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CONSUMER BEHAVIOR UNDER IMPERFECT INFORMATION: A REVIEW OF
PSYCHOLOGICAL AND MARKETING RESEARCH AS IT RELATES TO ECONOMIC THEORY*

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1. INTRODUCTION

In recent years theoretical economists have begun to examine the effects of imperfect information on the existence, uniqueness, and efficiency of market equilibria, both in labor markets [40, Mortensen, 1976; 69, Wilde, 1977] and in consumer product markets [7, Butters, 1977; 51, Salop and Stiglitz, 1977; 70, Wilde and Schwartz, 1977]. Two significant conclusions can be drawn from this literature: (1) the properties of market equilibria are extremely sensitive to the search strategies used by consumers or workers, and (2) the key to "stabilizing" markets at price or wage distributions which are competitive in an appropriate sense is direct comparison shopping. With direct comparison shopping, consumers, for example, actually compare brands to each other and choose the best from those that they have seen.¹

Economists commonly assume that consumers search by defining a hypothetical reservation (or cutoff) level against which brands or jobs are compared sequentially. Economic theory, however, is not (or, at least, has not been) very useful in identifying which search strategies are appropriate to specific informational settings. Moreover, since consumers and workers who face positive information acquisition costs

are likely to choose a "satisfactory" alternative rather than an "optimal" one [35, March and Simon, 1958], the issue of which search strategies people should use may only be resolvable empirically.

This paper concentrates on consumer product markets as opposed to labor markets. This is primarily because the relevant noneconomic literature is dominated by psychologists and marketing specialists.² Further, consumer information acquisition problems are currently attracting more attention than the information acquisition problems of workers because there has been more legislative and regulatory intervention in consumer product and financial markets than labor markets. For example, Day [10, 1976] lists nineteen information disclosure requirements related to consumer product and financial markets implemented between 1970 and 1976, and another twenty-nine which he called "probable for the future" (serious proposals under consideration). Moreover, his tabulation is illustrative, not comprehensive. Given the profound impact of some of this legislation, it is crucial that we better understand the process of information acquisition and its implications for market structure.

This paper will also concentrate on the process of information acquisition; its primary purpose is to review experimental and empirical evidence related to individual consumer behavior under imperfect information. Thus I won't say much about market structure. Mainstream economics, of course, has always focused on market outcomes as opposed to individual decision rules, the emphasis being on institutions rather than people.³ But the literature has now reached a

point where some detailed attention must be paid to the latter.

Most of the nontheoretical work reviewed in this paper deals with survey data or experiments. Both of these sources have well-known shortcomings which I will not discuss in detail.⁴ My intent is to introduce economists, psychologists and consumer researchers to literatures which may be new to many. The paper is organized as follows. In the next section an overview of the consumer's information acquisition problem is presented. In Section 3 formal models of information acquisition, primarily as developed by economists, are then reviewed. In Section 4 evidence relevant to these formal models is presented. Sections 5 and 6 are focused on two special topics, "satisfactory search" and "information overload." In a final section directions for future research are suggested.

Two generalizations emerge from the discussion which follows. First, it appears that many consumers do little shopping. For example, the surveys discussed in Section 4 typically find that 40 to 60 percent of the respondents visit only one store prior to purchasing a good, regardless of whether it is durable or nondurable. What this implies is not clear. Certainly it is not altogether surprising, given the large number of purchase decisions the average consumer must make each day, but whether observed levels of search are socially optimal is an unresolved issue.⁵ Second, even though most consumers do relatively little shopping, they are sensitive to the costs and benefits of search. Hence, while the specific models of consumer behavior under imperfect information proposed by economists may not always be

appropriate, the underlying methodology seems extremely useful.

