependent variables of the study, it is fair to conclude that overall, support was found for the hypothesized differences between single and multiple item decisions. Subjects in the Multiple Item group generally searched more information with less variable search patterns than those who were asked to select only a single alternative. They also tended to use more alternative-based search patterns, and to spend a significantly greater amount of time on their decisions than those asked to select only one item. When these findings are interpreted within the context of the broad distinction between compensatory and noncompensatory decision strategies, one may conclude that there was a greater tendency for subjects who selected more than one alternative to use information acquisition strategies consistent with a compensatory heuristic than those who selected only a single item. Implications of these findings are taken up in section 9.4 where implications of the overall findings of the study are discussed. For now, however, we discuss the results for the second set of hypotheses (i.e., H7 - H11) tested in the study.

9.3 Effects of Size of Subset to be Selected

The study reported in this dissertation also investigated and found differences in information acquisition strategies when subjects selected different subset sizes in multiple item decisions. Specifically, it was hypothesized that subjects who had to select very small and very large subset sizes, would acquire a smaller proportion of the available information with more variable search patterns than those who select moderate subset sizes. Furthermore, those who select small and large subsets were expected to spend less time making their decisions, and to report lower levels of perceived task difficulty than those who select moderate subset sizes. No hypothesis was specified for differences in search sequences. Table 9.2 shows summaries

of the relevant hypotheses and findings for this part of the empirical study.

Table 9.2
Summary of Hypotheses and Findings for Differences Attributable to Size of Subset
to be Selected in Multiple Item Decisions

Dependent Variable	Hypothesis	Differences Significant at $\alpha=0.05$?	Differences Significant with Covariate?	Direction of Differences
Proportion of Information Searched	Inverted U-shaped as a function of subset size	No	Yes	Regular U-shaped relationship
Variability in Search per Alternative	Regular U-shaped as a function of subset size	Yes	Yes	Positive Linear Relationship
Variability in Search Per Attribute	Regular U-shaped as function of subset size	Marginally	Yes	Inverted U-shaped Relationship
Sequence of Search	No specific hypothesis	Yes	Yes	More alternative-based for small and large subset sizes than for moderate sizes
Decision Time	Inverted U-shaped as a function of subset size	No	No	Negative Linear Relationship
Perceptions of Task Difficulty	Inverted U-shaped as a function of subset size	No	Yes	Inverted U-shaped Relationship

As shown in Table 9.2, tests of these hypotheses provided some mixed findings. First, for all but one of the dependent variables, there were statistically significant group differences only when individual differences were partialled out. The only dependent variables for which significant group differences were found without a covariate are variability in search per alternative and sequence of search. Second, for almost all dependent variables, the direction of group differences were not consistent with that specified in the relevant hypotheses. For example, with regards to proportion of information searched and perceptions of task difficulty, an inverted U-shaped relationship as a function of subset size was hypothesized. However, the data showed a regular U-shaped relationship. On the other hand, the data showed inverted U-shaped or linear relationships for variables for which regular U-shaped relationships were

hypothesized.

Overall, the results of this part of the study indicate that, *when individual differences are controlled for,* subjects who selected small or large subset sizes tended to search a higher proportion of available information with lower variability in search per attribute than those who selected moderate subset sizes. Furthermore, subjects who selected small and moderate subset sizes were more likely to use alternative-based processing strategies, and to report higher task difficulty than those who selected a moderate subset size. However, this was not associated with a corresponding lower variability in search per alternative. Rather those who selected low and moderate subset sizes tended to have less variable search per alternative than those who selected a large subset size. The general pattern of results for this part of the study presents two issues that are worthy of discussion. These are:

1.   The statistically significant linear relationship for variability in search per alternative.

2.   The lack of directional support for all but one of the hypotheses in this part of the study.

These two issues will be discussed in turn, beginning first with the significant linear relationship found for variability in search per alternative. This finding seems inconsistent with other results for this part of the study because, in theory and principle, with larger amounts of information searched there is an increased likelihood that variability in search per alternative would be lower. Therefore, to be consistent with the trends suggested by the data, an inverted U-shaped relationship should have been found for this variable. More specifically, to be consistent with the results for proportion of information searched, variability in search per alternative for the Choose 7 condition of the study should have been at approximately the same level as for the Choose 3 condition, or at least it should have been lower, not higher than for the Choose 5 condition.

In the detailed examination of individual search patterns, it was discovered that this seemingly inconsistent finding for variability in search per alternative arose because, for some reason or another, some subjects in the Choose 7 condition (i.e. the large-subset-size group) tended

to search all or almost all attributes for some alternatives and few or no attributes at all for other alternatives. It is difficult to find any plausible explanation for why this happened, especially when one considers the earlier suggestion that, since alternatives were identified by alphabets, the only way to limit processing would be to limit the number of attributes used in the evaluations not the number of alternatives for which information is sought. Suffice it to say that this peculiar search behavior of some subjects in this group combined with the specific manner in which variability in search per alternative was calculated, to produce unusually high variability in search per alternative for this group.

Recall again from chapter 6, that variability in search per alternative was operationalized as the standard deviation of amount of search per alternative across *all available alternatives*. As such even if a subject searched a high proportion of the available information, variability in search per alternative could still be high if a few alternatives were not searched at all. As an illustration, one subject in the Choose 7 group (respondent 54) searched for information on only 9 out of the 10 available alternatives. For these 9, all attributes were searched on 8 alternatives, and 9 attributes were searched on one alternative. Overall, this subject searched 89% (a reasonably high proportion) of the available information. However, because one alternative was not searched at all, variability in search was 2.98 (again, quite high) when calculated as the standard deviation of amount of information searched per alternative across *all available alternatives*. Note here that, variability would have been 0.31 if it were calculated across the set of *searched alternatives* (i.e., by reference to the 9 alternatives for which information was searched).[69]

In addition, to this effect which can be attributed to the particular way variability in search per alternative was operationalized, certain types of search patterns in this group also resulted in a high proportion of information searched with a corresponding high variability in search per alternative. For example, another subject in this group who searched at least some information on all alternatives, first began by searching all attributes for each alternative. After searching the first 3 alternatives on all provided attributes, s/he switched strategy and started searching the remaining alternatives on only 6 of the provided attributes. Thus, overall

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[69] The interested reader may verify that standard deviation of the array 10, 10, 10, 10, 10, 10, 10, 10, 9, 0 is 2.98, whilst that of the array 10, 10, 10, 10, 10, 10, 10, 10, 9 is 0.314.

s/he searched 72% of the available information (fairly high). However, because of the switch in strategy, variability in search was 1.83 for this subject (also fairly high).[70]

In sum, the linear relationship between subset size and variability in search per alternative can be attributed to two main factors. One is the prevalence of certain individual search patterns in the Choose 7 group which, although systematic and useful to the subjects under the conditions of this study, are not exactly anticipated in current models of consumers' decision strategies. The second is a method artifact, specifically the operational definition of variability in search used in contemporary decision research that uses a process-tracing methodology. These findings clearly have methodological implications for future research to which the discussion will turn at the appropriate place in this chapter. For now, however, it would be useful to pursue discussion of the general lack of directional support for the hypotheses in this part of the study.

In this regard it would be worthwhile to briefly summarize the main arguments that were advanced in support of these hypotheses.[71] First, based on the findings by Shafir (1993), it was deduced that, in general subjects who are required to select small subsets and those required to select large subsets would have fairly similar information acquisition patterns. Second, it was argued that as size of subset to be selected increases, task difficulty would increase upto the point where subset size equals half the number of available alternatives. Thereafter, difficulty will decrease as subset size increases, thereby suggesting an inverted U-shaped relationship between subset size and task difficulty. Finally, task difficulty was expected to affect information acquisition variables in a manner reflecting an extension of the predicted effects of task difficulty on differences in information acquisition between single and multiple item decisions.

It is worth noting that the results of this study provide support for the first two deductions. With the exception of variability in search per alternative, for all other variables for which

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[70] The reader may again verify that standard deviation of the array 10, 10, 10, 6, 6, 6, 6, 6, 6, 6 is 1.833.

[71] The reader may refer to chapter 5, section 5.2.2 for the detailed arguments.

significant differences were found, mean values for subjects who selected 3 alternatives (small subset size) were consistently quite similar to those for subjects who selected 7 alternatives (large subset size). Furthermore, the data also show that perceived task difficulty was lower for subjects who selected small and large subsets (3.92 and 3.57 respectively) and higher for those who selected moderate subset size (4.44).[72] Therefore, the lack of directional support for the hypotheses can neither be attributed to lack of similarity between the small-subset and large-subset groups, nor to lack of differences in perceived difficulty in the predicted direction.

Given this situation, the only plausible reason for this lack of directional support seems to be due to some inadequacy of the third set of arguments, i.e. those relating to the effect of task difficulty on information acquisition in multiple item decisions. For example, whilst it was expected that higher task difficulty in selecting a moderate subset size would be associated with a higher proportion of information searched, the results show that this higher difficulty is actually associated with a lower proportion of information searched. Clearly, this prediction seems inadequate, and there are two possible reasons why this may be so.

1.   The effects of task difficulty on information acquisition might have been wrongly specified in the hypotheses. Stated differently, task difficulty has an effect on information acquisition in multiple item decisions, but higher difficulty leads to a lower (not higher) proportion of information searched with associated higher (not lower) variability in search patterns.

This explanation is doubtful in view of the earlier lack of task difficulty effects on information acquisition differences between single and multiple item decisions. In other words, if task difficulty has an effect on information acquisition in multiple item decisions, it should have had an effect on processing differences between single and multiple item decisions. This must be so unless there is a theoretical reason why task difficulty can help explain information acquisition differences when different subset sizes are to be selected, but are incapable of explaining differences between single and multiple item decisions. As at now

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[72] Mean scores on a 7-point Likert scale where 1=Very Easy .... 7=Very Difficult.

the author does not have access to any such theoretical explanation. Consequently, this first explanation has to be rejected. This leads to the second possible reason why the predictions contained in H7 to H11 may have been inadequate, namely,

2.   Task difficulty, at least as measured in this study, does not have an effect on information acquisition in multiple item decisions. In other words, the observed direction of differences among the three multiple item groups is due to some other factor(s), not task difficulty.

