THE RELATIVE IMPORTANCE OF INTERNAL AND EXTERNAL INFORMATION IN CONSUMER CHOICE ENVIRONMENTS

by

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DEDICATION

To my wife Shelley, and my two daughters Megan and Erin, for all of their support and understanding.

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ABSTRACT OF THE DISSERTATION

The Relative Importance of Internal and External Information in Consumer Choice Environments

by

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This thesis investigates the roles of both memory and externally-based information in consumers' choice processes. A cost-benefit framework is employed to identify factors likely to influence the relative use of internal and external information sources. A set of hypotheses is derived using the cost-benefit perspective, and an experimental design is proposed to test these hypotheses.

The experimental results indicate that time pressure and the cost of acquiring external information have a significant impact on information search both alone and when combined. Furthermore, there is strong evidence suggesting that the proportion of external information search to total internal and external information search changes significantly with variations in the choice environment. High time pressure, a high external information cost, and an increased willingness to expend cognitive effort on the part of consumers all led to an increased relative use of internal information sources during choice.

CHAPTER 1: INTRODUCTION

Consider a consumer making a choice among breakfast cereals in the aisles of a supermarket. This consumer is faced with an external information environment that includes on-package product information, package cues to advertising, price information, point-of-purchase displays, and so on. At the same time, the consumer also has a large store of internally available information, in the form of long term memory traces, that is likely to be factored into the decision at hand. This internal information can take the form of individual items of attribute information, global (or summary) evaluations of individual brands developed through prior purchase experiences or through exposure to that brand's advertising, price expectations, and so forth. While the original source of this information may at one time have been external, the information is now available internally and can be used by the consumer only if it is retrieved at the time of choice.

Consumer researchers have emphasized the distinction between internal and external sources of information (e.g. Bettman 1979, Howard and Sheth 1969, Biehal and Chakravarti 1983, 1986). This thesis examines the influence of various factors on the relative importance of internal and external sources of information. In particular, those factors that affect the relative use of internal and external information in choice, and thereby influence the final choice outcome, are identified.

Focus of Study

Considerable effort has been devoted to the analysis of how individuals make choices using information available in the external environment (e.g. Bettman 1979, Bettman, Johnson, and Payne 1988, Johnson and Payne 1985, Payne, Bettman and Johnson 1988, Svenson 1979, Tversky 1969, Tversky 1972, and Wright 1975). An important assumption of this line of research is that the complete set of information needed to make a decision is readily available to the decision maker in the immediate external environment. When the complete information set can be easily accessed at any time, there appears to be little reason for individuals to carry summary brand evaluations in long term memory from one choice occasion to the next, or for them to retrieve individual pieces of attribute information from memory at the time a choice is made.

On the other hand, recent work suggests that memory processes play an integral part in choice (e.g. Alba and Hutchinson 1987, Bettman 1986, Biehal and Chakravarti 1983, 1986, Johnson and Russo 1984, Lynch and Srull 1982, Nedungadi 1988, Payne, Bettman, and Johnson 1988). Furthermore, in many natural choice settings, external information is frequently incomplete, and may sometimes be missing entirely. Therefore, it is important to understand the role that internally available information plays in choice, and to recognize the influence that various individual and context specific factors have on the extent to which this information is employed.

This thesis investigates the roles of both memory-based evaluations and individual pieces of attribute information stored in memory in choice processes. A cost-benefit framework is employed to identify factors that are likely to influence the relative use of internal and external

information sources. A set of hypotheses is derived using the cost-benefit perspective, and an experimental design is proposed to test these hypotheses. The results of this experiment are reported, and implications of these findings are detailed. Finally, issues warranting further research are discussed.

CHAPTER 2: LITERATURE REVIEW AND HYPOTHESES

In this chapter, a detailed review of previous work relevant to the current study is conducted. It begins with an examination of the literature dealing with choice strategies, focusing on the differences between internally-based, externally-based, and mixed choice strategies. This is followed by a review of the cost-benefit literature. Finally, four key factors likely to influence the relative importance of internal and external information sources in choice are identified.

Internally-Based, Externally-Based, and Mixed Choice Strategies

When a consumer's choice involves the sole use of internal information, the choice strategy employed is likely to be based on global evaluations rather than on individual pieces of attribute information. There is growing evidence that summary (or global) brand evaluations are stored in long-term memory independent of the attribute information used to form those evaluations (Carlston 1980, Kardes 1986, Biehal and Chakravarti, 1983, 1986, Srull 1986, Hastie and Park 1986). All of these studies provide evidence suggesting that when individuals form "on-line" judgments (i.e. evaluations formed at the moment when attribute information is originally presented), they are more likely to retrieve these judgments during a subsequent judgement task than they are to retrieve the original attribute information. In contrast, when no "on-line" impression is formed, individuals are likely to retrieve the individual items of information in order to arrive at a judgment. Consumers who have had previous occasion to make choices in a product category are therefore

likely to employ any existing previous evaluations for brands when making subsequent product choices.

Consumers new to an established product class generally find themselves faced with a large amount of new product information, and a relatively large set of available brands. There is considerable evidence that suggests that individuals frequently use phased decision strategies when faced with complex, multi-alternative choice settings (e.g. Pras and Summer 1975, Payne 1976, Wright and Barbour 1977, Lussier and Olshavsky 1979, Gensch 1987, Johnson and Payne 1985, Payne, Bettman, and Johnson 1988) . The first stage of such a strategy involves the use of a noncompensatory rule to eliminate most of the available alternatives from further consideration. The second phase of this strategy then involves a more detailed compensatory evaluation of the remaining alternatives. The use of this type of strategy may be essential for inexperienced consumers, since they cannot rely on existing brand evaluations to simplify their choices.

In contrast, experienced consumers are likely to have already established evaluations for at least some of the available brands. These evaluations are the result of prior use and previous choice processes. In making previous choices, these experienced consumers will in many cases have considered several alternatives in detail. Whenever a new choice has to be made, experienced consumers are able to retrieve these evaluations from memory in order to simplify the choice task.

Wright (1976) described two potential choice strategies that depend solely upon such summary evaluations: (1) a sequential, pairwise comparison of brand evaluations, where the alternative with the higher evaluation at each comparison is retained for the next round, and (2) a

comparison of each brand's summary evaluation with a predetermined cutoff value. In the first case, the alternative remaining at the end of the comparison process is chosen, while in the second case the first alternative with a summary evaluation that exceeds the cutoff value is selected. The first strategy attempts to select the best option from the complete set of available alternatives; the second strategy is clearly a "satisficing" strategy (Simon 1955), since it leads to the selection of the first satisfactory alternative encountered or remembered. A third model of choice that involves the sole use of summary brand evaluations similar to the exhaustive comparison model proposed by Wright, but includes the possibility that the comparison process may terminate prior to completion, whenever the cognitive costs of continuing becomes excessive. This could occur, for example, when the summary evaluation retrieval costs for some of the brands are high, or when the total set of brands to be compared becomes very large and the number of comparisons to be made is therefore significantly greater than the number that the individual is willing (or able) to complete.

In general, investigations of internal choice strategies have been few in number. In contrast, extensive research has been devoted to the identification and examination of externally-based choice strategies (e.g. Bettman 1979, Svenson 1979, Johnson and Payne 1985). Initial work in this area focused primarily on compensatory linear choice models such as the weighted additive model (Fishbein and Ajzen 1972, Slovic and Lichtenstein 1971). Work done by Dawes (1979) suggests that the linear model is quite robust across many settings, provided that the key explanatory variables can be identified readily. Many noncompensatory choice models have also been proposed. (Early examples of work done in this area include Dawes

1964, Tversky 1969, Einhorn 1970, and Wright 1975.) Examples of these noncompensatory choice models include the lexicographic, conjunctive, and disjunctive choice strategies (Bettman 1979), and elimination by aspects (Tversky 1972).

In addition to the "pure" choice strategies discussed above, "mixed" choice strategies that rely on the use of both internal and external sources of information can also be considered (e.g. Lynch, Marmorstein, and Weigold 1988). A mixed strategy requires an individual to integrate diverse pieces of information. In general, the cognitive costs associated with comparing global evaluations and individual pieces of attribute information are likely to be very high, since these sources of information are not directly comparable. It is more likely that the integration process will involve the employment of similar types of information (e.g. Hastie and Park 1986, Kardes 1986). As a result, mixed choice strategies should generally involve the sole use of either global evaluations or individual pieces of attribute information drawn from both internal and external information sources. Strategies that involve the integration of internally-based global evaluations with externally-based attribute information are likely to require the expenditure of considerable cognitive effort and are therefore unlikely to be used in many consumer choice settings, but may be necessary if other sources of information are lacking.

The Cost-Benefit Framework for Strategy Selection

As already noted, a wide variety of choice strategies can be employed by an individual at different points in time. In order to compare externally-based choice strategies to internally-based and mixed choice strategies, a common conceptual domain is needed. The cost-benefit

framework has been used by a variety of researchers to explain how decision makers select a choice strategy. For example, Beach and Mitchell (1978) examined the costs and benefits associated with a wide range of choice strategies. They argued that the strategy selected by an individual would be that strategy that optimally traded-off the benefits and costs of using the strategy. In a similar vein, Einhorn and Hogarth (1981) suggested that decision strategies could themselves be considered as multidimensional objects, with the dimensions reflecting the various costs and benefits associated with the different strategies.

Shugan (1980) explored the "costs of thinking" associated with various decision strategies. Identifying the relative expected costs required to employ a variety of these strategies, he argued that the decision maker would use that strategy employing the lowest relative cost. Shugan made no attempt to measure the actual cost of using the various strategies. Instead, he decomposed the strategies into simpler cognitive tasks, and then simply summed the number of these tasks associated with use of the individual strategies.

These studies incorporate a very "rational" view of strategy selection within the cost-benefit framework. One implicit assumption of much of this work has been that the individual explicitly determines the costs and benefits associated with the use of various strategies, and then trades these factors off to make a final strategy selection. A second major assumption in this line of research has been that the costs and benefits associated with the use of a particular strategy do not vary very much from one choice to the next. Recent work within the cost-benefit framework, however, has focused on a more contingent description of the strategy selection process (e.g. Payne 1982). Using this contingent

approach, the task and context factors that comprise the information environment are seen to influence directly the type of information processing undertaken by the individual. By employing a production system framework (essentially a set of "if..then" rules), one can estimate the cognitive effort expended by an individual using a particular choice strategy when faced with a given set of individual and context-specific conditions. Work along these lines, using external sources of information exclusively, has been conducted by Johnson and Payne (1985), Payne, Bettman, and Johnson (1988), and Bettman, Johnson, and Payne (1988).

One fundamental result of this work can be the mapping of an "efficient frontier" for decision strategy selection. Using simulation studies, Johnson and Payne (1985) found that there is an apparent trade-off between cognitive effort (cost) and accuracy (benefit). This basic finding was validated by Payne, Bettman, and Johnson (1988) using human subjects. Payne et. al. observed that subjects apparently determine levels of effort and accuracy appropriate to a given decision problem. They further noted that the structure of the decision environment faced by an individual influenced the amount of cognitive effort that the individual employed in making the decision. In this paper, focus is placed on the implications that a variety of these factors have for the selection of a choice strategy, on the total amount of effort employed, and on the relative uses of internal and external sources of information.

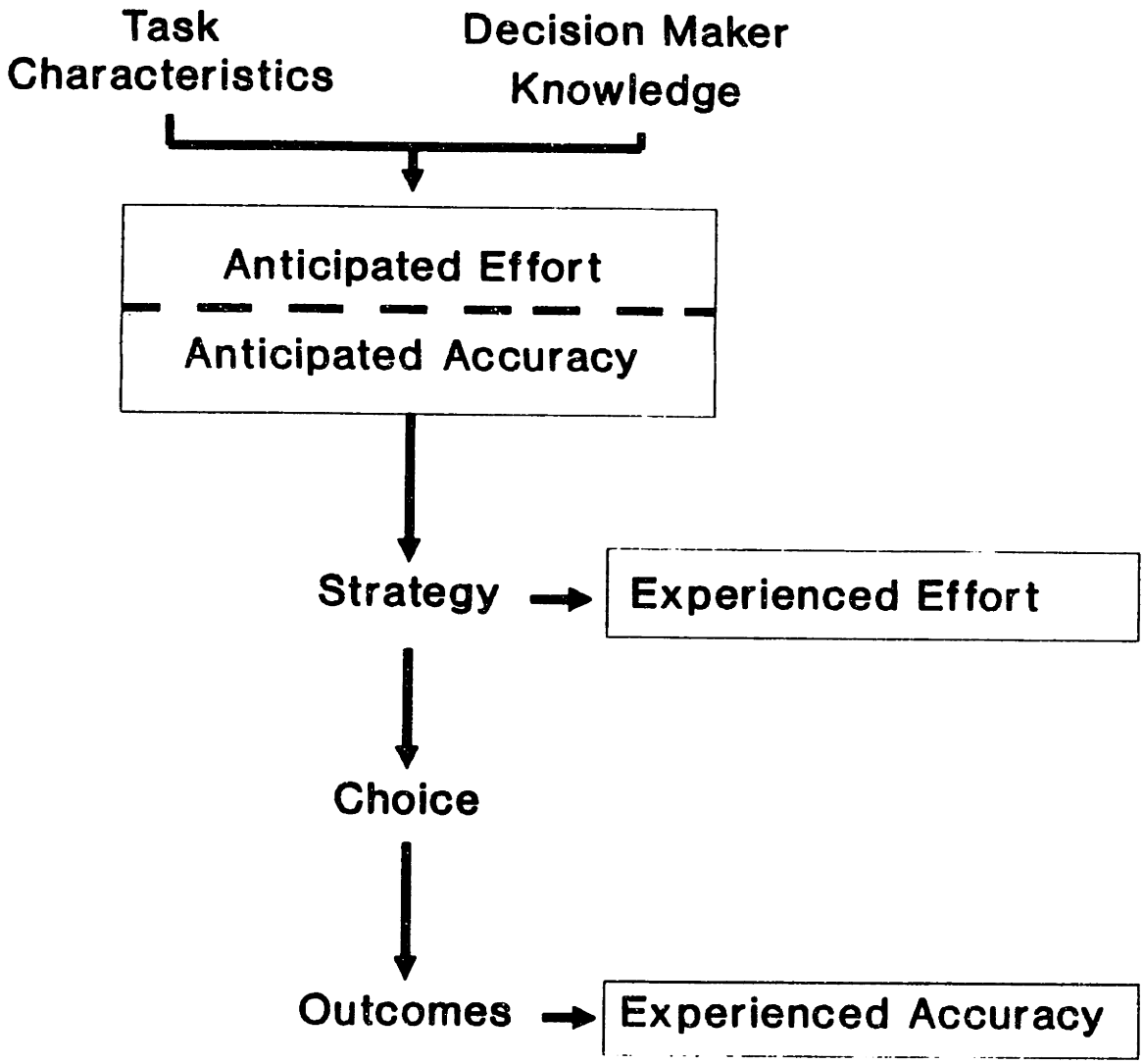
The work of Thorngate (1980) and Johnson and Payne (1985) investigated the accuracy of various strategies in risky choice settings. In both of these studies, the accuracy of a particular choice strategy was determined by examining how closely the choices made using that strategy matched the choices obtained by following an expected value strategy. In

these studies, the expected value choice was defined as the optimal (i.e. "normatively best") choice. The accuracy of a particular choice strategy was then determined in terms of the performance of that strategy relative to the performance obtained by using an expected value strategy. However, in many consumer settings, determination of an expected value (or expected utility) strategy is extremely difficult, since the measurement errors and the small differences in utility that can occur in many consumer situations make identification of this alternative problematic. As a consequence, the accuracy associated with the use of various individual choice strategies in consumer domains is frequently difficult to ascertain, and it is virtually impossible to define one choice as more "appropriate" for an individual than another. On the other hand, the effort associated with a consumer's product choice can be measured in a number of different ways (e.g. self reports, information search patterns, total choice times).

The above framework, as employed in this paper, is summarized in Figure 1 (from Kleinmuntz and Schkade 1990). Following the contingent approach suggested by Payne (1982), an individual's strategy selection is seen to be influenced by a variety of environmental factors (shown at the top of Figure 1). These factors affect strategy selection by influencing the anticipated effort and anticipated accuracy associated with the use of different choice strategies. While these perceptions are not measured directly in this paper, it is assumed that individuals in the study form these perceptions at the start of the choice task. Using the effort-accuracy framework, the argument here is that an individual willing to expend cognitive effort in choice believes that by doing so he or she will make a better (i.e. "more accurate") choice. In this context, decision accuracy represents the extent to which a particular choice strategy leads

FIGURE 1

Overview of the Strategy Selection Process



(From Kleinmuntz and Schkade, 1990)

to the selection of the choice alternative that would be selected if a utility maximization choice strategy was employed by the individual. This latter strategy is expected to identify the best choice, and is therefore the most accurate choice strategy available. Not all individuals will employ this strategy in making a choice, however, since its use involves high expenditures of cognitive effort.

Conversely, an individual who is unwilling to expend considerable cognitive effort in making the choice decides that the anticipated additional cognitive cost is greater than the anticipated gain. This trade-off is influenced by the individual and context-specific factors that affect the perceived appropriate level of effort. It is therefore important to examine factors that affect the cost of using internal and external information, which change the effort associated with various choice strategies, and thereby influence the choice strategy selection. Even if decision accuracy is an important consideration in consumer choice, contrary to the preceding assumption, studying the effects of various task and individual specific characteristics on cognitive effort and strategy selection is likely to prove helpful. In this latter case, however, it will also be important for further studies to investigate the role that decision accuracy plays in these processes.

The above trade-off may be between effort and accuracy, or between effort and some other variable representing the potential benefit of a choice strategy, such as the minimization of decision regret (Bell 1983) or the attainment of a pre-determined "acceptable" level of effort for the type of decision at hand. Determining which of these variables is actually in operation for a particular individual and a given consumer choice context is likely to be an extremely difficult task. In this study, the

research focus is on the strategy selection and experienced effort that result from particular task and decision maker characteristics, rather than on the effort-accuracy trade-off per se. That is, given a particular set of task characteristics and decision maker knowledge, the observed outcomes (including the use of internal and external sources of information) are emphasized in this study at the expense of the (unobserved) intermediary process.

The total effort associated with the employment of a given choice strategy can be partitioned into three separate components: external search effort (ES), internal search effort (IS), and non-search effort. External search effort is the fraction of total effort devoted to the acquisition of information available from external sources. Similarly, internal search effort is that portion of the total effort employed that is devoted to the retrieval of internally-available information (i.e. global evaluations and individual pieces of attribute information). In this thesis, external sources of information are those that are external to memory, while internal information sources are memory-based.

Search effort represents both the amount of information searched and the time spent searching that information. Non-search (NS) effort would include effortful cognitive processes such as the evaluation of information and the integration of information from various sources, as well as other non-search information processing activities such as the direct comparison of two global evaluations or the elimination of an alternative from further consideration. Non-search effort plays a major role in determining the total effort (T) associated with various choice strategies. However, while internal and external search effort can be measured directly, non-search effort can be determined only through indirect means (e.g. NS = T -

(IS + ES)). Since this thesis is predominantly concerned with the relative levels of internal and external search, however, little attention is focused on these non-search activities.

In addition to examining internal and external search effort, two related variables are worth consideration: total search effort (TS) and relative external search effort (RS). Total search effort represents the extent to which both internal and external information sources are employed in the choice process, and is expressed as the sum of the two:

$$TS = IS + ES \quad (1).$$

Relative external search effort (or relative search effort) on the other hand, represents the extent to which external information search is employed relative to the total amount of internal and external information search that takes place. Relative search effort is thus a proportional measure of the allocation of the total search effort applied to information search from external sources, and it provides an estimate of the relative importance of internal and external information sources in choice. Relative search is expressed as the ratio of external search effort to total search effort:

$$RS = ES/(IS + ES) \quad (2).$$

Individual and Context-Specific Factors

This section focuses on four factors that may influence the relative importance of internal and external information in choice: the cost of external information, time pressure, previous experience with the product class of interest, and individual willingness to expend cognitive effort. The first two of these factors are context-specific, while the latter two are individual-specific. In the discussion that follows, the role that

each of these factors plays in determining the relative amounts of internal and external search effort expended in making a choice is identified and discussed.

External Cost of Information: The cost of external information is likely to have a direct impact on the level of cognitive effort employed by the individual to process externally-based information (e.g. Bettman 1979, Brucks 1985). An increase in the external information search cost would be expected to lead to an increase in the effort associated with the execution of externally-based choice strategies. Therefore, as this cost of external information increases, internally-based strategies should become relatively more attractive to the decision-maker (assuming he or she is capable of using such strategies), leading to an increase in the amount of internal search effort. Simultaneously, the external search effort is likely to decline with an increase in the external information cost. Since internal search is expected to increase as external search decreases, it is not possible to predict the *a priori* effect of the external information cost on total search effort. On the other hand, a decrease in relative search effort (again, the proportion of external search effort to total search effort) is expected, as detailed in Appendix A. These observations lead to the following formal hypothesis:

H_1: An increase in the unit cost of external information is expected to result in:

(a) a decrease in external search effort;

(b) an increase in internal search effort; and

(c) a decrease in relative search effort

Prior Experience: The second factor of interest is the individual's relevant prior decision making experience. Experience has been identified by researchers as an important influence in consumers' decision processes (e.g. Johnson and Russo 1984, Sujan 1985). Prior decision making experience in a product class determines whether or not internal information will be readily available to that individual during choice. An inexperienced consumer is forced to use external information due to the absence of an easily accessed internal information source, whereas an experienced consumer may rely on either internal or external information sources (or both). In addition, Alba and Hutchinson (1987) cite considerable evidence to suggest that experienced consumers are better able to remember product information. One logical consequence of this is that experienced consumers are likely to employ more internal search effort than inexperienced consumers.

The impact of prior experience on external search effort is much more difficult to predict. Johnson and Russo (1984), for example, provide evidence that experienced consumers are likely to search more externally-available information than their inexperienced counterparts when faced with a choice task. However, it has also been shown that experienced consumers can search new information more efficiently than inexperienced consumers (e.g. Bettman and Park 1980, Brucks 1985). As a result, experienced consumers should be able to exert equal or smaller amounts of external search effort than inexperienced consumers in arriving at a final choice.

An individual's prior experience in a product class can be diagnostic of the importance of the current decision to that individual. That is, he or she may already have considerable prior experience because the product class itself is an important one to that individual. All other things

being equal, then, experienced consumers are likely to exert more total search effort than inexperienced consumers towards making the current choice. However, this will depend upon how much effort is required to make distinctions between the various available product alternatives. If there are sharp differences between alternatives (for example, differences in perceived quality), and if such differences are easy to determine, then experienced consumers may be able to make a final choice while expending relatively little total search effort due to the efficiency of their search. In this case, inexperienced consumers are likely to expend more total search effort than experienced consumers. In contrast, if differences exist but are difficult to discern, experienced consumers may expend more total search effort than their inexperienced counterparts, particularly since the latter may simply "give up" and settle for the first satisfactory alternative encountered.

For most consumer product categories, brand name alternatives are likely to be distinct from one another. In these cases, experienced consumers would be expected to conduct less external search than inexperienced consumers. Since internal search effort is expected to be greater for experienced consumers, and external search effort lower, the relative search effort for experienced consumers should also be lower than for inexperienced consumers. More formally:

H_2: Experienced consumers, when compared to inexperienced consumers, will:

(a) engage in more internal search effort;

(b) engage in less external search effort; and

(c) engage in a lower level of relative search effort.

Willingness to Expend Cognitive Effort: The third factor -- willingness to expend cognitive effort -- has a direct impact on the total amount of cognitive effort that the individual employs in making the required choice. If the individual's willingness to expend cognitive effort is high, he or she is likely to undertake both considerable external and internal search effort (where internal information sources exist and are accessible). If an individual's willingness to expend cognitive effort is low, on the other hand, both internal and external search effort are expected to be low. Willingness to expend cognitive effort is seen to influence the cost-benefit determination that takes place during choice strategy selection. Since both internal and external search effort increase with an increase in the individual's willingness to expend cognitive effort, total search effort should also increase. However, relative search may increase, decrease, or undergo no change at all. Thus:

H_3: Increasing an individual's willingness to expend cognitive effort is likely to lead to:

(a) an increase in internal search effort;

(b) an increase in external search effort; and

(c) an increase in total search effort.

Time Pressure: Finally, time pressure faced by an individual at the time of choice is likely to influence the overall performance of the selected choice strategy (Wright 1974, Bettman 1979, Payne 1982, Park, Iyer, and Smith 1989). Unlike the willingness to expend cognitive effort construct, time pressure is believed to influence choice strategy performance rather than choice strategy selection (Payne, Bettman, and Johnson 1988 provide some evidence to support this distinction. See also Klein and Yadar 1989,

and Bettman 1988). Time pressure is therefore expected to have a somewhat different impact than willingness to expend cognitive effort on the four search effort variables.

Individuals faced with a high degree of time pressure are expected to expend less external search effort than they would when facing no time pressure. There are two reasons for this. One, if they employ a choice strategy that is either primarily or exclusively based on externally available information, they may simply run out of time before making their final choices. Two, individuals who have internal sources of information readily accessible would be very likely to substitute these sources (which can be used more efficiently) for external ones when the available time is low. An increase in time pressure would therefore be expected to lead to an increase in internal search effort.

Since external search effort decreases as time pressure increases, while internal search effort increases, the <u>a priori</u> effect of time pressure on total search effort cannot be predicted. On the other hand, an increase in time pressure is expected to result in a decrease in relative search effort. In summary:

H_4: Increasing the time pressure faced by an individual is expected to lead to

(a) an increase in internal search effort;

(b) a decrease in external search effort; and

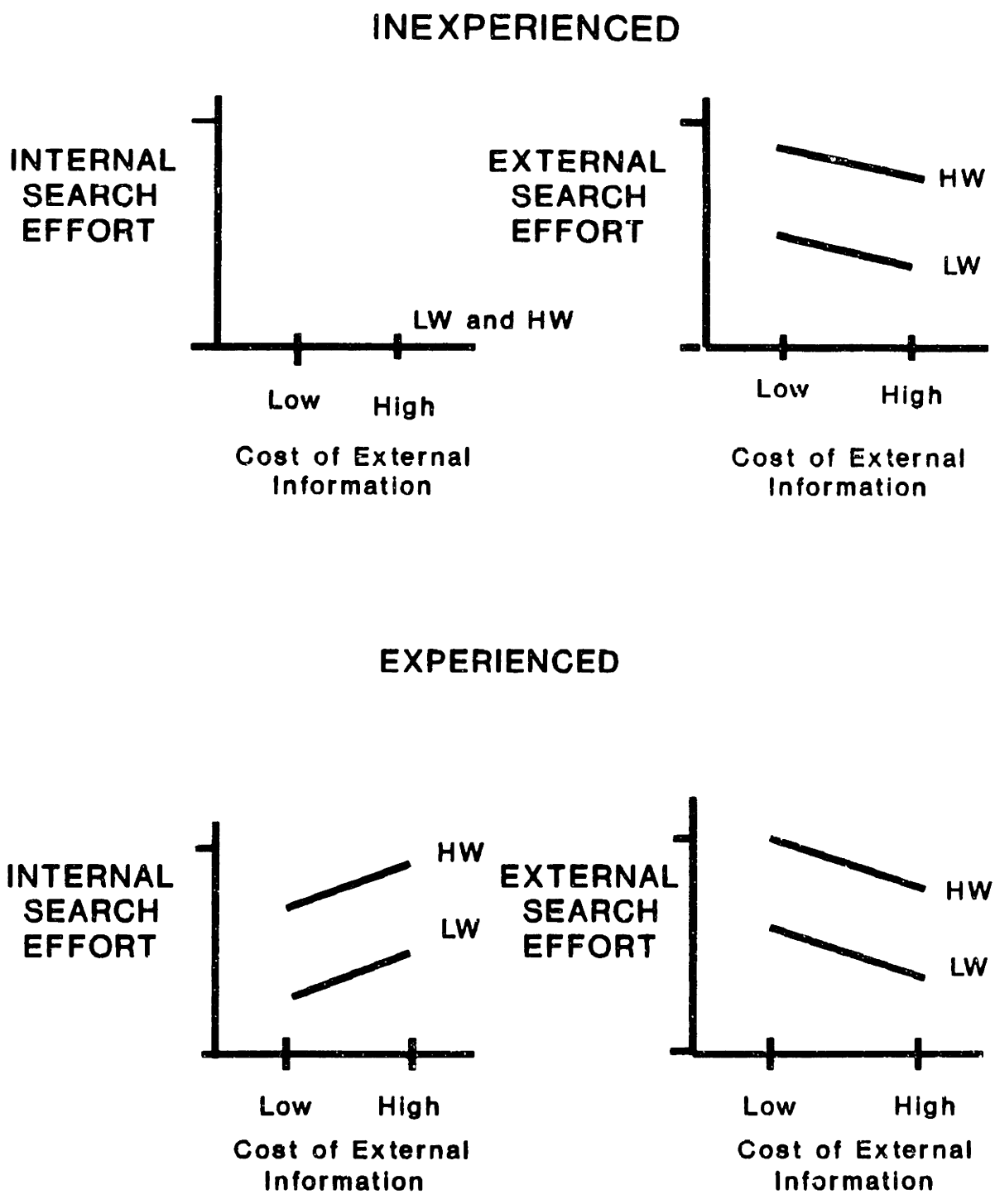
(c) a decrease in relative search effort.

<u>Interactions</u>: The preceding discussion identifies the main effects that the four individual and context-specific factors are likely to have on the

total level of search effort employed in the choice process (total search effort) and on the allocation of that effort to internal and external information sources (external search effort, internal search effort, and relative search effort). In addition to these main effects, one can also consider the various interaction effects of these four factors. However, while it is possible to describe all such potential interactions, only two of the three factor interactions are of real interest. The complex interaction between all four independent variables is not likely to be of much interest, since willingness to expend cognitive effort and time pressure are viewed as having competing effects on strategy selection and choice behavior. When time pressure is high, individuals find it difficult to execute most choice strategies, independent of their degree of willingness to expend cognitive effort. Throughout the remaining discussion, it is therefore assumed that individuals do not face both of these factors simultaneously. The predicted effects of the aforementioned interactions on the four search effort variables are discussed below.

First, consider the hypothesized three way interaction between external information cost, prior experience, and willingness to expend cognitive effort (shown in Figure 2). Since inexperienced consumers have no easily accessed internal store of information to call upon at the moment of choice, they are forced to rely primarily on external information. Thus the internal search effort for an inexperienced consumer should always be small. However, since some use of external information will inevitably be required, the level of relative search effort employed by an inexperienced consumer is expected to generally be quite high, regardless of the cost of external information or his or her willingness to expend cognitive effort. Inexperienced consumers are also expected to expend more external search

FIGURE 2



(HW • High Willingness to Expend Cognitive Effort;
LW • Low Willingness to Expend Cognitive Effort)

effort when the cost of external information is low than when it is high, both when their willingness to expend cognitive effort is low and when it is high. However, an inexperienced individual with a high willingness to expend cognitive effort is predicted to employ more external search effort than that same individual would when his or her willingness to expend cognitive effort is low. Finally, a decrease in external search effort due to an increase in the cost of external information is anticipated to be at least as great for an individual with a low willingness to expend cognitive effort as for an individual with a high willingness to expend cognitive effort. In the latter case, the individual consumer might continue to use some external information to ensure that he or she is not missing important information and thereby making a "poor" choice, while in the former case he or she is generally likely to be unwilling to expend the additional search effort required.

In contrast with their inexperienced counterparts, experienced consumers can rely on both internal and external information sources in the choice process. Experienced consumers should therefore expend at least some degree of internal search effort in choice. These consumers should also make greater use of internal search when their willingness to expend cognitive effort is high and/or when the cost of external information is high. Furthermore, the increase in internal search effort due to an increase in the external information cost is likely to be at least as great for individuals willing to expend a large amount of cognitive effort as for individuals willing to expend only a small amount of cognitive effort.

Changes in external search effort due to changes in the various individual and context-specific factors are expected to be the same for experienced consumers as for inexperienced consumers (see above). However,

since the effects of experience on external search effort can not be completely anticipated, no predictions regarding interactions among the different factors on total search effort and relative search effort can be made. In summary;

H_5: Increasing the cost of external information:

(a) should decrease an individual's external search effort, regardless of their prior experience or their willingness to expend cognitive effort;

(b) should lead to an equal or greater decrease in external search effort when willingness to expend cognitive effort is low as compared to when willingness to expend cognitive effort is high, both for experienced and inexperienced consumers;

(c) should have no effect on the level of internal search effort undertaken by inexperienced consumers; but

(d) should lead to an equal or greater increase in internal search effort for experienced consumers willing to expend a high amount of cognitive effort than the increase in internal search effort for experienced consumers willing to expend a low amount of cognitive effort.