2. AN OVERVIEW OF THE CONSUMER'S INFORMATION ACQUISITION PROBLEM

In its most general formulation the consumer's problem is quite complex. It includes deciding when to search and where, how to collect information, how to process it, how to compare different alternatives, and when to stop searching. Several methods for dealing with these problems are available to consumers. Following Hirschleifer [25, 1973], it is useful to distinguish two general classes. The first involves an active adaptation to uncertainty in which the consumer either produces information by direct search or buys information from market sources (consumer magazines, employment services, want-ads, etc). The second class involves a more passive adaptation to uncertainty in which the consumer monitors and evaluates information exogenously disseminated by firms or other consumers. These distinctions emphasize that information acquisition is a more general process than information search, a point made by Bettman [3, 1977]. Bettman also draws a distinction between internal search and retrieval (information sought from memory) and external search (information sought from outside sources). He describes the consumer's search process as follows:

It is proposed that information search generally begins with internal search, with memory explored for relevant information. As the consumer examines information in memory, that information

may prove to be sufficient for the purposes at hand, and no further search may be undertaken. However, that information may not be sufficient. Several pieces of information may conflict, information may be lacking, and so forth. [A]lthough the consumers' responses to such conflicts or lack of information will vary, one major type of response to insufficient information or conflicting information is external search.^[6]

During external search, the consumer examines the environment to see if relevant information is available. The consumer in general uses different detailed search patterns and searches for different amounts of information in different choice situations. Information acquired during external search will lead to further internal search to interpret or elaborate that information. Thus, there is a continual cycling between internal and external search processes. Eventually, of course, the consumer will cease searching for information and make a choice. [3, 1977, pp. 2-3].

The passive mode of information acquisition, monitoring and evaluating exogenously disseminated information, forms a backdrop to the active mode described above; there is a continuous learning process that creates a stock of information which is available to the consumer for internal search and retrieval. If the consumer is able to decide solely on the basis of the stock of stored information, then external search is irrelevant. But (as far as I know) no one has studied this aspect of decisionmaking. Hence this survey will concentrate on the

external component of information search.

3. FORMAL MODELS OF EXTERNAL SEARCH BEHAVIOR

The fundamental article in the economics literature on consumer information acquisition is Stigler's "The Economics of Information" [60, 1961]. Stigler's theory of consumer behavior under imperfect information advanced the proposition that an individual would invest in information until the marginal cost of further investment is greater than or equal to the marginal gain (in terms of lower expected purchase price). This premise, unsurprisingly, set the tone for most of the subsequent work by economists since it is a natural extension of conventional full-information consumer theory.

Stigler considered an imperfectly informed consumer faced with positive information acquisition costs and interested in purchasing one unit of a homogeneous good. Since the consumer was assumed only to have some general notion of prices, Stigler also assumed the choice method would be to set a fixed number of stores to visit (*a priori*) and then buy from the store charging the lowest price of those sampled. The optimal number of stores to visit is determined by a simple cost-benefit calculation.

Stigler's theory, based on the fixed sample size rule, has been criticized by economists on two grounds. McCall [36, 1965; 37, 1970] argued that the best search strategy is a sequential rule in which, after visiting any store, a decision is made whether or not to search further, and Rothschild [48, 1973] criticized both Stigler and McCall

for analyzing only one side of the market.⁷ That is, he criticized them for taking wage or price dispersion as given and simply analyzing worker or consumer behavior, thus arguing, once again, for a focus on markets as opposed to individuals.

While Rothschild's comments inspired a number of attempts to "close" the search model by explicitly incorporating firms, the resulting work has ultimately led back to the actual search strategies used by consumers; establishing the existence of persistent price dispersion (in equilibrium) turns out to be extremely sensitive to the way consumer information acquisition is modeled.

It now appears that while the sequential rule is optimal as a strategy when consumers know the true distribution of prices, it might not be optimal under less restrictive assumptions regarding consumer expectations. For example, Gastwirth [17, 1976] has shown if the consumer's estimate of the distribution of prices is inaccurate, a sequential rule could lead to a significant overinvestment in information. Hence the optimal sample size rule may dominate the sequential rule in such a case [48, Rothschild, 1973].⁸

Psychologists have used experiments to study both fixed sample size rules [19, Green, Halbert, and Minas, 1964] and sequential rules [45, Pitz, 1968].⁹ In an especially interesting experiment, Fried and Peterson [15, 1969] directly compared the two. In these experiments subjects faced a panel consisting of two columns, each containing 24 pairs of red and green bulbs with a button between each pair. Pushing the button caused one member of the pair to light. Which bulb lit up

was determined randomly according to some fixed probability. Subjects were not told the true probability but rather that it was one of two values. The subjects' task was to determine which one, based on their observations.