This explanation is much more consistent with the overall findings of this study, especially when findings for the two parts of the study are considered as a whole. It however, presents a new challenge, viz the need to find alternative explanations for the observed differences in information acquisition strategies among the three groups of multiple item selection decisions. More specifically, the challenge is to explain why subjects who selected five out of 10 alternatives tended to search a lower proportion of available information with more variable patterns than those who selected either three or seven alternatives from the same set. One possible explanation may be found in the interaction between effort/accuracy framework of adaptive strategy selection (Payne, Bettman, and Johnson, 1988; Klein and Yadav, 1989; Payne et al., 1992) and the constructive nature of consumer decision processes (Bettman and Zins, 1977).

Building on an assumption that decision strategy selection is sensitive to the relative emphasis placed by the decision maker on accuracy versus effort, the effort/accuracy framework suggests that consumers may have as processing goals the need to achieve accuracy in choice versus the need to reduce processing effort. When the goal is to maximize choice accuracy, consumers will search more information with less variable search patterns and spend more time on their decisions. On the other hand, where the goal is to minimize effort, consumers would search less information with more variable search patterns and generally spend less time on their decisions.[73]

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[73]Payne, Bettman, and Johnson (1988) present results of simulation and experimental studies that confirm these effects of processing goals on strategies adopted by consumers in decision making.

Constructive decision making posits that consumers do not always begin a decision with a predetermined processing strategy which they execute throughout the decision process. Rather, decision strategies may be constructed for specific decision situations depending on the task or context factors associated with the specific situation. Thus, the

> "heuristic used is developed at the actual time of choice....[and] ... the individual makes up the strategy as he or she goes along" (Payne et al., 1992; p. 123)

This line of argument suggests that, during any particular stage in the decision process, a consumer may change his/her processing strategy depending on information acquired up to that point. It also implies that as the decision progresses, relative emphases between maximizing accuracy and minimizing effort may change as the consumer learns more about the decision context. For example, the consumer may start out with the goal of achieving decision accuracy. However, after learning more about the decision context, s/he may discover that no alternative clearly dominates all others, and so accuracy in choice would have to be achieved at the expense of greater processing effort. At this stage, the consumer evaluate the extent to which this increased processing effort would lead to any substantial improvement in choice accuracy, *given his/her current knowledge about the decision context*. The result of this evaluation may be a shift from the initial goal of maximizing accuracy to one of minimizing effort in subsequent processing.

In order to appreciate how a combination of effort/accuracy predictions with constructive decision making can help explain the tendency of the Choose 5 group to search a lower proportion of information with more variable patterns than the Choose 3 and Choose 7 groups, we need to consider how the number of alternatives to be selected by this group may have impacted on their need to maximize accuracy versus minimize processing effort. Since subjects in this group were required to select half of the available alternatives, even with a purely random choice strategy (i.e, one in which no information is searched at all), there is a reasonable chance that some good alternatives would be included in the chosen subset. Subjects in this group might then have started out with an objective of minimizing effort rather than maximizing accuracy. This, according to the effort/accuracy framework, would have predisposed them to be selective in their search for information.

Alternatively, subjects in the Choose 5 group might have started out with a goal of achieving accuracy in choice. However, after searching some information on all alternatives, they would have discovered that all alternatives had excellent ratings on some attributes and very bad ratings on other attributes. In other words, that no alternative dominates all others. Following predictions of the constructive process framework, this situation might have led to a change in processing goal from the initial objective of maximizing accuracy to one of minimizing processing effort. Again, such a shift would lead to more selective information search, thus explaining the relatively low proportion of search found for the Choose 5 group.

In conclusion, the pattern of results for the three multiple item groups are better explained by reference to constructive decision making and effort/accuracy principles than by the effects of task complexity. It should, however, be noted that this may not be the only explanation of these results. However, given the present state of knowledge about multiple item selection decisions, this explanation seems to be the most plausible. Future theoretical developments to explain the observed differences among the three multiple item groups is definitely called for.

9.4 Implications

The findings reported in this study have a number of interesting implications for decision research. These findings clearly demonstrate that the number of items to be selected in a decision has an impact on strategies used by consumers in acquiring and integrating available information. When subjects were presented with the same set of alternatives, those who were asked to select more than one item tended to adopt more compensatory decision processes than those asked to select only one alternative. In the decision literature, compensatory processes have been found mostly for judgement tasks, and for choice tasks in which either there are a few available alternatives, or the compensatory process is used in a two-phased process. The present findings show that for decisions in which multiple items are to be selected, the compensatory heuristic would be used inspite of the large number of available alternatives.

The obvious conclusion is that, as has been suggested elsewhere in the limited available literature, multiple item decisions have certain structural properties that distinguish them from single item decisions. In addition, within multiple item decisions, this study found information acquisition differences for different sizes of subset to be selected. The obvious implication is that decision researchers need to devote more attention to studying multiple item decisions than has been the case in the past. The findings have particular implications for theory-building where there is the need for alternative theoretical frameworks to explain why information acquisition differs between single and multiple item decisions, as well as for selection of different subset sizes in multiple item decisions.

In addition, to implications of the general results of this study, one specific finding has useful implications for decision research. This is the persistent effects of individual differences on all the information acquisition variables studied in this dissertation. For almost all variables, there were highly significant effects of corresponding variables from Session 1 of the study when these were included as covariates in an analysis of covariance model. In fact, for the comparison between single and multiple item decisions the lowest covariate effect had an F-value of 11.036 for 1,107 d.f. An obvious implication of this finding is that decision researchers need to pay more attention to correcting for individual differences when investigating information acquisition and integration strategies. In particular, when sample sizes are small and therefore, statistical power is expected to be low, using a within-subjects design to allow for partialling out individual differences, appears to be a useful prelude to valid inferences.

Another specific finding that has direct relevance for decision research is that related to the insignificant (or opposite directional) effects of task difficulty. As discussed earlier in this chapter, one possible explanation for the lack of significant effects in the distinction between single and multiple item decisions, may be inadequate tapping of the construct. Specifically, the speculations contained in the discussion of this variable, imply that future research along the same lines as the present study, should distinguish between pre- and post-decision task difficulty. This would enable a more complete identification of the specific aspect of difficulty that can have an impact on the distinction between single and multiple item decisions.

Finally, if future research confirms the results of this study, this may have implications for design and marketing of products for which consumers ordinarily select multiple items. As regards design, the present findings suggest that marketers of such products should not be too concerned that individual items in their product offerings do not excel on all attributes relevant for evaluating alternatives in the product class. This is because, since consumers tend to adopt compensatory processes in evaluation of such products, deficiencies in certain product attributes would be compensated by strengths in other aspects. Similarly, as regards marketing communication, marketers of such products may need to emphasize the overall worth of each product alternative, rather than its excellence on a few selected attributes. This would then lead to creation of a positive overall product impression and increase the likelihood that each item would be included in an eventually chosen subset. It is worth mentioning, however, that at this stage, these implications are only speculatory. First, because the present study had a more theoretical than practical orientation. Second, because further research is needed before the results of the present study can be considered as conclusive.

CHAPTER 10

STRENGTHS, LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

This final chapter is organized into three sections as follows. Section 10.1 discusses some unique strengths of the methodology used in the study. In section 10.2, limitations in the study are discussed and suggestions made for future research in multiple item decision making. Section 10.3 evaluates the strengths and limitations in a philosophy of science perspective. This section also presents some general concluding remarks.

10.1 Strengths

One of the major strengths of the study reported in this dissertation lies in the methodology used for the empirical study. Certain aspects of the design need discussion in this respect. First, by using a computerized information board, certain weaknesses of the traditional information board technique were overcome in the present study. Specifically, because time taken to make the decision was recorded by the computer, the experimenter did not have to be present to record the time taken. This ensured that the data was collected with a minimum amount of obtrusion from the experimenter. In fact, for the three doctoral students used in the study, the software was simply handed to them on diskettes, and they performed the tasks at their own convenience in their own offices.

Second, by designing the software so that it also recorded time spent on each information value, it was also possible to perform detailed analysis of each subject's data in a manner

similar to verbal protocol analysis. Specifically, by examining the time spent on each information value, it was possible to break down each subject's search pattern into distinct segments corresponding with marked differences in time spent on certain information values. For instance, if for the first six information items a subject spent an average of 20 seconds, but then spends 70 seconds on the seventh information value, this represents a distinct pause in the search pattern, and could be an indication that the subject was evaluating the information acquired up to that point. Indeed, analyses of individual search patterns showed that such distinct pauses were often followed by a switch in processing strategy (e.g. from alternativewise to attributewise), or they were followed by search patterns in which some alternatives were never again searched (indicating that these had been eliminated during the evaluation phase). Such detailed analyses were also facilitated by reference to the notes taken by subjects during the experiment, another feature of that obviously represents a strength in the methodology. Researchers using an information board paradigm may consider emulating this example by measuring time spent on each information value in future research.

Third, the fact that data was not presented in matrix format in the present study is a factor that strengthened some aspects of the data collection. As Brucks (1985) notes, the traditional information board approach, and by implication the computerized versions that provide the subject with an alternative-by-attribute matrix,

> "delimit(s) the size of the brand choice problem by defining the number of available alternatives and attributes,... [and]... actually provide a partial solution to the original brand choice problem, since much of (people's) ability to solve problems lies in (their) ability to form a useful representation of a problem's structure".

To overcome these problems, Brucks (1985) used a methodology in which subjects were simply presented with the decision problem and were not told how many alternatives and attributes are available. Subjects were also provided with a limited amount of money and time, and any information they requested was obtained at a cost either in time or money. For example they could make "store visits" which cost them travel time, or "phone calls" to stores which cost them money.