The anticipated joint effects of external information cost, prior experience, and time pressure on the search effort variables are quite analogous to those summarized in hypothesis H_5. Whereas willingness to expend cognitive effort is expected to have a general positive effect on the search effort variables, the effect of time pressure on search effort

is generally expected to be negative. That is, individuals should expend more cognitive effort in making a choice when they have good reason to do so. When time pressure limits external search, the cognitive resources employed are expected to be smaller. Without restating the arguments provided in the previous section, the following results due to the external cost of information, prior experience, and time pressure are anticipated (see also Figure 3):

H_6: Increasing the cost of external information:

(a) should decrease an individual's external search effort, regardless of their prior experience or the degree of time pressure faced;

(b) should lead to an equal or greater decrease in external search effort when time pressure is high as compared to when time pressure is low, both for experienced and inexperienced consumers;

(c) should have no effect on the level of internal search effort undertaken by inexperienced consumers; but

(d) should lead to an equal or greater increase in internal search effort for experienced consumers facing high time pressure than the increase in internal search effort for experienced consumers faced with little time pressure.

The preceding hypotheses are summarized in Table 1. The predicted main effects of the individual and context-specific factors on the four search effort variables are noted in the first half of this table. In the second half of the table, the anticipated interactions described above are recorded.

FIGURE 3

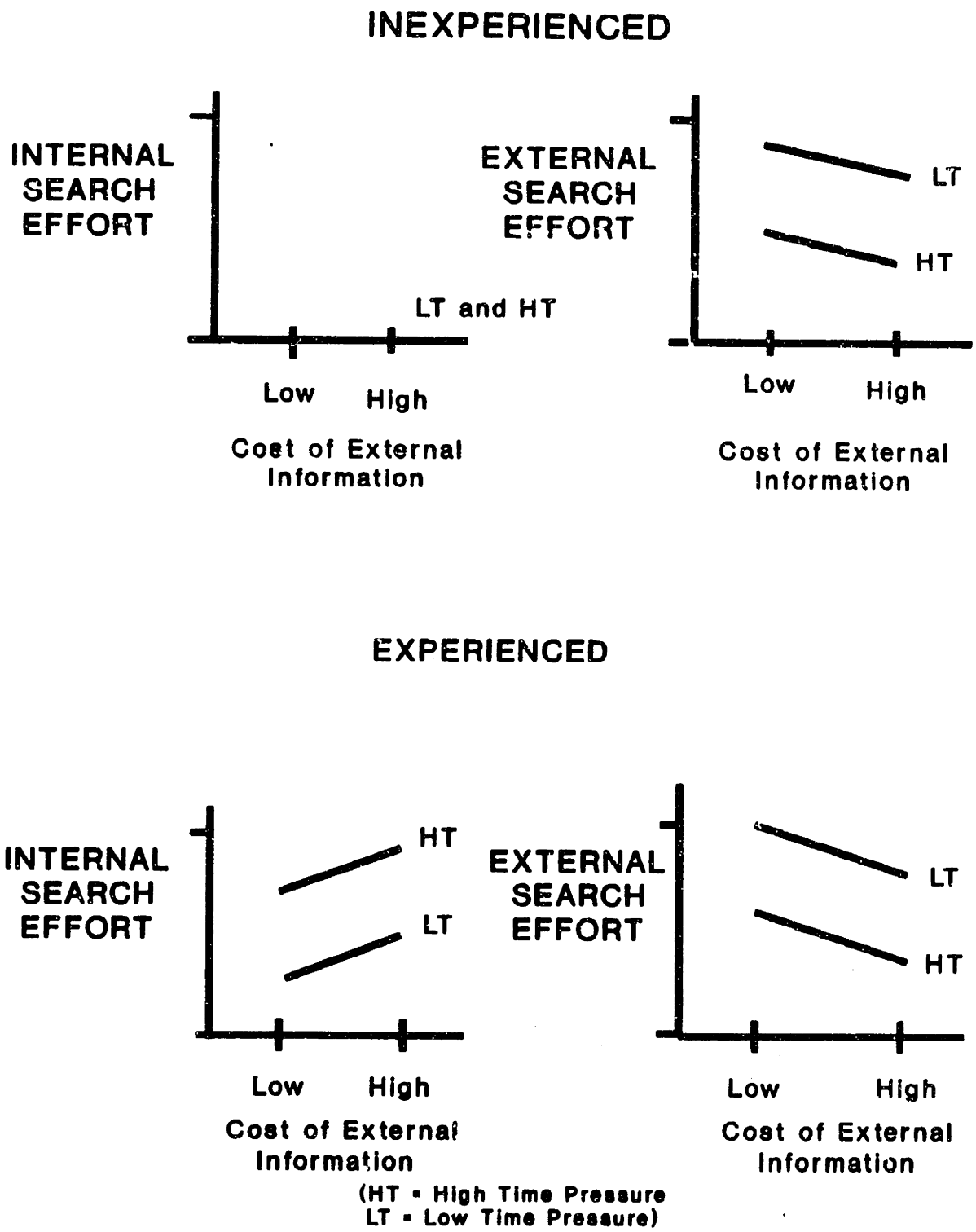

INEXPERIENCED
INTERNAL SEARCH EFFORT
LT and HT
Low
High
Cost of External Information
EXTERNAL SEARCH EFFORT
LT
HT
Low
High
Cost of External Information
EXPERIENCED
INTERNAL SEARCH EFFORT
HT
LT
Low
High
Cost of External Information
EXTERNAL SEARCH EFFORT
LT
HT
Low
High
Cost of External Information
(HT = High Time Pressure
LT = Low Time Pressure)

TABLE 1

Summary of Hypotheses

(A) Main Effects: Hypothesis	ES	IS	TS	RS
H_1: Increased cost of external information	Decrease	Increase	--	Decrease
H_2: Increased consumer experience	Decrease	Increase	--	Decrease
H_3: Increased willingness to expend cognitive effort	Increase	Increase	Increase	--
H_4: Increased time pressure	Decrease	Increase	--	Decrease

(B) Interactions:

	ES		IS	
	Low Willingness	High Willingness	Low Willingness	High Willingness
H_5: Increased cost of external information; inexperienced consumers vs.	Decrease ≥	Decrease	No change	No change
experienced consumers	Decrease ≥	Decrease	Increase ≤	Increase

TABLE 1 (cont'd)

	ES		IS	
	No Time Pressure	High Time Pressure	No Time Pressure	High Time Pressure
H_6: Increased cost of external information; inexperienced consumers vs. experienced consumers	Decrease ≤	Decrease	No change	No change
	Decrease ≤	Decrease	Increase ≤	Increase

CHAPTER 3: EXPERIMENTAL METHOD

In this chapter the subject group employed and the operationalizations for the four independent variables used in this study are discussed. The experimental procedure employed is then described in detail. Finally, the manner in which the dependent variables were measured is discussed.

Subjects

Sixty subjects were recruited from the Massachusetts Institute of Technology Sloan School of Management community. Twenty subjects were members of the Sloan support staff, while the remainder were undergraduate students (n=10), graduate students (n=26), or spouses (n=4). Sixty percent (n=36) of the subjects were female, and the average study participant was 29 years in age. Almost all (n=55) of the subjects spoke English as their native language, but the remaining subjects were also highly proficient with written and spoken English. All subjects received $5.00 for participating in the study. In addition, subjects in the willingness to expend cognitive effort condition had a possibility of winning a twelve issue subscription to a magazine of their choice.

Independent Variables

The predicted roles of prior experience, willingness to expend cognitive effort, external information cost, and time pressure on the choice process have already been discussed in Chapter 2. In order to employ these individual and context-specific factors in tests of the

hypotheses, however, a description of how each was operationalized in this study is required.

Prior Experience: Prior product class experience is a difficult concept to manipulate experimentally. Attempting to provide individual subjects with decision-making experience in an existing consumer product category would seem to be undesirable for at least two reasons. First, many consumers are likely to already have prior purchase experience in the chosen product class. In this case, a simple manipulation of experience will not be adequate. Second, the task of providing consumers with such experience is likely to be expensive and time-consuming, since it would presumably involve repeated product choice and actual product consumption and/or use over time.

To avoid becoming involved with these extensive manipulation procedures, prior experience was measured directly instead. This was done in two different ways. First, the individual was asked to provide a summary evaluation of his or her prior experience with the relevant product category. Second, for a set of ten brands within that category, the individual was asked to indicate his or her familiarity with and prior exposure to each of the brands separately. The prior exposure measure asked subjects to indicate the frequency with which they had read the particular magazine in question in the past year, linking prior exposure to actual recent use. The familiarity measure, on the other hand, asked subjects to provide an overall self-assessment of their familiarity with each of the magazines. This familiarity might be the result of recent usage, but could also come about through longer term readership of the

magazine, through an on-going awareness of the magazine's advertising, or through other influencing factors.

While the summary self-report is a simpler measure to use as an estimate of experience, it may prove to be insufficient. For example, Brucks (1985) demonstrated that clear distinctions need to be made between subjective knowledge and objective (or declarative) knowledge. Alba and Hutchinson (1987) have argued that consumer knowledge consists of two major components: familiarity and expertise. They define familiarity as "the number of product-related experiences that have been accumulated by the consumer," and expertise as "the ability to perform product-related tasks successfully." The summary self-assessment measure employed in this study is representative of the latter component of consumer knowledge, while the detailed measures of brand familiarity are more representative of the first component. However, the summary self-assessment measure provides clearer evidence of relevant prior decision-making experience, and therefore yields a better estimate for experience as defined here.

External Cost of Information: In contrast to the experience construct, the unit cost of external information, the willingness to expend cognitive effort, and the time pressure factors are all manipulated experimentally. The unit cost of external information is operationalized in terms of the effort that an individual must expend to access a particular individual piece of information. Traditionally, most information display board studies have assumed that, once an individual decides to access a particular piece of information, only a small and uniform acquisition effort is involved. In contrast, several recent studies have argued that the primary cost of consumer information acquisition may be the effort

associated with obtaining that information (e.g. Brucks 1985). Since a computer is used in the information search phases of this study, it is easy to operationalize the external information cost as a motor performance task. As the cost increases, the motor performance task is made more demanding. (Further details on this and the other operationalizations are provided below.)

Willingness to Expend Cognitive Effort: The second design factor -- willingness to expend cognitive effort -- is more difficult to deal with than the external information cost. There are a variety of ways in which to operationalize this factor experimentally. For example, it is possible to inform individuals that there is a normatively "best" alternative, and that their choice performance will be assessed through comparison with this standard. This approach may induce subjects to significantly alter their search behavior, however, in order to determine this "correct" response. Any changes in observed behavior could then be attributed primarily to demand effects inherent in the experimental design (Sawyer 1975). Furthermore, in many existing product categories consumers may have already defined the "best" alternative, and attempts to convince them otherwise are likely to prove problematic. Alternatively, individuals might be told that they will be asked to later justify their choice to another individual. However, this operationalization of willingness to expend cognitive effort may lead individuals to use different choice strategies than they might normally employ under more natural conditions. Furthermore, it is not clear exactly how the justification procedure would lead to an increase in subjects' willingness to expend cognitive effort.

Instead of using either of the above approaches, in this study individuals in the high willingness to expend cognitive effort condition were provided with a simple incentive to expend more effort. These individuals were given both a standard payment for acting as an experimental subject and an additional, consequence-based incentive. Individuals in the low willingness to expend cognitive effort condition received only the standard subject payment. Individuals who were offered the incentive were informed that they had a chance at winning a year's subscription to their chosen alternative in a random drawing to follow the completion of the study. These individuals were also informed that the subscription could be for their own use, or for the use of any other person that they designated. The potential problem associated with this operationalization of willingness to expend cognitive effort is that many of the subjects involved with the study might already have been willing to expend considerable effort in making their choices. If this was the case, a "ceiling effect" would be observed in the data, regardless of the size of the incentive offered. Results from a limited pretest suggested that this was not a major problem for the current study. It therefore seemed reasonable to expect individuals faced with a potential one year magazine subscription to expend at least a moderate amount of effort in determining an acceptable final choice, particularly in comparison to someone with nothing to gain.

Time Pressure: In the low time pressure conditions, individuals were free to search and process information for as long as they desired. In the high pressure condition, however, individuals were required to provide a final choice after a short period of time (90 seconds). Bettman, Johnson, and

Payne (1988) imposed a 15 second deadline on their high time pressure subjects. However, the external information set used in their study was less complex than the one used here. Subjects in their study were asked to select one of four risky options. Each option had four potential outcomes, and subjects were given information about both the outcomes associated with each option and the probability of each outcome's selection. Their external information set therefore involved twenty items of information based on artificially constructed alternatives. Furthermore, their subjects had virtually instantaneous access to external information. In contrast, some subjects in the
current study were required to expend considerable effort in order to access external information and all subjects were presented with a 49 item external information matrix. As a consequence, subjects were likely to require more total time to make even a cursory search of the available external information, particularly when they had to relate this information to information already available in memory.

Experimental Procedure

Overview: All subjects were first run through a business magazine choice session, and then a women's magazine choice session. Before participating in either of these sessions, however, all subjects first completed a familiarization task. During the course of this task, subjects were asked to provide self-assessments of their business and women's magazine product class knowledge, relative to the rest of the population.

Once they had completed the familiarization task, subjects were assigned to one of six different experimental conditions. This assignment was essentially random, but an attempt was made to balance the number of

high and low knowledge subjects assigned to each experimental condition. For example, if a large proportion of the subjects previously assigned to a particular experimental condition had reported high business magazine and high women's magazine knowledge, a new subject also reporting high prior knowledge in both categories would be randomly assigned to one of the other five conditions. Three of these experimental conditions involved a high external information acquisition cost, and the other three involved a low external cost. In addition to being assigned to either a high or low external cost condition, subjects were also assigned one of three different information processing conditions: (i) an incentive condition, (ii) a high time pressure condition, or (iii) a neutral (control) condition. The information processing and external cost conditions were factorially crossed, yielding the six distinct experimental cells.

After being given instructions related to the assigned experimental conditions, subjects were allowed to examine an externally available business magazine information matrix. Once the external information search phase was completed, subjects were asked to indicate their first choices. Following an intervening and unrelated task, subjects were then presented with a surprise second choice task. The intervening task was included in order to separate the first and second choices in time, thereby requiring individuals to retrieve information from long term memory. Subjects were asked for their second choices in order to obtain a second measure of internal information search. They were not informed previously of the second choice since prior knowledge of this task might influence earlier information search and therefore bias the measure of internal search for the first choice. Concurrent verbal protocols were recorded throughout both choice tasks using a tape recorder located next to the computer.

Once the second choice was completed, subjects were asked to provide evaluations for various choice alternatives. Information for some, but not all, of these alternatives had been available in the external information environment. Subjects were also asked to provide information about their prior experiences with various individual business magazines. Subjects indicated both their overall self-assessed familiarity with and their readership within the past year of each of these magazines.

After responding to a series of manipulation check questions, subjects advanced to the second product category. The experimental conditions faced by an individual subject did not change from one product category to the next, but his or her prior experiences with each of the two categories were measured separately, and therefore not constrained.

While the set of external information and the list of choice alternatives available to subjects differed from one session to the next, in all other respects the two sessions were identical. Following completion of the manipulation check questions for the second session, subjects were asked to provide a set of final paper and pencil measures (to be used as potential covariates). Once they had completed this task, subjects were debriefed.

Computer Equipment and Software: Subjects spent virtually all of their time during the study interacting with a microcomputer. All instructions were presented via a series of screens that were advanced at each subject's own pace. Subjects advanced screens, responded to questions, and accessed external information items by using a "mouse". The microcomputer used for information presentation and data collection in this study was an Apple Macintosh SE, equipped with a 20 MB hard disk. All of the programs used to

provide information to and collect information from subjects were written using Apple's HyperTalk language. HyperTalk allows a programmer to develop computer-based information environments on the Macintosh that are similar in form to those that can be developed on an IBM microcomputer using the Mouselab system (see Johnson, Payne, Schkade, and Bettman 1986). Greater details regarding the software developed for use in this study are provided in Appendix B.

The Familiarity Task: Prior to beginning the computer based sessions, each subject was asked to read and sign an informed consent form that explained the procedures to be used. Once they agreed to participate in the study, subjects were asked to begin reading the instructions presented on the computer screen. Subjects were also shown how to use the mouse to move the cursor about the screen and to advance to the next screen.

Subjects were then asked to respond to a set of six product class knowledge questions. For each of these questions, subjects were asked to provide a self-assessment of their knowledge for the indicated product category, relative to the population as a whole. Appropriate definition of this reference population was left to the subject. These assessments were made on a five point scale, consisting of the following alternative responses: well below average, below average, average, above average, and well above average. In every case, a subject was required to choose one of these five responses before he or she could advance further. Prior to answering any of these product class knowledge questions, subjects were given instructions about how to go about making responses.

Two of these product category knowledge self-assessments were directly relevant to the remainder of a subject's involvement in the study:

those for business magazines and women's magazines. Both of these responses were unobtrusively recorded for later use in assigning subjects to the experimental conditions and subsequent data analysis.

Once the knowledge self-assessment questions were completed, subjects were introduced to a practice task requiring them to choose one apartment from three alternatives. This task was described in detail. Subjects were informed that they would be allowed to search an on-screen matrix consisting of information for the three alternatives. Each apartment was described on three dimensions: monthly rent, an overall safety measure, and convenience (the walking distance from the apartment to the nearest transit line, in minutes). Subjects were also asked to provide concurrent verbal protocols as they searched the information matrix and as they made their final choices.

Once the tape recorder was turned on and a password was typed on the screen by the investigator (in order to prevent subjects from accessing information in the matrix before the taping began), subjects were presented with the on-screen information matrix. A specific piece of attribute information for a single alternative could be obtained by pointing the mouse at and clicking the mouse on the appropriate box in the matrix. That piece of information would then appear on the screen and remain there until the subject indicated he or she was ready to go on. A maximum of one piece of information could be viewed at any one time, and this information was hidden once a subject returned to the information matrix.

The number of items accessed, the order in which they were accessed, and the time spent on each piece of information were left strictly to the discretion of the subjects. When this search of the available information had been completed, each subject was asked to indicate his or her final

choice from an on-screen list of the three alternatives. When a subject had selected one of the apartments, the tape recorder was turned off. A brief delay was then experienced while the computer recorded the business and women's magazine knowledge self assessments, the total time taken to complete the entire familiarization session, and a detailed account of the information acquisition pattern for the apartment matrix.

Once this information was recorded, the computer indicated the subject's self-reported level of business magazine knowledge on the screen. This was used by the experimenter to assign the subject to one of the six experimental conditions. An attempt was made to balance the number of self-reported high knowledge ("well above average", "above average", or "average") and low knowledge ("below average" and "well below average") subjects assigned to each condition. As shown in Table 2, there were very few subjects who reported low knowledge of both magazine product classes. Furthermore, since assignment of subjects across all experimental conditions was critical in the early phases of data collection in order to conduct a preliminary test of the study's success, it became impossible to completely balance subject knowledge across all conditions. Once a subject was assigned to an experimental condition the business magazine session began.

The Business Magazine Session: Subjects were first asked to read a series of introductory screens explaining the choice task and the external information environment. These screens varied somewhat depending upon whether subjects faced a low or high cost of external information, and whether they were provided with a processing incentive, faced external information search time pressure, or had no additional processing

TABLE 2

Subject Assignment to Experimental Conditions

External Cost of Information	Processing Condition	Self-Reported Magazine Knowledge Business/Women's				
		Low/Low	High/Low	Low/High	High/High	Total
Low	Control	0	4	3	3	10
Low	High Willingness	1	2	2	5	10
Low	High Time Pressure	1	2	2	5	10
High	Control	0	4	3	3	10
High	High Willingness	2	2	2	4	10
High	High Time Pressure	0	4	2	4	10
TOTAL		4	14	18	24	

conditions placed upon them. The discussion that follows will focus on the session experienced by the low external cost, control group subjects. Subsequently, details of the differences encountered by subjects facing the other conditions will be provided.

Subjects were told that they would soon be given an opportunity to examine information for seven business magazine alternatives, and that the extent to which this information was searched was up to them. They were also informed that after they had finished looking at this information they would be asked to indicate which business magazine they would most prefer to purchase. It was pointed out at this time that they were free to choose business magazines not included in the external information matrix.

Subjects were instructed that they would have as much or as little time to examine the external information matrix as they wished, and that they could examine individual pieces of information simply by pointing and clicking the mouse at the appropriate box in the matrix. (These instructions were appropriate for the low external cost, control group. Subjects in some of the other experimental conditions received somewhat different instructions.) The attributes employed in the external information matrix were then described, and it was noted that all of the information had been taken from recent issues of real business magazines.

Each alternative was denoted by a single letter from the sequence A-G, so that subjects could not identify alternatives in the matrix without conducting some degree of external search. Each alternative was described on seven attributes: name, frequency, pages, annual price, single issue price, articles, and cover. The seven alternatives included in the information matrix were (in the order they appeared in the matrix): Sylvia Porter's Personal Finance, Financial World, Success, Money, Forbes, The

Economist, and Barron's. This set of magazines was selected for several reasons. First, the focus of these magazines varied from general business (e.g. Forbes) to personal investing (e.g. Money), meeting a wide range of reader interests. Second, some of the magazines were quite well known (e.g. Forbes) and some were much less familiar (e.g. Success). It was expected that for most individuals, at least some of these alternatives would be unfamiliar. In order to even consider one of these magazines for final choice, a subject would therefore have to process relevant external information. Finally, several well known business magazines (Business Week and Fortune) were not included in the matrix, but instead reserved for the final choice list. The wide-spread familiarity of these last magazines assured that many of the subjects would have prior evaluations for them.

Once they had finished reading the attribute descriptions, subjects were given instructions asking them to speak their thoughts out loud as they considered the available information in arriving at their final choices. When they were ready to proceed, they informed the researcher (who remained in the room with subjects during all verbal protocol phases of the study) of this fact. A password was then entered and the tape recorder turned on. Subjects were informed that they could begin the choice process at any time by pointing and clicking at a button at the bottom of the screen. Following a brief delay, the external information matrix appeared on the screen and subjects were free to examine as much or as little of the available information as desired.

Once subjects were satisfied with the amount of external information that they had examined, they indicated their readiness to make their final selection. A screen with a set of choice alternatives listed alphabetically then appeared. This list included all seven of the

alternatives described in the information matrix as well as three additional alternatives: Business Week, Fortune, and Inc. As already mentioned, many of the subjects had had prior experiences with the first two of these new alternatives. They were thus forced to integrate this internally-based prior knowledge with information that they had gained from external search (but that was now also internally-based).

Once the first choice was selected, subjects were asked to answer six simple questions completely unrelated to the business magazine choice task. These questions were included so that any information in short-term memory regarding the various magazines would not be retained when subjects were asked to make an unexpected second choice. Three of these questions asked subjects to indicate which of three options they most preferred. For example, one of these questions asked subjects to indicate whether they most preferred Ford, GM, or Chrysler. The other three questions asked subjects to type a 5 to 7 character word that appeared at the top of the screen. The words selected for use in these questions were not associated with any of the tasks or measures used in the study.

After the six questions were answered, subjects were again unexpectedly presented with the list of business magazines. They were informed that their first choices were unavailable due to distribution problems, and they were asked to indicate a second choice. This second choice was a surprise in order to prevent subjects from processing the available information to make both choices at the same time, since this would likely bias the first choice measure. The second choice task was included as a potential additional measure of internal search. Subjects could only advance to subsequent screens once they had made a second choice

different from the first. At this point the tape recorder was turned off, and the researcher left the room.

Following the unexpected second choice task, subjects were presented with a series of screens asking them to indicate their overall evaluations for various business magazines. They saw two screens in succession for each alternative. The first simply presented the name of a business magazine, along with two buttons labelled "Good" and "Bad". Subjects were forced to choose one of these two alternative evaluations for the named magazine. The time that elapsed from the moment that the name was presented until one of the two buttons was selected was recorded (to the nearest 60th of a second) for every subject on each magazine. These times represent estimates of subjects' evaluation accessibilities for the various magazines. Previous research (e.g. Fazio et. al 1982) has shown that strongly held evaluations can be retrieved from memory much more rapidly then weakly held evaluations. Since the speeds with which these evaluations are accessed and retrieved from memory are expected to have a potentially significant impact on subjects' final choices, they are important measures in the context of the present study.

The second screen seen for each alternative was included in order to obtain a more detailed measure of subjects' evaluations. The name of the magazine was again shown on the screen, and subjects were asked to indicate their overall evaluation for the alternative on a seven-point scale. If they were not familiar with an alternative, subjects were asked to select the "unfamiliar" response rather than provide an evaluation. Subjects' response times were <u>not</u> measured for this second evaluation.

This pattern of alternating back and forth between the two evaluative screens was continued through the entire set of business magazine

alternatives offered earlier in the choice list. Evaluations for the first magazine encountered in this sequence -- Business Week -- were measured again at the end of the sequence. In addition, three fictitious magazines were included in the sequence. This was done in order to obtain response latency measures for alternatives where no previous evaluations could exist. These latency measures could then be compared to those obtained for the real magazines. The order of the business magazine evaluations was identical for all subjects, and is shown in Table 3.

Following this sequence of evaluation questions, subjects were asked a set of six additional questions for each of the ten alternatives in the choice list. These questions focused on (i) the degree to which subjects actively considered each alternative in making their final choices, and (ii) subjects' prior experience and familiarity with each magazine. The latter questions were considered central for an examination of the effects of prior experience on total information search and choice, while the former were included as secondary measures of internal search.

Finally, a sequence of seven manipulation check questions was presented to all subjects. These questions were included in order to assess whether or not subjects perceived the effects of the experimental manipulations as intended. Once these questions had been answered, subjects were informed that there would be a brief delay while the computer prepared the women's magazine session.

Women's Magazines: Most of the screens seen by subjects during the business magazine session were repeated in the women's magazine session. Since the experimental conditions did not vary from one session to the next, the introductory screens for both sessions were virtually identical.

TABLE 3

Order of Business Magazine Presentation in the Evaluation Sequence

Rank Order	Magazine
1	Business Week[a]
2	Barron's
3	Fortune[a]
4	Personal Wealth[b]
5	The Economist
6	Sylvia Porter's Personal Finance
7	Inc.[a]
8	Business Life[b]
9	Money
10	Financial World
11	Bull & Bear[b]
12	Success
13	Forbes
14	Business Week[a]

NOTE: All of the above magazines were described in the external information matrix, except where otherwise noted:

[a]These magazines are real, but not included in the matrix;
[b]These magazines are fictitious.

All of the instructions remained the same, and the seven matrix alternatives were described on the same seven attributes. Indeed, the information matrix seen in the women's magazine session was identical to that shown in the business magazine session, although the individual pieces of information were different.

The seven alternatives included in the matrix were (in order): Woman's World, Working Woman, Family Circle, McCall's, Vogue, Elle, and Lear's. As before, these magazines were selected on the basis of their variety of focus and on the likely variability of subject familiarity. For example, Family Circle and Vogue were quite well known to most subjects, while Lear's and Working Woman were much less familiar.

Subjects were again allowed to examine as much or as little information for these alternatives as they wished, and when done were presented with the choice list. The three new alternatives in this case were Cosmopolitan, Good Housekeeping, and Ms. All three of these alternatives were familiar to a large proportion of the subjects, and were therefore likely to stimulate some degree of internal information search.

Following their first choices, subjects again completed a set of unrelated questions, and then indicated their second choice magazine. An alternating sequence of "Good"/"Bad" and more detailed evaluation screens was then presented to subjects, following the order shown in Table 4. Consideration and experience measures were then taken for each alternative in the choice list. Following this, the set of manipulation check questions was repeated for this second product category. Finally, subjects were informed that the computer based sessions were complete.

Subjects were then asked to complete a reduced form of Cacioppo and Petty's need for cognition scale (Cacioppo and Petty 1982, Cacioppo, Petty,

TABLE 4

Order of Women's Magazine Presentation
in the Evaluation Sequence

Rank Order	Magazine
1	Cosmopolitan[a]
2	Lear's
3	Good Housekeeping[a]
4	Single Woman[b]
5	Elle
6	Vogue
7	Ms.[a]
8	High Fashion[b]
9	McCall's
10	Family Circle
11	City Living[b]
12	Working Woman
13	Women's World
14	Cosmopolitan[a]

NOTE: All of the above magazines were described in the external information matrix, except where otherwise noted:

[a]These magazines are real, but not included in the matrix;
[b]These magazines are fictitious.

and Kao 1984) and a reduced version of Zaichkowsky's involvement scale (Zaichkowsky 1985). Subjects completed both of these scales using pen and paper. Both scales were included for use as potential covariates in an examination of external information search, since in both cases a previous link between the measure and external search had been reported. Finally, subjects answered several demographic questions. They were then debriefed, and paid $5.00 for their participation in the study. Subjects in the high willingness to expend cognitive effort condition were also asked to provide information about where and when they could be contacted if they won a magazine subscription in the random drawing to follow the study's completion. Most subjects completed the entire study in about one hour.

Cost of External Information: The cost of external information was manipulated by increasing the cognitive effort required to access external information. In the low cost of external information condition, subjects could simply access external information by pointing and clicking at the appropriate box in the information matrix. Essentially, then, once a subject in the low cost condition decided to access an item of external information, it could be acquired immediately, thus employing few cognitive resources in the act of information acquisition.

For high external information cost subjects this was not the case. In order to access an item of external information, these subjects had to first click on a box in the matrix. They then had to type in the first three letters of the attribute to be examined, a space, and then the single letter representing the alternative to be examined. Following completion of this typing task, subjects could examine the requested piece of information. Subjects could also cancel the information request at any

time prior to completing the typing task. Subjects were instructed on how to access the matrix information in the screens preceding the choice task. They were also presented with a set of three acquisition tasks that ensured they understood how to access external information before beginning the magazine choice task.

It should be clear that choosing the correct letter sequence and typing it in requires the use of considerably greater cognitive resources than simply clicking on a box. Furthermore, in both the low and high external information conditions subjects must point and click on an external information matrix button. In the low cost case this is the only action required to examine an information item. In the high cost case, however, subjects must also type the five character sequence. As a result, the high external cost condition must involve more effort than the low external cost condition.

Willingness to Expend Cognitive Effort: Subjects in the high willingness to expend cognitive effort condition were given an incentive not offered to subjects in the control and high time pressure conditions. This incentive took the form of a chance to win a 12 or 13 issue subscription to each subject's first choice magazine. While these subscriptions could be designated by those subjects for the use of other individuals, the incentive subjects had a strong reason for not making their choice at random. The high willingness to expend cognitive effort subjects were informed that their names would be entered into a random drawing to follow the study's completion, in order to award four free subscriptions. While these subjects did not know the exact odds of winning in this draw, they

were told in the introductory screens that their chances were "relatively good".

The high willingness to expend cognitive effort subjects were informed of the added incentive on the first screen seen for both the business magazine and women's magazine sessions. This information was not seen by the other subjects. Since all subjects already expected to receive payment for their participation in the study, the incentive was expected to induce the high willingness to expend cognitive effort subjects to invest a greater overall level of cognitive resources in the choice task than would be the case for the other subjects. While subjects were aware that the additional incentive would be awarded on a chance basis, they also knew that if they did win the random drawing they could only receive their first choice magazine. This operationalization of the willingness to expend cognitive effort construct is not explicitly linked to each individual's determination of an appropriate effort level for the choice at hand. However, subjects provided with this incentive should have been willing to expend sufficient cognitive effort to assure that they made an acceptable first choice. In contrast, subjects not receiving the incentive were likely to have been less concerned about the quality of their choice, and therefore have employed less cognitive effort in making that choice.

Time Pressure: Subjects in the high time pressure condition were first informed of this fact in the introductory screens preceding the start of the choice task. They were told that they would have a total of 90 seconds to search the information environment, and that they would hear computer-generated beeps at 30, 60, and 80 seconds so that they might keep track of the time elapsed and remaining. These high time pressure subjects were

also informed that the external search phase would begin at their direction any time after the tape recorder had been turned on. When the full 90 seconds had elapsed, the computer program removed whatever had been on the screen at that moment and replaced it with the final choice alternative list. Once this occurred, there was no way for subjects to return to the external information environment. Many high time pressure subjects were surprised that the 90 seconds passed by as quickly as they did, but all were able to make a final choice on the basis of information either seen or remembered.