Two variations of this design were used by Fried and Peterson; in the first the proportion of red to green lights was either 70:30 or 30:70 and in the second the proportion was either 60:40 or 40:60. In the first design subjects earned \$.30 for a correct decision and were fined \$1.70 for an incorrect decision. In the second design these values took on \$.50 and \$1.50 respectively. In either case the cost of observing any pair of bulbs was \$0.01. Within each treatment sequential and fixed sample size rules were used on alternative trials. In the former the subjects could observe light bulb pairs one-at-a-time and make a decision whenever they liked. In the latter they had to specify a fixed number of light bulb pairs to observe at the start of the trial and then make a decision based only on the outcome of those observations.

The results of the Fried and Peterson experiment are somewhat surprising. As one might expect, average earnings under the sequential rule were greater than average earnings under the fixed sample size rule. But performance under the fixed sample size rule more closely approximated optimal performance than performance under the sequential rule. In particular, in the first design, a risk neutral subject could expect to earn \$3.60 using the optimal sequential rule as compared to \$1.00 using the optimal fixed sample size rule. Mean actual earnings

were \$2.60 using sequential rules and \$1.06 using fixed sample size rules. In the second design the optimal sequential rule would have yielded expected earnings of \$3.38 and the optimal fixed sample size rule would yield expected earnings of -\$2.60. Mean actual earnings were \$.37 and -\$1.85 respectively.

While the theoretical work of Gastwirth and the experiments of Fried and Peterson suggest that it may sometimes be inappropriate to assume that consumers use pure sequential search rules, both sequential and fixed sample size rules share several important features. These include predictions that the amount of information acquired is inversely related to its cost, and that as prices become more dispersed the expected total cost of purchase decreases [49, Rothschild, 1974].

The more fundamental of these two predictions is that the amount of information acquired is inversely related to its cost. However, this result is often less useful in application than one might expect. Consider, for example, the effect of education on external search. Some authors have predicted a positive relationship between the two since education "represents ability and interest in seeking and evaluating information" [44, Newman and Staelin, 1972, p. 252]; that is, they argue that education is inversely related to direct search costs for two reasons: (1) educated consumers are more efficient shoppers, and (2) educated consumers may enjoy the information acquisition process. These arguments may or may not be true, but, in any event, indirect search costs must also be taken into consideration; one could also argue that an educated consumer will have high opportunity

costs associated with time spent shopping if education increases the value of leisure time. Thus education may reduce external search. The point of these arguments is that the theoretical relationship between education and external search is ambiguous even if the effect of increased search costs is always to decrease external search.

Similar problems arise with respect to the effect of income on external search. Consumers with high incomes can afford more search than consumers with low incomes, but they also have higher opportunity costs associated with time spent shopping. Hence, as in the case of education, a negative theoretical relationship between search costs and external search does little to help predict the relationship between income and external search.

4. EVIDENCE RESPECTING EXTERNAL SEARCH

The principal aspects of external search are direction and intensity. Direction refers to the sources of information used by consumers and intensity refers to the level of investment in search. Since different sources of information have different costs, the distinction between direction and intensity is not always clear. Nevertheless, consumer researchers have traditionally drawn just such a distinction and it has begun recently to be recognized by economists as well [e.g., 52, Satterthwaite, 1977]. Examples of potential sources of information include shopping at stores, conversations with salespersons or friends, advertisements, and consumer magazines. An additional source of information is direct consumption of goods. This form of

information acquisition has been labeled experience by Nelson [41, 1970], who was the first contemporary economist to recognize its importance. Experience can be useful when the variance in unobservable qualitative characteristics is high relative to the variance in observable characteristics such as price. It is also likely to be useful for low cost products. An early classification of goods similar to Nelson's was made by Copeland [9, 1923]. He divided goods into three classes: shopping goods, convenience goods, and specialty goods. Shopping goods correspond to search goods while convenience goods and specialty goods correspond roughly to experience goods.¹⁰