It must be admitted that the present study defined the number of alternatives and attributes, and therefore, "delimited the size of the brand choice problem". Furthermore, in terms of incorporating an explicit cost of information search, the present methodology was not as sophisticated as suggested by Brucks (1985). However, by not presenting the information in matrix format, this study did not pre-structure the decision problem. Subjects were free to structure the problem as they desired. Infact, detailed individual analysis showed that whilst some subjects constructed an alternative by attribute matrix on the pieces of paper provided for taking notes, others did not. Furthermore, by making subjects type in combinations of alphabets and numerals anytime they wanted a particular information value, this study introduced an aspect of cost associated with information search. This is consistent with some aspects of the methodology suggested by Brucks (1985) to overcome her reservations.

One final strength of the present study lies in the degree of confidence that can be attached to the results. In particular, including a Choose 1 condition in the study did not only allow comparison of the search statistics for this group with those for the Multiple Item group, it also allows comparison of search statistics for this group with findings from previous studies in which subjects selected only one of the available alternatives. In this regard, it is noteworthy that the proportion of information searched by the Single Item group compares well with what has been found in previous studies. For example, Payne's (1976) subjects searched an average of 48.4% of available information for a 12 by 8 matrix[74] (i.e., 96 information values). Shields (1983) found a mean of 56% for a 9 by 13 matrix (117 information values), Cook (1987) reported a mean of 50% for a 10 by 7 matrix (70 information values), whilst Olshavsky (1979) found a mean of 31% for a 12 by 15 matrix (180 information values). The present study found a mean of 57% for the Single Item group using a 10 by 10 matrix (100 information values).

Although no study that used a 10 by 10 matrix was found for direct comparison, these comparisons are still useful in light of the cost/benefit hypothesis that proportion of information searched will decline as the total amount of available information increases. In that case, we note that the means reported above are all associated with about the same

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[74] i.e. 12 alternatives and 8 attributes. The same convention is used for subsequent studies. The first numeral refers to number of available alternatives and the second to number of provided attributes.

amounts of provided information values, and so the comparison may not be completely out of place. It is also worth noting that proportion of information searched by the Single Item group compares well with previous findings inspite of the fact that subjects in the present study had the opportunity to take notes and could spend as much time on the decision as they liked. These aspects of the methodology had the potential to facilitate more information use. All the same the Single Item group did not take advantage of this to search more information than those in previous studies who did not have the opportunity to take notes.

Given then that information search statistics for the Single Item group compares well with previous studies, there is additional grounds for increased confidence in the observed differences between the Single and Multiple Item groups of the present study.

10.2 Limitations and Suggestions for Future Research

Just as the present study has some unique strengths as discussed above, it also has a number of limitations. The first of these is the use of student samples which may have consequences for our ability to generalize the present findings beyond the sample used in the study. A number of studies cited in Troye (1983) have expressed serious reservations about the use of student samples in experimental research. Other studies (e.g. Capon and Kuhn, 1979; Capon and Burke, 1980) have found students to have superior information processing abilities compared to the average consumer. In the present study, the highly structured manner in which subjects made their decisions may be due to this superior information processing capabilities. Furthermore, because certain courses in business school curricular emphasize structure and "rational" decision making, respondents in the present study who were all business students, may have been behaving more "rationally" under the conditions of the study than ordinary consumers would behave.

A related issue is the use of a single product class. Here too, the literature suggests that consumers' information acquisition behavior may vary as a function of product class. This also has implications for our ability to generalize the present findings beyond the setting of the experimental study. Specifically, it suggests that in view of the lack of previous studies

along the same lines as the one reported in this dissertation, one has to be cautious about generalizing the findings to other product classes. Clearly, there is a need for future research to replicate the present study with a different product class and using other respondents besides students.

The second possible limitation of the present study relates to the between-subjects design used for the experiments. Although significant differences were found among the experimental groups, a relevant research question is whether or not the same individual would adopt different information acquisition strategies depending on the number of alternatives to be selected in a decision. Clearly, this question can only be answered with a within-subjects design. Whilst the choice of between-subjects design for the present study was based on well thought-out considerations, future research might consider employing a within-subjects design to determine how information acquisition is affected when the same person selects a single and multiple items from a product class.

Third, the present study focussed exclusively on _external_ information search. Internal search (or search from memory) was not investigated. It is however, well known from models of consumer decision making (see e.g. Bettman, Johnson and Payne, 1991) that internal search is an important aspect of consumer decision processes. In addition to this, there are other relevant aspects of consumers' decision processes that were not addressed in the study. In particular, current conceptualizations in the literature view consumer decision making as a narrowing down process in which a consideration set is first formed prior to detailed evaluation of alternatives (e.g. Troye, 1983). Our study did not distinguish between the two stages of consideration and choice.

This suggests that one fruitful area of future research in multiple item decision making would be to examine how consideration sets are formed for these types of decisions. Interesting research issues would be to determine whether or not the consideration set formation process is the same for these decisions as for single item decisions, how size of the consideration set varies across the two types of decisions, and whether the same factors as has been found for single item decisions (e.g. Grønhaug, 1973/74) affect size of the consideration set. For example, as regards consideration set size, one possible proposition is that consideration set

size would be larger for consumers who intend to make multiple selections than for those who intend to make a single selection.

Furthermore, as discussed in the literature review chapter of the dissertation, a number of task and context factors have been found to affect how consumers acquire and integrate information in their purchase decisions. The present study did not (and to be honest, could not) investigate the effects of any of the individual, context or task factors suggested in the literature. Again, this opens up a great number of possibilities for future research to examine how these factors affect information acquisition strategies in multiple item selection decisions. For example, an interesting research issue would be to examine what impact changes in the number of available alternatives/attributes have on information acquisition strategies when more than one item is to be selected from a product class.

10.3 Concluding Remarks

This chapter has shown that, as is common with most academic endeavors, the study reported in this dissertation has both strengths and limitations. However, most of the limitations arise out of the fact that no one study can ever address all variables relevant for studying a particular phenomenon. In that case, the limitations may be viewed as opportunities for future research. This chapter has taken this view throughout the discussions, and has offered useful directions along which future research may take. It is only through a collection of studies that the specific intricacies of multiple item decisions can be unravelled.

There is, however, one limitation discussed in this chapter that is not directly related to our inability to address every facet of multiple item decisions. This is the issue about our ability to generalize the results beyond the sample and setting used in this study. To what extent this actually represents a limitation is an issue that was contended in the famous Calder, Phillips, Tybout versus Lynch debate in the early 1980s (Calder, Phillips, Tybout, 1981; 1982; Lynch, 1982; McGrath and Brinberg, 1983). Calder and his colleagues argue that in a study like the present one, where the interest is in "theory applications" rather than "effects applications", the use of student samples in an experimental setting actually constitutes a strength because

it maximizes internal validity. This view is consistent with the often quoted Cook and Campbell (1979) position that:

> "Few theories specify crucial target settings, populations, or times to or across which generalization is desired. Consequently, external validity is of relatively little importance. In practice, it is often sacrificed for the greater statistical power that comes through having isolated settings, standardized procedures, and homogenous respondent populations. For investigators with theoretical interests our estimate is that the types of validity, in order of importance, are probably internal, construct, statistical conclusion, and external validity" (p. 83).

In the final analysis, when this study is evaluated, its strengths and weaknesses need to be considered within the context of its focus on theory application. In that case, the rigorous manner in which internal validity has been pursued at the expense of external validity is quite within the bounds of contemporary experimental design philosophy.

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APPENDICES

Appendix A
Questionnaire Used to Elicit Attributes for Constructing Product Profiles

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Fellow Student,

I am currently planning the data collection for my dissertation, and will like you to help me by devoting a little time in answering the following questions. Your answers to the questions will be used in designing a larger experiment for the main data collection.

I will also like to take this opportunity to invite you to participate in the main experiment which will take place in about three weeks time. In the experiment, you will use information provided by a computer to make various interesting decisions. The experiment will last about 45 minutes and you have a chance of winning kr. 500 in a lottery. Please indicate at the end of this questionnaire whether or not you are interested in participating in the experiment. If you will participate, please write your name in the space provided so that I can contact you later.

I wish to thank you in advance for devoting your precious time to answer these questions.

Alhassan G. Abdul-Muhmin
Institute of Marketing Economics

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1. In recent times, many Norwegians have been travelling to Asian destinations for their annual vacation. In your opinion, what are some of the reasons for this increasing popularity of Asia among Norwegian holiday-makers?

2. If you were deciding to travel to Asia for a vacation which countries/cities would you like to visit?

3.   What factors did you consider important in your selection of the above countries/cities?

4.   Participation in main experiment. Please indicate below whether or not you are willing to participate in the main experiment (Check the appropriate box):

a)   .... I am willing to participate in the main experiment. My name, contact address and telephone number are:

    ....

    ....

b)   .... Unfortunately, I cannot participate in the main experiment.

Please Turn Over

5. Assume that for question 4 above, you had not yet decided which countries/cities you would like to visit, how important would the following factors be for your decision?

	Helt uvesentlig				*Svært vesentlig*
Friendliness of the People	1	2	3	4	5
Quality of Cultural Attractions	1	2	3	4	5
Cleanliness of the Environment	1	2	3	4	5
Possibilities for Shopping	1	2	3	4	5
Quality of Historic Attractions	1	2	3	4	5
Quality of Accommodation	1	2	3	4	5
Level of Prices in the City	1	2	3	4	5
Standard of Parks in the City	1	2	3	4	5
Natural Beauty	1	2	3	4	5
The City's Accessibility	1	2	3	4	5
Nightlife and Entertainment	1	2	3	4	5
Possibilities for Camping	1	2	3	4	5

Thank you for taking time to answer these questions. Please return the completed questionnaire to the professor after the end of this class session.

Appendix B1
Supplier Profiles and Attributes Used in Session 1.

SUPPLIER I.D.	ATTRIBUTE NUMBER					
	1	2	3	4	5	6
A	4	3	6	2	5	7
B	3	4	1	6	7	5
C	5	1	2	7	4	6
D	3	6	7	2	5	1
E	6	7	1	4	3	2
F	7	3	2	1	4	5

Note: Profiles consist of ratings of suppliers on each of the provided attributes. Ratings are on a 7-point scale where 1 = Very Bad and 7 = Very Good

ATTRIBUTE NUMBER	DESCRIPTION
1	Product Quality
2	Payment Conditions
3	Technical Service
4	Delivery Conditions
5	Customer Follow-Up
6	Quality of Customer Training

Appendix B2
City Profiles and Attributes Used in Session 2 of the Experiment.