A duration of 90 seconds was chosen for the high time pressure condition for two major reasons. First, pretests indicated that subjects could examine about seven items of external information in this period of time, even when the external information cost was high. They could thus look at roughly one piece of external information per alternative included in the matrix. This would be insufficient time, however, for subjects to form overall evaluations for all of the alternatives based solely on the external information set. Second, pretest subjects spent far more than 90 seconds looking at external information when this search was unconstrained. A 90 second limit was therefore expected to have a significant impact on most individuals' external search.

Dependent Measures

As noted earlier, there are four dependent measures of interest: external search effort, internal search effort, total search effort, and relative search effort. In order to estimate these various search effort variables, a number of separate measures were employed in the study. First, subjects were asked to provide concurrent verbal protocols

describing their thoughts as they examined and processed information to arrive at their final choices. These protocols were then broken down into individual segments and coded to reflect whether internal or external information was being employed, and whether or not active information search (rather than information processing or some other non-search activity) was occurring. Second, computer-based traces of subjects' information search processes were collected and recorded to provide additional measures of external and internal search. An alternate measure of total effort -- individual self assessment -- has been used effectively by Bettman, Johnson, and Payne (1988). However, the current study is more interested in looking at total search effort than at total effort. Self assessment measures are unlikely to be of much help in estimating the former.

The entire verbal protocol collected for an individual during the choice process represents the activities taking place in short term memory during information processing. From an analysis of the protocol data, the number of segments devoted to both internal and external information search can be determined. This information can be used in a number of different ways to estimate internal and external search effort. Total search effort and relative search effort can both then be derived from these two measured variables. For example, one can simply count up the number of protocol segments that are associated with internal and external search. While this approach is likely to identify the relative usage of the two information sources, however, it does not adequately measure the effort associated with this internal and external search.

Consider an individual who -- according to her verbal protocol -- accesses five pieces of internal and five pieces of external information,

but who spends twice as much time examining each piece of external information as each piece of internal information. In this case, the two information sources have been used equally, but twice as much time has been devoted to the external source as to the internal. This example emphasizes an important distinction between the amount of search conducted and the time spent on that search. In this thesis, time measures of search and measures of the numbers of items examined are both used as proxies for the cognitive effort employed in search. However, considerably greater emphasis is placed on the time-based measures than on the amount-based measures. This is done for two major reasons. First, the time-based measures of internal search are likely to be more accurate than any other measures. Second, time-based measures of search have been used with success in the past (e.g. Bettman, Johnson and Payne 1988). In general, the assumption used here is that the time spent searching and processing information is a good proxy for the cognitive effort used for those activities.

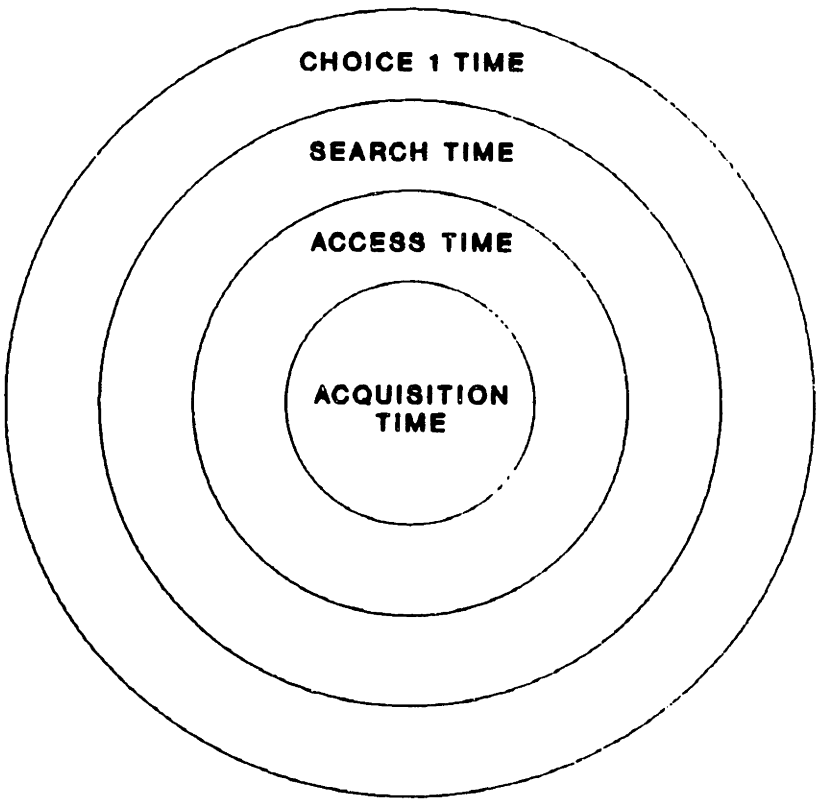
It has been argued that verbal protocols distort information processing for two main reasons (Biehal and Chakravarti 1989). First, the generation of verbal protocols during choice processes may require subjects to both expend extra effort and to focus some of their cognitive resources on the verbalization task rather than on the choice task. Second, subjects may consciously attempt to manage the impression that they give to the researcher by editing their verbalizations to present a more rational perspective of their thought processes. To reduce these concerns, computer-based measures of external search were also taken unobtrusively as individual subjects examined the on-screen external information matrix.

Every subject was presented with an opportunity to examine information that was externally available to them on a computer screen. For high incentive and control subjects, the extent to which they searched this information and the time that they took in doing so was entirely at their discretion. Those in the high time pressure condition were limited in terms of the time available for external search, but their pattern of external search was not constrained.

In the process of examining external information and making a final choice, each subject produced several time-based measures of search. These measures are represented in Figure 4. Each larger concentric circle contains all previous smaller circles as time subsets. For example, the total access time employed by an individual during the external information search phase is represented by the second smallest circle in Figure 4. However, access time is composed entirely of reading time and acquisition time. Reading time refers to the total time that the individual had actual pieces of information before him or her on the screen. Acquisition time, on the other hand, represents the total time taken to acquire this information. When the cost of external information is low, the total acquisition time employed by an individual is almost negligible, representing the time taken by the computer to produce a piece of information on the screen following a click of the mouse on a box in the information matrix. Conversely, when the cost of external information is high, the acquisition time represents a sizable proportion of the total access time. In both cases, however, acquisition time is a strict subset of access time, and the acquisition time measure obtained from an individual must be less than the access time measure obtained from the same individual during the same external search phase.

FIGURE 4

Partitioning Computer-Based Time Measures



Search time represents the total time taken by an individual to search the externally available information matrix. This time was measured from the moment that the information matrix was first made available until the subject indicated that he or she had finished examining external information or until the full time allowed for external search in the high time pressure conditions had elapsed. The first choice time measure includes the search time measure above, as well as the additional time taken by the subject to make a final choice. Since the final choice set included a number of alternatives not presented in the external information matrix, the subject had to employ internal information in order to make this final choice.

A number of additional measures of external information search that are often reported in the information processing literature were also taken (see, for example, Payne, Bettman, and Johnson, 1988). The total number of items of external information acquired is an important measure of the depth of external search, while the average time spent acquiring and reading each item of information provide measures of the acceleration of external information processing that might take place under varying experimental conditions. Total time per acquisition represents the total time invested in acquiring and reading an average external information item, while reading time per acquisition represents only the actual average reading time per external information item.

Several processing pattern measures were also taken. Variances in the proportions of time spent on each alternative and on each attribute were determined for each individual. As might be expected, these variances indicate the degree of selectivity employed by individuals. When the variance is high, only some of the available information is being employed.

For example, a relatively high variance in the proportion of time spent by individuals on attribute information would indicate their use of only a few of the available attributes during external information search.

Finally, a measure of information processing transitions first employed by Payne (1976) is reported. This measure is based on an examination of an individual's complete sequence of external information acquisition. Each pair of items acquired in this sequence is examined separately. If the individual examines the same alternative on two different attributes in an information pair, the transition is coded as Type 1 (or alternative-based). When the individual examines two different alternatives on the same attribute, the transition is coded as Type 2 (or attribute-based). All other pair-wise transitions are ignored. A relative measure of alternative-based and attribute-based transitions is then determined by calculating the number of Type 1 transitions minus the number of Type 2 transitions divided by the sum of Type 1 and Type 2 transitions. Ranging from a value of -1.0 (for pure attribute-based processing) to +1.0 (for pure alternative-based processing), this measure indicates which type of processing is more prevalent.

In addition to these traditional measures, two further measures related to external search were collected. These measures both identify the relative importance of the NAME attribute in the external search process. As Ford et al (1989) have noted, "unlabelled alternatives...allow for the examination of how preexperiment notions affect information search and decision strategy." Previous research has generally not dealt with this issue. However, since one of the key issues of interest in this study is the role of prior consumer experience on internal and external search,

measuring the relative importance of the name attribute across the various experimental conditions is of considerable importance.

The two measures used to identify the importance of name in this study identify (i) the number of subjects who have a high (value = 1) average rank order of access for the name attribute and (ii) the number of subjects who have a high (value = 1) average rank proportion of external search time devoted to looking at the name attribute. The first measure represents the degree to which an individual used the name attribute to guide external search. If the name attribute was examined on average very early in the search process, the order rank value will be high. If the name attribute was examined later in the external search process or was not examined at all, on the other hand, the rank value will be lower. The second measure represents the ranked proportion of external search time devoted to the name attribute. If more external search time was spent on name than on any other attribute, the time proportion rank value of name is high. If name was only briefly examined or not examined at all, the rank value of name would be lower. Variations in both these measures are examined across experimental conditions.

The time measures depicted in Figure 4 can also be used to estimate the degree to which individuals conduct internal information search. For example, since the time taken between the end of an individual's external search and his or her final choice selection occurs in the absence of external information, this time must involve only internal search. A measure subtracting total external search time from total choice time thus represents a lower bound estimate of an individual's internal search effort.

However, the preceding estimate of internal search presumes that no internal search takes place during the external information search phase. Since some portion of the total search time for an individual is likely to not be devoted to external information examination, this assumption leads to an underestimate of internal search. As an alternative, a measure based on the subtraction of total reading time from total choice time can be examined. Total reading time is in turn determined by subtracting acquisition time from access time (refer to Figure 4). This measure assumes that all time not spent reading external information is devoted to internal search, and thus clearly overestimates internal search effort. This must be true, since some cognitive effort will be reserved for calculating, comparing, and eliminating alternatives, as well as for other non-processing tasks. All subjects were asked to make a second choice following their first, in the absence of external information. The time taken by individuals to make this second choice in the complete absence of external information provides a third measure of internal search effort.

Estimates of total search effort and relative search effort are calculated from the estimates of internal and external search effort. Since the observed number of external information item acquisitions cannot be easily combined with the internal search effort time estimates, only the time-based measure of external search effort is used in the calculations of total and relative search effort. Both the liberal and conservative estimates of internal search effort are used in these calculations, leading to two alternate measures for both total and relative search effort.

CHAPTER 4: RESULTS

Overview

This chapter begins with an analysis of the manipulation check questions to assess the extent to which the experimental manipulations were perceived by subjects. The experimental measures described in the preceding chapter are then presented in detail by experimental condition. Analyses of these data are left for the next chapter.

Manipulation Checks

For each of the three experimentally manipulated factors (cost of external information, willingness to expend cognitive effort, and time pressure) subjects were asked to provide responses on seven-point scales to two manipulation check questions. Subjects' responses to the two questions for each manipulation check were summed to form three separate indices: a willingness to expend cognitive effort index, an external cost index, and a time pressure index. Each index ranged in value from -6 (high perceived absence of the factor) to +6 (high perceived presence of the factor). Each of the three experimental factors is examined separately below using these indices, both when the business and women's magazine product categories are considered separately, and when subjects' responses for the two categories are combined. The mean and standard deviation values for each of the three indices are reported in Table 5 by experimental condition and magazine session. Corresponding main effect values for the three indices are provided in Table 6. For the individual categories, one-tailed t tests are conducted, since the effect directions are anticipated by the experimental design. For the combined measures, F-tests based on Hotelling's T^2 values

TABLE 5

Mean and Standard Deviation Values for the Manipulation Check Indices, by Experimental Condition and Magazine Session

Experimental Condition	Willingness to Expend Cognitive Effort Index		External Cost Index		Time Pressure Index	
	Business	Women's	Business	Women's	Business	Women's
Incentive						
Low cost	4.60 (1.51)	3.60 (2.07)	-2.00 (4.11)	-1.60 (3.72)	-4.90 (2.28)	-5.20 (1.32)
High cost	2.40 (2.07)	1.50 (3.60)	-1.00 (3.87)	-0.80 (3.71)	-4.20 (2.90)	-4.80 (1.93)
Time Pressure						
Low cost	2.40 (3.24)	2.30 (2.95)	-0.40 (2.59)	-0.90 (3.28)	3.60 (2.99)	3.30 (2.36)
High cost	1.40 (2.12)	1.00 (2.75)	2.90 (2.23)	2.70 (2.71)	4.80 (1.14)	3.10 (2.27)
Control						
Low cost	2.90 (1.66)	1.70 (2.16)	-1.30 (2.11)	-0.70 (2.83)	-4.30 (1.57)	-3.30 (1.96)
High cost	0.10 (3.75)	-0.10 (2.77)	1.40 (4.27)	0.70 (3.89)	-5.40 (1.26)	-4.20 (3.46)

NOTE: Values in the table above are presented in the form: Mean (Standard Deviation).

TABLE 6

Main Effect Means and Standard Deviation Values for the Manipulation Check Indices, by Magazine Session

Main Effect	Willingness to Expend Cognitive Effort Index		External Cost Index		Time Pressure Index	
	Business	Women's	Business	Women's	Business	Women's
Means						
Incentive (20)	3.50 (2.09)	2.50 (3.05)	-1.55 (3.91)	-1.20 (3.64)	-4.55 (2.56)	-5.00 (1.62)
Time pressure (20)	1.90 (2.71)	1.65 (2.85)	1.25 (2.90)	0.90 (3.46)	4.20 (2.28)	3.20 (2.67)
Control (30)	1.50 (3.17)	0.80 (2.59)	0.05 (3.56)	0.00 (3.39)	-4.85 (1.50)	-3.75 (2.77)
Low cost (30)	3.30 (2.39)	2.53 (2.47)	-1.23 (3.02)	-1.07 (3.20)	-1.87 (4.55)	-1.73 (4.14)
High cost mean (30)	1.30 (2.83)	0.80 (3.03)	1.07 (3.83)	0.87 (3.66)	-1.60 (4.99)	-1.97 (4.60)
Grand (60)	2.30 (2.79)	1.67 (2.88)	-0.08 (3.61)	-0.10 (3.54)	-1.73 (4.74)	-1.85 (4.34)

obtained from a repeated measures multivariate analysis of variance (MANOVA) analysis are reported. The correlations between each pair of manipulation check questions used to form the three previously mentioned indices were quite high. The inter-item correlations for the business magazine session (n = 60) were 0.6280, 0.6847, and 0.9520 for the willingness to expend cognitive effort, external cost, and time pressure indices respectively. The corresponding Cronbach alpha values for these indices were (respectively) 0.7715, 0.8128, and 0.9754 indicating a high degree of inter-item reliability in all three cases. All three inter-item correlations differed significantly from zero at the .0001 level. For the women's magazine session, the respective inter-item correlations were 0.6299, 0.6378, and 0.8513, while the corresponding alpha values for the indices were 0.7729, 0.7788, and 0.9197. Once again, all three inter-item correlations differed significantly from zero ($p < .0001$).

The perceived cost of external information was significantly higher for subjects in the high external information cost conditions than for those in the low external cost conditions, both when business and women's magazines were considered independently ($t_{58} = 2.58$, $p < .01$ and $t_{58} = 2.18$, $p < .025$ respectively), and when subjects' perceptions for the two product categories were combined ($F(1,54) = 4.66$, $p < 0.05$). For the combined data, there were no significant within-subject effects for the external cost index, and no other significant between-subjects effects.

Subjects were highly attuned to the presence or absence of time pressure. Subjects in the high time pressure condition perceived a much higher level of time pressure than subjects in the control and incentive grcups. The mean values for this index are reported in Table 6. Across subjects, the difference in the time pressure index mean was highly

significant for both business magazines (t_{38} = 14.82, $p < .0001$) and women's magazines (t_{38} = 8.08, $p < .0001$). (These t-values are based on a comparison of the control and high time pressure groups only.) For the combined set of observations, the between-subjects analysis indicated that the high time pressure subjects perceived a significantly greater degree of time pressure than did subjects in the control and incentive groups ($F(1,54) = 156.82$, $p < .0001$). No other between-subjects effects were significant. Within-subjects analysis indicated that the change in the mean time pressure index value for the control group differed significantly from the changes observed for both the incentive and the time pressure groups ($F(1,54) = 4.76$, $p < .05$ and $F(1,54) = 8.75$, $p < .01$ respectively). Furthermore, there was a significant within-subjects main effect for magazine session ($F(1,54) = 4.17$, $p < .05$). These significant findings result from the fact that the control group subjects perceived an increase in time pressure from the first session to the second, while subjects in the other two groups perceived a decrease in time pressure. The information collected in this study does not really help to explain these complex interactions. However, it should be emphasized that there are strong difference in subjects' perceptions of time pressure across the experimental groups for <u>both</u> magazine sessions, and that the interactions do not alter these main effect differences.

Finally, subjects provided with an additional incentive to process information indicated that they perceived the importance of expending greater cognitive effort in making their final choices. The mean value on the willingness to expend cognitive effort index was higher for the incentive group than for the control group. This difference was statistically significant both for business magazines (t_{38} = 2.36,

$p < .025$) and for women's magazines ($t_{38} = 1.96$, $p < .05$). When the two categories were combined, a between-subject analysis indicated a significantly higher mean willingness to expend cognitive effort index value for the incentive group than for subjects in the control and time pressure groups ($F(1,54) = 6.55$, $p < .025$). However, there was also a significant difference in the willingness to expend cognitive effort index for the external cost manipulation ($F(1,54) = 5.07$, $p < .05$). Subjects in the high external information cost conditions were significantly less willing to expend cognitive effort than their counterparts in the low external information cost conditions. This difference was also observed individually for the business ($t_{38} = 2.95$, $p < .005$) and women's ($t_{38} = 2.42$, $p < .01$) magazine categories.

The above results confirm that subjects did perceive differences in the three experimentally manipulated factors in directions consistent with prior expectation. Furthermore, in virtually every case the experimental manipulations had a significant influence only on the expected index. However, there was one exception to this observation as already noted. Subjects' willingness to expend cognitive effort (as measured by the manipulation check index) was influenced both by the incentive manipulation and by the cost of external information manipulation. However, there was no significant interaction effect between the external information cost and incentive manipulations on the value of the willingness to expend cognitive effort index.

In summary, the incentive, external cost, and time pressure manipulations appear to have had the desired effect on subjects' perceptions of the choice environment. In addition, the external cost

manipulation influenced subjects' perceived willingness to expend cognitive effort as well as their perceptions of the external cost of information.

Computer-Based Time Measures

Mean values for each of the computer-based measures described in the previous chapter are provided in Tables 7, 8, and 9. These means are broken down by experimental condition and are presented independently for the business and women's magazine sessions. The means for the main effects of these measures on external search effort are presented in Tables 10, 11, and 12. Tables 7 and 10 relate to overall external search effort, while Tables 8, 9, 11, and 12 relate to external search strategy.

The total number of items of external information examined represents an overall measure of external search depth. The total external search time measure is determined by subtracting the acquisition time measure from the search time measure. Since the cost of external information varies quite widely across individuals, this correction is necessary for meaningful comparisons across experimental conditions. For example, individuals faced with a high cost of external information in the business magazine session spent more time searching information in the external environment than individuals faced with a low external cost (221 seconds versus 131 seconds). However, the high external information cost subjects actually spent almost 45% of this time acquiring the information. When the acquisition times are subtracted out, however, it becomes clear that the low external information cost subjects spent more non-acquisition time on external information than did high external cost subjects (131 seconds versus 122 seconds). It is this latter measure of total external search that is reported in Tables 7 and 10.

TABLE 7
Means for Computer-Based External Search Effort Measures, by Experimental Condition and Magazine Category

Experimental Condition (n)	Number of Items Examined		Total External Search Time (secs)	
	Business	Women's	Business	Women's
Incentive				
Low cost (10)	31.4	29.3	201	169
High cost (10)	26.3	21.5	178	121
Time Pressure				
Low cost (10)	10.9	14.1	41	38
High cost (10)	6.5	7.9	27	26
Control				
Low cost (10)	27.2	26.5	152	136
High cost (10)	28.1	19.0	164	85

TABLE 8

Means for Computer-Based External Search Strategy Measures, by Experimental Condition and Magazine Category

Experimental Condition (n)	Average Access Time Per External Item (secs)		Average Read Time Per External Item (secs)		Variance in Proportion of Time Spent on Attributes		Variance in Proportion of Time Spent on Alternatives	
	Business	Women's	Business	Women's	Business	Women's	Business	Women's
Incentive								
Low cost (10)	5.87	5.77	5.73	5.63	.033	.042	.009	.005
High cost (10)	11.65	10.15	6.05	5.28	.059	.044	.006	.007
Time Pressure								
Low cost (10)	4.40	3.23	4.35	3.35	.068	.079	.014	.011
High cost (10)	9.37	7.73	4.50	3.37	.116	.088	.012	.007
Control								
Low cost (10)	6.00	5.73	5.95	5.68	.038	.050	.012	.005
High cost (10)	10.15	8.42	5.98	4.77	.034	.043	.009	.011

TABLE 9

Additional Means for Computer-Based External Search Strategy Measures, by Experimental Condition and Magazine Category

Experimental Condition (n)	Information Processing Transition Index		Proportion Having NAME Attribute with Average Rank Order = 1		Proportion Having NAME Attribute with Proportion of Time Spent Rank Order = 1	
	Business	Women's	Business	Women's	Business	Women's
Incentive						
Low cost (10)	-.290	-.342	.400	.500	.200	.100
High cost (10)	-.174	-.176	.700	.600	.500	.400
Time Pressure						
Low cost (10)	-.632	-.755	.500	.700	.500	.500
High cost (10)	-.883	-.678	.600	.800	.600	.800
Control						
Low cost (10)	-.184	-.224	.500	.600	.100	.100
High cost (10)	-.268	-.563	.600	.500	.400	.400

TABLE 10

Main Effect Means for Computer-Based External Search Effort Measures, by Magazine Category

Main Effect	Number of Items Examined		Total External Search Time (secs)	
	Business	Women's	Business	Women's
Incentive (20)	28.8	25.4	188	145
Time Pressure (20)	8.7	11.0	34	32
Control (20)	27.6	22.7	158	111
Low cost (30)	23.2	23.3	131	115
High cost (30)	20.3	16.1	122	77
Grand (60)	21.7	19.7	127	96

TABLE 11

Main Effect Means for Computer-Based External Search Strategy Measures, by Magazine Category

Main Effect	Average Access Time Per External Item (secs)		Average Read Time Per External Item (secs)		Variance in Proportion of Time Spent on Attributes		Variance in Proportion of Time Spent on Alternatives	
	Business	Women's	Business	Women's	Business	Women's	Business	Women's
Incentive (20)	8.77	7.95	5.88	5.45	.046	.043	.007	.006
Time pressure (20)	6.88	5.48	4.42	3.36	.092	.084	.013	.009
Control (20)	8.07	7.08	5.97	5.23	.036	.046	.010	.008
Low cost (30)	5.42	4.92	5.33	4.88	.046	.057	.012	.007
High cost (30)	10.38	8.77	5.52	4.47	.070	.058	.009	.008
Grand (60)	7.90	6.83	5.43	4.68	.058	.058	.010	.008

TABLE 12

Additional Main Effect Means for Computer-Based External Search Strategy Measures, by Magazine Category

Main Effect	Information Processing Transition Index		Proportion Having NAME Attribute with Average Rank Order = 1		Proportion Having NAME Attribute with Proportion of Time Spent Rank Order = 1	
	Business	Women's	Business	Women's	Business	Women's
Incentive (20)	-.232	-.259	.500	.550	.350	.250
Time pressure (20)	-.758	-.716	.550	.750	.550	.650
Control (20)	-.226	-.394	.550	.550	.250	.250
Low cost (30)	-.369	-.440	.467	.600	.267	.233
High cost (30)	-.442	-.473	.633	.633	.500	.533
Grand (30)	-.405	-.456	.550	.617	.383	.383

The times spent acquiring and reading an average item of external information are reported in Tables 8 and 11. The first time measure represents the total average time invested in acquiring and reading external information, while the second represents the actual average reading time per external information item examined.

Several processing pattern measures are also reported in this table. Variances in the proportions of time spent on each alternative and on each attribute were calculated for each subject. As previously noted, these measures indicate the degree of search selectivity employed by an individual. When the measure of variance is high, only some of the available information is being employed. For example, the relatively high variance in the proportion of time spent on attributes by individuals in the high time pressure condition (0.092 during the business magazine session versus an average of 0.041 for the other two conditions) indicates the predominant use of a few attributes during external information search. A third measure of search pattern presented in Tables 9 and 12 is the information processing transition index first employed by Payne (1976). As noted in the previous chapter, this measure is based on an examination of an individuals complete sequence of external information acquisition, and it ranges from a value of -1.0 for pure attribute-based processing to +1.0 for pure alternative-based processing.

Finally, two measures identifying the importance of the NAME attribute in subjects' external search processes are reported in Tables 9 and 12. First, the average rank order of examination for each of the seven attributes was determined for every individual. The proportion of individuals who had an average rank order of one for the NAME attribute was then determined for each experimental condition. Second, the average rank

order of the proportion of time spent on each of the seven attributes was also determined for every individual. The proportion of individuals who had an average rank order of one for the NAME attribute was again determined for each experimental condition. These proportions are reported in the final two columns of Tables 9 and 12.

As discussed in Chapter 3, three computer-based time measures of internal search exist. The time taken between the end of external search and the final choice selection occurs in the absence of external information. This measure represents a conservative estimate of an individual's internal search effort. However, this estimate assumes that no internal search takes place during the external information phase. An alternate measure of internal search assumes that all time not spent on external information acquisition and reading is devoted to internal search. This measure represents a liberal estimate of internal search effort. The third and final measure of internal search is the time taken by subjects to make a second choice. Means for all of the above estimates of internal search effort are presented in Tables 13 and 14, by experimental condition and magazine session.

Estimates of total search effort and relative search effort are calculated from the estimates of internal and external search effort presented earlier. Since the observed number of external information item acquisitions cannot be easily combined with the internal search effort estimates obtained in this study, only the time-based measure of external search effort is used in the calculations of total and relative search effort. Both the liberal and conservative estimates of internal search effort are used in these calculations, leading to two alternate measures for both total and relative search effort. These estimates are reported

TABLE 13

Means for Computer-Based Internal Search Measures, by Experimental Condition and Magazine Category

Experimental Condition (n)	Conservative Estimate of Internal Search Time (secs)		Liberal Estimate of Internal Search Time (secs)		Second Choice Time (secs)	
	Business	Women's	Business	Women's	Business	Women's
Incentive						
Low cost (10)	26.1	35.9	224.5	197.2	22.3	20.7
High cost (10)	22.9	24.9	180.2	111.6	22.2	22.1
Time Pressure						
Low cost (10)	30.6	35.8	78.9	81.8	28.6	21.8
High cost (10)	27.0	27.4	60.2	57.4	18.3	17.1
Control						
Low cost (10)	27.7	19.2	183.4	154.5	20.3	20.1
High cost (10)	13.3	19.8	157.6	102.7	23.8	17.3

TABLE 14

Main Effect Means for Computer-Based Internal Search Measures, by Magazine Category

Main Effect	Conservative Estimate of Internal Search Time (secs)		Liberal Estimate of Internal Search Time (secs)		Second Choice Time (secs)	
	Business	Women's	Business	Women's	Business	Women's
Incentive (20)	24.5	30.4	202.4	154.4	22.2	21.4
Time pressure (20)	28.8	31.6	69.6	69.6	23.4	19.5
Control (20)	20.5	19.5	170.5	128.6	22.0	18.7
Low cost (30)	28.2	30.3	162.3	144.5	23.7	20.9
High cost (30)	21.1	24.0	132.7	90.6	21.4	18.8
Grand (60)	24.6	27.2	147.5	117.5	22.6	19.9

for total search effort in Tables 15 and 16, and for relative search effort in Tables 17 and 18. In both cases, these measures are reported by experimental condition and magazine session.

Verbal Protocol Measures

Subjects were asked to provide concurrent verbal protocols as they worked towards making a final choice in each of the two product categories. These verbalizations of the choice process were collected on a tape recorder, both when external information was present and when it was absent. These protocols were transcribed by the investigator, and then divided into a series of protocol segments. Two independent coders blind to the hypotheses under investigation each assigned a single code to each of the segments defined previously by the experimenter. This was done for each subject, for each of the two magazine categories.

Coders assigned codes using the protocol coding scheme proposed by Bettman and Park (1980). A total of 1,648 protocol segments were generated for the 60 subjects' business magazine choices, while 1,490 segments were produced for the women's magazine choices. The two judges agreed on the coding for 922 (or 56.0%) of these segments for business magazines, and 867 (58.2%) for women's magazines. While these levels of agreement would appear to be somewhat low, it should be noted that the Bettman-Park coding scheme incorporates a total of 70 unique codes. An agreement level of 80 or 90% is therefore an unrealistic goal. More fundamentally, however, the exact assignment of these codes may not matter with respect to the issues being investigated here. Since the primary concern of this research is on the relative use of internal and external sources of information, the fine

TABLE 15

Means for Computer-Based Total Search Measures, by Experimental Condition and Magazine Category

Experimental Condition	Conservative Estimate of Total Search Time (secs)		Liberal Estimate of Total Search Time (secs)	
	Business	Women's	Business	Women's
Incentive				
Low cost (10)	227.3	205.6	425.7	366.9
High cost (10)	198.4	145.7	355.7	232.4
Time Pressure				
Low cost (10)	71.2	73.7	119.6	119.7
High cost (10)	54.2	53.4	87.4	83.4
Control				
Low cost (10)	179.3	155.7	334.9	291.0
High cost (10)	176.8	104.7	321.1	187.6

TABLE 16

Main Effect Means for Computer-Based Total Search Measures, by Magazine Category

Main Effect	Conservative Estimate of Total Search Time (secs)		Liberal Estimate of Total Search Time (secs)	
	Business	Women's	Business	Women's
Incentive (20)	212.8	175.7	390.7	299.6
Time pressure (20)	62.7	63.6	103.5	101.6
Control (20)	178.0	130.2	328.0	239.3
Low cost (30)	159.2	145.0	293.4	259.2
High cost (30)	143.1	101.3	254.7	167.8
Grand (60)	151.2	123.1	274.0	213.5

TABLE 17

Means for Computer-Based Relative Search Measures, by Experimental Condition and Magazine Category

Experimental Condition	Conservative Estimate of Relative Search		Liberal Estimate of Relative Search	
	Business	Women's	Business	Women's
Incentive				
Low cost (10)	.854	.820	.456	.453
High cost (10)	.822	.822	.432	.495
Time Pressure				
Low cost (10)	.598	.549	.339	.325
High cost (10)	.526	.505	.318	.317
Control				
Low cost (10)	.838	.863	.448	.466
High cost (10)	.900	.779	.490	.451

TABLE 18

Main Effect Means for Computer-Based Relative Search Measures, by Magazine Category

Main Effect	Conservative Estimate of Relative Search		Liberal Estimate of Relative Search	
	Business	Women's	Business	Women's
Incentive (20)	.838	.821	.444	.474
Time pressure (20)	.562	.527	.328	.321
Control (20)	.869	.821	.469	.458
Low cost (30)	.763	.744	.414	.415
High cost (30)	.750	.702	.413	.421
Grand (60)	.756	.723	.414	.418

grain detail that results from the Bettman-Park coding scheme is not really necessary.

For the purposes of this study, the Bettman-Park codes are assigned to one of five new categories. The first two of these -- external information use and internal information use -- represent the key categories of interest. The remaining three revised coding categories -- statements of strategy selection or choice, statements about the task, and miscellaneous statements -- are included so that all protocol segments may be uniquely assigned. The external category includes all statements referring to comparisons (the A codes in the Bettman-Park coding scheme), all brand-based statements (the B codes), and all processing plans or needs statements (the P codes). The internal category includes all statements based on the recall and/or use of prior knowledge. (In the Bettman-Park scheme, this includes all E codes, as well as the G7 general category code.) In addition, the coders were given three additional micro-level protocol codes -- P6, P7, and P8 -- that were to be used whenever subjects made processing plans or needs statements that obviously referred to internally based information. These three codes are also included in the internal statements category. The strategy/choice (codes G1-G5), task (G6, G8), and miscellaneous (G9) statement categories round out the set of higher level categories used.