Some work, especially survey research, has considered the direction of external search, Katona and Mueller [31, 1955] providing an early example. The study which most explicitly focuses on direction is Udell [68, 1966]. Udell concentrated his survey of shopping behavior on the types of information consumers seek and the sources of information they utilize in shopping for small appliances, concluding that "the typical consumer does not go from store to store to gather information and to compare products and prices when shopping for small electrical appliances. He or she prefers to do much of this searching and shopping in the comfort of the home by using out-of-store sources of information, especially past experience with products and brands, discussions with friends, and printed media advertising." Furthermore, "[a]lmost two-thirds (65%) of the purchasers believed that they had sufficient information and were ready to buy when they made their first visit to a retail store" [68, 1966, p. 52].

In a more recent study, Claxton, Fry, and Portis [8, 1974] examined the prepurchase search behavior of furniture and appliance buyers, concentrating on the total number of sources used, number of stores visited, and total deliberation time. This study is somewhat unique in its emphasis on the "multi-dimensional profile of search activity" [3, Bettman, 1977, p. 19]; in other words, it considers both the direction of search and the intensity of search. Other studies, such as Katona and Mueller [31, 1955] or Newman and Staelin [44, 1971] tend to focus on aggregate measures of information search (see also Engle, Kollat, and Backwell's discussion of external search [13, 1973] or Newman and Lockeman's critique of measures of information search [43, 1977]).

The Claxton, Fry and Portis survey identified three subgroups of buyers. The first, "thorough/store-intense" (5 percent of the furniture buyers and 8 percent of the appliance buyers) visited a very large number of stores, used many sources, and took a long time to decide. The second, "thorough/balanced" (44 percent of the furniture buyers and 27 percent of the appliance buyers), visited fewer stores, still used several sources, and took a moderate amount of time to decide. The final subgroup, "nonthorough" (34 percent of the furniture buyers and 65 percent of the appliance buyers), made few store visits (one or two), used only about one source, and deliberated little.

Regarding the distinction between direction of search and intensity, the interesting comparison in this study is between the thorough/store-intense and the thorough/balanced subgroups for

appliance buyers. The former used fewer sources of information and made more store visits than the latter; that is, there may be a trade-off between direction (in this case in-store sources of information) and intensity -- consumers who use fewer sources of information may use them more intensely. If different sources of information are approximately equal in terms of content, this means that total information acquisition may be independent (roughly speaking) of the source/intensity mix. Under these circumstances, the economic approach to information acquisition (which ignores, for the most part, the distinction between the two) might still yield useful predictions. Whether this is true, however, is an open question since the precise nature of the source/intensity trade-off has not been studied further, either theoretically or empirically.

Existing work provides little help in the effort to unravel these effects since it provides few clues as to what sort of search strategies consumers commonly use. For example, many of the buyers in Udell's study of small appliance purchases might have used sequential strategies. He found "a shopper is not likely to examine a small appliance, leave the store without buying it, and return at a later time to make the purchase [68, 1966, p. 52]. But Udell did not study the amount of in-store comparison shopping. Similar problems plague other studies. While data is available on number of store visits [4, Bruce and Dommermuth, 1968; 6, Bucklin, 1966; 11, Dommermuth, 1965; 12, Dommermuth and Cundiff, 1967; 31, Katona and Mueller, 1955; 44, Newman and Staelin, 1972; 68, Udell, 1966], number of shopping trips prior to

purchase [6, Bucklin, 1966], number of prepurchase visits to the store of purchase [68, Udell, 1966], and number of brands examined [11, Dommermuth, 1965], no systematic survey is complete enough to support plausible inferences regarding search strategies.

The studies just discussed considered both the intensity of search and the direction. In general the intensity of external search is a function of its perceived costs and benefits. An Engle, Kollat, and Blackwell put it, "whether external search occurs as well as the extent to which it occurs appear to depend on the consumer's perception of the value of the results of search and the costs involved in engaging in search" [14, 1973, p. 376]. This is in accord with the economists' view as outlined in Section 3. The major difference is that psychologists take into account a greater variety of gains and costs associated with external search than do economists.