CITY	ATTRIBUTE					NUMBER					SUM
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**SUM**
A	5	1	7	6	4	3	2	5	6	7	46
B	6	7	4	2	5	1	3	6	7	5	46
C	2	1	3	7	4	5	6	7	1	2	38
D	1	7	4	3	1	6	2	5	2	3	34
E	4	2	3	5	6	1	7	4	3	2	37
F	7	3	2	6	4	5	4	3	5	1	40
G	4	4	5	7	6	2	3	1	5	6	43
H	5	6	7	1	7	2	5	4	6	3	46
I	6	4	1	2	3	7	5	6	7	1	42
J	7	5	2	4	3	1	6	7	1	2	38

Note: Profiles consist of ratings of cities on each of the provided attributes. Ratings are on a 7-point scale where 1 = Very Bad and 7 = Very Good

Attribute Number	Attribute Description
1.	Friendliness of the People
2.	Possibility of being understood (Language)
3.	Crime Level in the City
4.	Accessibility to Attractions Outside the City
5.	Quality of Cultural Attractions
6.	Security for Foreign Tourists in the City
7.	Standard of Accommodation in the City
8.	Quality of Historical Attractions
9.	Quality of Nightlife and Entertainment in the City
10.	Possibility of Escaping from the City's Tourist Mass

Appendix C
Overview of the Research Instrument - IAMS

The Information Acquisition Monitoring Software (IASM) is designed to run on personal computers that meet the following minimum hardware requirements:

1.   IBM PC or IBM compatible PC with 80286 processor, 12 mhz - MS-DOS operating system 3.0 or higher

2.   2 Mbytes of hard disk space

3.   350 K of free RAM

4.   Color monitor

The above are the minimum requirements but it is recommended that IASM be run on a PC with 80386-SX processor at 16 mhz. The software itself is divided into two interfaces (a decision maker interface and a researcher interface).

Researcher Interface

The researcher interface (RI) allows the researcher to define the parameters of the decision environment prior to the experimental task. This interface contains 4 main files:

1.   An attribute-list file. This is an ASCII format file in which the researcher enters the attribute descriptions. Each attribute description can contain a maximum of 45 characters including spaces between words. The first attribute description begins on the first line of the file. Separate lines are used for each description, and there should be no spaces before the first letter of each attribute description. When all attributes are entered the file is saved as "attrib.ala" in the same directory as other IASM files.

2.   A file containing the names (e.g brand names) of alternatives. This is also in ASCII format. Just as in the attribute-list file, names of alternatives are entered on separate lines in the file and saved in a file named "dest.ala". The name used to identify an alternative should not exceed 15 characters in length and there should be no space between the left margin of the page and the first letter of the name used to identify each alternative. In a second version of IASM this file is not necessary. This is useful

in decision tasks where the researcher intends to use alphabets to identify the alternatives. In that case IASM automatically assigns the letter A to the first alternative, B to the second, and so forth.

3. A file containing a matrix of numerical values (between 1 and 9) representing the ratings of alternatives on each attribute. Alternatives are represented in rows whilst attributes are represented in columns. As at now, IASM can be used only for decision tasks in which the decision matrix contains numerical values, specifically ratings of alternatives on the attributes. This matrix is also in ASCII format and saved in a file called "values.ala".

4. An executable file (hereafter called the 'manager program') which the researcher uses to specify the number of alternatives, number of attributes and number of selections for a particular decision task. The file name for the manager program is "IASMMAN.EXE". It is located in the same directory as the other files used by the software.

When the researcher runs this "manager program" by typing "iasmman" followed by 'Enter' a prompt appears on the screen asking her/him to specify the number of available alternatives for the decision task and press 'Enter'. Next s/he is asked to specify the number of attributes and press 'Enter'. Finally s/he is asked to type in the maximum number of alternatives to be selected by respondents in the decision task and again press 'Enter'. The manager program then uses this information to create an initialization file "init.ala" which is required by IASM. It is important that the information provided to the "manager program" corresponds to the information in each of the 4 files above. For example, if the attribute-list file contains a list of 5 attributes and the researcher enters 6 when prompted by the "manager program" IASM will crush when it is run. However, there is no problem if the attribute-list file contains 6 attributes but the researcher enters 5 when prompted by the "manager program". In that case the program will simply use the first 5 attributes in the list. The same applies to the matrix file. If this file ("values.ala") contains a matrix that is smaller than specified in the manager program IASM will crush when run. For example, if during prompts by the "manager program" the researcher specified 6 for number of available alternatives and 5 for number of

attributes, then IASM expects "values.ala" to contain a 6x5 matrix of numerical values. If however, "values.ala" contains a 5x4 matrix, then IASM will crush when it is run. On the contrary, a "values.ala" file with a larger matrix than specified in the manager program will work because IASM will simply use the upper left corner of the matrix. Therefore, it is of extreme importance that the researcher exercises care in defining the decision environment prior to running the experiment.

5.   The last set of files in the researcher interface are the results files which are generated after the respondent has gone through the decision task. Two files are generated for each experimental session.

The first file contains a record of the cells in the alternative X attribute matrix which were accessed by the respondent, the order in which the information was requested, the amount of time spent on each piece of information and the alternatives selected by the respondent. IASM also keeps track of the number of times the respondent accesses the attribute and alternative lists, the time spent viewing these lists each time they are accessed, and the total time taken to make a decision. Appendices F1 and F2 show printouts of this file for one of the respondents in our study. The second file generated after each session contains a record of the same information as above, but in a format that enables the researcher to import the results into a spreadsheet program like *Microsoft Excel* for subsequent graphing. Appendix G shows the results in Appendix F1 displayed in graphical form.

Decision Maker Interface
The decision maker interface (DMI) is the part of IASM with which the respondent interacts. This interface presents the respondent with information about the decision environment, instructions about the decision task, and guidelines as to how to work through the program. It also provides relevant information (list of available alternatives, description of attributes, and ratings of alternatives on attributes) when this is requested by the respondent. The DMI is divided into two experimental sessions - a Practice Session and a Main Session.[75] As

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[75] The researcher can also use the Practice Session actively in a within-subjects design. All that needs to be done is to change the instructions for this session.

discussed earlier, in our study, the practice session involved selection of 3 suppliers from whom to request quotations for the supply of a computer network system. (see appendix... for instructions for this session), whilst the Main Session involved selection of cities to visit during a vacation. For instructions given in this session, see Appendix D2.

IASM is menu-driven and available information is not displayed in matrix format. Upon starting the program, the respondent is first presented with a general information screen (Appendix D1) welcoming him/her to the experiment and telling him/her what s/he is expected to do in the experiment. The information screen also informs the respondent that there is a practice session which s/he can go through to become familiar with the experimental task. All subjects were encouraged to go through this session and to take it as seriously as they would take the main session. The subject is instructed to press 'Enter' when s/he has finished reading this information screen. Thereafter s/he is presented with the following main menu of the program.

Main Menu

This is the main menu of the program. You can select the option to run by typing in the number associated with the option.

        1. Run Practice Session

        2. Run Main Session

        3. Display Information Screen

        4. Quit Program.

Enter your Selection Here ====>_

Both the Practice and the Main sessions have the same structure. After selecting which of these sessions to run, the subject is again presented with an instruction screen describing the particular decision environment and the number of items to be selected for that session. If, for example, the respondent selected option 1 for practice session, the information contained in appendix D3 is displayed on the screen. When the subject has finished reading the

instructions and pressed 'Enter', s/he is then shown the following menu for the practice session.

Practice Session Menu

At this stage you can request the following information from the computer.

Type in the number associated with the information you wish to see.

1. *Names of Suppliers*

2. *Description of Attributes*

3. *Ratings of Suppliers on Attributes*

4. *Selecting Suppliers to Request Quotations*

5. *Instruction Screen for Practice Session*

6. *Quit the Program*

Enter Your Selection Here =====>_

If the respondent selects option 1 or 2 from the menu the list of alphabets used to identify alternatives or the list of attribute descriptions is displayed on the screen. A clock automatically starts each time any of these lists is accessed so that the amount of time spent on the list can be determined. The respondent can return to the lists as many times as s/he desires during the decision task.

Option 3 enables the respondent to request ratings of cities (suppliers) on the provided attributes. The software was designed such that this information is not displayed in matrix form. Rather the respondent has to search for information sequentially by typing in combinations of alphabets and numerals that define cells in the alternative X attribute matrix. In the version of IASM used in our empirical study, the alternatives (suppliers and cities) were identified by alphabets (A, B, C...), whilst attributes were identified by numerals (1, 2, 3...) in addition to attribute descriptions. For example, in the main session the attribute "Friendliness of the People" was identified by the numeral "1". To ask for the rating of city

A on friendliness of the people, the respondent entered the letter "A" followed by the number "1". The program itself is menu-driven. If the respondent selects option 3 from the menu the following information appears:

Screen A

> ***Requesting Information About Cities (Suppliers)***
>
> *To find out how a city (supplier) is rated on a particular attribute, first type in the alphabet used to identify the city (supplier) and press 'Enter'. Next type in the number associated with the attribute for which information is required and press 'Enter'.*
>
> *Type in the letter used to identify the city (supplier) here ======>_*
>
> (After pressing 'Enter' the following appears on the screen):
>
> *Type in the number associated with the attribute here ======>_*

Assuming that the subject were in the main session and wanted to see the rating of City A on Attribute 1. S/he would then have entered 'A' for the prompt requesting him/her to type in the letter used to identify the city, and '1' for the corresponding prompt for attribute. In that case, immediately s/he presses 'Enter' after typing in the attribute number, the following screen appears at the same time as a clock automatically starts:

Screen B

> ***Requesting Information About Cities (Suppliers)***
>
> *You have asked for information about how city A is rated on attribute 1, i.e. 'friendliness of the people'. City A has a rating of 5 on this dimension.*
>
> *To ask for more information - Press 'Enter'*
>
> *To return to the main menu - Press 'Esc'*

The clock stops when the respondent presses either 'Enter' or 'Esc' and the time elapsed since the initial display of the information is written to the results file. Pressing 'Esc' takes the respondent back to the main menu where s/he can again view the list of cities (or suppliers), the list of attributes, the instruction screen, enter the option for recording her/his selections or return to the option for requesting information about the alternatives. If on the other hand the respondent presses 'Enter', then Screen A above is repeated.