The codes assigned to the individual choice protocol segments by the two judges were reassigned to one of the five categories just described. The judges now agreed on the assignment of 1,375 of the 1,648 business magazine segments, for an agreement level of 83.4%. For women's magazines, the coders agreed on 1,194 of 1,490 segments (80.1%). While these levels of agreement may appear to be relatively high, it has long been known that

the percentage of agreement measure is heavily influenced by the number of coded categories available to the coders. (See, for example, Cohen 1960). Given the use of only the five distinct categories in the current study, a reasonably high level of inter-judge agreement could be expected by chance.

Cohen (1960) proposed the use of his kappa index of inter-judge reliability as one way of overcoming the above problem. The kappa value is determined by first calculating the likelihood of chance agreement between two judges, and then removing this chance level of agreement from the observed frequency of agreement for the two judges. The probability of chance agreement between the two judges is estimated (using Cohen's approach) as the product of their two independent marginal probabilities. The index ranges from +1.0 when the judges are in perfect agreement to 0.0 when their level of agreement is no better than chance. It therefore is appropriate to test the value of kappa calculated in a particular situation against a null hypothesis value of zero. In the present setting, the expected frequency of inter-judge agreement due to chance alone for the business magazine protocols was determined to be about 818 statements. The resulting value of kappa for agreement between the two judges was 0.671, a value that is different from zero at the 0.0001 level of statistical significance. For the women's magazine protocols, the expected chance frequency of agreement was 663 statements. In this case kappa was calculated to be 0.642, a value again different from zero at the 0.0001 level. In both cases, then, the observed reliabilities were significantly better than chance.

These values of kappa are actually quite low for studies of the nature described here. However, it has been noted (Brennan and Prediger 1981; Perreault and Leigh 1989) that Cohen's kappa is inappropriate when

the marginal probabilities are heavily skewed. That is, kappa provides a good measure of inter-judge reliability when all category responses are more or less equally likely. When some categories are far more likely to be selected by the coders than others, the chance probability of inter-judge agreement determined by Cohen's method is overstated. This is the case in the present study, where the external statement category was used far more frequently than any of the other coding categories by both judges.

While a number of methods have been proposed to overcome the above concern, the most appropriate measure of inter-judge reliability in this case appears to be one devised by Perreault and Leigh (1989). They derive a statistic that depends upon "the frequency of agreement expected due to the true (population) reliability of the overall coding process," rather than on an estimate of the chance agreement between the two judges. The advantages of this approach are that (i) no specific model of chance agreement need be specified, (ii) highly skewed marginal probability distributions do not influence the statistic, and (iii) a confidence interval can be easily calculated. Use of their statistic is in many ways comparable to the use of xbar as an estimate of an underlying (but unknown) population mean. The form of their index of reliability statistic (Ir) is as follows:

$$I_r = \{[(F_o/N) - (1/k)][k/(k-1)]\}^{.5}, \text{ for } F_o/N > 1/k$$

where F_o is the observed frequency of agreement between the two judges, N is the total number of coded statements, and k is the number of coding categories employed. When N is greater than about 30, the upper and lower confidence interval limits for I_r (based on a critical value of z_c for a c percent confidence interval) are

$$\text{Limits} = I_r \pm z_c \, [I_r(1 - I_r)/N]^{.5}$$

For the business magazine protocol segments coded by the two judges, F_o = 1,375, N = 1,648, and k = 5. Perreault and Leigh's statistic (I_r) is therefore calculated to be 0.8904, and a 99.9% confidence interval about this estimate has the limits (0.8596, 0.9212). This value of I_r is therefore significantly different from zero, and it can be concluded that the observed inter-judge reliability is therefore statistically well above chance levels. Similarly, for the women's magazine protocol segments, F_o = 1,194, n = 1,490, k = 5, and I_r = 0.8670. The resulting 99.9% confidence interval has the limits (0.8318, 0.9022). Again, the observed inter-judge reliability is statistically meaningful, and therefore better than chance.

Tables 19 and 20 report mean values for the number of external segments, the number of internal segments, the sum of these two segments, and the ratio of the external measure to the sum of the internal and external measures. These protocol measures are given by experimental condition and magazine session, and they represent estimates of external search effort, internal search effort, total search effort, and relative search effort respectively.

Total Effort

In addition to the search effort measures already reported, it is instructive to also look at measures of the total effort employed by individuals to make their choices. Tables 21 and 22 report the means for two measures of total effort, by experimental condition and magazine category. The first measure is based on subjects' self-assessments of how much effort they employed. This measure ranged from a value of -3 (very little effort employed) to +3 (substantial effort employed). The second

measure reported in these tables indicates the total time taken from the introduction of the external information matrix to the final selection of a choice alternative.

TABLE 19

Means for Protocol Based Measures of Search, by Experimental Condition and Magazine Category

Experimental Condition	Number of External Statements		Number of Internal Statements		Number of Internal and External Statements		Ratio of Number of External Statements to Number of Internal and External Statements	
	Business	Women's	Business	Women's	Business	Women's	Business	Women's
Incentive								
Low cost (10)	28.7	20.1	5.8	7.8	34.5	27.9	.695	.371
High cost (10)	25.2	13.3	3.5	3.8	28.7	17.1	.226	.240
Time Pressure								
Low cost (10)	10.1	10.5	3.7	3.5	13.8	14.0	.311	.524
High cost (10)	4.4	8.4	3.5	4.1	7.9	12.5	.181	.430
Control								
Low cost (10)	18.0	19.0	2.9	5.9	20.9	24.9	.771	.576
High cost (10)	23.1	20.2	5.6	4.2	28.7	24.4	.661	.590

TABLE 20

Main Effect Means for Protocol Based Measures of Search, by Magazine Category

Experimental Main Effect	Number of External Statements		Number of Internal Statements		Number of Internal and External Statements		Ratio of Number of External Statements to Number of Internal and External Statements	
	Business	Women's	Business	Women's	Business	Women's	Business	Women's
Incentive (20)	27.0	16.7	4.6	5.8	31.6	22.5	.461	.306
Time pressure (20)	7.2	9.4	3.6	3.8	10.8	13.2	.246	.477
Control (20)	20.6	19.6	4.2	5.0	24.8	24.6	.716	.583
Low cost (30)	18.9	16.5	4.1	5.7	23.0	22.2	.592	.490
High cost (30)	17.6	14.0	4.2	4.0	21.8	18.0	.356	.420
Grand (30)	18.2	15.2	4.2	4.9	22.4	20.1	.474	.455

TABLE 21

Means for Overall Effort Measures, by
Experimental Condition and Magazine Category

Experimental Condition	Overall Effort Self-Report (secs)		Total First Choice Time	
	Business	Women's	Business	Women's
Incentive				
Low cost (10)	1.1000	2.2000	430	371
High cost (10)	0.2000	1.0000	496	336
Time Pressure				
Low cost (10)	-0.2000	-0.3000	120	121
High cost (10)	-0.2000	-0.1000	119	117
Control				
Low cost (10)	0.7000	0.9000	338	291
High cost (10)	0.1000	0.5000	435	258

TABLE 22

Main Effect Means for Overall Effort Measures, by Magazine Category

Main Effect	Overall Effort Self-Report		Total First Choice Time (secs)	
	Business	Women's	Business	Women's
Incentive (20)	0.6500	1.6000	463	354
Time pressure (20)	-0.2000	-0.2000	120	119
Control (20)	0.4000	0.7000	386	274
Low cost (30)	0.5333	0.9333	296	261
High cost (30)	0.0333	0.4667	350	237
Grand (60)	0.2833	0.7000	323	249

CHAPTER 5: ANALYSIS

Overview

The primary focus in this chapter is on the analysis of how time pressure, the external cost of information, and incentives influence individuals' choice behavior. Four main dependent measures are examined: external search effort, internal search effort total search effort, and relative search effort. Observed modifications in external search behavior are also reported. However, a formal discussion of how these results relate to the hypotheses advanced previously is left for the next chapter.

This chapter begins with an overall examination of the data using a repeated measures MANCOVA. Each of the four major dependent search effort measures are then analyzed separately. In turn, these four main dependent measures are broken down into the individual univariate measures reported in Chapter 4. In addition, the results of univariate analyses of the two measures of total effort are presented.

Multivariate Analysis

There are likely to be a number of relatively large correlations between the twenty computer and verbal protocol-based process measures reported in Tables 7 through 20 of Chapter 4. It is therefore appropriate to begin the analysis of this data using a repeated measures multivariate analysis. The within-subject factor employed in this analysis is the magazine session (business or women's magazines).

A total of nine distinct individual-specific covariates were also included in the original analysis: (1) the subject's self-reported experience with the appropriate product class, 2) the subject's involvement

with the product class (Zaichkowsky 1985), (3) the subject's need for cognition (Cacioppo and Petty 1982, Cacioppo, Petty and Kao 1984), (4) the subject's average reading time (in seconds) for the first six screens encountered at the start of each session, (5) the subject's sex, (6) the subject's age, (7) the subject's status at MIT (i.e. undergraduate student, support staff member, etc.), (8) whether or not the subject was a support staff member, and (9) whether or not the subject's native language was English. The first two covariates varied across the two sessions, and they were therefore treated as repeated measures covariates. The remaining covariate measures were session-independent.

Initial analyses employing all of the above covariates indicated that only the average reading speed measure had any significant impact on the search effort measures. The self-reported magazine experience covariate measures were not significant for any of the major MANCOVA analyses conducted. However, in order to formally test the hypotheses advanced in this thesis, it is important to include these covariates in later analyses despite the initial "null" findings. In all of the remaining discussion, results from analyses employing both the reading speed covariate alone and in conjunction with the self-reported experience covariates will be reported. However, where the experience covariates are not significant, only the results from the reading covariate MANCOVA analyses will be reported in detail. All covariates other than reading speed and self-reported experience were dropped from further consideration.

Since all measures of total search effort reported in this thesis are derived directly from the measures of internal and external search effort, it was not possible to examine all four main dependent measures simultaneously in a single MANCOVA analysis. Instead, two separate MANCOVA

analyses were conducted, one involving the complete set of internal and external search effort measures and the other involving the full set of total and relative search effort measures. The results of each of these analyses are discussed in turn below. In each case, a combined session, repeated measures MANCOVA analysis was conducted along with two single session MANCOVA analyses.

The internal and external search effort measure means were reported in Tables 7-14, 19, and 20 of Chapter 4. An overall analysis employing both the reading speed and magazine experience covariates was conducted. The combined effect ($F(30, 74) = 1.36$) of these covariates on internal and external search effort was not significant. However, this insignificance was primarily due to the inclusion of the experience covariates, which were insignificant ($F(15,39) = 0.89$, n.s.). These covariates were dropped, and a new analysis was conducted. The effect of the reading speed covariate alone ($F(15,39) = 1.98$) <u>was</u> significant ($p < .05$). The results of this latter analysis are reported below.

Overall, the main effects of time pressure ($F(15,39) = 7.92$) and cost of external information ($F(15,39) = 21.19$) were both highly significant ($p < .001$), while the main effect of willingness to expend cognitive effort ($F(15,39) = 1.71$) was marginally significant ($p < .10$). Neither the time pressure by external cost ($F(15,39) = 0.96$) nor the willingness to expend cognitive effort by external cost ($F(15,39) = 1.46$) interactions were significant. The within-subjects analysis indicated a significant main effect for magazine session ($F(15,40) = 2.58$, $p < .01$) and a marginally significant magazine session by external information cost interaction effect ($F(15,40) = 1.78$, $p < .10$).

The existence of a significant within-subjects main effect due to magazine session suggested two separate MANCOVA analyses of the combined internal and external search measures for each magazine category. For business magazines, the main effects of time pressure ($F(13,39) = 5.04$) and cost of external information ($F(13,39) = 16.26$) were both highly significant ($p < .001$), but the willingness to expend cognitive effort main effect was not significant ($F(13,39) = 1.14$, n.s.). Neither the time pressure by external cost interaction ($F(13,39) = 1.17$) nor the willingness to expend cognitive effort by external information cost interaction ($F(13,39) = 1.39$) were significant. The effect of the reading speed covariate ($F(13,39) = 1.74$) was marginally significant ($p < .10$).

For the women's magazine session, the pattern of results was somewhat different. The main effects of time pressure ($F(13,39) = 6.17$) and external information cost ($F(13,39) = 19.42$) were again both highly significant ($p < .001$), while the main effect of willingness to expend cognitive effort ($F(13,39) = 1.84$) was marginally significant ($p < .10$). While the willingness to expend cognitive effort by external cost of information interaction ($F(13,39) = 1.03$) was not significant, the time pressure by external information cost interaction ($F(13,39) = 2.36$) was significant ($p < .025$). The effect of the reading speed covariate was quite significant ($F(13,39) = 2.91$, $p < .01$).

An analysis similar to the one just completed for internal and external search effort was also conducted for the total and relative search measures. The mean values for these measures were previously reported in Tables 15 through 20 of Chapter 4. As in the previous case, an initial analysis employing both the reading speed and experience covariates indicated that the combined effect of the covariates on total and relative

search ($F(12,92) = 0.85$) was not significant. In this case, neither the effect of the reading speed covariate alone ($F(16,48) = 1.14$) nor the effect of the knowledge covariates alone ($F(6,48) = 0.65$) were significant. The results from analyses employing only the reading speed covariate are reported below, in order to be consistent with the results presented previously.

Overall, the main effect of time pressure ($F(6,48) = 16.61$) was highly significant ($p < .001$), and the main effect of willingness to expend cognitive effort ($F(6,48) = 2.33$) was also significant ($p < .05$). The main effect of cost of external information ($F(6,48) = 1.28$) was not significant. Neither the time pressure by external information cost interaction ($F(6,48) = 0.45$) nor the willingness to expend cognitive effort by external information cost interaction ($F(6,48 = 0.73$) were significant. The within-subjects analysis revealed only a marginally significant main effect for magazine session ($F(6,49) = 2.06$, $p < .10$). All other within-subjects effects were not significant. Since there was a marginally significant within-subjects main effect for session, the total and relative search effort measures were also analyzed for each magazine session separately.

For business magazines, the main effect of time pressure was highly significant ($F(6,48) = 11.91$. $p < .001$), but neither the main effect of willingness to expend cognitive effort ($F(6,48) = 0.96$) nor the main effect of external information cost ($F(6,48) = 1.28$) were significant. The time pressure by external information cost ($F(6,48) = 1.03$) and the willingness to expend cognitive effort by external information cost ($F(6,48) = 0.79$) interactions were both not significant. The effect of the reading speed covariate ($F(6,48) = 0.78$) was not significant.

For women's magazines, the main effect of time pressure ($F(6,48) = 13.13$) was highly significantly ($p < .001$) while the main effect of willingness to expend cognitive effort ($F(6,48) = 2.28$) was marginally significant ($p < .10$). The main effect of external information cost ($F(6,48) = 1.81$) was not significant. Neither the time pressure by external information cost interaction ($F(6,48) = 0.42$) nor the willingness to expend cognitive effort by external information cost interaction ($F(6,48) = 0.67$) was significant. The effect of the reading speed covariate ($F(6,48) = 1.64$) was not significant.

Two major conclusions can be drawn from the preceding set of analyses. First, there is evidence to suggest that all four main search effort measures do vary across the experimental conditions. There is also some evidence to suggest that changes in search effort take place due to an interaction between time pressure and external information cost. However, there is no evidence of any interactive effect between willingness to expend cognitive effort and the external cost of information on any of the four search effort measures. This latter interaction effect was therefore excluded from all subsequent analyses.

Second, there appear to be systematic differences in search effort from the first magazine session to the second. This could be the result of either (i) an increasing weariness with the choice task on the part of the experimental subjects, or (ii) fundamental choice task differences between business and women's magazines. As many features of the choice task as possible were replicated from one session to the next to reduce the likelihood of the latter. There is also some evidence (both in the measures reported in Chapter 4, and as informally observed by the chief investigator) to suggest that subjects were more likely to oversearch the

available information in the first session than in the second. The experimental design used in this thesis did not produce information that could be used to support either one of these explanations over the other. Nonetheless, the observed differences in the search effort measures across sessions argue for separate analyses of the data by magazine category, as well as analyses using the combined set of observations.

In the next four sections of this chapter, each of the four main search effort measures is examined separately. In each case, the discussion begins with a MANCOVA analysis and then reports the results of individual ANCOVA analyses, both overall and by individual magazine session.

External Search Effort

External search effort was measured in this study by the nine computer-based process measures reported in Tables 7 through 12 and by the number of external statements in subjects' verbal protocols, as reported in Tables 19 and 20. A repeated measures MANCOVA analysis was conducted using these external search effort measures and both the reading speed and prior experience covariates. The combined effect of these covariates on external search effort ($F(20,84) = 1.99$) was significant ($p < .025$) but this is attributable primarily to the reading speed covariate ($F(10,44) = 3.07$, $p < .01$) rather than the experience covariates ($F(10,44) = 1.10$, n.s.). The results reported below are therefore based on analyses using only the reading speed covariate.

Overall, the main effects of time pressure ($F(10,44) = 7.12$) and cost of external information ($F(10,44) = 33.13$) were highly significant ($p < .001$). The main effect of willingness to expend cognitive effort on

external search effort was not significant ($F(10,44) = 1.28$). The time pressure by external information cost interaction ($F(10,44) = 1.13$) was also not significant. A significant within-subjects main effect ($F(10,45) = 2.86$, $p < .01$) was observed, along with a marginally significant ($p < .10$) within-subjects interaction effect for magazine session by external information cost ($F(10,45) = 1.98$).

For the business magazine session alone, the main effects of time pressure ($F(10,44) = 5.87$) and cost of external information ($F(10,44) = 25.26$) on external search effort were highly significant ($p < .001$), while the main effect of willingness to expend cognitive effort ($F(10,44) = 0.80$) was not significant. The time pressure by external information cost interaction was not significant ($F(10,44) = 1.57$, n.s.). The effect of the reading speed covariate ($F(10,44) = 2.44$) was significant ($p < .025$). On the other hand, the effect of the experience covariate on external search effort ($F(10,44) = 1.29$) was not significant.

For the women's magazine session, the main effects of time pressure ($F(10,44) = 5.38$), cost of external information ($F(10,44) = 29.85$), and willingness to expend cognitive effort ($F(10,44) = 2.11$) on external search effort were all significant ($p < .001$, $p < .001$, and $p < .05$ respectively). The time pressure by cost of external information interaction was also significant ($F(10,44) = 2.57$, $p < .025$). The effect of the reading speed covariate was highly significant ($F(10,44) = 3.52$, $p < .005$), while the effect of the experience covariate on external search effort was not significant ($F(10,44) = 0.74$, n.s.).

In summary, the main effects of both time pressure and the external cost of information on external search effort were found to be highly significant for both magazine categories. For the women's magazine

session, but not for the business magazine session (and not overall), the main effect of willingness to expend cognitive effort and the effect of the interaction between time pressure and the external information cost on external search effort were both significant. The effect of the reading speed covariate was highly significant, while the effect of the experience covariates was not significant.

Before examining the individual measures of external search effort, however, an important distinction between these measures needs to be made. The external search effort measures reported in Tables 7 through 12 are measures of the effort associated with the use of particular external search strategies rather than measures of overall external search effort. Only the number of items examined, the total external search time (both in Tables 7 and 10) and the number of external search protocol segments (Tables 19 and 20) provide estimates of overall external search effort. The remaining measures reported in Tables 8, 9, 11, and 12 identify changes in the external search strategy employed. Both of these sets of measures are important, but since only the first set can be used to test the experimental hypothesis, the two sets need to be examined separately.

Overall External Search Effort

Overall, the main effect of time pressure ($F(3,51) = 7.20$) was significant ($p < .001$), while the main effects of willingness to expend cognitive effort ($F(3,51) = 0.53$) and the cost of external information ($F(3,51) = 0.88$) were not significant. The interaction effect between time pressure and external information cost ($F(3,51) = 0.65$) was not significant. The effect of the reading speed covariate ($F(3,51) = 6.70$) was highly significant ($p < .001$) while the effect of the experience

covariates ($F(3,51) = 0.85$) was not significant. Within-subjects, there was a marginally significant main effect for magazine session ($F(3,52) = 2.54$, $p < .10$).

For business magazines, only the main effect of time pressure ($F(3,51) = 5.98$) was significant ($p < .001$). The main effects of willingness to expend cognitive effort ($F(3,51) = 0.24$) and the cost of external information ($F(3,51) = 0.34$), and the interaction effect between time pressure and the external information cost ($F(3,51) = 0.36$) were all not significant. The effect of the reading speed covariate ($F(3,51) = 5.47$) was highly significant ($p < .005$), while the effect of the experience covariate ($F(3,51) = 0.18$) was not significant.

For women's magazines, a similar pattern of results emerged. The main effect of time pressure on overall external search effort ($F(3,51) = 6.88$) was highly significant ($p < .001$), while the main effects of willingness to expend cognitive effort ($F(3,51) = 1.92$) and the external cost of information ($F(3,51) = 1.60$) were not significant. The interaction effect of time pressure by external information cost ($F(3,51) = 1.22$) was also not significant. The effect of the reading speed covariate ($F(3,51) = 6.89$) was highly significant, while the effect of the experience covariate ($F(3,51) = 0.98$) was not significant.

In summary, the pattern of results reported above indicates that only time pressure has a significant impact on overall external search effort. Furthermore, the effect of the experience covariate is consistently insignificant, while the effect of the reading speed covariate is highly significant.

The preceding analyses deal with overall external search effort from a multiple dependent measures perspective. However, in order to fully

understand the effects of the choice environment factors on overall external search, separate univariate analyses of each of the three dependent measures also need to be considered. The following sections deal separately with the number of external items examined, the total time spend acquiring and reading external information, and the number of externally-based protocol segments. Only significant and marginally significant effects are reported for these analyses to avoid tedious exposition and to focus attention on the significant findings.

Number of External Items Examined: The number of external information items examined declined significantly under high time pressure. This was true both when the categories were examined together ($F(1,53) = 19.18$, $p < .001$) and when the business and women's magazine categories were looked at separately ($F(1,53) = 16.30$, $p < .001$ and $F(1,53) = 12.05$, $p < .001$ respectively). For the women's magazine category alone, the main effect of the cost of external information on the number of items examined ($F(1,53) = 4.25$) was also significant ($p < .05$).

Total External Search Time: The total time spent acquiring and reading external information (i.e. the total external search time) was significantly lower for subjects in the high time pressure groups than for subjects in the incentive and control groups. This main effect of time pressure on total external search time was significant when the magazine categories were examined together ($F(1,53) = 18.79$, $p < .001$), and was significant for both business and women's magazines separately ($F(1,53) = 12.99$, $p < .001$ and $F(1,53) = 21.37$, $p < .001$ respectively). For the women's magazine category there was also a significant decline in

total external search time due to the main effect of the external information cost ($F(1,53) = 4.37$, $p < .05$).

Number of Externally-Based Protocol Segments: The number of external protocol segments declined significantly due to high time pressure. This main effect of time pressure on the number of external segments was significant, both for the combined categories ($F(1,53) = 5.23$, $p < .05$) and for the women's magazine session ($F(1,53) = 5.75$, $p < .025$). For the business magazine session, the main effect of time pressure ($F(1,53) = 3.90$) was marginally significant ($p < .10$).

External Search Strategy

Overall, the main effects of time pressure ($F(7,47) = 8.64$) and cost of external information ($F(7,47) = 56.96$) on external search strategy were both highly significant ($p < .001$). The main effect of willingness to expend cognitive effort ($F(7,47) = 1.18$) and the interaction effect of time pressure by external information cost ($F(7,47) = 0.56$) were both not significant. The effect of the reading speed covariate ($F(7,47) = 4.15$) was highly significant ($p < .001$), while the effect of the experience covariate ($F(7,47) = 1.47$) was not significant. The within-subjects analysis indicated a significant magazine session main effect ($F(7,48) = 3.14$, $p < .01$), a significant cost of external information by magazine session interaction effect ($F(7,48) = 2.30$, $p < .05$), and a marginally significant cost of external information by time pressure by magazine session interaction ($F(7,48) = 2.18$, $p < .10$).

For business magazines, the main effects of time pressure ($F(7,47) = 7.70$) and cost of external information ($F(7,47) = 44.17$) were

highly significant ($p < .001$) while the main effect of willingness to expend cognitive effort ($F(7,47) = 0.78$) and the time pressure by external information cost interaction effect ($F(7,47) = 1.45$) were not significant. The effect of the reading speed covariate ($F(7,47) = 2.62$) was significant ($p < .025$) while the effect of the experience covariate ($F(7,47) = 1.81$) was not.

For the women's magazine session, the main effects of time pressure ($F(7,47) = 5.93$ and cost of external information ($F(7,47) = 51.71$) were again highly significant ($p < .001$). The main effect of willingness to expend cognitive effort ($F(7,47) = 1.15$) and the time pressure by external information cost interaction effect ($F(7,47) = 1.78$) were both not significant. The reading speed covariate had a significant effect on external search strategy ($F(7,47) = 4.56$, $p < .001$) while the effect of the experience covariate was insignificant ($F(7,47) = 0.93$, n.s.).

In summary, the above multivariate results indicate that external search strategy was significantly affected by time pressure and the cost of external information. Univariate analyses of each of the seven individual dependent search strategy variables follow below.

Average Access Time Per External Item: The average access time (acquisition time plus reading time) per external item was lower for subjects in the time pressure groups than for the control and incentive group subjects, and was lower for the low external information cost groups than for the high external information cost groups. The main effect of time pressure was highly significant for the combined categories ($F(1,53) = 11.81$, $p < .001$), and was separately significant for the business and women's magazine categories ($F(1,53) = 4.91$, $p < .05$ and

$F(1,53) = 14.37$, $p < .001$ respectively). The main effect of the cost of external information was highly significant for the combined categories ($F(1,53) = 76.28$), for business magazines ($F(1,53) = 50.98$, $p < .001$), and for women's magazines ($F(1,53) = 58.20$, $p < .001$). For women's magazines, the effect of the time pressure by external information cost on the average access time per item ($F(1,53) = 4.16$) was also significant ($p < .05$). In addition, there was a strong within-subjects main effect for magazine session ($F(1,54) = 10.80$, $p < .005$).

These findings must be interpreted with some caution. The experimental manipulation of external information cost involved an increase in the physical acquisition time of external information. As a consequence, the strong main effects noted for the cost of external information should be viewed as verification of the experimental manipulation rather than important findings in their own right. However, the strong support for a main effect of time pressure on average access time per external information item suggests that individuals faced with high time pressure accelerated their external information search processes. This observation is consistent with the results found in Payne, Bettman and Johnson (1988). The results from the women's magazine session also suggest that individuals faced with both high time pressure and a high external cost attempted to accelerate the external search process to an even greater extent than did other individuals.

Average Reading Time Per External Item: This measure is closely related to the previous one. In the face of high time pressure or a high information cost, individuals might attempt to speed up their external search either by reducing their average acquisition time or their average reading time per

item. However, in this study reductions in the average reading time are likely to have had a greater impact on total search time than reductions in average acquisition time, since subjects could only modestly affect the latter.

The average reading time per item declined when time pressure was high compared to when it was low. This main effect of time pressure was highly significant for the combined categories ($F(1,53) = 16.33$, $p < .001$), and was significant for both business and women's magazines separately ($F(1,53) = 7.14$, $p < .01$ and $F(1,53) = 19.35$, $p < .001$ respectively). There was also a significant within-subjects main effect for magazine session ($F(1,54) = 5.30$, $p < .025$).

As was the case for average access time per external item, the average reading time per item measure provides strong evidence of an acceleration in external information processing when time pressure is high.

Variance in the Proportion of Time Spent on Each Attribute: For the combined categories, the main effect of time pressure on the variance in the proportion of time spent on each attribute measure ($F(1,53) = 19.83$) was highly significant, while the main effect of the external information cost was marginally significant ($F(1,53) = 3.32$, $p < .10$). The interaction effect of time pressure by external information cost was also marginally significant ($F(1,53) = 3.65$, $p < .10$). A within-subjects external information cost by magazine session interaction effect was significant as well ($F(1,54) = 8.58$, $p < .005$).

For business magazines, the main effects of time pressure ($F(1,53) = 24.53$) and cost of external information ($F(1,53) = 10.02$) were both highly significant ($p < .005$), and the effect of the time pressure by

cost of external information interaction was also significant ($F(1,53) = 6.63$, $p < .025$). For women's magazines, only the main effect of time pressure was significant ($F(1,53) = 8.53$, $p < .005$).

Individuals were significantly more selective in choosing external attributes to process when time pressure was high, and the variances in the proportions of time that they spent on each attribute were correspondingly higher. For business magazines, the high external information cost subjects were more selective than the low cost subjects. Furthermore, there was higher attribute selectivity observed for the high pressure, high external cost subject group than that observed for any other group. When the women's magazine session was encountered, these differences in selectivity became less extreme. This can be attributed in part to the fact that the same seven attributes were used in both sessions. However, this explanation does not identify why the effect of the cost of external information diminished from very significant for business magazines to virtually negligible for women's magazines.

Before proceeding to the next dependent variable, it should be noted that the magnitude of the attribute variances observed in this study are substantially (i.e. 3 to 4 times) higher than those observed by Payne, Bettman, and Johnson (1988). In their study, for each new choice all attributes were initially equally important. Through external search, a subject would then learn which of the attributes were important and which were unimportant to the current choice. In this study, however, subjects are likely to have had prior experience with the attributes and to therefore value some more highly than others. This prior experience would then guide the external search process, and lead to the higher levels of attribute selectivity observed. Similar high levels of attribute

selectivity might therefore be expected whenever real choice alternatives are employed in studies of external search.

Variance in the Proportion of Time Spent on Each Alternative: In stark contrast to the preceding discussion, there is very little evidence in this study of any alternative selectivity. The only significant effect observed was the time pressure by external information cost interaction for women's magazines ($F(1,53) = 8.02$, $p < .01$). This interaction is significant since the high time pressure, high external information cost subjects were more selective than the high time pressure, low external cost subjects, while low external cost subjects in the control and incentive groups were more selective than their high external cost counterparts. While the effect is statistically significant, it is not very informative since it appears to represent a random shift in external processing strategy.

Subjects in this study exhibited relatively low levels of alternative selectivity. Since the alternatives were real, but could not be identified without undertaking external search, most subjects looked at all seven alternatives at least once.

Information Processing Transition Index: The main effect of time pressure on the value of the transition index was significant for the combined categories ($F(1,53) = 8.00$, $p < .01$) and for business magazines ($F(1,53) = 9.84$, $p < .005$), and marginally significant for women's magazines ($F(1,53) = 3.62$, $p < .10$).

The value of the transition index was significantly more negative for subjects in the time pressure groups than it was for subjects in the control and incentive groups. This indicates that the time pressure

subjects were far more likely to resort to predominantly attribute-based external information processing strategies. However, all of the subject groups exhibited negative mean transition index values, demonstrating a tendency towards attribute-based processing.

The mean index values observed in this study tended to be more negative than those measured in other studies. For example, Payne, Bettman, and Johnson (1988) determined the mean index value to be about -0.120 for their low time pressure subjects, versus a mean value of about -0.375 for their high time pressure subjects. In contrast, the overall mean value of the index in this study was -0.430, while the high time pressure subjects' mean index value was -0.737. This latter value is close to the one calculated by Payne (1976) for "search patterns classified as intradimensional" (i.e. attribute-based).

Proportion of Subjects Having the Name Attribute With an Average Access Rank Order of One: While the average rank order of access of the name attribute was expected to vary across the experimental conditions, no significant differences were found. In general, most subjects tended to examine the name attribute early in their external search regardless of the choice environment they faced. On average, between fifty-five and sixty percent of the subjects accessed the name information earlier than information for any other attribute. This occurred despite the fact that the name attribute would give them no real discriminating information other than that which they might already have available in long-term memory.

Proportion of Subjects Having the Name Attribute With A Proportion of Time Spent Rank Order of One: The mean proportion of time spent on the name

attribute is a second indicator of the importance of the name attribute in consumers' choice processes. This measure is based on the proportion of all subjects within an experimental group that spent more time examining the names than any other attribute.