The value of external search depends, in the psychologists' view, on the amount and appropriateness of stored information, and the perceived risk of the purchase decision. Perceived risk encompasses uncertainties associated with "the use of the product and the social consequences inherent in using it" as well as the monetary consequences [23, Hansen, 1972, p. 89]. Thus it is affected by financial risk (involving both price and the expected lifetime of the good), and other social-psychological risk factors [14, Engle, Kollat, and Blackwell, 1973, pp. 376-82]. Additional psychological benefits might include increased satisfaction with the purchase or feeling that one did a thorough job [3, Bettman, 1977, p. 20]. The psychologists' model

predicts that a high degree of perceived risk is associated with more external search. This prediction, along with a more general discussion of perceived risk, can be found in Bauer [1, 1960]. Bauer argues that consumers often use other techniques for reducing perceived risk besides external search. These include developing brand loyalty, using advertising, or following opinion leaders. Nelson [41, 1970] discusses, to some extent, the economic incentives for using these various techniques.

The prediction that perceived risk is positively related to external search is consistent with predictions of economic models that greater price dispersion [49, Rothschild, 1974] and greater durability [71, Wilde, 1977] imply more search. However, because search increases with perceived risk, the psychologists' model also predicts that higher prices imply more search; economic models, by contrast, consider price alone to be irrelevant. The models discussed in Section 3 typically analyze the behavior of a consumer interested in purchasing a single unit of some good, acting so as to minimize the expected total cost of purchase (final price plus search costs). In this case a simple shift in the distribution of prices may change some of the parameters which define an optimal strategy (for example, the reservation price associated with a sequential rule), but it will not change the expected amount of search. The scanty evidence available in the economics literature weakly supports the psychologists' position on this issue. Pratt, Wise, and Zeckhauser [48, 1979], for example, sample prices of 50 products by selecting pages at random from the Boston telephone

directory. Eliminating products for which the collection of price information was difficult, 39 categories remained. For these the authors found a "large positive relationship between standard deviation and mean price."¹¹ Further evidence from the noneconomics literature which supports the psychologists' prediction of a positive relationship between price and external search is discussed later in this section.

Regarding costs of search the psychological model includes time and money expended, the cost of delaying decisions, and such psychological costs as frustration and the annoyance of dealing with sales personnel. Obviously, the psychological model predicts that higher costs lower external search.

This cost-benefit hypothesis is implicit in the work of Houlton [26, 1961], Bucklin [5, 1963], and Winter [76, 1975], and is given explicit treatment in Bucklin [6, 1966] and Swan [65, 1972]. Bucklin surveyed female heads of household, gathering information about both the number of stores visited per shopping trip and the number of shopping trips taken prior to purchase of a nonfood item worth \$5 or more. He used the density of retail establishments as one proxy for search costs, comparing the number of intratrip shopping stops at downtown retail sites with stops at nondowntown sites. In his sample the proportion of products shopped for twice or more in downtown sites was 20.7 percent compared with 11.8 percent for nondowntown sites. This was interpreted as support for the proposition that higher search costs imply less external search.

Swan [65, 1972] devised a simple experiment which included measuring the effect of search costs. He asked subjects to judge the quality of flashlight batteries. The subject who most consistently chose the battery with the longest life won \$1. There were five phony brands from which to pick. Choice proceeded sequentially, and after each choice a report on the life of one battery of the brands chosen was given to the subject. One group was allowed to switch brands costlessly, the other group had a fixed number of points subtracted from their scores each time they switched brands. Under the cost treatment the mean number of brand switches was 2.6 compared to 7.8 under the no cost treatment.