When the respondent has looked at enough information and decided to make his/her selection s/he has to return to the menu for the particular session and select option 4. The following screen appears:

a)

Recording Your Preferred Cities (Suppliers)

To select a city (supplier) to visit (to request quotes) type in the letter used to identify the city (supplier) and press 'Enter'. This is your first (second, etc) selection.

Type in your selection here =========>_

(After pressing 'Enter' the following appears on the screen):

To record another selection - Press 'Enter'
To return to main menu   - Press 'Esc'

If the respondent decides to make all selections at once (i.e. without requesting further information) s/he simply presses 'Enter'. Then IASM clears the second part of the screen above. In that case, "this is your first selection" becomes "this is your second selection". This process is repeated until all the necessary selections for the decision task have been made. When the last alternative is selected, IASM displays the following message:

...... This happens to be your last selection. Press 'Enter' to continue.

After the respondent has pressed 'Enter', the screen that appears depends on whether the session just completed is the practice or main session. If it is the main session, a screen appears thanking the respondent for participating in the experiment and requesting that s/he presses 'Enter' to exit the program. If, however, it is the practice session the following screen is displayed:

Results from the Practice Session

You have now come to the end of the practice session. The suppliers you selected are:

> *First Choice   - Supplier A*
>
> *Second Choice - Supplier B*
>
> *Third Choice   - Supplier C*

If you had any problems during the practice session, please contact the experimenter before proceeding to the main session. If you feel conversant with the decision situation you may proceed to the main session.

> *If you had any problems   - Press 'Esc'*
>
> *If you feel conversant   - Press 'Enter'*

Even though the objective of the practice session was to familiarize the respondent with the software and how it works, IASM was designed such that results from this session are also written to a separate file. This provides additional information for comparison with the results of the Main Session. Furthermore, as was done in our study, the researcher can vary the

decision structure between the two sessions, thus allowing for investigation of effects attributable to other task variables like number of available alternatives, number of attributes, or product class. In other words, by keeping a record of information search statistics for the Practice Session, IASM gives the researcher the opportunity to incorporate within-subject analysis into a between-subject design.

Appendix D1
Preliminary Information About the Experimental Task

Welcome to this experiment. In the experiment you would be required to make a number of decisions on the basis of information provided to you by the computer. You may use as much or as little of the available information as you please. However, the decisions have to be made using only the information provided to you by the computer.

Available information will not be automatically displayed on the screen so you have to ask the computer for information you require. To familiarize you with the decision environment and how the software works, a practice session has been included. Please work carefully through the ENTIRE practice session before moving on to the main session. The computer will guide you through both sessions.

Thanks in advance for agreeing to participate in this experiment.

Press 'Enter' to Continue

Appendix D2
Main Instructions for Session 1 of the Experiment

Welcome to the Practice Session.[76] In this session, assume that you are the purchasing officer in a large Norwegian oil company. The company is planning to restructure its entire data management system, and top management has voted to replace the present computer network system. As purchasing officer, you are responsible for requesting bids from suppliers of network systems.

Previous experience shows that you often gain little by requesting bids from more than 3 suppliers. Therefore, you have decided to limit the number of bids requested to 3. You have a list of 6 suppliers from whom to select these 3.

A group of experts has evaluated all 6 suppliers along a number of dimensions, and their evaluations are available to you as a basis for making your decision. The computer will guide you as to how to obtain these evaluations. Remember to follow instructions on the screen at all times.

Press 'Enter' to Continue

---

[76] "Practice Session" was later changed to "Part 1".

Appendix D3
Instructions for Session 2 of the Experiment[1]

Welcome to the Main Session.[77] In this session, assume that you have won a competition organized by your local travel agency, and has been offered a one-month[2] summer vacation in Asia. The travel agency organizes charter tours to 10 Asian cities, and management has decided to use the opportunity to test your preferences for these cities. They have therefore decided to conduct a blind test in which you are required to select 3[3] out of the 10 cities which you would consider visiting during the vacation. Assume that you desire to have as varied an experience as possible during the vacation.

A close friend of yours who has previously visited all 10 cities has evaluated them on a number of dimensions, and you are required to use these evaluations as a basis for your decision. As in the practice session, the computer will guide you in your requests for available information. Please, remember to follow instructions on the screen at all times.

Press 'Enter' to continue

[1] Instructions were for the Choose 3 condition.

[2] For the Choose 1, Choose 5, and Choose 7 conditions, "two-week", "six-week", and "two-month" respectively, were substituted for "one-month".

[3] For the Choose 1, Choose 5, and Choose 7 conditions, "select 1", select 5" and "select 7" respectively were substituted for "select 1".

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[77] "Main Session" was later changed to "Part 2".

Appendix E1
Questionnaire Administered After Experimental Session - Multiple Item Groups

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Now that you have completed the decisions, we will like you to answer a few questions about your experience with the experiment. Your answers form a vital part of the data collection, and so it is important that you answer as accurately as possible.

PART 1 - YOUR EXPERIENCE WITH THE PRACTICE SESSION

1. How satisfied are you with the decision you made in this part of the experiment? Circle the number that best represents your opinion.

    Very dissatisfied   *Very Satisfied*

        1   2   3   4   5   6   7

2. How certain are you that you selected the "right" suppliers? Circle the number that best represents your opinion.

    Very Uncertain   *Very Certain*

        1   2   3   4   5   6   7

3. How difficult was it for you to decide which suppliers to select? Circle the number that best represents your opinion.

    Very Easy   *Very difficult*

        1   2   3   4   5   6   7

4.   How important were each of the following factors for your decision in this part of the experiment? Circle the number that best represents the importance of each factor.

	Not at all Important						*Very Important*
Product Quality	1	2	3	4	5	6	7
Payment Conditions	1	2	3	4	5	6	7
Technical Service	1	2	3	4	5	6	7
Delivery Conditions	1	2	3	4	5	6	7
Customer Follow-Up	1	2	3	4	5	6	7
Quality of Customer Training	1	2	3	4	5	6	7

5.   Which of the following statements best describes how you searched for information prior to making your decision? *(Select only one statement).*

a)...... I first selected a supplier and looked at his ratings on each of the factors. Then I selected another supplier, then a third, and so forth.

b)...... I first selected a factor and compared all the suppliers on this factor. Then I selected a second factor, then a third, and so forth.

c)...... I didn't follow any systematic pattern, i.e. I asked for information at random.

d)...... Other (Please specify)

....

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....

6. Which of the following statements best describes how you decided on which suppliers to request bids from? *(Select only one statement).*

a)...... I selected suppliers who met minimum criteria on one or more of the factors *(Put a check mark next to any factors for which the supplier had to meet minimum criteria in order to be selected):*

...... Product Quality

...... Payment Conditions

...... Technical service

...... Delivery Conditions

...... Customer Follow-Up

...... Quality of Customer Training

b)...... I selected suppliers who, based on an *overall evaluation,* were better than the others, i.e. I was predisposed to select a supplier with a bad rating on some dimensions if it had good ratings on the other dimensions.

c)...... I did not have any particular rule for making my selections.

d)...... Other (Please Specify):

....
....
....

PART 2 - YOUR EXPERIENCE WITH THE MAIN SESSION

1. How satisfied are you with the decision you made in this part of the experiment? Circle the number that best represents your opinion.

    Very dissatisfied   *Very Satisfied*

       1   2   3   4   5   6   7

2. How certain are you that you selected the "right" cities? Circle the number that best represents your opinion.

    Very Uncertain   *Very Certain*

       1   2   3   4   5   6   7

3. How difficult was it for you to decide which cities to select? Circle the number that best represents your opinion.

    Very Easy   *Very difficult*

       1   2   3   4   5   6   7

4.   How important were each of the following factors for your decision in this part of the experiment? Circle the number that best represents the importance of each factor.

	Not at all Important					*Very Important*	
Friendliness of the People	1	2	3	4	5	6	7
Possibility of being understood (Language)	1	2	3	4	5	6	7
Crime Level in the City	1	2	3	4	5	6	7
Accessibility to Attractions Outside the City	1	2	3	4	5	6	7
Quality Cultural Attractions in the City	1	2	3	4	5	6	7
Security for Foreign Tourists in the City	1	2	3	4	5	6	7
Standard of Accommodation in the City	1	2	3	4	5	6	7
Quality of Historical Attractions	1	2	3	4	5	6	7
Nightlife and Entertainment in the City	1	2	3	4	5	6	7
Possibility of Escaping from the Tourist Mass	1	2	3	4	5	6	7

5.   Which of the following statements best describes how you searched for information prior to making your decision? *(Select only one statement).*

a)...... I first selected a city and looked at its ratings on each of the factors. Then I selected another city, then a third, and so forth.

b)...... I first selected a factor and compared all the cities on this factor. Then I selected a second factor, then a third, and so forth.

c)...... I didn't follow any systematic pattern, i.e. I asked for information at random.

d)...... Other (Please specify)

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6. Which of the following statements best describes how you decided on which cities to select for your vacation? *(Select only one statement)*.

     a)...... I selected cities which met minimum criteria on one or more of the factors *(Put a check mark next to any factors for which a city supplier had to meet minimum criteria if it were to be selected):*

        ......   Friendliness of the People

        ......   Possibility of being understood (Language)

        ......   Crime Level in the City

        ......   Accessibility to Attractions Outside the City

        ......   Level of Cultural Attractions

        ......   Security for Foreign Tourists in the City

        ......   Standard of Accommodation in the City

        ......   Quality of Historical Attractions

        ......   Nightlife and Entertainment in the City

        ......   Possibility of Escaping from the City's Tourist Mass

     b)...... I selected cities which, based on an *overall evaluation,* were better than the others, i.e. I was predisposed to select a city with a bad rating on some dimensions if it had good ratings on the other dimensions.

     c)...... I selected cities which, taken together, would give me a more varied vacation experience

     d)...... I did not use any particular rule in making my selections.

     e)...... Other (Please Specify):

        ....