The main effect of time pressure was significant for business magazines ($F(1,53) = 4.15$, $p < .05$), for women's magazines ($F(1,53) = 8.97$, $p < .005$), and for the combined categories ($F(1,53) = 10.87$, $p < .005$). The main effect of the cost of external information was also significant for women's magazines ($F(1,53) = 8.82$, $p < .005$) and for the combined categories ($F(1,53) = 5.83$, $p < .025$), but was not significant for business magazines.

When individuals faced high time pressure, or a high external information cost, they were significantly more likely to spend their external search time examining name attribute information.

Summary: There is strong evidence to suggest that shifts in individuals' search strategies took place when they faced either high time pressure or a high external cost of information. Under high time pressure subjects accelerated their information processing activities and shifted to the use of more attribute-based choice strategies. In particular, the high time pressure subjects put a greater emphasis on the name attribute than did other subjects.

The effect of a high external information cost on individuals' search strategies was less extreme than the effect of time pressure. High external information cost subjects were also likely to focus their attention on the name attribute, but there was little evidence in this

study of dramatic shifts in their processing strategies due to the high external cost.

Internal Search Effort

The mean values for the four measures of internal search effort employed in this study were reported in Tables 13, 14, 19, and 20 of Chapter 4. These four measures of internal search effort include the conservative and liberal estimates of internal search time, the time taken to make a second choice, and the number of internally-based protocol segments. All four measures were included in an initial MANCOVA analysis.

For the combined categories, the main effect of time pressure on internal search effort ($F(4,50) = 8.32$) was highly significant ($p < .001$), while the main effects of external information cost ($F(4,50) = 1.39$) and willingness to expend cognitive effort ($F(4,50) = 0.55$) were not significant. The effect of the time pressure by external information cost interaction was also not significant ($F(4,50) = 0.52$, n.s.). Neither the effect of the reading speed covariate ($F(4,50) = 0.67$) nor the effect of the experience covariates ($F(4,50) = 0.47$) was significant. The within-subjects analysis indicated only a marginally significant time pressure by external information cost by magazine session interaction ($F(4,51) = 2.47$, $p < .10$).

For the business magazines alone, the main effect of time pressure on internal search effort ($F(4,50) = 4.85$) was significant ($p < .005$) while the main effects of external information cost ($F(4,50) = 0.91$) and willingness to expend cognitive effort ($F(4,50) = 0.30$) were not. The effect of the time pressure by external information cost interaction was also not significant ($F(4,50) = 1.29$, n.s.). Finally, neither the effect

of the reading speed covariate ($F(4,50) = 0.92$) nor the effect of the experience covariate ($F(4,50) = 0.08$) was significant.

For women's magazines, the main effect of time pressure ($F(4,50) = 8.24$) was again highly significant ($p < .001$), while the main effect of the cost of external information was marginally significant ($F(4,50) = 2.47$, $p < .10$). The main effect of willingness to expend cognitive effort ($F(4,50) = 0.67$) and the time pressure by external information cost interaction effect ($F(4,50) = 0.85$) were both not significant. The reading speed covariate had a marginally significant effect on internal search effort ($F(4,50) = 2.14$, $p < .10$), but the experience covariate had no significant effect ($F(4,50) = 1.25$, n.s.).

In summary, there was evidence of a strong effect of time pressure on internal search effort, and modest evidence (in the case of women's magazines) of an effect of the external cost of information. There was no evidence to suggest that willingness to expend cognitive effort or prior experience had an effect on internal search effort.

Conservative Time Estimate of Internal Search: For the combined categories, the effect of time pressure on internal search effort ($F(1,53) = 3.80$) was marginally significant ($p < .10$). This was also the case when the business and women's magazine categories were examined separately ($F(1,53) = 2.92$, $p < .10$ and $F(1,53) = 3.04$, $p < .10$ respectively). In all cases, the internal search time was greater for the high time pressure groups than for either the incentive or control groups. For women's magazines, the main effect of the cost of external information was also marginally significant ($F(1,53) = 3.65$, $p < .10$). As the cost of external information increased, the internal search time also increased.

Liberal Time Estimate of Internal Search: When the categories were combined, the main effect of time pressure ($F(1,53) = 12.23$) was highly significant ($p < .001$), while the main effect of cost of external information ($F(1,53) = 3.98$) was marginally significant ($p < .10$). For the business magazine session, only the main effect of time pressure was significant ($F(1,53) = 11.08$, $p < .005$). For women's magazines, the main effects of both time pressure ($F(1,53) = 10.28$) and cost of external information ($F(1,53) = 9.25$) were significant ($p < .005$).

For this measure, as the cost of external information increased, the internal search time decreased. Similarly, the internal search times observed for subjects in the high time pressure groups were much lower than those observed for the control and incentive group subjects. These findings contradict those obtained using the conservative time measure of internal search (reported immediately above), and they point out a major problem associated with the use of the liberal measure. The liberal time measure of internal search incorporates a good portion of subjects' external search processes. When external search time was constrained (as it was for the high time pressure groups), the liberal internal search time measure would also be constrained. Use of the liberal estimate to test the experimental hypotheses may therefore be inappropriate. This issue is raised again in the following chapter of the thesis.

Second Choice Time: There were no significant differences across experimental groups in the time it took subjects to complete the surprise second choice task.

Number of Internally-Based Protocol Segments: As was the case for the second choice times, there were no significant differences across the experimental groups in the number of internally-based verbal protocol segments measured.

Summary: There is clear evidence that time pressure influenced internal search effort. There is also weak evidence that the cost of external information had an impact on internal search.

Total Search Effort

The mean values for the conservative time measures of total search effort were reported in Tables 15 and 16 of Chapter 4, while the total number of internal plus external protocol segments was presented in Tables 19 and 20 of the same chapter. For the combined categories, the main effect of time pressure on total search effort ($F(3,51) = 6.35$) was highly significant ($p < .001$). The main effects of cost of external information ($F(3,51) = 1.12$) and willingness to expend cognitive effort ($F(3,51) = 0.63$) were not significant, and the effect of the time pressure by cost of external information interaction was also not significant ($F(3,51) = 0.43$, n.s.). The effect of the reading speed covariate was marginally significant ($F(3,51) = 2.35$, $p < .10$), while the effect of the experience covariates was not significant ($F(3,51) = 0.51$, n.s.). There were no significant within-subjects effects.

For business magazines, the main effect of time pressure ($F(3,51) = 4.70$) was significant ($p < .01$), while the main effects of cost of external information ($F(3,51) = 0.39$) and willingness to expend cognitive effort ($F(3,51) = 0.23$) were not. The effects of the reading

speed covariate ($F(3,51) = 0.41$) and the experience covariate ($F(3,51) = 1.55$) were both not significant. The time pressure by external information cost interaction was also not significant ($F(3,51) = 0.41$, n.s.).

For women's magazines, the main effects of time pressure ($F(3,51) = 6.57$) and external information cost ($F(3,51) = 2.99$) were both significant ($p < .001$ and $p < .05$ respectively), while the main effect of willingness to expend cognitive effort was not significant ($F(3,51) = 1.82$, n.s.). The time pressure by cost of external information interaction was not significant ($F(3,51) = 0.75$, n.s.). The effect of the reading speed covariate was significant ($F(3,51) = 3.28$, $p < .05$) while the effect of the experience covariate was not ($F(3,51) = 1.55$, n.s.).

The preceding MANCOVA analyses suggests that the effects of time pressure and cost of external information on total search effort were both significant. In the sections below, the effects of these factors on each of the individual measures of total search effort are examined.

Conservative Time Estimate of Total Search: When the two magazine categories were combined, the main effect of time pressure ($F(1,53) = 13.05$) was highly significant ($p < .001$). Total search effort was significantly lower for subjects in the high time pressure groups than for the control and incentive group subjects. This significant decline in total search due to time pressure was also observed separately for business and women's magazines ($F(1,53) = 10.69$, $p < .005$ and $F(1,53) = 11.89$, $p < .001$ respectively).

For women's magazines, the effect of the cost of external information ($F(1,53) = 5.26$) was significant ($p < .05$). Although total search effort

declined with an increase in the external information cost for both magazine categories, this decline was significant only for women's magazines.

Liberal Time Estimate of Total Search: For the combined categories, the main effect of time pressure ($F(1,53) = 16.51$) was highly significant ($p < .001$), while the main effect of cost of external information was marginally significant ($F(1,53) = 2.94$, $p < .10$). For business magazines, only the main effect of time pressure was significant ($F(1,53) = 12.77$, $p < .001$). For women's magazines, the main effects of time pressure and cost of external information were both significant ($F(1,53) = 17.11$, $p < .001$ and $F(1,53) = 7.58$, $p < .01$ respectively).

In all cases, total search effort declined significantly when subjects faced high time pressure. The effect of a high cost of external information was also a decrease in total search effort. This latter decline was again observed in all cases, but was only significant for women's magazines and when the categories were combined.

Number of Internal Plus External Protocol Segments: The main effect of time pressure ($F(1,53) = 4.40$) was significant for the combined categories ($p < .05$). The main effect of time pressure was marginally significant for business magazines ($F(1,53) = 3.79$, $p < .10$), and significant for women's magazines ($F(1,53) = 4.34$, $p < .05$). In all cases, the number of internal plus external protocol segments was less for the high time pressure subjects than for the incentive or control group subjects.

Summary: All three of the measures of total search effort discussed above declined significantly when time pressure was high. There was also some evidence that total search effort declined when subjects faced a high cost of external information.

Relative Search Effort

Three measures of relative search effort (the ratio of external search effort to external plus internal search effort) were employed in this study. The mean values for the liberal and conservative time measures of relative search effort were reported in Tables 17 and 18 of Chapter 4. The mean values for the ratio of the number of externally-based protocol segments to the number of externally-based plus internally-based segments were presented in Tables 19 and 20 of Chapter 4.

For the combined categories, the main effect of time pressure on relative search effort ($F(3,51) = 34.17$) was highly significant ($p < .001$), while the main effects of cost of external information ($F(3,52) = 2.28$) and willingness to expend cognitive effort ($F(3,51) = 2.71$) were marginally significant ($p < .10$). The effect of the time pressure by cost of external information interaction was not significant ($F(3,51) = 0.20$, n.s.). Neither the effect of the reading speed covariate ($F(3,51) = 1.32$) nor the experience covariates ($F(3,51) = 0.56$) was significant. There was a main within-subjects effect for magazine session ($F(3,52) = 3.36$, $p < .05$).

The main effect of time pressure ($F(3,51) = 24.34$) was highly significant for business magazines ($p < .001$), while the main effects of willingness to expend cognitive effort ($F(3,51) = 1.30$) and cost of external information ($F(3,51) = 1.86$) were not. The effect of the time pressure by cost of external information interaction ($F(3,51) = 1.22$) was

not significant. The effects of the reading speed covariate ($F(3,51) = 1.37$) and the experience covariate ($F(3,51) = 1.33$) were both not significant.

For women's magazines, the main effect of time pressure was highly significant ($F(3,51) = 24.14$, $p < .001$), while the main effects of cost of external information ($F(3,51) = 1.21$) and willingness to expend cognitive effort ($F(3,51) = 2.01$), and the effect of the time pressure by external information cost interaction ($F(3,51) = 0.19$) were all not significant. Neither the main effect of the reading speed covariate ($F(3,51) = 0.60$) nor the main effect of the experience covariate ($F(3,51) = 0.27$) was significant.

The preceding MANCOVA analyses indicate a strong main effect of time pressure on relative search. There is also weaker evidence that the main effects of willingness to expend cognitive effort and cost of external information influence relative search. In the following sections, each of the three relative search effort measures are examined separately.

Conservative Time Estimate of Relative Search Effort: For the combined categories, the main effect of time pressure on relative search effort ($F(1,53) = 105.57$) was highly significant ($p < .001$). This effect was also significant and strong for business and women's magazines separately ($F(1,53) = 74.17$, $p < .001$ and ($F(1,53) = 74.13$, $p < .001$ respectively). In all cases, relative search was significantly lower in the high time pressure groups than in the control and incentive groups.

Liberal Time Estimate of Relative Search Effort: When the two magazine categories were combined, the main effect of time pressure on relative

search effort was highly significant ($F(1,53) = 39.56$, $p < .001$). The effect of time pressure was also significant separately for business and women's magazines ($F(1,53) = 23.56$, $p < .001$ and $F(1,53) = 29.59$, $p < .001$ respectively). In all three cases, relative search effort was significantly lower for the high time pressure subjects than for subjects in the control and incentive groups.

Ratio of the Number of E· ·al Segments to Number of Internal Plus External Segments: For the combined categories, the main effects of time pressure ($F(1,53) = 8.85$), cost of external information ($F(1,53) = 4.74$), and willingness to expend cognitive effort ($F(1,53) = 7.80$) were all significant ($p < .005$, $p < .05$, and $p < .01$ respectively). Subjects in the incentive and high time pressure groups had lower levels of relative search than the control group subjects. High external information cost subjects had lower levels of relative search than did low external information cost subjects. In all of these cases, a lower relative search measure indicates a proportionally higher use of internal information.

For the business magazine alone, the main effects of time pressure ($F(1,53) = 11.91$, $p < .001$) and cost of external information ($F(1,53) = 4.98$, $p < .05$) were both significant, while the main effect of willingness to expend cognitive effort ($F(1,53) = 3.70$) was marginally significant ($p < .10$). Relative search effort was lower for the high time pressure and incentive groups than for the control group, and lower for the high cost of external information subjects than for the low cost subjects.

For women's magazines, only the main effect of willingness to expend cognitive effort ($F(1,53) = 4.54$) was significant ($p < .05$). Relative

search effort was lower for the incentive groups than for the control and time pressure groups.

Summary: There is strong evidence that relative search declines when time pressure is high. There is also solid evidence that relative search declines when either willingness to expend cognitive effort or the cost of external information is high.

Total Effort

Total effort was measured using subjects' self-reports and the total time taken by subjects to arrive at a first choice. The means for these variables were reported in Tables 21 and 22, Chapter 4. Each of these variables was examined separately in a univariate analysis of covariance. The results of these analyses are summarized below.

Self-Assessed Total Effort: When the categories were combined, the main effect of time pressure ($F(1,54) = 3.91$) was marginally significant ($p < .10$) There was also a marginally significant within-subjects main effect for magazine category ($F(1,54) = 3.52$, $p < .10$). No other effects were significant when the categories were combined.

For business magazines alone, there were no significant effects. For women's magazines, the main effects of time pressure ($F(1,54) = 3.77$) and willingness to expend cognitive effort ($F(1,54) = 3.77$) on self-assessed total effort were both marginally significant ($p < .10$).

Total Choice Time: For the combined categories, the main effect of time pressure ($F(1,54) = 14.62$) was highly significant ($p < .001$). Within-

subjects, the main effect of magazine category ($F(1,54) = 3.84$) and the interaction effect of time pressure by magazine category ($F(1,54) = 3.93$) were both marginally significant ($p < .10$).

Examining the first choice times for business magazines alone, the main effect of time pressure ($F(1,54) = 12.13$) was highly significant ($p < .001$). For women's magazines, the main effect of time pressure was highly significant ($F(1,54) = 14.62$, $p < .001$), while the main effect of willingness to expend cognitive effort was marginally significant ($F(1,54) = 3.40$, $p < .10$).

Summary: The analyses reported above suggest that only time pressure had a significant impact on total effort. The high time pressure subjects reported expending significantly less total effort and were observed to spend significantly less total choice time than their control and incentive counterparts. In contrast, neither the incentive nor the high cost of external information experimental manipulations were observed to have any consistent impact on subjects' total effort expenditures. Excepting the high time pressure subjects, these results suggest that changes in external and internal search effort indicate a reallocation of cognitive resources rather than a change in the level of cognitive resources applied to the choice task. This issue will be raised again in greater detail in a subsequent chapter of the thesis.

CHAPTER 6: DISCUSSION

In this chapter, the data presented in Chapter 4 and analyzed in Chapter 5 are used to test the set of hypotheses proposed in Chapter 2. Each of the six hypotheses is dealt with separately below, with results from the preceding chapter being summarized at the appropriate time. A summary of these findings is then provided, along with a discussion of some of the limitations of this study. A more detailed discussion of the implications of these findings is left for the final chapter.

Cost of External Information

Earlier, it was hypothesized that an increase in the cost of external information would lead to (a) a decrease in external search effort, (b) an increase in internal search effort, and (c) a decrease in relative search effort. No prediction regarding the effect of the external cost of information on total search effort was made.

Each of the preceding predictions is examined in turn below. Results from the analyses in Chapter 5 are used to indicate whether or not the hypothesized effects were supported by the study. This is done for each of the magazine categories separately, as well as in combination. The effects of the cost of external information on all four search effort measures are examined individually, and these results are then combined in any overall summary.

External Search Effort: The three measures of external search effort employed in this study -- the number of items of external information examined, the total external search time, and the number of external

protocol segments -- all declined when the cost of external information was increased. This was true both for business and women's magazines as well as overall. However, these effects were not consistently significant. Indeed, for business magazines, none of the observed reductions in external search effort were statistically significant. On the other hand, for women's magazines the observed declines in both the number of items examined and the total search time were significant ($p < .05$ in both cases). When the categories were combined, the observed declines were again not significant.

A MANCOVA analysis of external search effort also revealed no significant effects due to the external information cost. However, when the verbal protocol measure was excluded from the MANCOVA analysis, the new results obtained for the women's magazine category became significant ($p < .05$).

In short, there is statistical support for $H_{1(a)}$ in this study using the data collected during the women's magazine category choices, but not for the business magazine category. As suggested earlier, this pattern of results may have occurred due to oversearch by the experimental subjects for the first choice category encountered (business magazines). This interpretation of the results argues that while subjects may have perceived the higher cost of external information, for their business magazine choices they ignored that cost. For the women's magazine category, however, these subjects were no longer inclined to oversearch, and the external information cost then had an impact on external search effort. However, it should be noted that category order and category type are confounded, since all subjects completed the business magazine session before starting the women's magazine session. An alternative explanation

for the observed differences in behavior across the two categories could therefore simply be due to inherent differences between the categories.

Internal Search Effort: For business magazines, none of the observed effects were significant. For women's magazines, two of the four measures of internal search effort significantly declined with an increase in the external cost, contrary to prediction ($H_{1(b)}$). The decline observed for the first of these measures -- the conservative time estimate of internal search effort -- was only marginally significant ($p < .10$). However, the decline observed for the second measure -- the liberal time estimate -- was highly significant ($p < .005$). This latter measure also indicated a marginally significant decline in internal search effort for the combined categories ($p < .10$).

The MANCOVA analysis indicated no significant overall effect of the cost of external information on internal search effort. This was also the case when business magazines alone were considered. For women's magazines, however, the MANCOVA analysis indicated a marginally significant effect ($p < .10$). Furthermore, when the protocol measure of internal search effort -- which varied very little across experimental conditions -- was dropped, the revised MANCOVA analysis results indicated a significant effect ($p < .05$) of external information cost on internal search effort for women's magazines.

Relative Search Effort: Neither the conservative nor the liberal time measures of relative search effort were significantly influenced by the external cost of information. On the other hand, the protocol-based ratio measure declined significantly ($p < .05$) due to an increased cost of

external information when business magazines were involved. This decline was not significant for women's magazines. When the categories were combined, the protocol-based ratio measure declined significantly ($p < .05$).

The MANCOVA analyses indicated a marginally significant decrease in relative search effort due to the increased information cost for the combined categories ($p < .10$). For each of the magazine categories alone, however, the declines were not statistically significant.

Total Search Effort: Although there was no prediction as to how the external information cost would affect total search effort, it is nonetheless worth examination. For business magazines, none of the observed declines in total search were statistically significant. On the other hand, for women's magazines, both the conservative and the liberal time measures of total search effort declined significantly due to the higher cost of external information ($p < .05$ and $p < .01$ respectively). For the combined categories, only the effect of the external cost of information on the liberal measure of total search was marginally significant ($p < .10$).

The MANCOVA analysis indicated no overall significant effect for the combined categories, nor any significant effect for the business magazines alone. For women's magazines, however, the MANCOVA analysis revealed a significant ($p < .05$) decline in total search effort when the cost of external information was high.

Summary: In the business magazine category, there were few statistically significant effects of external information cost on search effort. In the

case of women's magazines, there was significant evidence of a decline in both internal and external search effort with an increase in the external information cost. Total search effort also declined significantly, while the decline in relative search effort was not significant. When the categories were combined, however, the observed decline in relative search effort was marginally significant.

In summary, there is moderate evidence of a decline in external search effort, supporting $H_{1(a)}$. There is somewhat stronger evidence that internal search effort declined as well, rejecting $H_{1(b)}$. Finally, there is some marginal evidence that relative search effort decreased with an increase in the cost of external information, weakly supporting $H_{1(c)}$. In addition, the available evidence suggests that total search effort decreased with an increase in the cost of external information.

Prior Experience

It was predicted earlier that experienced consumers, when compared to inexperienced consumers, would engage in (a) more internal search effort, (b) less external search effort, and (c) engage in less relative search effort. However, as reported in the preceding chapter of this thesis, the measure of prior experience employed in this study was not significant in any of the MANCOVA analyses. This self-report measure indicated that prior experience had no significant impact on internal, external, relative, or even total search effort. As a consequence, there is no evidence to support any of the above three propositions.

The self-report measure of prior experience has been used previously (Johnson and Russo, 1984), and it appears to have acceptable validity. However, in the present study the variance associated with this measure is

relatively small, indicating a small effect size. The differences between experienced and inexperienced consumers appear to have been less dramatic than anticipated *a priori*. As a result, the variance in the responses on the self-report measure are smaller than expected.

Willingness to Expend Cognitive Effort:

In the theory section of this thesis, it was argued that increasing an individual's willingness to expend cognitive effort would lead to (a) an increase in internal search effort, (b) an increase in external search effort, and (c) an increase in total search effort. No prediction was made with respect to the effect of willingness to expend cognitive effort on relative search effort.

In general, the pattern of results provides strong *directional* support for all three of these propositions. However, none of the internal, external, or total search effort effects are statistically significant. The preceding set of propositions were therefore not supported in this study. However, there was evidence that relative search effort decreased. The effect of willingness to expend cognitive effort on the conservative and liberal time estimates of relative search effort was not significant. In contrast, the protocol-based ratio measure of relative search effort declined significantly with an increased willingness to expend cognitive effort, both for business magazines ($p < .10$) and for women's magazines ($p < .05$), as well as for the combined categories ($p < .01$).

The results observed for all four search effort variables were consistent with the predictions in all cases. Furthermore, the responses given by subjects to the manipulation check questions indicated that those

individuals in the incentive groups perceived the appropriateness of expending more cognitive effort in making their choices. However, the absence of statistically significant effects suggests that the experimental manipulation of willingness to expend cognitive effort may have been weaker than desired.

Time Pressure

It was argued earlier that an increase in time pressure would lead individuals to (a) increase internal search effort, (b) decrease external search effort and (c) decrease relative search effort. No prediction regarding the effect of time pressure on total search effort was made.

External Search Effort: All three measures of external search effort declined significantly when time pressure was high. This was true both for business and women's magazines separately, as well as for the two categories combined. The declines observed for the number of items examined and the total search times were both highly significant ($p < .001$ for each category alone and when combined, for both measures). The number of external protocol segments also declined, marginally ($p < .10$) for business magazines, but significantly for women's magazines ($p < .025$) and for the combined categories ($p < .05$).

The MANCOVA analysis indicated a strongly significant decrease in external search effort when time pressure was high. The declines for business magazines ($p < .001$), women's magazines ($p < .001$), and the combined categories ($p < .001$) were all highly significant. There was therefore strong evidence to support $H_{4(b)}$.

Internal Search Effort: As noted previously, there is a major problem associated with the use of the liberal time estimate of internal search effort to examine the effect of time pressure. Since the liberal measure is partially based on the extent of external search undertaken by the individual, any constraint imposed on external search also constrains this measure. In the present case, the liberal and conservative time measures of internal search effort consistently disagree in direction. The conservative measure increased with an increase in time pressure while the liberal measure decreased. However, in this context, use of the former measure is more appropriate since it was not externally constrained as was the liberal measure. The conservative time measure increase was only marginally significant ($p < .10$), both for the business and women's magazines alone, and when the categories were combined.

The MANCOVA analyses indicated a strong and significant effect of time pressure on internal search effort. However, this analyses included the liberal time measure, and is therefore suspect. When the liberal time measure is dropped, the MANCOVA results no longer show a significant increase in internal search effort due to time pressure.

Relative Search Effort: All three measures of relative search effort declined significantly with an increase in time pressure. The declines observed for the conservative and liberal time measures of relative search effort were both highly significant, for business magazines, women's magazines, and combined ($p < .001$ in all cases). The protocol-based ratio measure of relative search also declined significantly for business magazines ($p < .001$) and when the categories were combined ($p < .005$), but the decline for women's magazines was not significant.

The MANCOVA results also indicated a strong, significant decline in relative search effort due to high time pressure. This was observed for business and women's magazines separately, as well as when they were combined ($p < .001$ in all three cases). $H_{4(c)}$ was therefore strongly supported.

Total Search Effort: Although no prior prediction was made regarding the effect of time pressure on total search effort, this relationship is worth further examination. The results indicate that total search effort declined significantly when time pressure was increased. The conservative time measure declined significantly for business ($p < .005$) and women's magazines ($p < .001$), and for the combined categories ($p < .001$). Similarly, the liberal time measure declined significantly ($p < .001$) in all three cases. The number of internal plus external protocol segments was also significantly lower when time pressure was high ($p < .10$ for business magazines, $p < .05$ for women's magazines, and $p < .05$ combined).

The MANCOVA analysis indicated a strong and significant decrease in total search effort when time pressure was high. This decline was significant for business magazines ($p < .01$), for women's magazines ($p < .001$), and for the two categories combined ($p < .001$).

Summary: The effects of time pressure on search effort appear to be very strong on the basis of the results obtained in this study. External search effort declined significantly, strongly supporting $H_{4(b)}$. Relative search effort also declined significantly, supporting $H_{4(c)}$. In addition, a significant decline in total search effort due to time pressure was observed. However, the observed increase in internal search effort was not

statistically significant, and $H_{4(a)}$ was therefore not statistically supported.

External Information Cost, Willingness to Expend Cognitive Effort, and Prior Experience

The fifth hypothesis predicted significant interactions between the cost of external information, willingness to expend cognitive effort, and prior experience. However, as the initial MANCOVA results reported in Chapter 5 indicated, the external information cost by willingness to expend cognitive effort interaction was not significant, even when the prior experience covariate was included in the analysis. As a result, only $H_{5(a)}$ is supported in this study. This proposition suggested that an increase in the cost of external information would lead to a decrease in external search effort, regardless of individuals' prior experience or their willingness to expend cognitive effort. Since it was earlier shown that the external information cost does have a main effect of decreasing external search effort, and since the interaction terms in the MANCOVA analyses were not significant, this proposition ($H_{5(a)}$) is supported.

External Information Cost, Time Pressure, and Prior Experience

Earlier it was argued that an increase in the cost of external information should: (a) decrease external search effort, regardless of prior experience or degree of time pressure; (b) lead to an equal or greater decrease in external search effort when time pressure was high as compared when time pressure was low, both for experienced and inexperienced consumers; (c) have no effect on the internal search effort of inexperienced consumers; and (d) lead to an equal or greater increase in

internal search effort for experienced consumers facing high time pressure than the increase for experienced consumers facing little time pressure. These four propositions are investigated below.

The original MANCOVA analyses reported in Chapter 5 indicated that the effect of the cost of external information by time pressure interaction was significant for women's magazines ($p < .025$), but was not significant for business magazines nor for the two categories combined. Two new MANCOVA's were examined for the women's magazine category to test this hypothesis, each involving only the cost of external information by time pressure interaction term. The first examined the effect of the interaction on external search effort (as measured by the number of items examined, the total external search time, and the number of externally-based protocol segments), while the second examined internal search effort (the conservative and liberal time measures, the number of internally-based protocol segments, and the second choice times). Each of these analysis are dealt with in turn below.

External Search Effort: For the external search effort analysis, the effect of the experience covariate was not significant ($F(3,53) = 1.04$, n.s.), while the effect of the reading speed covariate was highly significant ($F(3,53) = 7.79$, $p < .001$). The effect of the cost of external information by time pressure interaction ($F(3,53) = 2.34$) was marginally significant ($p < .10$). However, subsequent univariate analysis revealed that while the interaction had a significant impact on the total search time measure of external search effort ($F(1,55) = 5.77$, $p < .025$), neither the number of items examined nor the number of external protocol segments differed significantly ($F(1,55) = 1.27$, n.s. and $F(1,55) = 0.34$, n.s.

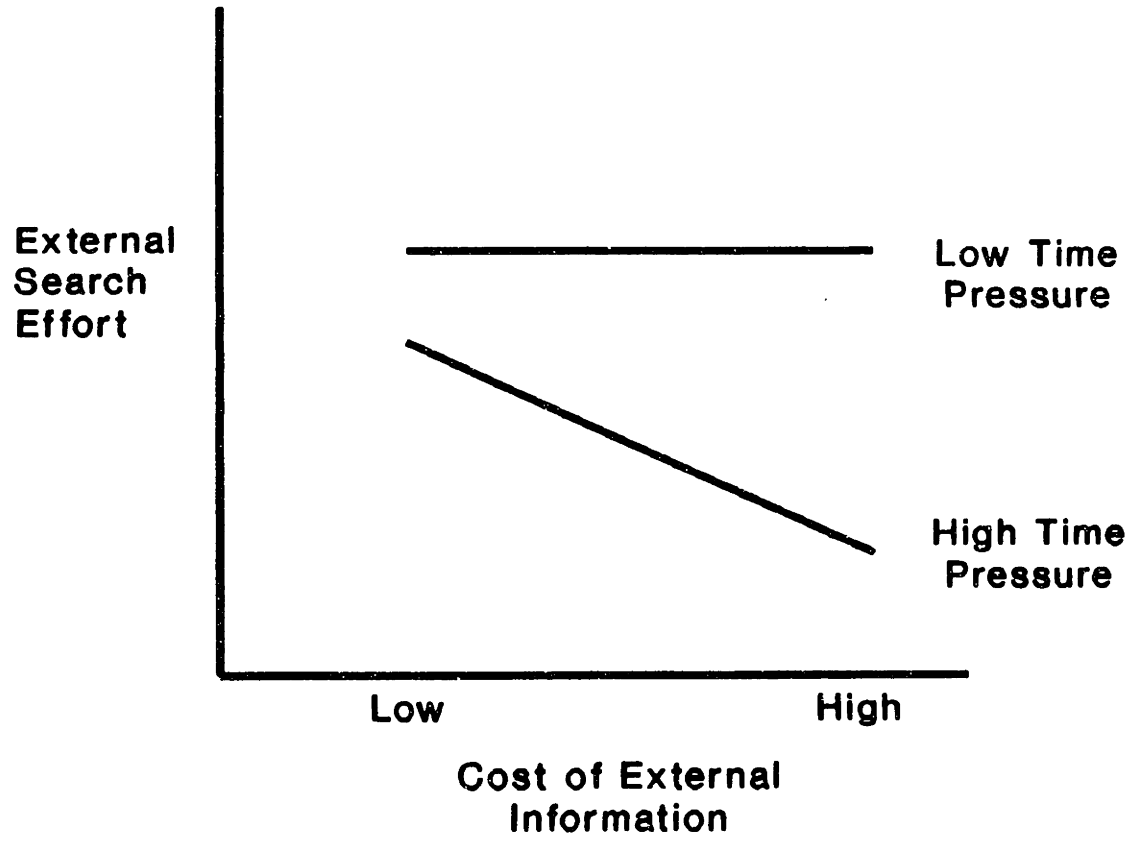
respectively). As a consequence, only the total search time measure is examined in greater detail below. The other measures do not reject the null hypothesis.

The pattern of results observed for the total search time measure is shown in Figure 5 broken down by time pressure and external information cost. This pattern is the same for both experienced and inexperienced consumers; there are no significant differences between the two groups. Low time pressure subjects' total external search times did not vary significantly from low external information cost to high (t_{13} = 1.09, n.s and t_{23} = 1.26, n.s. for inexperienced and experienced consumers respectively), although a decline was observed when the cost of external information was high. On the other hand, the total external search times observed for high time pressure subjects were significantly lower when the cost of external information was high than when it was low (t_5 = 3.32, $p < .025$ and t_{11} = 2.98, $p < .01$ for inexperienced and experienced subjects respectively).