        ....

        ....

7.   Have you ever travelled abroad?

        ...... Yes   (How many times? ....)

        ...... No

8.   Have you ever travelled to Asia?

        ...... Yes   (How many times? ....)

        ...... No

9.   Sex: ..... Male   ..... Female

10.   Would you like to guess the objective of this study?

        ....
        ....
        ....
        ....
        ....

THANK YOU VERY MUCH FOR YOUR HELP !!!

Appendix E2
Questionnaire Administered After Experimental Session - Single Item Group

Introduction exactly the same as for the Multiple Item groups

PART 1 - YOUR EXPERIENCE WITH THE PRACTICE SESSION

Exactly the same questions and question wording as for the Multiple Item Groups

PART 2 - YOUR EXPERIENCE WITH THE MAIN SESSION

1.   How satisfied are you with the decision you made in this part of the experiment? Circle the number that best represents your opinion.

Very dissatisfied   *Very Satisfied*

         1   2   3   4   5   6   7

2.   How certain are you that you selected the "right" city? Circle the number that best represents your opinion.

Very Uncertain   *Very Certain*

         1   2   3   4   5   6   7

3.   How difficult was it for you to decide which city to select? Circle the number that best represents your opinion.

Very Easy   *Very difficult*

         1   2   3   4   5   6   7

4. How important were each of the following factors for your decision in this part of the experiment? Circle the number that best represents the importance of each factor.

	Not at all Important						*Very Important*
Friendliness of the People	1	2	3	4	5	6	7
Possibility of being understood (Language)	1	2	3	4	5	6	7
Crime Level in the City	1	2	3	4	5	6	7
Accessibility to Attractions Outside the City	1	2	3	4	5	6	7
Quality Cultural Attractions in the City	1	2	3	4	5	6	7
Security for Foreign Tourists in the City	1	2	3	4	5	6	7
Standard of Accommodation in the City	1	2	3	4	5	6	7
Quality of Historical Attractions	1	2	3	4	5	6	7
Nightlife and Entertainment in the City	1	2	3	4	5	6	7
Possibility of Escaping from the Tourist Mass	1	2	3	4	5	6	7

5. Which of the following statements best describes how you searched for information prior to making your decision? *(Select only one statement)*.

a)...... I first selected a city and looked at its ratings on each of the factors. Then I selected another city, then a third, and so forth.

b)...... I first selected a factor and compared all the cities on this factor. Then I selected a second factor, then a third, and so forth.

c)...... I didn't follow any systematic pattern, i.e. I asked for information at random.

d)...... Other (Please specify)

....

....

....

6. Which of the following statements best describes how you decided on which city to select for your vacation? *(Select only one statement).*

a)...... I selected the city which met minimum criteria on one or more of the factors *(Put a check mark next to any factors for which a city had to meet minimum criteria if it were to be selected):*

...... Friendliness of the People

...... Possibility of being understood (Language)

...... Crime Level in the City

...... Accessibility to Attractions Outside the City

...... Level of Cultural Attractions

...... Security for Foreign Tourists in the City

...... Standard of Accommodation in the City

...... Quality of Historical Attractions

...... Nightlife and Entertainment in the City

...... Possibility of Escaping from the City's Tourist Mass

b)...... I selected the city which, based on an *overall evaluation,* was better than the others, i.e. I was predisposed to select a city with a bad rating on some dimensions if it had good ratings on the other dimensions.

c)...... I selected the city which would give me the most varied experience

d)...... I did not have any particular rule for making my selections.

e)...... Other (Please Specify):

....

....

....

7. Have you ever travelled abroad?

    ...... Yes   (How many times? ....)

    ...... No

8. Have you ever travelled to Asia?

    ...... Yes   (How many times? ....)

    ...... No

9. Sex: ..... Male   ..... Female

10. Would you like to guess the objective of this study?

    ....
    ....
    ....
    ....
    ....

THANK YOU VERY MUCH FOR YOUR HELP !!!

Appendix F1
Example of Output Produced by IAMS for Session 2

Last destinations id.: J   No. of attributes: 10   Max. attempts: 3

1. attempt.
Values Checked:
Dest.List 2 (140secs)
Attr.List 2 (205secs)
A,1 (46secs)   A,2 (54secs)   A,3 (36secs)   A,4 (104secs)   A,5 (20secs)   A,6 (25secs)
A,7 (57secs)   A,8 (58secs)   A,9 (29secs)   A,10 (181secs)   B,1 (461secs)   B,2 (63secs)
B,3 (14secs)   B,4 (12secs)   B,5 (18secs)   B,6 (12secs)   B,6 (11secs)   B,7 (15secs)
B,8 (17secs)   B,9 (19secs)   B,10 (434secs) C,1 (15secs)   C,2 (22secs)   C,3 (11secs)
C,4 (12secs)   C,5 (11secs)   C,6 (19secs)   C,7 (10secs)   C,8 (28secs)   C,9 (20secs)
C,10 (287secs) D,1 (26secs)   D,2 (12secs)   D,3 (10secs)   D,4 (10secs)   D,5 (12secs)
D,6 (13secs)   D,7 (10secs)   D,8 (17secs)   D,9 (16secs)   D,10 (94secs)   E,1 (15secs)
E,2 (10secs)   E,3 (10secs)   E,4 (13secs)   E,5 (9secs)   E,6 (16secs)   E,7 (11secs)
E,8 (21secs)   E,9 (13secs)   E,10 (203secs) F,1 (20secs)   F,2 (17secs)   F,3 (12secs)
F,4 (16secs)   F,5 (10secs)   F,6 (12secs)   F,7 (13secs)   F,8 (9secs)   F,9 (11secs)
F,10 (184secs) G,1 (22secs)   G,2 (17secs)   G,3 (14secs)   G,4 (11secs)   G,5 (10secs)
G,6 (11secs)   G,7 (10secs)   G,8 (45secs)   G,9 (10secs)   G,10 (291secs) H,1 (16secs)
H,2 (10secs)   H,3 (13secs)   H,4 (9secs)   H,5 (38secs)   H,6 (13secs)   H,7 (11secs)
H,8 (31secs)   H,9 (14secs)   H,10 (325secs) I,1 (22secs)   I,2 (11secs)   I,3 (10secs)
I,4 (9secs)   I,5 (17secs)   I,6 (22secs)   I,7 (10secs)   I,8 (11secs)   I,9 (53secs)
I,10 (203secs) J,1 (19secs) J,2 (11secs)   J,3 (9secs)   J,4 (10secs)   J,5 (8secs)
J,6 (11secs)   J,6 (8secs)   J,7 (14secs)   J,8 (10secs)   J,9 (11secs)   J,10 (270secs)
City selected: A

2. attempt.
Information Values Searched:
City selected: H

3. attempt.
Information Values Searched:
City selected: C

Time spent on attribute list
2 : 205 secs.

Time spent on city list
2 : 140 secs.

Total time spent on attribute list: 205 secs.
Total time spent on city list: 140 secs.
Total time spent on information bits: 4636 secs.
Total time spent on decision: 4981 secs.

Appendix F2
Example of Output Produced by IAMS for Session 1

Last city id.: F No. of attributes: 6 Max. attempts: 3

1. attempt.
Information Values Searched:
Supp.List 1 (48secs)
Attr.List 1 (113secs)
A,1 (74secs) A,2 (30secs) A,3 (53secs) A,4 (38secs) A,5 (22secs) A,6 (69secs)
B,1 (19secs) B,2 (15secs) B,3 (15secs) B,4 (15secs) B,5 (30secs) B,6 (55secs)
C,1 (18secs) C,2 (19secs) C,3 (30secs) C,4 (31secs) C,5 (11secs) C,6 (39secs)
D,1 (23secs) D,2 (16secs) D,3 (53secs) D,4 (10secs) D,5 (19secs) D,6 (73secs)
E,1 (12secs) E,2 (13secs) E,3 (13secs) E,4 (12secs) E,5 (20secs) E,6 (83secs)
F,1 (29secs) F,2 (24secs) F,3 (12secs) F,4 (25secs) F,5 (36secs) F,6 (32secs)
Supplier selected: F