A nonsignificant decline in external search effort was observed for the low time pressure subjects and a significant decline was observed for the high time pressure subjects. External search effort therefore declined regardless of the degree of time pressure, and did so for both experienced and inexperienced consumers, supporting hypothesis $H_{6(a)}$. Furthermore, the decline observed for the high time pressure subjects was significant, while the decline for the low time pressure subjects was not. Hypothesis $H_{6(b)}$ was therefore also supported for both experienced and inexperienced consumers.

FIGURE 5

External Search Effort (Total Search Time), by Degree of Time Pressure and Cost of External Information



Internal Search Effort: For the internal search effort analysis, the effects of both the experience covariate ($F(4,52) = 0.72$), and the reading speed covariate ($F(4,52) = 2.33$) were not significant. The effect of the cost of internal information by time pressure interaction ($F(4,52) = 2.59$) was marginally significant ($p < .10$). Subsequent univariate analyses revealed that only the liberal time measure of internal search changed significantly across conditions ($F(1,55) = 6.82$, $p < .025$). The effect of the time pressure by external information cost interaction on the conservative time measure ($F(1,55) = 0.19$), on the number of internally-based protocol segments ($F(1,55) = 2.20$), and on the second choice time ($F(1,55) = 0.11$) was not significant in each case.

However, as has previously been noted, the liberal time measure of internal search effort is closely associated with external search when time pressure is high. The high time pressure manipulation constrains the total amount of time allowed for external search. In addition, however, it also constrains the amount of internal search taking place while the external information is present. As a consequence, the liberal time measure will decrease in value simply because there is less time to search external information, even when internal search effort does not change.

Since the liberal time measure is the only measure of internal search that varies significantly across the time pressure by external information cost conditions, and because of the above concern, no test of hypotheses $H_{6(c)}$ and $H_{6(d)}$ can be made. That is, there were no significant observed differences in internal search effort due to the interaction between cost of external information, time pressure, and prior experience.

Summary and Discussion

The primary purpose of this study was to examine the effects that a number of environmental and individual-specific factors would have on the relative uses of internal and external information sources in choice. A cost-benefit framework was employed to predict the extent to which the various factors would influence this relative usage. Summaries of the findings obtained from this study of consumer choice behavior are presented in Tables 23, 24, and 25.

First, time pressure was observed to be the single factor of the four investigated to have the greatest impact on the search effort measures. External search effort declined dramatically as time pressure was introduced, but this was primarily a result of the time pressure manipulation and therefore expected. No statistically significant change in internal search effort was observed, although a non-significant increase was noted. The decrease in external search was far more extensive than the increase in internal search, and total search effort was therefore observed to decline substantially. Relative search effort also declined significantly. That is, individuals facing high time pressure replaced external information sources with internal sources, but not on a one-for-one basis.

Individuals were also observed to alter their information processing strategies in the face of high time pressure. Subjects in the high time pressure condition were far more likely to employ an attribute-based choice strategy than were subjects not facing time pressure. The high time pressure individuals were also observed to make greater use of the NAME attribute, suggesting that name takes on particular importance when the choice process is constrained.

TABLE 23

Summary of Main Effects of Choice Environment Factors on Internal and External Search Effort

	External Search		Internal Search	
Main Effect	Predicted	Observed	Predicted	Observed
Increased cost of external information	Decrease [$H_{1(a)}$]	No change (B,C) Decrease (W)	Increase [$H_{1(b)}$]	No change (B,C) Decrease (W)
Increased consumer experience	Decrease [$H_{2(b)}$]	No change (B,W,C)	Increase [$H_{2(a)}$]	No change (B,W,C)
Increased willingness to expend cognitive effort	Increase [$H_{3(b)}$]	No change (B,W,C)	Increase [$H_{3(a)}$]	No change (B,W,C)
Increased time pressure	Decrease [$H_{4(b)}$]	Decrease (B,W,C)	Increase [$H_{4(a)}$]	No change (B,W,C)

NOTE: The observed effects are reported separately for business magazines (B), women's magazines (W) and the combined magazine categories (C). All changes reported in this table are statistically significant.

TABLE 24

Summary of Main Effects of Choice Environment Factors on Total and Relative Search Effort

	Total Search		Relative Search	
Main Effect	Predicted	Observed	Predicted	Observed
Increased cost of external information	NA	No change (B,C) **Decrease (W)**	Decrease [$H_{1(c)}$]	No change (B,W) **Decrease (C)**
Increased consumer experience	NA	No change (B,W,C)	Decrease [$H_{2(c)}$]	No change (B,W,C)
Increased willingness to expend cognitive effort	Increase [$H_{3(c)}$]	No change (B,W,C)	NA	**Decrease** **(B,W,C)**
Increased time pressure	NA	**Decrease (B,W,C)**	Decrease [$H_{4(c)}$]	**Decrease** **(B,W,C)**

NOTE: The observed effects are reported separately for business magazines (B), women's magazines (W) and the combined magazine categories (C). All changes reported in this table are statistically significant. NA indicates that no a priori prediction was made.

TABLE 25

Summary of Interactive Effects of Choice Environment Factors on Internal and External Search Effort

Interaction	External Search			Internal Search		
	Low Willingness		High Willingness	Low Willingness		High Willingness
Increased cost of external information versus:						
(i) Inexperienced consumers	Decrease [$H_{5(a)}$]	$\geq$ [$H_{5(b)}$] NC	Decrease [$H_{5(a)}$]	NC [$H_{5(c)}$]	NC	NC [$H_{5(d)}$]
(ii) Experienced consumers	Decrease [$H_{5(a)}$]	$\geq$ [$H_{5(b)}$] NC	Decrease [H_{5a}]	Increase	$\leq$ [$H_{5(d)}$] NC	Increase

TABLE 25 (cont'd)

	External Search			Internal Search		
	No Time Pressure		High Time Pressure	No Time Pressure		High Time Pressure
Increased cost of external information versus:						
(i) Inexperienced consumers	Decrease [$H_{6(a)}$]	≤ [$H_{6(b)}$]	Decrease [$H_{6(a)}$]	NC	[$H_{6(c)}$]	NC
	NC	≤	Decrease		NC	
(ii) Experienced consumers	Decrease [$H_{6(a)}$]	≤ [$H_{6(b)}$]	Decrease [$H_{6(a)}$]	Increase	≤ [$H_{6(d)}$]	Increase
	NC	≤	Decrease		NC	

NOTE: Entries in this table indicate the anticipated interaction effect above the observed effect. Where no significant effect was observed or expected, this is indicated as "NC".

Second, the external cost of information had a strong impact on the levels of both internal and external search effort, at least for the women's magazine category. As expected, external search effort declined as the cost of acquiring external information increased. However, this decrease in external search effort was not accompanied by the anticipated increase in internal search effort. Instead, internal search effort also declined significantly in the face of an increase in the external information cost. This unexpected result can be explained as follows: Suppose individuals make an effort-accuracy assessment at the outset of the choice process, and thereby determine an appropriate effort level for the decision at hand. When the cost of external information is high, more of this effort is expended in the task of external information acquisition. As a consequence, less of the total allocated effort is available for other tasks (including external information examination and internal search). As demonstrated in Chapter 5, the subjects in this study who faced a high external information cost employed the same overall effort in making their choices, but less search effort than their low external cost counterparts, expending considerable effort on external information acquisition. In short, the high external information cost individuals employed the same total effort, but less total search effort.

In addition, relative search was significantly lower for the high external information cost individuals than for the low information cost individuals in this study. The evidence here is weaker than anticipated, and is a consequence of the observed decline in internal search effort due to the high external information cost. Individuals do appear to replace external search with internal search in the face of a high external

information cost, but this displacement is far less extensive than was anticipated.

Once again, it is possible to speculate about why this pattern was observed in this study. Having made earlier assessments of the appropriate amount of effort to allocate to the choice at hand, subjects may subsequently attempt to expend effort in a manner consistent with their earlier assessments. When the cost of external information was high, however, a significant proportion of total effort expenditure involved information acquisition rather than information search. However, if total effort was to remain relatively stable, total search effort would have to then decrease when the cost of external information was high. Individuals in this study appeared to limit both internal and external search effort in order to bring their experienced total effort in line with their prior expectations. At the same time, they replaced external information sources, which required relatively more effort to examine when the cost of external information was high, with internal sources. In short, subjects appear to have made an initial assessment about an appropriate level of total effort. The levels of internal and external search conducted then depended upon both this prior assessment and the relative costs faced for the two sources of information.

The interaction between the external cost of information and time pressure was also significant. Subjects faced with little time pressure tended to reduce their external search effort only slightly as the cost of external information increased. On the other hand, those subjects facing high time pressure dramatically reduced their external search efforts as the cost of external information increased. This same pattern was observed for both experienced and inexperienced consumers. While the interaction

between the external information cost and time pressure had a strong impact on external search effort, however, no corresponding impact on internal search effort was observed. In fact, internal search effort remained remarkably stable across the experimental conditions. This might be attributable to relatively consistent use of internal sources of information regardless of the set of externally available information, but could also simply be the result of insufficiently accurate measures of internal search effort.

The third factor -- prior experience with the relevant product category -- had no significant impact on information search effort, contrary to expectations. While internal, external, and total search effort all increased somewhat with an increase in an individual's prior experience, these increases did not approach statistical significance. Furthermore, the evidence with respect to relative search effort was inconsistent, and no conclusion can therefore be drawn regarding the effect of prior experience on relative search effort.

Informal observation of subjects' search processes by the principle investigator suggested that, while experienced subjects could apparently search through the available external information set more efficiently than their inexperienced counterparts, they nonetheless tended to also look at non-essential information when they had an opportunity to do so. It was only when they faced high time pressure or a high external cost that these experienced consumers modified their search behaviors. However, under these same conditions, inexperienced consumers were also forced to modify their search strategies.

The changes observed in search effort due to the final factor -- willingness to expend cognitive effort -- were modest, probably because

many of the subjects involved with this study were already willing to expend considerable cognitive effort in making their choices. There is evidence from the study to suggest that increases in individuals' willingness to expend cognitive effort led to increases in internal, external, and total search effort. However, none of these increases reached statistical significance. In addition, there was no significant change observed in the relative usage of internal and external information sources as measured by relative search effort.

In addition to the preceding comments, several observations regarding subjects' external search activities independent of the experimental conditions also warrant further discussion. For example, the variances in the proportions of time spent on the attributes in this study were much higher than those observed by Payne, Bettman and Johnson (1988). Furthermore, subjects in this study were very likely to employ an attribute-based information processing strategy, even when faced with little time pressure and a low cost of external information.

Subjects in this study were also very likely to look at the name attribute information early in their external search, and they tended to spend a fairly high proportion of their total external search time looking at this variable. This suggests that prior experience <u>did</u> play an important role in subjects' external search processes, although the measure of prior experience employed in this study did not reflect that importance. These findings are also consistent with the contention of Ford <u>et. al.</u> (1989) that "preconceived notions about one or more alternatives would also have an effect on information search."

Study Limitations

A number of limitations associated with the present study need to be addressed. First, the effects noted for prior experience in this study are extremely weak. Given the importance of prior knowledge in previous studies (e.g. Johnson and Russo 1984, Bettman and Park 1980, Brucks 1985), the use of a greater diversity of measures of prior experience (Alba and Hutchinson 1987) may be required. Alternatively, an experimental design involving the direct manipulation of consumer experience might yield more significant results.

Second, the experimental manipulation of willingness to expend cognitive effort employed in this study did not significantly affect search effort. As noted earlier in the thesis, however, it appears that the major problem encountered in this regard is that all subjects tended to have a high willingness to expend cognitive effort. Even though the incentive may have been sufficient, then, a "ceiling effect" was observed when the high willingness to expend cognitive effort groups were compared to the control groups. It should be emphasized that subjects' perceptions of the incentive indicated significant differences between these two groups. However, no significant differences in search behavior were observed.

Third, the measures of internal search effort employed here were quite imprecise. While changes in internal search effort were observed in many cases the measurement error was sufficiently large to render these changes statistically insignificant. Much work needs to be done to improve the available measures of internal information processing.

Fourth, as noted earlier the study reported in this thesis required subjects to first choose a business magazine and to then choose a women's magazine. A reversed product category order was not employed in this

study. As a result, it was not possible to separate the effects of category order from any category-specific effects. Observed differences in behavior for business and women's magazines can be attributed to either the order in which they were seen or fundamental differences between the two categories. As previously noted, every attempt was made to minimize the differences between the two categories, but fundamental distinctions that influenced subjects' behaviors may nonetheless have remained.

Finally, this study was conducted under experimental laboratory conditions. This approach was employed so that the results of this study would be directly comparable to earlier studies of information search. However, subjects were required to examine information and make choices in an artificial environment. As a result, the general applicability of the findings in this study to more naturalistic consumer settings is unknown.

CHAPTER 7: CONCLUSIONS AND IMPLICATIONS

The final chapter begins with a discussion of the theoretical and methodological implications of the thesis. This is followed by a detailed examination of both how the study's limitations might be addressed through additional study and how the primary findings might be extended through future research.

Study Implications

Theoretical Implications: The patterns of individual behavior observed in this study are consistent with the contingent decision behavior framework proposed by Payne (1982). Specifically, the results here show that changes in the choice environment can have a significant impact on both individual search and individual choice behavior. However, these results may also be compatible with other theoretical frameworks. The experimental method employed in this thesis was focused on testing a particular set of hypotheses derived from the contingent decision making framework rather than critically testing that framework against competing theories of consumer behavior.

Despite its inability to conclusively validate the contingent decision behavior framework, this thesis makes several unique contributions. For example, this study is the first of its kind to explicitly and simultaneously look at the relative usage of both internal and external sources of information in the choice process. While other researchers certainly emphasized the importance of both internal and external information sources (e.g. Biehal and Chakravarti 1986, Lynch, Marmorstein, and Weigold 1988), they neither measured nor explicitly

examined the extent to which these two information sources are employed in making a final choice. Furthermore, these studies generally avoided dealing with pre-existing stores of knowledge that individuals might have about the available set of choice alternatives.

The current study provides evidence of significant changes in the relative usage of internal and external information with changes in the choice environment factors faced by an individual. The relative usage of internal information sources was observed to increase with increases in time pressure, the cost of external information, and the individual's willingness to expend cognitive effort. These finding suggest that choice environment factors can influence consumers' choices by affecting their relative usage of internal and external sources of information.

The current study differs from many other studies employing a cost-benefit approach in that it employs existing product categories. Its second theoretical contribution is therefore an integration of prior knowledge and experience with choice environment and individual motivation factors. Prior knowledge and its effects on search have been looked at previously (e.g. Bettman and Park 1980, Johnson and Russo 1984, Brucks 1985), but not within the context of the effects of choice environment factors on decision behavior. The results obtained from this study suggest that prior experience plays a relatively small role in directly influencing search and choice. However, they also indicate the importance of the product name in external search, and suggest a need for better understanding of how brand or product names guide search.

Finally, in a comprehensive review of research focused on decision making processes, Ford et. al. (1989) noted that "no studies [in this area have] examined person and environmental factors together." The results

obtained here suggest that these factors have an important influence on the cognitive processes underlying decision making. Ford et. al. also noted that few studies have looked at the isolated impact of environmental factors (such as choice importance and time pressure) on search and choice. Many of the effects employed here have received only limited previous investigation. This stands in stark contrast to the observation by Ford et al (1989) that "most of the research using process tracing approaches has focused attention on the effects of task rather than environmental and person characteristics on decision behavior." The task factors examined in the studies reviewed by Ford et. al. included task complexity (the joint impact of the number of alternatives and the number of attributes), display format, and response mode (judgement or choice). In this study, these task characteristics were held constant in order to examine the effects of the environmental and person-specific factors on choice behavior.

Methodological Implications: Four major methodologically based implications of this work should be noted. First, a number of explicit measures of internal search are employed in this study. The results presented here indicate the importance of internal search in consumers' choice processes. The existing measures of internal search were found in this study to be largely inadequate. While this is an area in need of considerable additional work, however, the results provided here suggest that individual levels of internal search can be examined and that such investigation is worthwhile. A better understanding of when and to what extent internal sources of information can influence decision processes is clearly needed.

Second, an attempt was made in this study to measure search effort, rather than simple search quantity. Researchers in this area have traditionally emphasized analysis of the number of items examined and the pattern of information acquisition. However, measures of the time spent examining individual pieces of information (both internal and external) and processing that information are likely to be more closely linked to the cognitive resources marshalled by an individual to make his or her choice. This is likely to be true since an individual can spend a great deal of time acquiring and examining a particular item of information and very little time on another. The former measure of information search would not distinguish between these two items, while the latter measure would. It is the allocation of these cognitive resources that is most likely, in turn, to be influenced by individual-specific and environmental factors. This thesis therefore places an increased emphasis on measures of search effort, although a great deal more work along these lines is also needed.

Third, the results obtained in this study suggest that the relative search effort measure is far more sensitive to changes in the choice environment than are direct measures of internal and external search effort. As discussed previously, the total effort applied to a particular choice appears to remain relatively stable across the choice environments employed in this study. On the other hand, the allocation of that effort varies significantly across those same choice environments. Measures of relative search effort may therefore prove to be of considerable value in looking at consumers' contingent decision behaviors.

Finally, this study is one of a small number to employ both verbal protocol analysis and information measures of decision making processes. Payne, Braunstein, and Carroll (1978) have argued strongly for the use of

multiple measurement methodologies. The current study attempts to make use of both measurement methods to better understand consumers' choice processes. In several cases, use of these multiple measures provided results that would have otherwise been missed.

Future Research: Limitations and Extensions

Before turning to a more general discussion of potential future research, each of the four environmental factors employed in this study is discussed in turn. For those factors yielding results consistent with prior expectations, some thought is given to ways in which the current research can be extended and refined. On the other hand, for those factors yielding either insignificant or inconsistent results, the discussion will focus predominantly on research that might be conducted to clarify why results were not as expected/predicted.

Cost of External Information: As previously noted, internal search effort decreased with an increased cost of external information, contrary to expectation. However, this result neither indicates that the cost-benefit theoretical framework should be rejected, nor that it needs to be modified. Instead, the findings from this study suggest that the explanation provided earlier about the impact of the external cost of information on internal and external search effort needs to be modified. The process measures collected in this study suggest that whenever an external information item is examined, some internal processing effort is also encountered. Thus, there is internal processing "overhead" associated with external search. Consequently, as the amount of external search decreases, this associated internal processing also decreases. Although internal search for global

evaluations may increase under these same conditions, this study suggests that any such increase will be more than offset by the decrease in internal processing accompanying the decrease in external search. In other words, internal global evaluations are likely to be much easier to use than external information items in consumers' choice processes.

This is one area that appears to warrant considerable further research attention. An experiment designed to more directly identify the relationship between external search and the various components of internal search effort is needed. Furthermore, better measures of internal search need to be found. The existing measures don't separate search for global evaluations from search for attribute information, and both of these search activities are further interconnected with other internal processing.

Using an experimental approach somewhat similar to that employed by Bettman, Johnson, and Payne (1988) for external information, it might be possible to separate out these different internal cognitive activities. A relatively small number of subjects would be asked to make a large number of choices (50 to 60). These choices could be made, for example, from a set of unfamiliar alternatives in a familiar product category (such as the calculators used in the 1983 study by Biehal and Chakravarti) or from a set of job candidates (Bettman, Johnson, and Payne 1988). The size of the total information matrix would vary from choice to choice, ranging from two attributes by two alternatives to four attributes by five alternatives.

For a given choice, a subject would initially be shown a subset of the total matrix. This information would then be removed (i.e. it would become internally based), and replaced by some or all of the remaining information. The format of the initial information would be one of three types: (i) information about one attribute for some -- but not all -- of

the choice set alternatives, or (ii) overall evaluations for some -- but not all -- of the alternatives, or (iii) a complete set of attribute information for one alternative, along with attribute importance weights. In the first two cases, the subject would be instructed to memorize the information, while in the last case he or she would be asked to form an overall evaluation.

Manipulating the format of the initial information set should influence the type of information available internally when new information is seen subsequently. The single attribute format leads to an attribute only internal information base, while the overall evaluations format leads to a global evaluations only information base. The third format allows subjects to form an internal information base that includes both attribute and global evaluation information, although it is unlikely that both types of information will be equally accessible at a later time.

The second (external) set of information could then be designed to be either congruent or incongruent in format with the original (internal) set of information. As an example of how this would be done, consider a two alternative by two attribute choice problem. If the initial information was a description of alternative A on attribute x, a congruent set of subsequent information would describe alternative B on attribute x and both alternatives on attribute y, as well as providing attribute importance weights. An incongruent second information set might provide overall evaluations for both A and B. In the former case, the memory-based attribute information would be directly relevant to the choice at hand, and would therefore need to be retrieved. However, in the latter case, the memory-based information would not be relevant, and any observed internal search activity would therefore be associated with processing "overhead".

When overall evaluations are provided initially, the subsequent information could again be either congruent or incongruent. Using the two by two example, subjects would initially receive an overall evaluation for alternative A. A congruent second set of information would then provide an overall evaluation for alternative B. In contrast, an incongruent second set might describe alternative B on attributes x and y and include the attribute importance weights.

Finally, there is the case when subjects initially receive attribute and attribute importance information for a subset of the choice alternatives. Using the same example as before, this initial information would describe alternative A on attributes x and y, and would provide the attribute importance weights. Congruent subsequent information would describe alternative B on attributes x and y (and again include the importance weights), while incongruent subsequent information might provide an overall evaluation for B.

Crossing the initial information format with the congruity of subsequent information factors, and allowing the choice problem sizes to vary within individual, it should be possible to obtain separate estimates of internal search effort relating to attribute information, global evaluations, and cognitive processing. The dependent measures used in such a study might include total choice time, as well as self-reported measures of overall effort and satisfaction with the decision. Since it would be quite possible to track external search by basing the choices on a micro-computer, this experimental design could be used to examine the internal search effort elements in detail. In addition, subjects could be asked to separately retrieve global evaluations and items of attribute information for an additional sequence of choices. In these cases, subjects would see

the initial information and then be asked to retrieve it once it had been removed. This would provide additional, direct estimates of the internal effort associated with attribute and evaluation retrieval.

This study would be conducted along the lines of the preceding discussion in order to obtain a better understanding of internal search processes. However, to bring this study back into the context of the cost of external information, a second study based loosely on the first could then involve the manipulation of the external information cost. This second study would then make it possible to directly test the revised explanation of the effect of the external cost of information on internal search effort.

Prior Experience: Although no significant relationship between prior experience and any of the search effort measures was observed, this is more likely due to flawed measurement than evidence of a true, underlying null relationship. There was limited variation both in the overall self-reported knowledge measure and in the more detailed magazine-by-magazine experience measures. As a result, the statistical conclusion validity for prior experience was low in this study.

The real problem in this case appears to be the result of studying inexperienced rather than naive consumers. In retrospect, the hypotheses relating search effort to prior experience were developed for experienced and naive consumers, where the latter were expected to have absolutely no internal information sources available during choice. However, while some of the subjects employed in this study were relatively inexperienced, none were truly naive. These inexperienced consumers had at least a limited amount of declarative (or substantive) knowledge for the product category

at hand. However, the procedural knowledge held by these inexperienced consumers was greater than expected. These individuals were able to efficiently search through external information and assimilate it with existing, memory-based information. Furthermore, although these inexperienced consumers professed to have little awareness of the product category, they nonetheless tended to have global evaluations availabe in memory for at least some of the alternatives encountered.

New studies could be designed to overcome these problems, and thereby permit a better assessment of the effects of prior experience on search effort. For example, a more detailed study involving a smaller set of consumers could be conducted to obtain an in-depth description of their choice processes. The focus in this case would be on how consumers make use of internal and external information sources during an actual choice occasion. Such a study might potentially involve following individual consumers into a store and asking them to describe their thought processes as they examine and select (or reject) particular magazines. At the very least, a study of this type would ask consumers to describe their magazine selection process in detail. The researcher could use a series of interview questions to then assess the prior experience of the individual.

Related to this, the current study suggests that a broader conceptualization of individuals' knowledge bases is needed. Most studies that have examined the impact of prior knowledge on decision making (including this one) have focused on individuals' prior knowledge of information about sets of available alternatives. However, individual consumers can also have rich stores of knowledge about general approaches to shopping for consumer goods. These latter stores of information have been largely ignored in existing studies of consumer decision making, but

they clearly warrant considerable attention. For example, a consumer planning to make a new consumer electronics purchase may know nothing about the product category under consideration (e.g. compact disc players), but may have considerable experience with related product categories (e.g. turntables, stereo receivers, VCR's). This previous experience is likely to guide the consumer's decision making in the new product category. It would be extremely valuable to study these stores of general consumer knowledge in greater detail.

The relationship between prior experience and search effort could also be investigated by employing a truly novel product class. In this case all individuals would begin the study as naive subjects. By providing information to some subjects and asking them to make several product choices over time, a subset of experienced consumers could be developed. Rerunning the current experiment with this new set of naive and experienced consumers could then be expected to yield stronger results. In this case prior experience would also be a manipulated (rather than measured) factor. However, from a managerial perspective, naive subjects are likely to be of limited interest, and the costs of conducting such a study would need to be weighed against expected benefits.

Alternatively, a decision domain such as weather forecasting could be chosen, were both experienced and naive individuals can be found and identified easily. In this case, prior experience could be objectively rather than subjectively measured as was done in the current study. As suggested by Brucks (1985), objective measures of experience may be more closely related to external search than subjective measures.

Willingness to Expend Cognitive Effort: The results reported previously suggest two potential methodological problems associated with the operationalization of willingness to expend cognitive effort in this study. First, there is a problem with the incentive manipulation in that there is only an indirect link between a subject's action and the consequences that he or she faces. Although these individuals were given a chance in a lottery to win a subscription to their first choice magazines, they were not guaranteed such a subscription. Consequently, their willingness to expend cognitive effort may not have been much higher with the incentive than without. One obvious way to overcome this problem would be to offer subscriptions to all subjects in the high incentive condition.

The second methodological problem encountered in this study was already discussed. Virtually every subject taking part in this study appeared to be willing to expend considerable cognitive effort in making the choices. As a result, a restriction in range was observed since most subjects engaged in considerable internal and external search. This could be overcome in future work by deliberately selecting subjects with less enthusiasm for the study, by requiring subjects to complete another, unrelated study before beginning this one, or by providing subjects with a much more complex set of external information (e.g. 100 alternatives described on 50 attributes). In the first case one would expect to observe larger differences between the incentive and non-incentive conditions than noted here. In the second case, it is expected that subjects would be generally less willing to expend cognitive effort after already completing another cognitively demanding task in the same session. The final case provides a more realistic representation of many consumer categories, and

would also be likely to reduce subjects' willingness to search through the complete external information environment.

Time Pressure: In this study the observed effects of time pressure on search effort were strong. However, the time constraint employed was both artificial and arbitrary. It might therefore be useful to examine the impact that more realistic time constraints would have on consumer search. There is some evidence that the effects of time pressure on consumer behavior are fairly robust (e.g. Park, Iyer, and Smith 1989). However, the effects of time pressure on internal and external search effort in more naturalistic settings are currently unknown.

There is evidence here and elsewhere to suggest that time pressure causes a shift in choice strategy rather than a simple truncation of the original strategy. However, the extent to which such a shift occurs and the conditions under with it is more or less likely to occur need to be explored in greater depth. The extent of strategy shifting that takes place under time pressure might be explored further by asking subjects to explicate their strategies both before beginning a choice and after the choice is complete. In this case one would look for systematic changes between subjects' before and after statements. A variety of environmental conditions could also be employed along with time pressure to systematically study its effects on search effort. Finally, a "surprise" time pressure condition might be employed, where subjects do not anticipate the time limit. In this case subjects would be forced to truncate their decision strategies. Subject behavior in this condition could then be compared to other conditions which allowed for strategy modification.

Related Issues: The study conducted in this thesis does not critically test the effort-accuracy framework against competing theories. Furthermore, the current study does not measure the perceived accuracy associated with different choice strategies and varying choice environment conditions. In order to better understand the strategy selection process employed by individuals, researchers must look at measures of both effort and accuracy. Preliminary work is being done to clarify the role that the effort-accuracy trade-off plays in strategy selection (Kleinmuntz and Schkade, 1990), but considerable additional work in this area is needed.

This is particularly true in the domain of consumer choice. For the purposes of this study, an effort-accuracy trade-off prior to choice strategy selection was assumed. As noted earlier, however, the accuracy associated with a consumer choice is not well defined, and it is not at all clear whether consumers trade perceived effort off against perceived accuracy or against some other perceived benefit to be gained from search. In order to determine the accuracy of an individual's product choice it may be necessary to obtain importance weight measures for each of the attributes relevant to the product choice and to then predict an optimal choice for the individual. A comparison of the actual choice versus this optimal choice would then indicate the accuracy of the choice strategy employed. For products with concrete measurable attributes (e.g. hand soaps, blank computer diskettes), this approach may provide useful results. However, for product choices involving abstract attributes such as social approval (e.g. perfumes, fashion clothing), this approach would appear to be problematic.

An alternate approach would involve obtaining measures from subjects' of the perceived effort and the perceived benefits associated with the use

of particular choice strategies prior to beginning search, and then measuring these same perceptions after their choices are made. Appropriate measures need to be identified, however, since there are indications that subjects' perceptions of effort are not closely related to the effort they experience (Bettman, Johnson, and Payne 1988, Kleinmuntz and Schkade 1989).

Second, as noted by Klein and Yadav (1989), a fundamental question that needs to be addressed in this area of research is "how deliberately [do] decision makers adapt their strategies to context"? The results from this and other studies clearly indicate that individuals' choice strategies do vary with changes in the choice environment. What is not clear, however, is whether this variation is a result of deliberate assessments of the choice environment or of incremental adaptations to information obtained from that environment. In the latter case, the choice strategy is constructed as information from the choice environment is acquired and examined (see also Bettman 1979, Bettman 1988).

To properly address this issue, a research perspective that is more dynamic than the one employed here is required. In particular, it would be useful to look at how perceived (and/or experienced) effort and accuracy influence subsequent choice strategy selection, by taking these measures across a sequence of choices. Use of an experimental method like the one employed in this study would be impractical. Instead, a simpler choice domain (such as job candidate selection) could be used, with all information externally available for each choice. Subjects' perceptions of effort and accuracy could be measured before and after each choice, and experienced external search effort could be observed by basing the information matrix on a micro-computer. Subjects might simply be asked to

complete the entire sequence of choices as already described. Alternately, after each choice a subject might be given feedback about how good or bad that particular choice was relative to some objective (and hidden) standard. This feedback could be manipulated systematically in order to observe its effect on subsequent choice strategy selection. For some recent work along these lines see Creyer, Bettman, and Payne (1990).

Third, as noted by Ford et al (1989), more research attention needs to be paid to the effects of environmental and person-specific characteristics on decision behavior. While the effects that task factors such as the number of alternatives and the number of attributes have on judgment and choice processes have been well documented, the effects of environmental and individual-specific factors on decision processes have not been systematically investigated. Furthermore, as some of the results in this study suggest, a great deal more work needs to be done in examining the interactive effects of task, environment, and person-specific characteristics on individuals' decision processes.

In addition to the task, environment, and person-specific factors discussed in this paper, Payne (1982) has suggested a number of other factors that could influence decision processes, including agenda effects and the similarity of alternatives. Tversky and Sattath (1979) demonstrated that constraints placed on the order in which individual alternatives were encountered had an impact on the final choice probabilities of those alternatives. While a number of studies have built on this basic foundation (Plott and Levine 1978, Hauser 1986, Hulland 1988), a full understanding of how these agendas work to influence individuals' decision processes remains elusive. Kleinmuntz and Schkade (1990) have recently suggested that since agendas are in most cases hidden

to the decision maker and cannot be easily anticipated, they are unlikely to influence strategy selection and modification. On the other hand, agendas are expected to have a strong influence on strategy performance.

The effects of similarities between alternatives on choice have been studied far more extensively. While these investigations have shown that similarity clearly influences choice, however, the mechanisms underlying these observations remain unclear. Shugan (1980), for example, suggested that choice difficulty is inversely related to the perceived similarity of the alternatives. That is, as the similarity increases, making a choice from the alternatives set becomes more difficult. In a somewhat different vein, Tversky (1977) has argued that perceptions of similarity and difference between alternatives are in turn based upon the sets of features that define each alternative, and the relative salience of the various features involved. While considerable work has been done on looking at the effects of similarity on choice, much less attention has been focused on how these similarity perceptions are themselves formed. More investigation into this latter process is necessary if researchers hope to gain a better understanding of <u>how</u> similarity influences choice.

Fourth, future research needs to be designed to identify appropriate experimental manipulations. While the external cost and incentive manipulations used in this study can be defended as both reasonable and preferable to the alternative approaches considered, better options may exist. For example, in the context of a durable good purchase, consumers might be given a fixed amount of money, then told the costs associated with accessing individual pieces of information. They would be charged for each piece of external information examined. Any remaining money could then be used to help purchase their first choice alternative. This approach, at

least at face value, appears to be both more realistic and a better manipulation of the incentive condition than the method used here. However, a systematic examination of the impact of various manipulations on search needs to be done if further experiments in this general area are to be conducted.

Such manipulations might be particularly effective when used in conjunction with a computer-based measurement technology expanding on the one described in this thesis. Using a laser disk as a source of visual information (including, but not restricted to advertisements, magazine articles, testimonials, etc.) in conjunction with the technology already described, one could unobtrusively observe consumers' information searches through extremely rich information environments. These observations of individual search, used in conjunction with measures of consumers' prior knowledge bases would seem to be capable of providing researchers with considerable and detailed insight into consumer judgment and choice processes.

The possibility of observing consumer search patterns in much greater detail than has previously been possible will likely require researchers to develop more refined models of search and choice. While these detailed sets of observations could certainly be aggregated for use in existing models of information search, the benefits of finer-grained observation would then be lost. Most existing models of consumer choice focus on how individuals integrate or eliminate individual pieces of externally available information. Few consumer choice models based on internal information have been proposed (e.g. Wright 1976), and no "mixed" choice models exist. As evidenced here and noted by Bettman (1982), however, it is likely that in many (and perhaps most) consumer settings, individuals

make use of both internal and external sources of information. Work on more comprehensive choice models that include both internal and external sources of information would therefore appear to be a high research priority.

A final major area for potential research suggested by this study involves a more detailed examination of consumers' global evaluations for product alternatives. In particular, a model of evaluation formation and evolution needs to be developed. There is clear evidence that such global evaluations exist (e.g. Biehal and Chakravarti 1986, Kardes 1986, Lynch, Marmorstein, and Weigold 1988), but the processes underlying their formation and change have not been looked at in any systematic manner.

This area of research would be likely to also involve an examination of the link between global evaluations and the composition of consumers' consideration sets. The consideration set has been defined as that set of alternatives that a consumer would ever consider seriously for purchase. Recently, Hauser and Wernerfelt (1989) have developed a model of the consideration process that encompasses a cost-benefit framework. They argue that individual alternatives will be included in a consumer's consideration set whenever the expected benefit of inclusion is greater than the expected cost. Hauser and Wernerfelt do not really address the issue of how benefits and costs can be operationalized in practice. However, when a dynamic perspective of consideration sets is taken, it appears that there may be a close link between global evaluations which change over time and changes in the consideration set composition. Both conceptual and practical researches are needed to develop a better understanding of the processes at work here.

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APPENDIX A

The Effect of an Increase in the External Information Cost on Relative Search Effort

Recall that RS = relative search effort, ES = external search effort, and IS = internal search effort. Define EXT = cost of external information.

By definition, $RS = \frac{ES}{ES + IS}$

Therefore, $\frac{dRS}{dEXT} = \frac{d}{dEXT}\left[\frac{ES}{ES + IS}\right]$

$$= \frac{(ES + IS)\frac{dES}{dEXT} - ES\frac{d}{dEXT}(ES + IS)}{(ES + IS)^2} \qquad (1)$$

Note that, since the denominator must always be non-negative, relative search will decrease as the external information cost increases if and only if the numerator in (1) is negative. Simplifying this expression:

$$(ES + IS)\frac{dES}{dEXT} - ES\frac{d}{dEXT}(ES + IS)$$

$$= ES\frac{dES}{dEXT} + IS\frac{dES}{dEXT} - ES\frac{dES}{dEXT} - ES\frac{dIS}{dEXT}$$

$$= IS\frac{dES}{dEXT} - ES\frac{dIS}{dEXT} \qquad (2)$$

However, $IS \geq 0$ and $\frac{dES}{dEXT} \leq 0$ by $H_{1(a)}$. Therefore, the first term in (2) must be non-positive. Similarly, $ES \geq 0$ and $\frac{dIS}{dEXT} \geq 0$ by $H_{1(b)}$, and the term $(-ES\ \frac{dIS}{dEXT})$ must therefore also be non-positive. Thus the overall expression (2)must be non-positive, and is likely to be negative.

Hence, the numerator in (1) is zero or negative, and RS must therefore remain constant or decline with an increase in the external information cost.

APPENDIX B

Description of the Software Employed for Data Collection

The microcomputer used for information presentation and data collection in this study was an Apple Macintosh SE, equipped with a 20 MB hard disk. All subjects used the same machine (in order to minimize subtle machine specific differences such as hard disk access times).

All of the programs used to provide information to and collect information from subjects were written using Apple's HyperTalk language. HyperTalk was used for four main reasons. First, since HyperTalk is bundled with the Macintosh, it is readily available for use. Second, fairly extensive documentation and expert resources are now available. Third, HyperTalk is a high level, powerful programming language. Rather than dealing with detailed machine language commands, the HyperTalk programmer works with a set of object resources. For example, one major class of HyperTalk objects are know as "buttons". It is very easy to change the shape, size, shading, and name of an individual button, and changing its "script" (the set of commands that tell the button what to do when someone points the mouse cursor at the button and then clicks) is also quite easy.

Finally, HyperTalk is an extremely flexible language. An individual can quickly develop a very complex, highly customized software package for his or her immediate use. For the present study, a programming langauge was needed that could be used to present text screens (instructions), produce an on-screen information display board (the external information environment), and create question screens (including response scales).

Johnson, Payne, Schkade, and Bettman (1986) developed their Mouselab system to meet many of these same objectives, and it has been used by them successfully in a number of different studies (eg. Bettman, Payne and Johnson 1987, Johnson, Payne, and Bettman 1988, Payne, Bettman and Johnson 1988). However, Mouselab was designed for use on IBM and IBM compatible microcomputers, and is not available for the Macintosh.

The Familiarity Task

Once they agreed to participate in the study, subjects were asked to begin reading the instructions presented on the computer screen. Subjects were also shown how to use the mouse to move the cursor about the screen and to advance to the next screen.

The first eight screens provided subjects with basic information about the study, and familiarized them with both the mouse and HyperCard buttons. Subjects had to use both the mouse and the on-screen buttons to advance from one introductory screen to the next.

Subjects were then asked to respond to a set of six product class knowledge questions. For each of these questions, subjects were asked to provide a self-assessment of their knowledge for the indicated product category, relative to the population as a whole. Appropriate definition of this reference population was left to the subject. These assessments were made on a five point scale, consisting of the following alternative responses: well below average, below average, average, above average, and well above average. In every case, a subject was required to choose one of these five responses before he or she could advance further.

Prior to answering any of these product class knowledge questions, subjects were given instructions about how to go about making responses.

The introductory program (which was used to present all of the familiarity task screens to all subjects) was written so that it randomly presented the response scale for each question in one of several different forms, in order to eliminate or reduce response biases. All response scales ran vertically from just below the product class name at the top of the screen to just above the bottom of the screen, and were diagonally offset so that the alternative responses were not directly on top of one another. (See Figures B-1(a) and B-1(b) for two examples of these screens.) However, the responses could either run from "well above average" at the top to "well below average" at the bottom (e.g. Figure B-1(a)), or in the reverse order (e.g. Figure B-1(b)). Which of these two orders would be used for each product category was determined randomly. Furthermore, an on-screen arrow pointing in the direction of the "well above average" response was employed so that subjects could quickly recognize the direction in which the current response scale ran. Finally, the response scales were alternately shifted slightly to the left and to the right so that when a subject advanced from one of these screens to the next, even if the response scale direction did not change, the subject would perceive the introduction of the next question.

Once the knowledge self-assessment questions were completed, subjects were introduced to a practice task requiring them to choose one apartment from three alternatives. This task was described in detail. Subjects were informed that they would be allowed to search an on-screen matrix consisting of information for the three alternatives. Each apartment was described on three dimensions: monthly rent, an overall safety measure, and convenience (the walking distance from the apartment to the nearest transit line, in minutes). Subjects were also asked to provide concurrent

FIGURE B-1(a)

Knowledge Self-Report Screen, Version 1

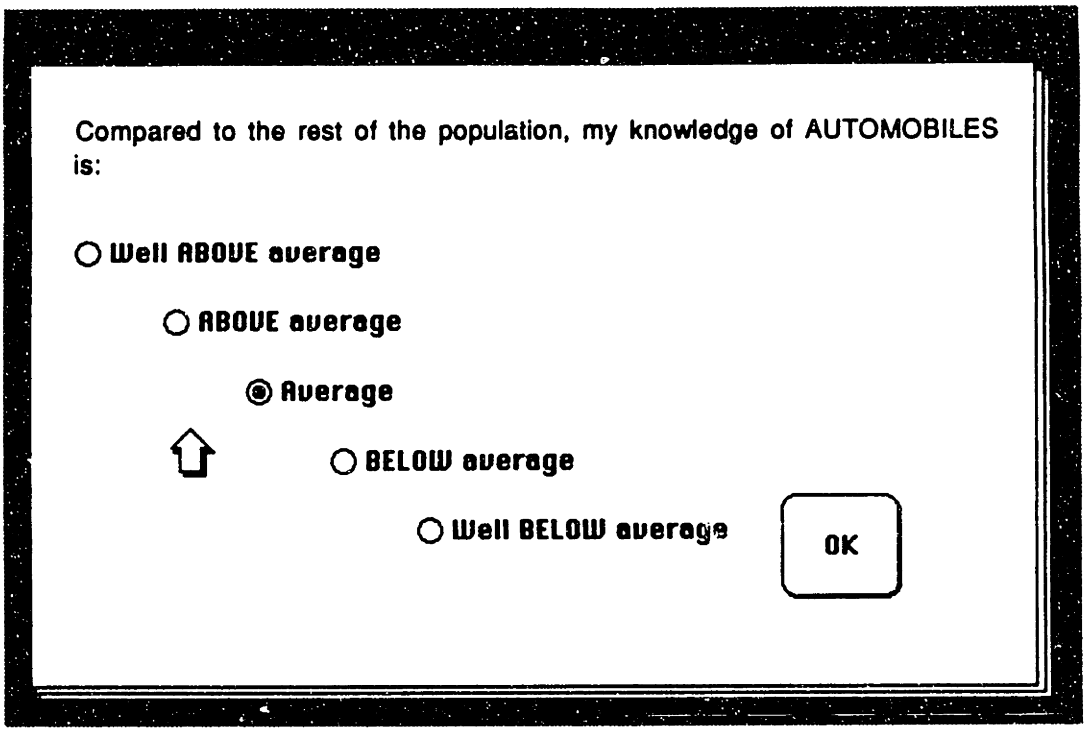
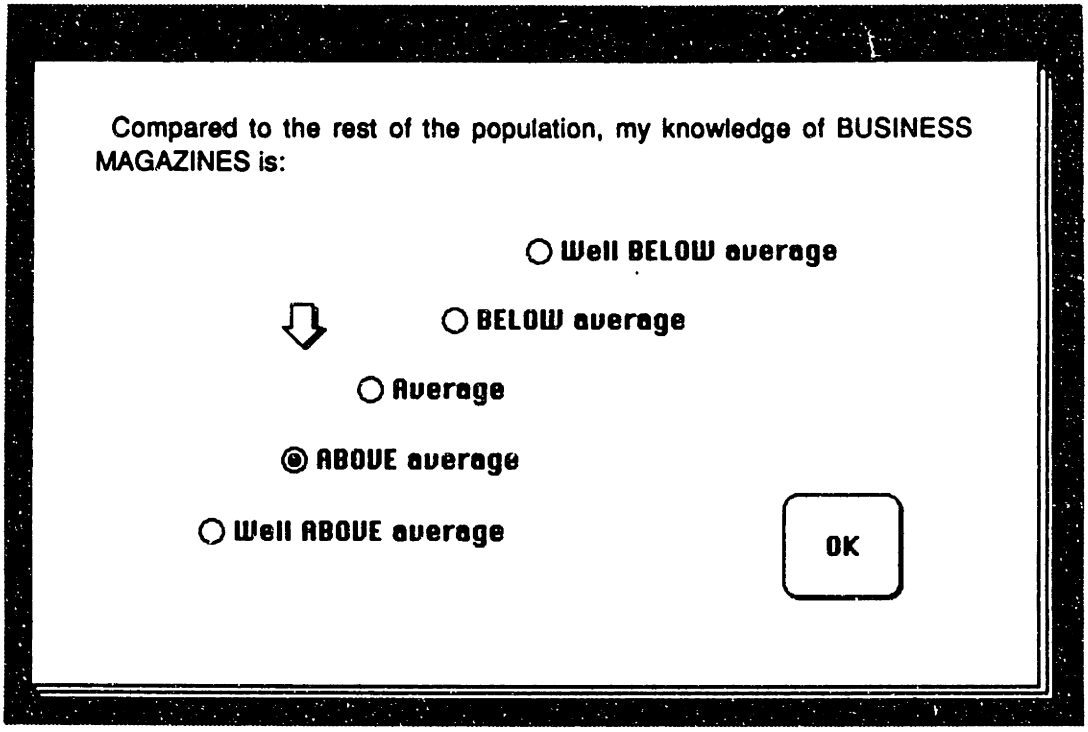


Figure B-1(b)

Knoweldge Self-Report Screen, Version 2



verbal protocols as they searched the information matrix and as they made their final choices.

Once the tape recorder was turned on and a password was typed on the screen by the investigator (in order to prevent subjects from accessing information in the matrix before the taping began), subjects were presented with the on-screen information matrix (see Figure B-2). A specific piece of attribute information for a single alternative could be obtained by pointing at and clicking on the appropriate box (actually a HyperCard button) in the matrix. That piece of information would then appear on the screen and remain there until the subject indicated that he or she was ready to go on. Figure B-3 provides an example of the first item available in the matrix. Note that the subject had to point and click the mouse at the "Return to Menu" button before he or she could continue. A maximum of one piece of information could be viewed at any one time, and this information was hidden once a subject returned to the information matrix.

The number of items accessed, the order in which they were accessed, and the time spent on each piece of information were left strictly to the discretion of the subjects. When subjects had completed their search of the available information to their satisfaction and were ready to make their final choices, they indicated this by pointing and clicking at the "Make Final Choice" button. They were then presented with a list of the three alternatives (see Figure B-4). Once they selected one of the apartments, the tape recorder was turned off. A brief delay was then experienced while the computer recorded the business and women's magazine knowledge self assessments, the total time taken to complete the entire familiarization session, and a detailed account of the information acquisition pattern for the apartment matrix.

FIGURE B-2

External Information Matrix, Warm-up Task

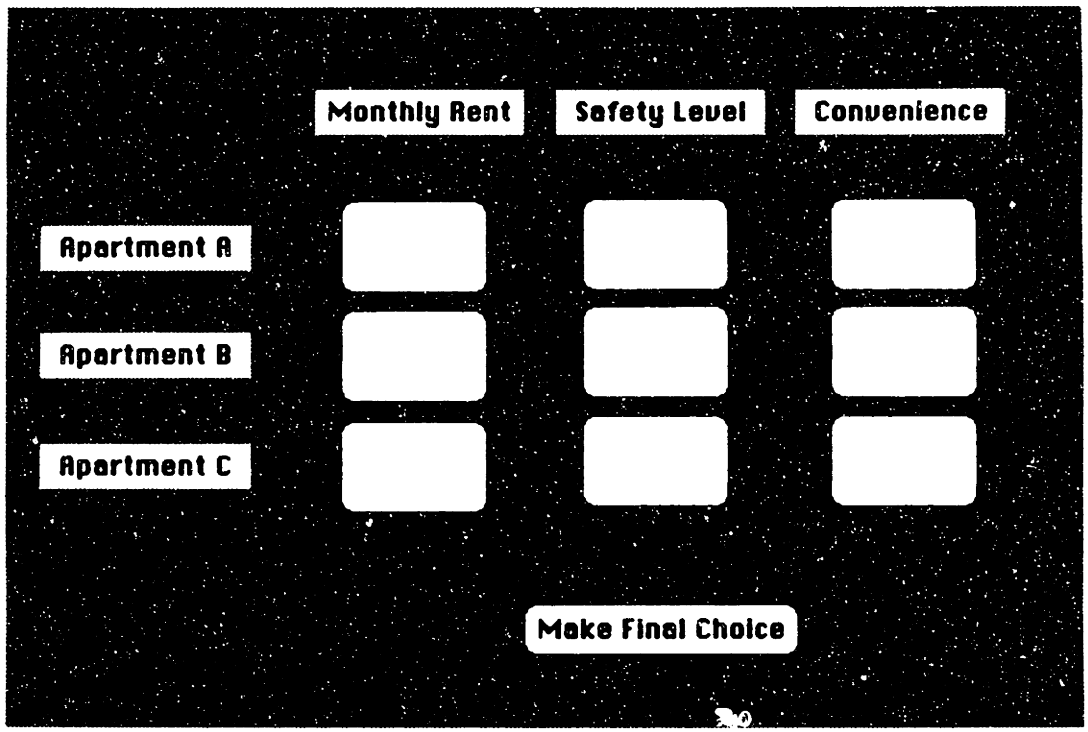


FIGURE B-3

Sample Information Item, Warm-up Task

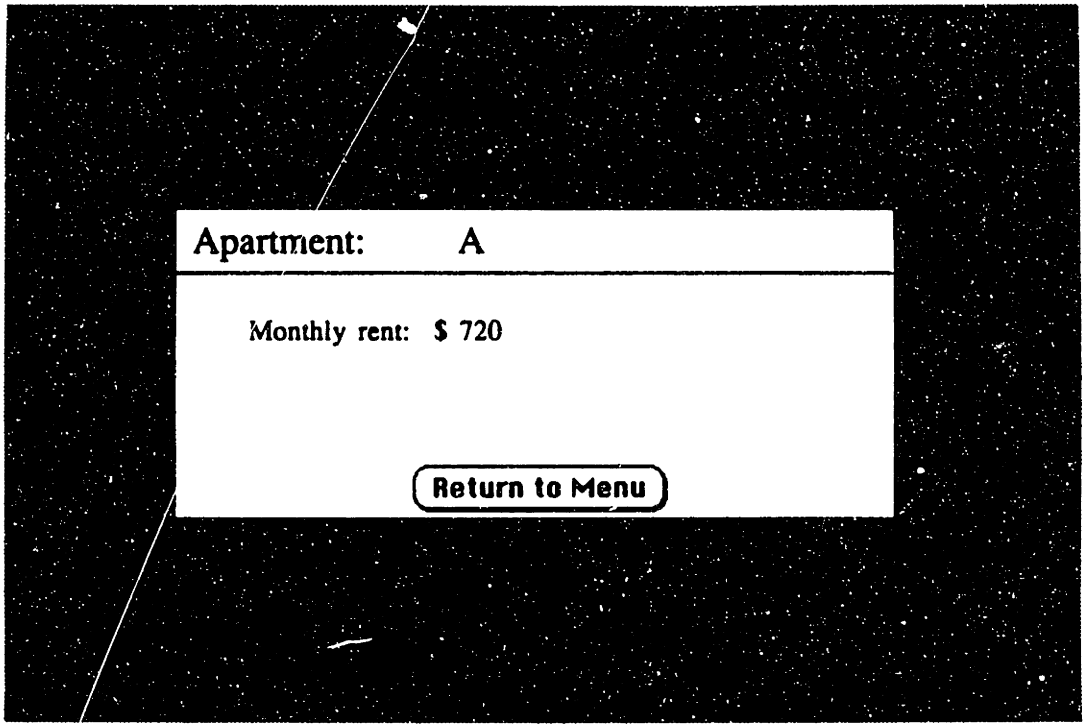
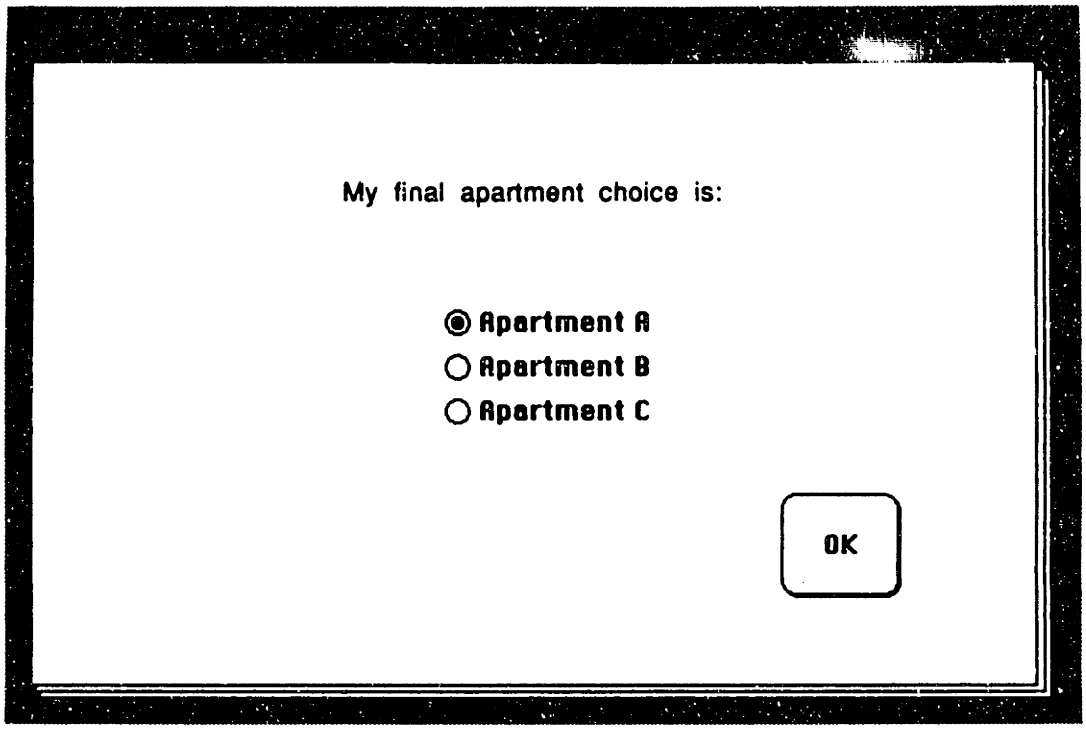


FIGURE B-4

Final Choice Screen, Warm-up Task



Once this information was recorded, the computer indicated the subject's self-reported level of business magazine knowledge on the screen. This was used by the experimenter to assign the subject to one of the six experimental conditions. When this assignment was completed, the business magazine session began.

The Business Magazine Session

Subjects were first asked to read a series of introductory screens explaining the choice task and the external information environment. These screens varied somewhat depending upon whether subjects faced a low or high cost of external information, and whether they were provided with a processing incentive, faced external information search time pressure, or had no additional processing conditions placed upon them (the control group).

In the first of these introductory screens, all subjects were told that they would soon be given an opportunity to examine information for seven business magazine alternatives, and that the extent to which this information was searched was up to them. They were also informed that after they had finished looking at this information they would be asked to indicate which business magazine they would most prefer to purchase. It was pointed out at this time that they were free to choose business magazines <u>not</u> included in the information matrix.

The next two screens instructed subjects that they would have as much or as little time to examine the external information matrix as they wished, and indicated that individual pieces of information could be examined simply by pointing and clicking the mouse at the appropriate button in the matrix.

The fourth and fifth screens then described the attributes employed in the external information matrix, noting that all of the information had been taken from recent issues of real business magazines. Subjects were informed that "a total of seven different alternatives (running from top to bottom) are described on seven separate attributes (running from left to right) in the information matrix." Each alternative was denoted by a single letter from the sequence A-G, so that subjects could not identify alternatives in the matrix without conducting some degree of external search. Each alternative was described on the seven attributes: name, frequency, pages, annual, price, articles, and cover. The external information matrix employed is shown in Figure B-5.

The "Name" attribute simply indicated the title of the business magazine. "Frequency" noted the number of issues of the magazine published within a single calendar year. "Pages" indicated the total number of pages (including advertising) contained in a recent issue of the magazine. "Annual" noted the annual subscription price for the magazine, while "Price" noted the single issue newsstand price of the magazine (both of these in U.S. dollars). "Articles" provided the subject with five or six representative magazine article titles taken from the table of contents from a recent issue of the magazine. Finally, "Cover" provided subjects with a visual representation of the cover of a recent issue of the magazine. Examples of each of these types of information are provided in Figures B-6(a) through B-6(g).

The seven alternatives included in the information matrix were (in the order they appear in the matrix): Sylvia Porter's Personal Finance, Financial World, Success, Money, Forbes, The Economist, and Barron's.

FIGURE B-5

External Information Matrix, Low External Cost Conditions

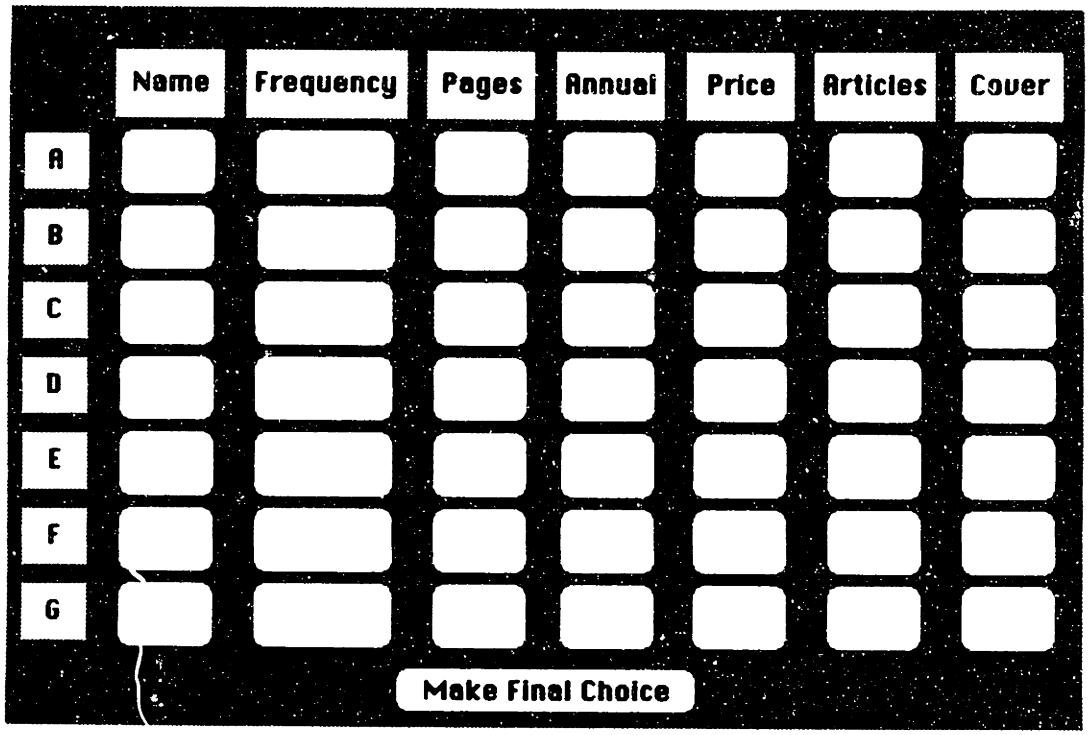


FIGURE B-6(a)

Sample Name Attribute Information

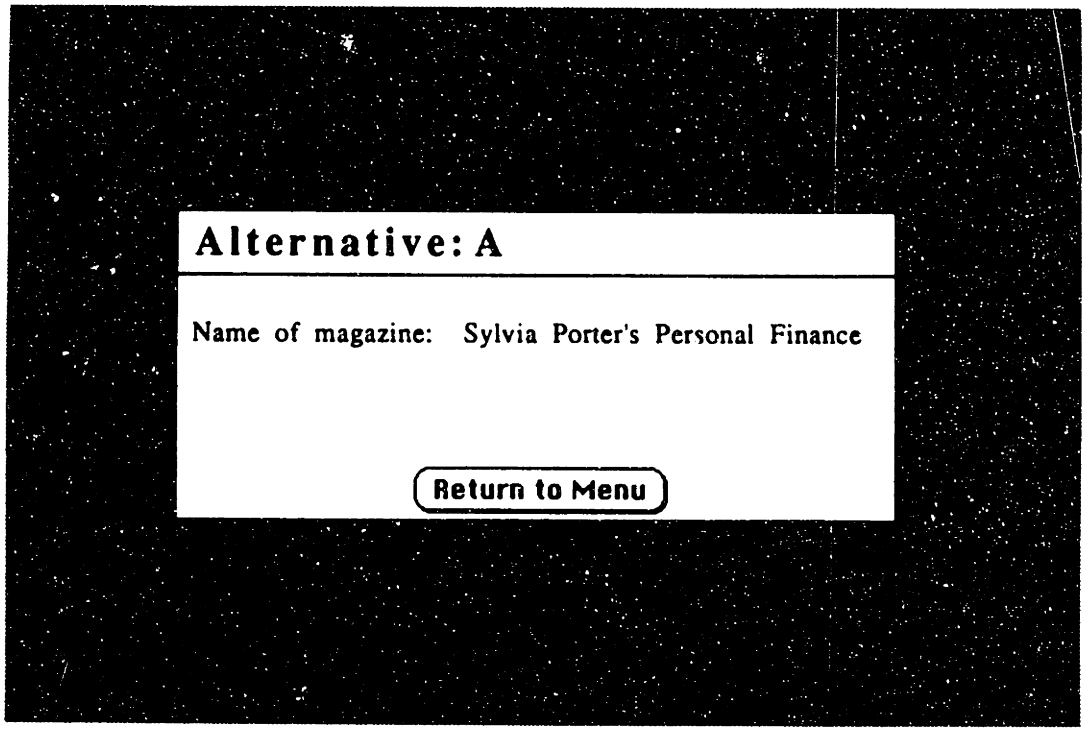


FIGURE B-6(b)

Sample Publication Frequency Attribute Information

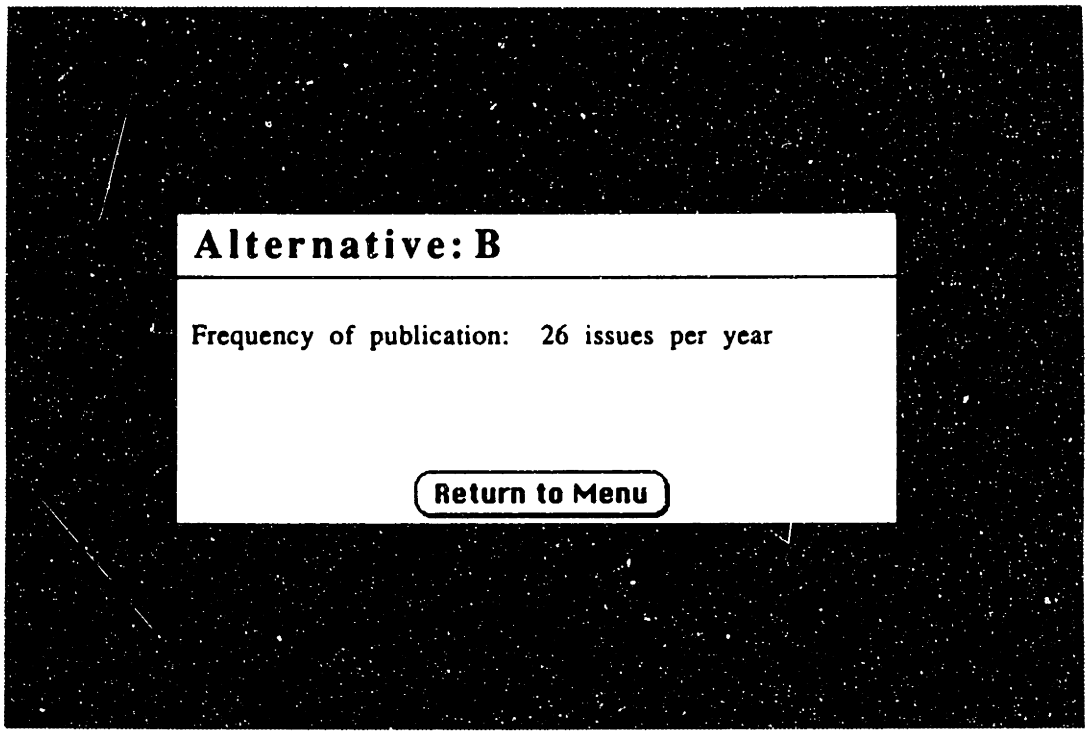


FIGURE B-6(c)