2. attempt.
Information Values Searched:
Supplier selected: E

3. attempt.
Information Values Checked:
Supplier selected: C

Time spent on attribute list
 1 : 113 secs.
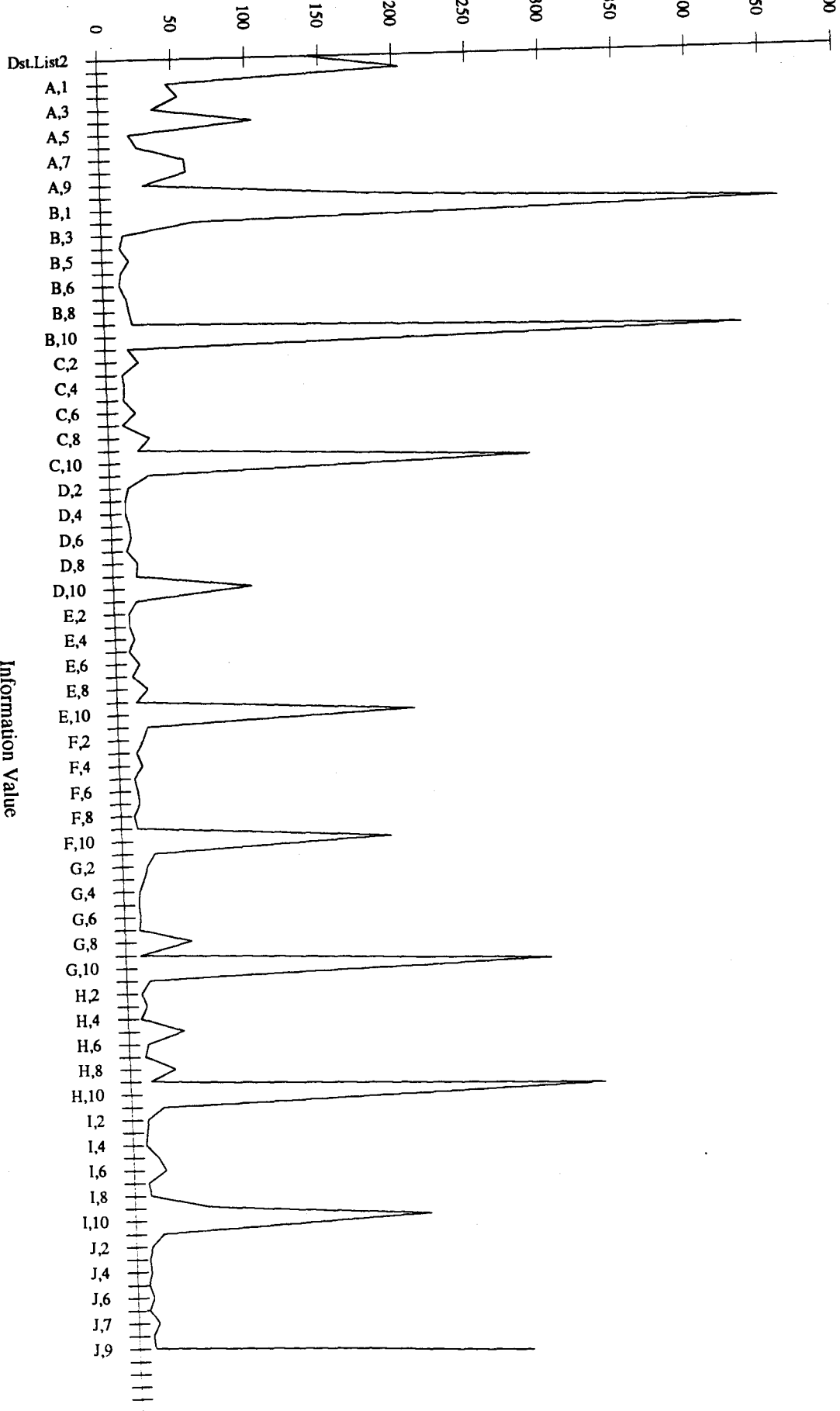
Time spent on Supplier list
 1 : 48 secs.

Total time spent on attribute list: 113 secs.
Total time spent on supplier list: 48 secs.
Total time spent on information bits: 1088 secs.
Total time spent on decision: 1249 secs.

Appendix G Graph for Time Spent on Decision Phases

Appendix H

Table 1a.
Descriptive Statistics for Single Item Group

Variable	Mean	St. Dev.	Kurtosis	Skewness	Min.	Max.
Proportion of Info. Searched	.573	.285	-1.117	.205	.02	1.00
Variability in Search per Alt.	1.843	1.664	-.670	.615	.00	4.90
Variability in Search per Attrib.	2.057	1.873	-1.655	.175	.00	5.00
Sequence of Search						
Payne's Index	.070	.871	-1.834	-.084	-1.00	1.00
Same Brand Index (SBI)	.505	.423	-1.829	-.024	.00	1.00
Same Attribute Index (SAI)	.461	.441	-1.843	.107	.00	1.01
Decision Time (in Minutes)	18.437	19.776	6.493	2.522	1.50	96.67
Perception of Task Difficulty	4.261	1.541	-.844	-.460	1	7

n = 46 for all variables

Table 1b.
Descriptive Statistics for Multiple Item Group

Variable	Mean	St. Dev.	Kurtosis	Skewness	Min.	Max.
Proportion of Info. Searched	.715	.277	-.867	-.609	.11	1.00
Variability in Search per Alt.	1.206	1.098	-.614	.692	.00	3.91
Variability in Search per Attrib.	2.013	1.913	-1.616	.333	.00	4.91
Sequence of Search						
Payne's Index	.371	.788	-1.047	-.835	-1.00	1.00
Same Brand Index (SBI)	.658	.384	-1.129	-.765	.00	1.00
Same Attribute Index (SAI)	.291	.371	-.900	.898	.00	1.00
Decision Time (in Minutes)	30.142	24.442	-.183	.923	4.40	99.05
Perception of Task Difficulty	3.986	1.495	.417	.434	1	7

n = 73 for all variables

Table 2a.
Results for Tests of the Assumption of Normally Distributed Treatment Populations for H1-H6

Variable	Single Item[a]		Multiple Item[b]	
	Kurtosis	Skewness	Kurtosis	Skewness
Proportion of Info. Searched	-1.117	.205	-.867	-.609
Variability in Search per Alt.	-.670	.615	-.614	.692
Variability in Search per Attrib.	-1.655	.175	-1.616	.333
Sequence of Search				
Payne's Index	-1.834	-.084	-1.407	-.835
Same Brand Index (SBI)	-1.829	-.024	-1.129	-.765
Same Attribute Index (SAI)	-1.843	.107	-.900	.898
Decision Time (in Minutes)	6.493	2.522	-.183	.923
Perception of Task Difficulty	-.844	-.460	.417	.434

[a] n = 46 for all variables
[b] n = 73 for all variables

Table 2b.
Results of Tests of the Assumption of Normally Distributed Treatment Populations for H7-H11

Variable	Choose 3		Choose 5		Choose 7	
	Kurtosis	Skewness	Kurtosis	Skewness	Kurtosis	Skewness
Proportion of Info. Searched	-.995	-.733	-.713	-.206	.185	-1.148
Variability in Search per Alt.	1.914	1.476	.652	.999	-1.500	-.204
Variability in Search per Attrb.	-1.259	.746	-1.651	-.330	-1.512	.534
Sequence of Search						
Payne's Index	-.224	-1.115	-1.781	-.366	-.224	-1.272
Same Brand Index (SBI)	-.595	-.958	-1.773	.333	-.331	-1.206
Same Attribute Index (SAI)	.189	1.257	-1.663	.425	-.162	1.291
Decision Time (in Minutes)	-1.166	.583	-1.473	.308	2.302	1.807
Perception of Task Difficulty	-1.428	-.257	1.041	.769	-.022	.310

n = 73 for all variables

Table 3a.
ANOVA for Sequence of Information Search Using Bettman and Jacoby's (1976) Same Attribute Index (SAI)

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Main Effects	.810	1	.810	5.083	.026
Experimental Group[a]	.810	1	.810	5.083	.026
Explained	.810	1	.810	5.083	.026
Residual	18.644	117	.159		
Total	19.454	118	.165		

[a]Group Means:
  Group 1 (Single Item Selection)   :   0.46 (n = 46)
  Group 2 (Multiple Item Selection) :   0.29 (n = 73)

Table 3b.
ANOVA for Sequence of Information Search Using Bettman and Jacoby's (1976) Same Attribute Index (SAI) with SAI for Session 1 as Covariate

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Covariates	7.159	1	7.159	73.509	.000
Same Attribute Index (Session 1)[a]	7.159	1	7.159	73.509	.000
Main Effects	0.337	1	0.337	3.460	.066
Experimental Group[b]	0.337	1	0.337	3.460	.066
Explained	7.496	2	3.748	38.385	.000
Residual	10.421	107	0.097		
Total	17.917	109	0.164		

[a]Unstandardized Regression Coefficient for Covariate = .606

[b]Group Means: Group 1 (Single Item Selection) : 0.46 (n = 44)
                   Group 2 (Multiple Item Selection): 0.27 (n = 66)

Table 4a.
ANOVA for Sequence of Information Search Using Payne's (1976) Index

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Main Effects	2.508	1	2.508	2.508	.056
Experimental Group[a]	2.508	1	2.508	2.508	.056
Explained	2.508	1	2.508	2.508	.056
Residual	78.079	116	.673		
Total	80.587	117	.689		

[a]Group Means:
      Single Item : 0.07 (n = 45)
      Multiple Items: 0.37 (n = 73)

Table 4b.
ANOVA for Sequence of Information Search Using Payne's (1976) Index (PI) with PI for Session 1 as Covariate

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Covariates	26.190	1	26.190	61.161	.000
Payne's Index (Session 1)[a]	26.190	1	26.190	61.161	.000
Main Effects	1.088	1	1.088	2.542	.114
Experimental Group[b]	1.088	1	1.088	2.542	.114
Explained	27.279	2	13.639	31.851	.000
Residual	44.963	105	.428		
Total	72.242	107	.675		

[a]Unstandardized Regression Coefficient for Covariate = .586

[b]Group Means:
      Single Item : 0.07 (n = 43)
      Multiple Items: 0.41 (n = 65)

Table 5a.
Differences in Same Attribute Index Among the Three Multiple Item Groups

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Main Effects	.445	2	.223	1.646	.200
Experimental Group[a]	.445	2	.223	1.646	.200
Explained	.445	2	.223	1.646	.200
Residual	9.463	70	.135		
Total	9.463	72	.138		

[a]Group Means:
       Choose 3: 0.25 (n = 26)
       Choose 5: 0.40 (n = 24)
       Choose 7: 0.22 (n = 23)

Table 5b.
Differences in Same Attribute Index (SAI) Among the Three Multiple Item Groups with SAI for Session 1 as Covariate

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Covariates	2.922	1	2.922	33.774	.000
Same Attribute Index (Session 1)[a]	2.922	1	2.922	33.774	.000
Main Effects	.203	2	0.101	1.171	.317
Experimental Group[b]	.203	2	0.101	1.171	.317
Explained	3.125	3	1.042	12.039	.000
Residual	5.364	62	.087		
Total	8.489	65	.131		

[a]Unstandardized Regression Coefficient for Covariate = .561

[b]Group Means:
       Choose 3: 0.23 (n = 24)
       Choose 5: 0.35 (n = 21)
       Choose 7: 0.25 (n = 21)

Table 6a.
Differences in Payne's Index Among the Three Multiple Item Groups

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Main Effects	2.257	2	1.128	1.861	.163
Experimental Group[a]	2.257	2	1.128	1.861	.163
Explained	2.257	2	1.128	1.861	.163
Residual	42.439	70	.606		
Total	44.696	72	.606		

[a]Group Means:

        Choose 3: 0.46 (n = 26)
        Choose 5: 0.12 (n = 24)
        Choose 7: 0.52 (n = 23)

Table 6b.
Differences in Payne's Index (PI) Among the Three Multiple Item Groups with PI for Session 1 as Covariate

SOURCE OF VARIATION	SUM OF SQUARES	D.F	MEAN SQUARE	F	SIG. OF F
Covariates	12.195	1	12.195	30.998	.000
Payne's Index (Session 1)[a]	12.195	1	12.195	30.998	.000
Main Effects	1.060	2	.530	1.347	.268
Experimental Group[b]	1.060	2	.530	1.347	.268
Explained	13.255	3	4.418	11.231	.000
Residual	23.999	61	.393		
Total	37.254	65	.582		

[a]Unstandardized Regression Coefficient for Covariate = .545

[b]Group Means:

        Choose 3: 0.50 (n = 24)
        Choose 5: 0.21 (n = 20)
        Choose 7: 0.48 (n = 21)

Appendix I
Analyses of Individual Search Protocols

As will be recalled from the discussion in chapter 6, subjects in the experiments were given lists of the provided attributes, as well as extra sheets of paper on which they could take notes during the experiment. Furthermore, as can be seen in Appendix F1, the software used in the experiment measured the time spent by subjects on each information value. By examining the time spent on each information value, we were able to break each subject's search matrix into distinct segments, usually by noting places in the matrix for which there were marked differences in time spent on a particular information value. For example, if for the first six information items, a subject spent an average of 20 seconds looking at each information value, but then spends 120 seconds on the information item, this is a marked difference corresponding to the end of one phase in the information acquisition process.