Sample Number of Pages Attribute Information

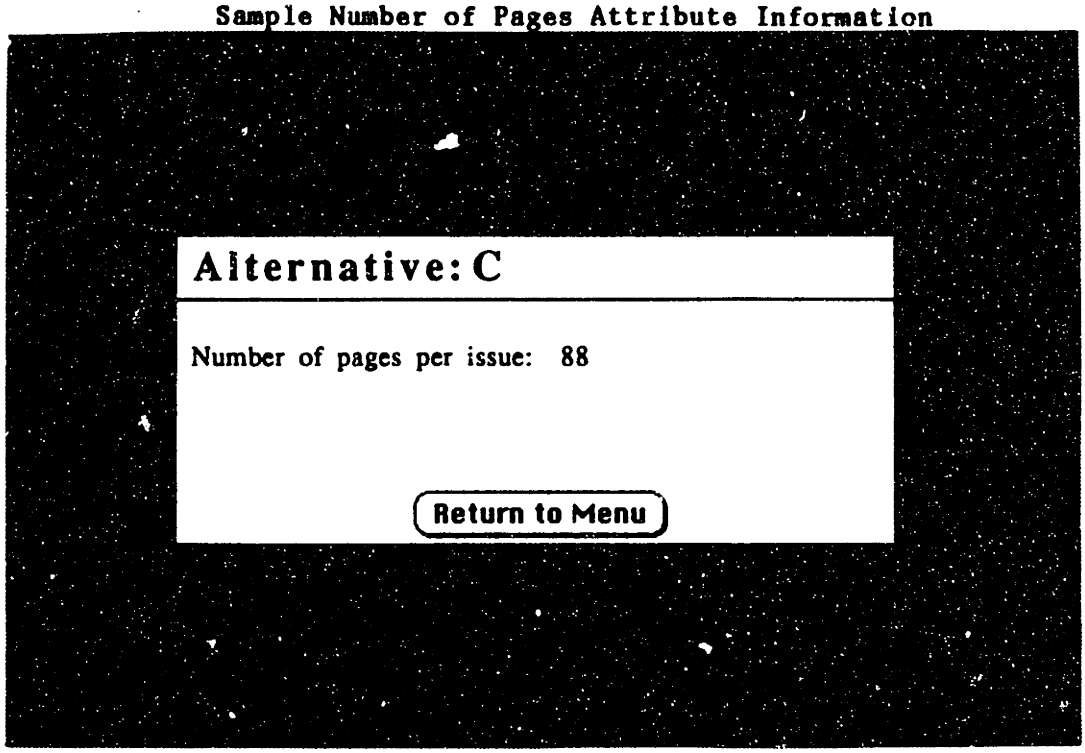


FIGURE B-6(d)

Sample Annual Subscription Attribute Information

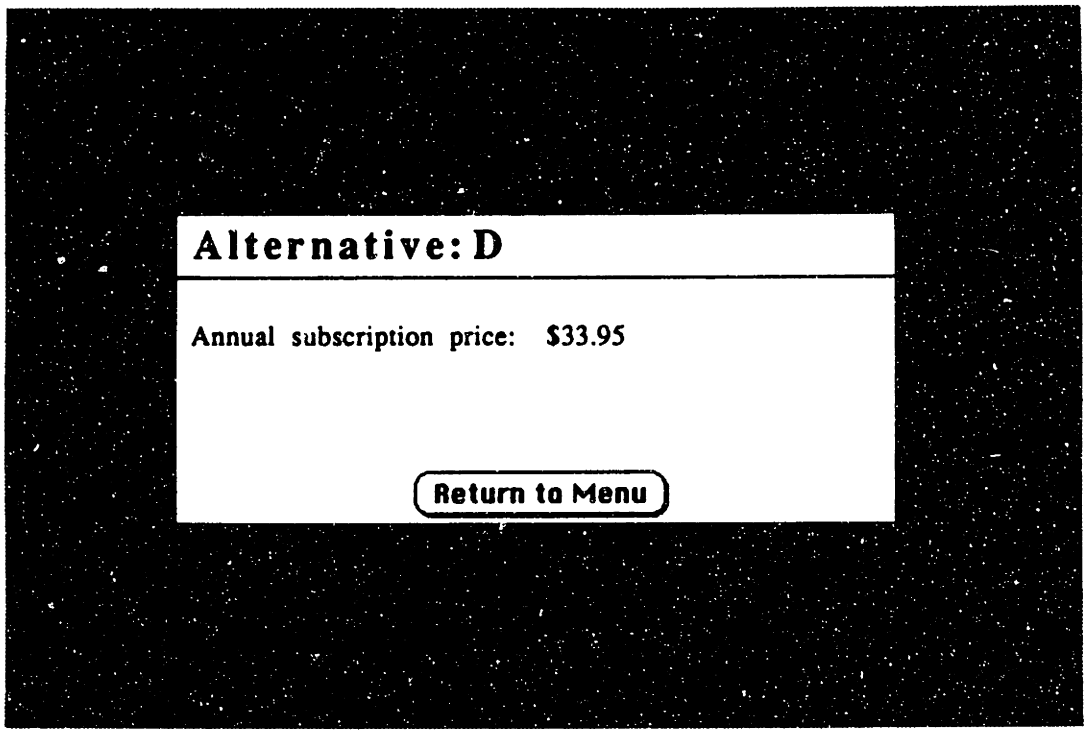


FIGURE B-6(e)

Sample Newsstand Price Attribute Information

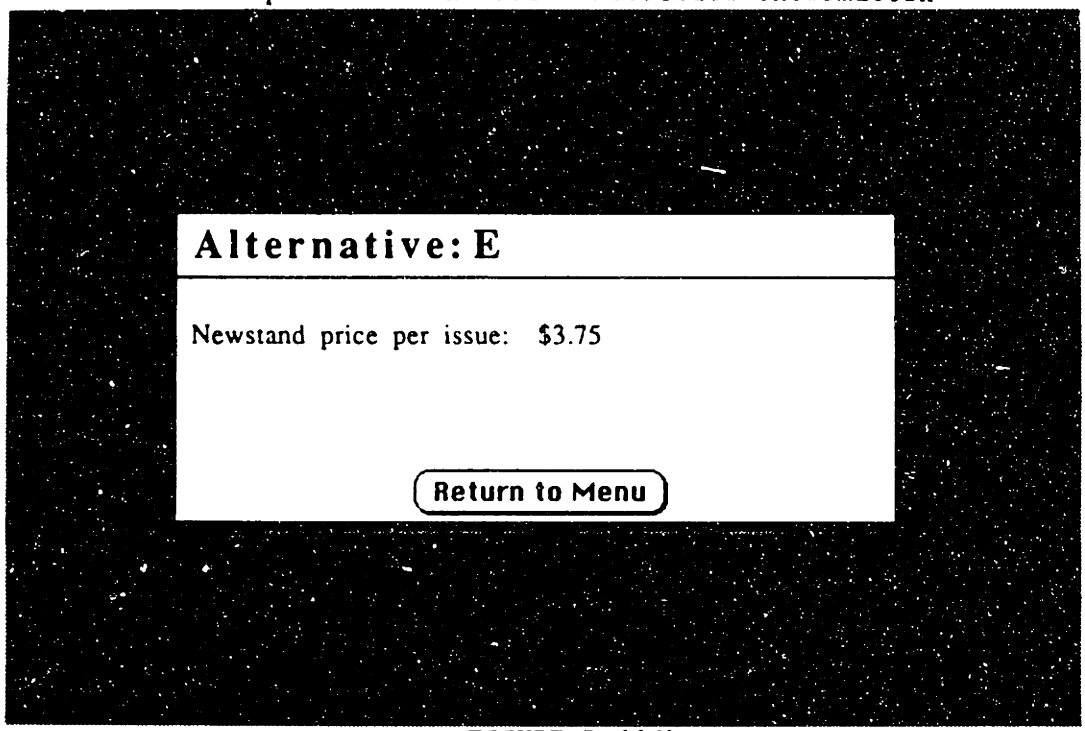


FIGURE B-6(f)

Sample Article Titles Attribute Information

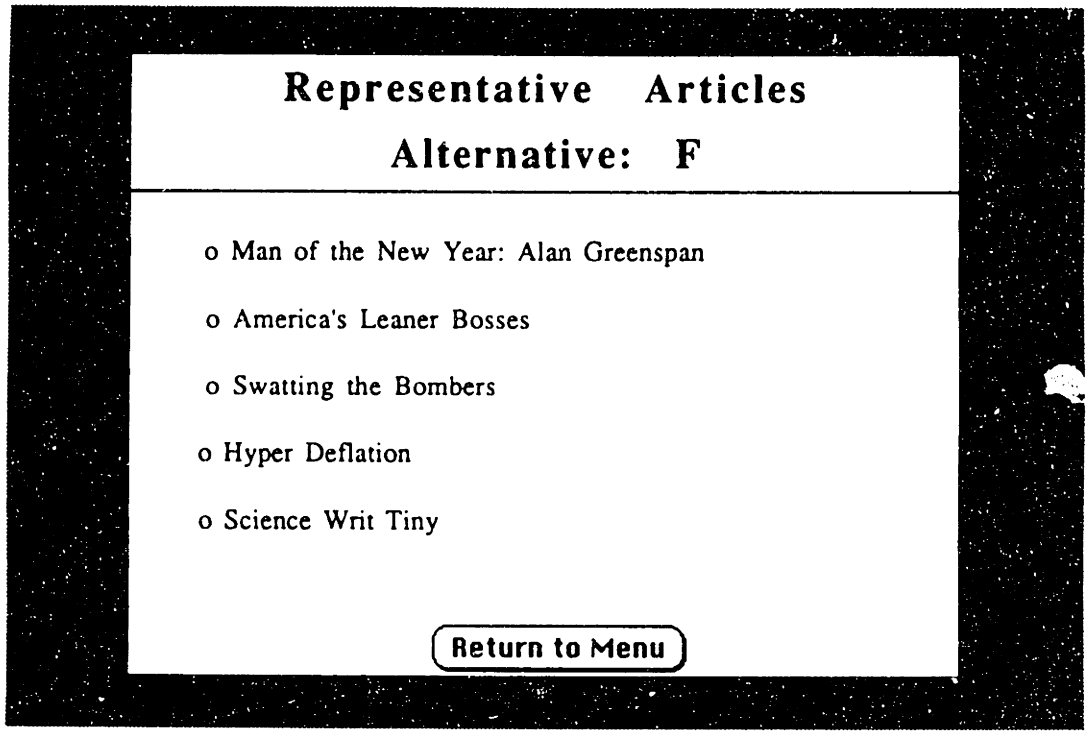
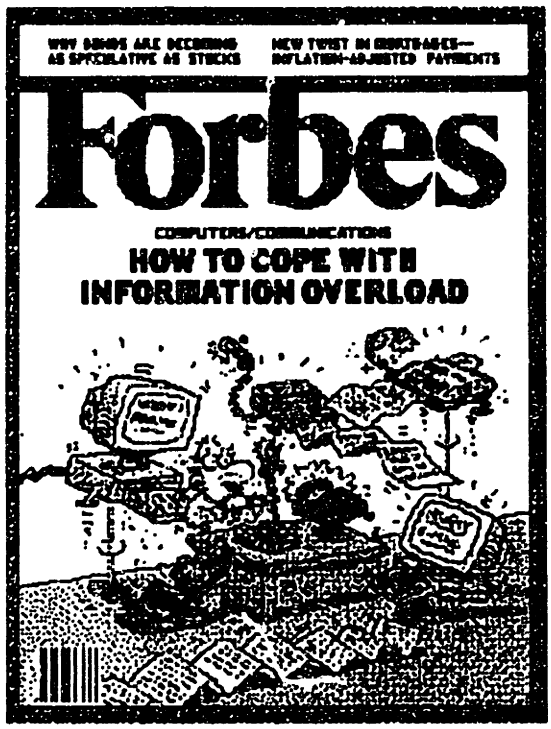


FIGURE B-6(g)

Sample Cover Attribute Information



Return to Menu

Once they had finished reading the attribute descriptions, subjects read a screen asking them to speak their thoughts out loud as they considered the available information in arriving at their final choices. When they were ready to proceed, they informed the researcher (who remained in the room with subjects during all verbal protocol phases of the study) of this fact. A password was then entered and the tape recorder turned on. Subjects were informed that they could begin the choice process at any time by pointing and clicking at a button at the bottom of the screen. Following a brief delay, the information matrix (Figure B-5) appeared on the screen and subjects were free to examine as much or as little of the available information as desired.

When subjects were satisfied with the amount of external information that they had processed, they indicated their readiness to make their final selection by pointing and clicking on the "make final choice" button at the bottom of the information matrix. A screen with a list of choice alternatives (listed alphabetically) would then appear (see Figure B-7). This list included all seven of the alternatives in the information matrix (and identified these both by name and by letter), as well as three additional alternatives: Business Week, Fortune, and Inc.

Once the first choice was selected, subjects were asked to answer six simple questions completely unrelated to the business magazine choice task. Three of these questions asked subjects to indicate which of three options they most preferred. (For example, one of these questions asked subjects to indicate whether they most preferred Ford, GM, or Chrysler.) The other three questions asked subjects to type a 5 to 7 character word that appeared at the top of the screen.

FIGURE B-7

Final Choice Screen, Business Magazines

Enter your first choice business magazine in the box below. You may choose ANY one of the business magazine listed.

After the six questions were answered, subjects were again unexpectedly presented with the list of business magazines (Figure B-7). They were informed that their first choices were unavailable due to distribution problems, and they were asked to indicate a second choice. Subjects could only then advance to subsequent screens once they had made a second choice different from the first.

Following the unexpected second choice task, subjects were presented with a series of screens asking them to indicate their overall evaluations for various business magazines. They were informed that they would see two screens in succession for each alternative. The first of these screens (see Figure B-8(a) for an example) simply presented the name of a business magazine, along with two buttons labelled "Good" and "Bad". Subjects were forced to choose one of these two alternative evaluations for the named magazine. The time that elapsed from the moment that the name was presented until one of the two buttons was selected was recorded (to the nearest 60th of a second) for every subject on each magazine.

The second screen seen for each alternative was included to obtain a more detailed measure of subjects' evaluations (see Figure B-8(b)). The name of the magazine was again shown on the screen, and subjects were asked to indicate their overall evaluation for the alternative on a seven-point scale. If they were not familiar with an alternative, subjects were asked to select the "unfamiliar" response rather than provide an evaluation. Subjects' response times were <u>not</u> measured for this second evaluation.

When subjects pointed and clicked on the "OK" button in the center of this screen, they then advanced to the next "Good"/"Bad" evaluation (and the next magazine). The "OK" button on the detailed evaluation screen was located such that the mouse was centered between the "Good" and "Bad"

FIGURE B-8(a)

Summary Evaluation Screen

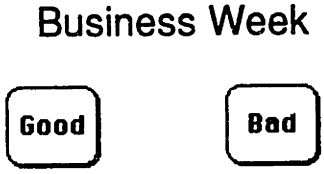
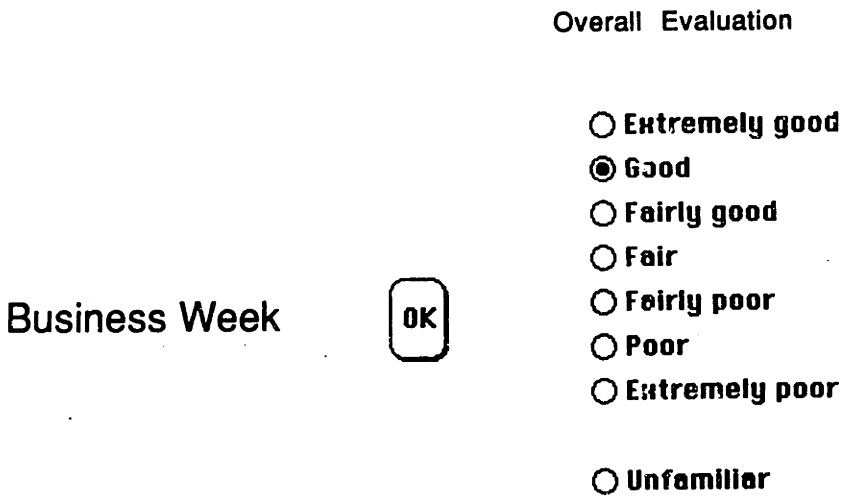


FIGURE B-8(b)

Detailed Evaluation Screen



evaluations on the next screen in order to minimize response and response time biases.

This pattern of alternating back and forth between the two evaluative screens was continued through the entire set of business magazine alternatives offered earlier in the choice list. Following this sequence of evaluation questions, subjects were asked a set of six additional questions for each of the ten alternatives in the choice list (see Figure B-9). These questions focused on (i) the degree to which subjects actively considered each alternative in making their final choices, and (ii) subjects' prior experience and familiarity with each magazine.

Finally, a final sequence of seven manipulation check questions was presented to all subjects. These questions were included in order to assess whether or not subjects perceived the effects of the experimental manipulations as intended. (See Figures B-10(a) through B-10(g).) Once these questions had been answered, subjects were informed that there would be a brief delay while the computer prepared the women's magazine session.

Women's Magazines

Many of the screens seen by subjects during the business magazine session were repeated in the women's magazine session. Since the experimental conditions did not vary from one session to the next, the introduction screens for both sessions were virtually identical. All of the instructions remained the same, and the seven matrix alternatives (again identified by the letters A through G) were described on the same seven attributes. Indeed, the information matrix seen in the women's magazine session was identical to that shown in Figure B-5 although the

FIGURE B-9

Consideration, Subscription, and Familiarity

Information Screen

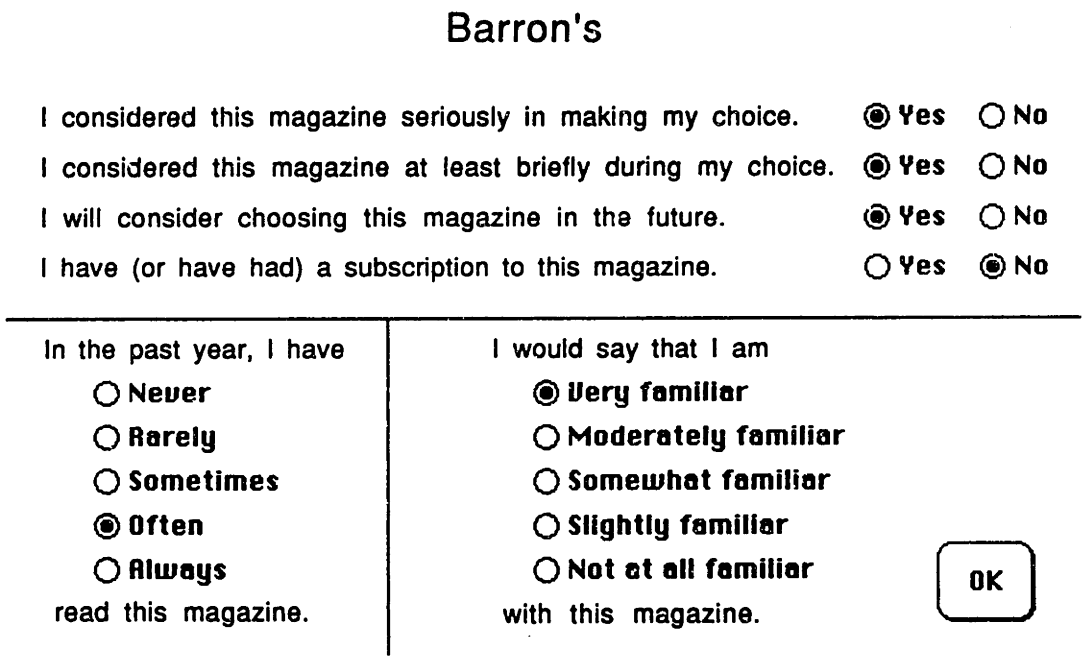


FIGURE B-10(a)

Overall Effort Manipulation Check

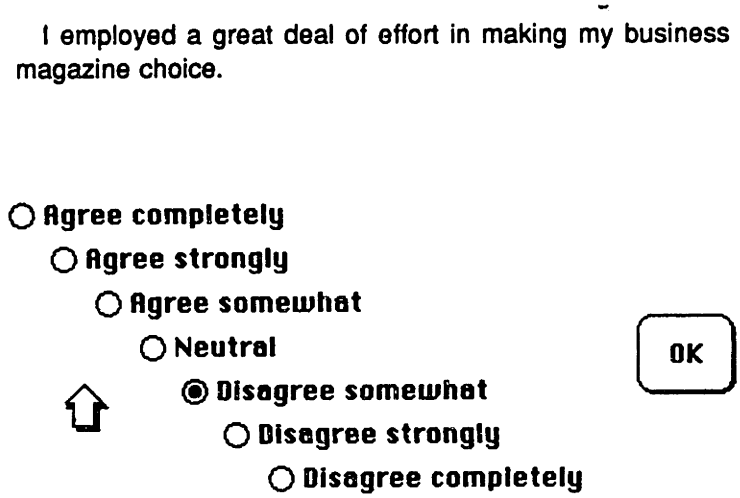


FIGURE B-10(b)

Cost of External Information Manipulation Check, Question 1

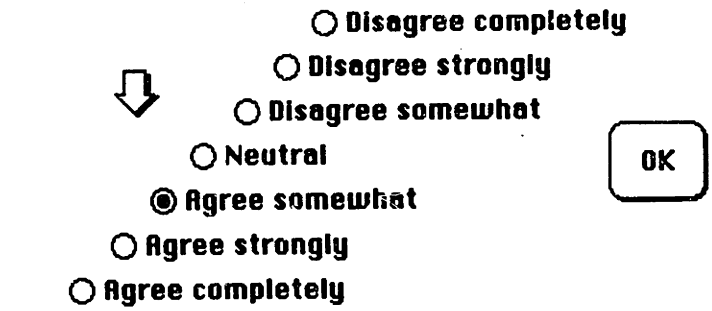


FIGURE B-10(c)

Willingness to Expend Cognitive Effort

Manipulation Check, Question 1

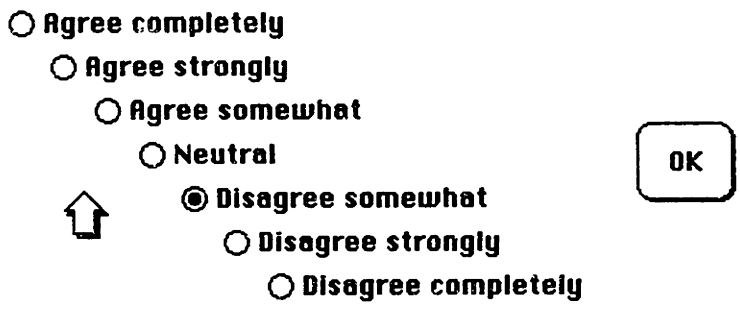


FIGURE B-10(d)

Time Pressure Manipulation Check, Question 1

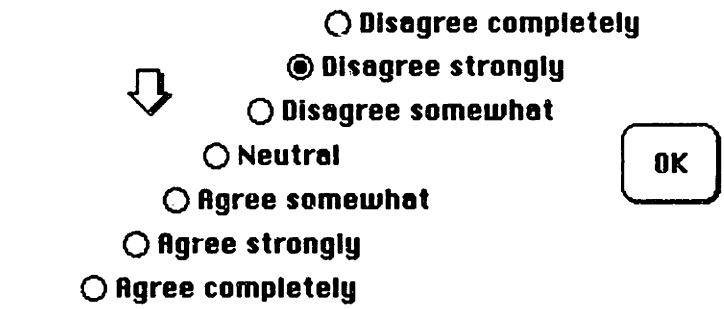


FIGURE B-10(e)

Willingness to Expend Cognitive Effort

Manipulation Check, Question 2

I really wanted to make the very best choice that I could.

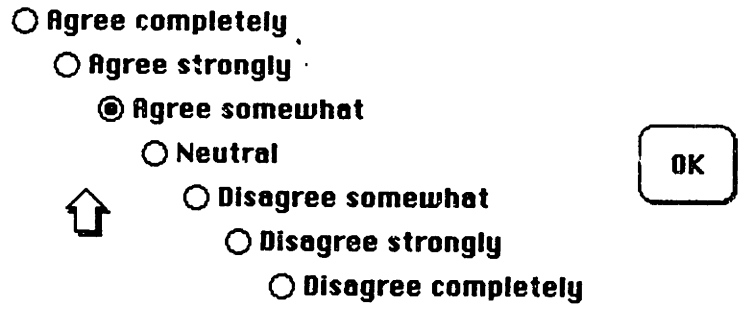


FIGURE B-10(f)

Cost of External Information Manipulation

Check, Question 2

In making my choice, I found it difficult to use the information available in the menu.

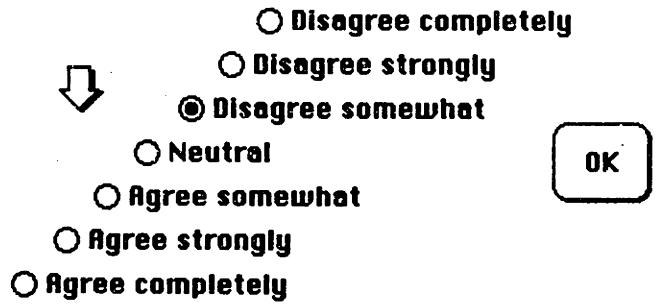
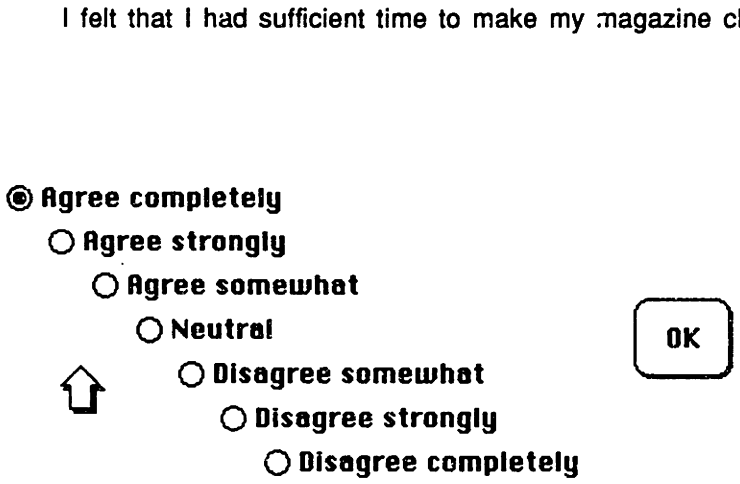


FIGURE B-10(g)

Time Pressure Manipulation Check,

Question 2



individual pieces of information were different since they now related to women's magazines.

The seven alternatives included in the matrix were (in order): Woman's World, Working Woman, Family Circle, McCall's, Vogue, Elle, and Lear's. As before, these magazines were selected on the basis of their variety in focus and on the likely variability of subject familiarity. (For example, Family Circle and Vogue are quite well known to most subjects, while Lear's and Working Woman are much less familiar.)

Subjects were again allowed to examine as much or as little information for these alternatives as they wished, and when they were done they were presented with the choice list shown in Figure B-11. In this case, the three new alternatives were Cosmopolitan, Good Housekeeping, and Ms. All three of these alternatives were familiar to a large proportion of the subjects, and they therefore were likely to stimulate some degree of internal information search.

Following their first choices, subjects again completed a set of unrelated questions. They were then again asked to indicate their second choice magazine. An alternating sequence of "Good"/"Bad" and more detailed evaluation screens were then presented to subjects. Consideration and experience measures were then taken for each alternative in the choice list. Following this, the set of manipulation check questions were repeated for this second product category. Finally, subjects were informed that the computer based sessions were complete.

FIGURE B-11

Final Choice Screen, Women's Magazines

Enter your first choice women's magazine in the box below. You may choose ANY one of the women's magazines listed.

- ○ Cosmopolitan
- ○ Elle (Magazine F)
- ○ Family Circle (Magazine C)
- ○ Good Housekeeping
- ○ Lear's (Magazine G)
- ○ McCall's (Magazine D)
- ○ Ms.
- ◉ Vogue (Magazine E)
- ○ Woman's World (Magazine A)
- ○ Working Woman (Magazine B)

OK

Cost of External Information

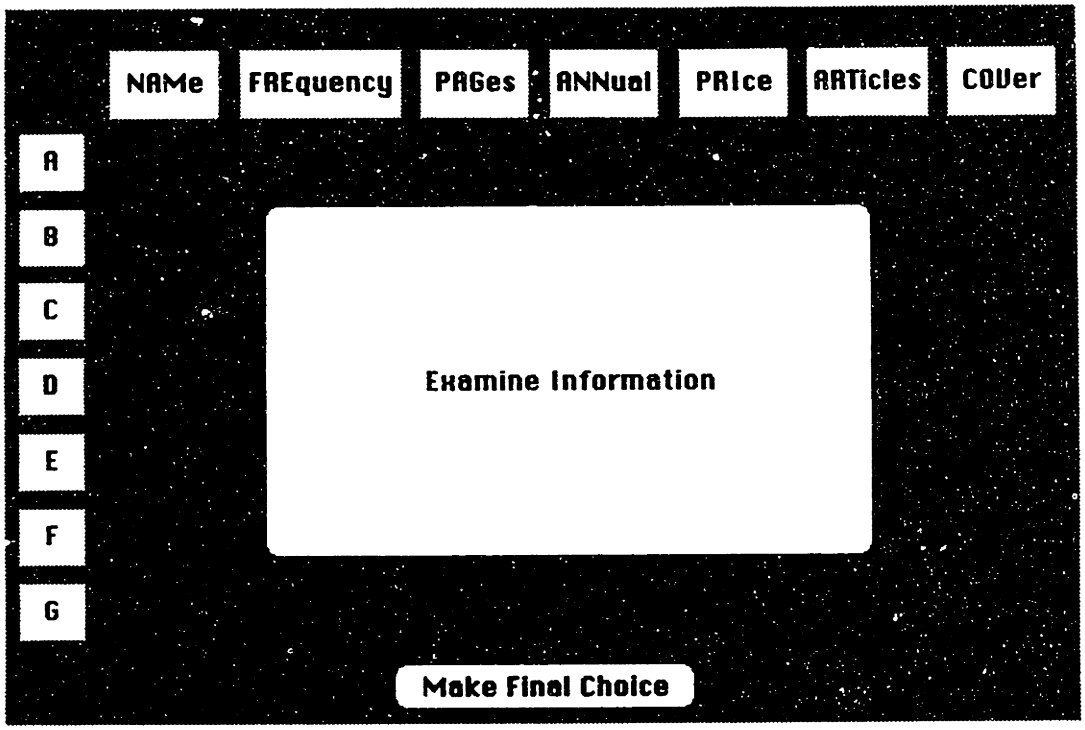
The cost of external information was manipulated by increasing the cognitive effort required to access external information. In the low external cost condition, subjects could simply access external information by pointing and clicking at the appropriate box in the information matrix. Essentially, then, once a subject in the low cost condition decided to access a piece of external information, it could be acquired immediately, thus employing few cognitive resources in the act of information acquisition.

For high external information cost subjects this was not the case. In order to access a piece of external information, these subjects had to first point and click on an "Examine Information" button in the matrix (see Figure B-12 for a screen representation of the matrix in the high external cost condition). This would then bring up a box which asked them to type in the first three letters of the attribute to be examined, a space, and then the single letter for the alternative to be examined. Following completion of this typing task, subjects could examine the requested piece of information as soon as they clicked the mouse on the "OK" button in the box. Subjects could also cancel the information request at any time prior to clicking on the "OK" button. Subjects were instructed on how to access the matrix information in the screens preceding the choice task. They were also presented with a set of three acquisition tasks that ensured they understood how to access external information before beginning the magazine choice task.

FIGURE B-12

External Information Matrix,

High External Cost Conditions



Time Pressure

Subjects in the high time pressure condition were first informed of this fact in the introductory screens preceding the start of the choice task. They were told that they would have a total of 90 seconds to search the information environment, and that they would hear computer-generated beeps at 30, 60, and 80 seconds so that they might keep track of the time elapsed and remaining. These high time pressure subjects were also informed that the external search phase would begin at their direction any time after the tape recorder (for the concurrent protocols) had been turned on.

The computer program employed in the other conditions was rewritten to deal with the external information search time constraint. The program kept continuous track of the time elapsed since the first appearance of the external information matrix. As noted above, audible beeps were generated after 30, 60 and 80 seconds. When the full 90 seconds had elapsed, the program removed whatever had been on the screen at that moment and replaced it with the final choice alternative list (Figure B-7). Once this occurred, there was no way for subjects to return to the external information environment.