The assumption was that, for such information values, the subject did not spend the entire time looking at that piece of information. Rather, it is more likely that a greater part of this time was spent evaluating the information acquired up to that point. In fact, such distinct phases were often accompanied either by a change in acquisition sequence (e.g. from alternativewise to attributewise), or they were followed by search patterns in which some alternatives were never searched again (indicating that these had been eliminated during the evaluation phase). Of course, at other times these pauses were not followed by any changes in acquisition strategies. However, what is of importance is that these distinct phases enabled us to break down each subject's matrix into segments suitable for the type of analysis that has become the strength of verbal protocol analysis.

After breaking down a subject's matrix into these segments, the author then tried to reconstruct each subject's search process. Copies of the decision matrix were made, and for each subject, we followed his/her search sequence circling on the decision matrix the information acquired by the subject. Then at places in the sequence with distinct pauses, we tried to imagine, based on the information acquired up to that point, what evaluation processes might have been used by the subject. This was often facilitated by comparing the information acquired with notes taken by the subject, and the information acquired immediately after the

pause. In most cases, it was possible to approximate the subject's thought-process during each evaluation phase.

After going through the entire matrix, we then tried to determine the basis upon each subject's choices were made. In some cases, this was very easy. Subjects who used a pure compensatory heuristic often computed a total score for all alternatives, rank-ordered them, and made their selections. Those who used non-compensatory heuristics often crossed out some of the alternatives in their notes, suggesting that these were eliminated during some phase in the evaluation. In most cases, it was possible even to determine during what phase the elimination was made. There were, however, others for which it was not entirely clear on what basis their selections were made. For these subjects, we often had to resort to their answers to question 6 in the post-decision questionnaire (Appendix E1).

The Table below illustrates how the search matrix for one subject in the Choose 7 group (Respondent 41) was broken down into distinct segments.[78] The first part of the Table shows the original search matrix, whilst the second part shows the derived protocols. Comments are included in this protocol to illustrate how we attempted to reconstruct the subjects "reasoning" throughout the decision. Notes taken by the subject are presented at the end of this appendix.

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[78]This particular search protocol was selected for illustration because it includes a number of interesting features which will be discussed shortly.

Table
Illustration of Individual Search Protocol Analysis

Last destinations id.: J No. of attributes: 10 Max. attempts: 7

1. attempt.
Information Values Searched:
Dest.List 2 (18secs)
A,1 (80secs) A,9 (32secs) B,9 (29secs) C,9 (47secs) D,9 (45secs) E,9 (29secs) F,9 (50secs) G,9 (69secs)
H,9 (53secs) I,9 (47secs) J,9 (130secs) A,3 (54secs) B,3 (73secs) H,3 (30secs) I,3 (100secs) A,2 (38secs)
B,2 (38secs) H,2 (54secs) I,2 (132secs) A,6 (21secs) B,6 (29secs) H,6 (57secs) I,6 (128secs) I,7 (47secs)
I,1 (379secs) F,6 (25secs) G,6 (247secs) C,6 (28secs) D,6 (23secs) E,6 (21secs) J,6 (279secs) D,1 (23secs)
D,2 (522secs) D,7 (93secs) F,7 (1137secs)A,7 (24secs) C,7 (25secs) G,7 (34secs) H,7 (346secs)
A,5 (23secs) C,5 (19secs) D,5 (21secs) G,5 (29secs) H,5 (190secs) C,2 (21secs) G,2 (427secs)
I,10 (26secs)

Destination selected: I

2. attempt. Information Values Searched: Destination selected: F

3. attempt. Information Values Searched: Destination selected: H

4. attempt. Information Values Searched: Destination selected: G

5. attempt. Information Values Searched: Destination selected: D

6. attempt. Information Values Searched: Destination selected: A

7. attempt. Information Values Searched: Destination selected: C

Time spent on destination list
2: 18 secs.

Total time spent on attribute list: 0 secs.
Total time spent on destination list: 18 secs.
Total time spent on information bits: 5374 secs.
Total time spent on decision: 5392 secs.

Table continued

PROCESS SEGMENTS

1. Circles attributes 1, 2, 3, 4, 6, 7, and 9 on the sheet with attributes provided.
2. Looks at destination list for 18 secs
3. Searches alternative A on attribute 1 (Pause: 80 secs)
4. Searches all alternatives on attribute 9 (Pause for 130 secs)
5. Searches alternatives A, B, H, I on attribute 3 (Pause for 100 secs)
   Comment: Alternatives A, B, H, I had ratings of 6 or more on attribute 9. In other words, the subject first established a minimum cutoff of 6.
6. Searches same alternatives as in (5) on attribute 2 (Pause for 132 secs)
   Comment: Scores of alternatives on this attribute are: A - 1, B - 7, H - 6, I - 4
7. Searches same alternatives as in (5) on attribute 6 (Pause for 128 secs)
   Comment: Scores on this attribute are: A - 3, B - 1, H - 2, I - 7
8. Searches alternative I on attributes 7 and 1 (Pause for 379 secs)
   Comment: I has a score of '5' on attribute 7, and '6' on attribute 1.
   The 379 secs spent here implies extensive evaluation.
   The next information values acquired suggests subject realizes that it will be difficult to find a dominating alternative. Also in the next segment, minimum cutoff from segment 4 is relaxed. The two alternatives searched (i.e. F and G have scores of '5' on attribute 9.
9. Searches F, G on attribute 6 (Pause: 247 secs)
   Comment: F scores '5' and G scores '2' on this attribute. Still not easy to decide. All other alternatives initially eliminated are now brought in.
10. Searches alternatives C, D, E, J on attribute 6 (Pause: 128 secs)
    Comment: Scores on this attribute are: C - 5, D - 6, E - 1, J - 1. Now D looks interesting, so it is searched in next segment
11. Searches D on attributes 1, 2 (Pause: 522 secs)
    Comment: D has score of '1' on attribute 1, and score of '7' on attribute 2. Low score on attribute 1 seems to make it difficult to decide the status of D, so in next segment this is searched further
12. Searches D on attribute 7 (Pause: 93 secs)
    Comment: D scores '2' on this attribute
13. Searches F on attribute 7 (Pause: 1137 secs)
    Comment: On the basis of information acquired up to this point, F scored '5' on both attributes 6 and 9. So far, this is the only information acquired. This probably made it a good candidate for further search on attribute 7 on which it scored '4'.
14. Searches A, C, G, H on attribute 7 (Pause: 346 secs)
    Comment: Difficult to see why these were searched. Possibly on basis of holistic evaluation, since based on information acquired up to this point, each of these have good and bad ratings.
15. Searches A, C, D, G, H on attribute 5 (Pause: 190 secs).
    Comment: These are the same alternatives as for segment 14, with addition of alternative D
16. Searches C, G on attribute 2 (Pause: 427 secs)
    Comments: It appears as if C, G were searched further because they are possible candidates for selection
17. Searches I on attribute 10

18. Alternatives eventually selected are: I, F, H, G, D, A, C

This protocol shows the purely constructive nature of this subject's decision process. The subject started out by specifying the attributes to be used in the evaluation. Then he looked at the list of cities for only 18 seconds. As for most respondents, a natural starting point was A,1 since attribute 1 was deemed important. At this point, he probably decided to further rank the important attributes according to importance. The 80 seconds spent on A,1 suggests this deliberation. Attribute 9 was then chosen and all alternatives searched on this attribute (segment 4). Four alternatives had ratings of 6 or better on this attribute. In segments 5, 6, and 7, these were searched further on attributes 3, 2, and 6 respectively. At this point, the subject switched from the initial attribute-based processing to alternative-based processing. By segment 9, it was clear that there were no clearly dominating alternatives, and so alternatives that were eliminated earlier were again brought into the evaluation.

From the notes taken by this subject, the following can also be observed.

1. The subject did not reconstruct the entire decision matrix. Rather, alternatives and their scores were specified for each attribute on the list provided see attachment to this appendix.

2. The subject outlined two sets of alternatives: alternatives that are NOT to be chosen, and alternatives to be chosen. Non of these sets was stable throughout the decision process. That is, alternatives entered and left these sets. Evidence for this is found in the notes where alternatives entered in these sets were later cancelled out and new alternatives entered.

3. Subject constructed a reduced matrix with alternatives A, C, D, F, G, H attributes 6, 9, 7, 5, and 2, apparently in the same order of importance. It is very likely that this matrix was constructed during the pause after segment 13.

Finally, this subject reported on the post-decision questionnaire that he selected alternatives on the basis of overall evaluations (i.e., he checked option (b) for question 6; see Appendix E1). Together, this answer, the search protocol, and notes taken during the decision indicate that this subject used a constructive decision process dominated by attribute-based processing

and overall evaluation of searched alternatives.