In a related experiment, Lanzetta and Kanareff [33, 1962] also found that as the direct cost of information increased, the amount of information demanded by decisionmakers fell. In their experiment subjects were presented with a series of hypothetical "problems" and asked to make decisions about their solutions. For example, the history of a mental patient would be described and several alternative treatments suggested. In order to receive a payoff, the subject would have to choose the "correct" solution from the offered alternatives, either on the basis of the given information or after obtaining up to five additional pieces of information. Two treatments were used; in the first the additional information was free and \$.05 was awarded for a "correct" answer, in the second each piece of additional information cost \$.05 and \$.30 was awarded for a "correct" answer. In fact, there was no "correct" answer, the probability of receiving a payoff being

predetermined as a linear function of the number of additional pieces of information the subject accessed, (specifically, the probability of receiving a payoff given the subject used n additional pieces of information was $.2n$). Subjects never used on average more than four additional pieces of information even when it was free. However, they systematically accessed significantly fewer additional pieces of information when it was costly than when it was free ("significantly" here being used in a statistical sense).

Regarding the gains from search, Katona and Mueller [31, 1955], Dommermuth [11, 1965], and Bucklin [6, 1966] all found evidence consistent with the prediction of the psychological model that search increases with product price. Bucklin, for example, reported that the percentage of two-plus-stops shopping increased monotonically from 38.8 percent in the \$5 to \$14 category to 64.4 percent in the \$100-plus category [6, 1966, p. 26] -- see Table 1.¹² As pointed out above, results such as Bucklin's, that external search is positively related to product price, are not predicted by any existing formal cost-benefit models. Economists have noted this anomaly [e.g., 66, Thaler, 1977 -- see footnote 11] but as yet have not resolved it.¹³

A relationship which is clearly predicted by the economics literature is that, other things constant, greater durability implies more search. This is due to two effects. First, greater durability implies that if a poor purchase is made it will take longer to correct for it by renewed search for a different (and hopefully better) brand; more care must be taken to select a good brand initially.¹⁴ Second,

TABLE 1

EXTENT OF SHOPPING AS A FUNCTION OF PRODUCT PRICE [6, BUCKLIN, 1966]*

	\$5 to \$14	\$15 to \$49	\$50 to \$99	\$100+	no data	total
One stop	61.2% (314)	55.4% (128)	46.9% (30)	36.6% (21)	33.3% (8)	56.2% (501)
Two-plus stops	38.8% (199)	44.6% (103)	53.1% (34)	64. % (38)	66.7% (16)	43.8% (390)

*Entries give percentages within each price category. Numbers in parenthesis give total observations for each cell. The no data column includes observations for which the price category was unknown.

greater durability implies less frequent purchase. Hence stored information is less useful and more external search is required. However, there appears to be little external search associated with the purchase of durables. Katona and Mueller reported such a result over 30 years ago [31, 1955]. More recently, Newman and Staelin in a study of prepurchase information seeking for new cars and major household appliances found that "half the buyers thought mainly of only one brand at the outset of the decision process." Furthermore, "[n]early 40% of the buyers who had not used the product before for example, also considered only one brand initially" [44, 1977, p. 256]. Although recent research in economics has begun to consider rigorously the question of "how much information is enough" to keep market performance within acceptable bounds (i.e., how many shoppers are needed to keep a market competitive -- see Wilde and Schwartz [70, 1979]), current judgments as to whether levels of nonshopping by consumers for major durables such as those reported by Newman and Staelin are problematic remain subjective and somewhat impressionistic. The issue is clouded by the argument that internal search (see Section 2) is heavily relied upon in the purchase of consumer durables. As Newman and Staelin point out in the conclusion of their paper, "the findings do not necessarily mean that the buyer is ill-informed. He may have started with what he regarded as sufficient knowledge" [44, 1955, p. 256].

The issue here is by no means a minor one, and it raises yet another conundrum for economists. Economic theory tends to ignore internal search. Yet the available evidence suggests that internal

search is an important element in the purchase of consumer durables. This makes intuitive sense since the purchase of durables may involve more foresight than the purchase of nondurables. Hence the information acquisition process may take place over an extended period of time. Ideally one would like to have measures of the total amount of search associated with a decision to purchase a good. But accurate measures of total search (internal search at the time the decision to consider a purchase is made, plus any subsequent external search) are likely to be hard to generate. In particular, survey measures will typically understate the actual amount of total search to the extent that consumers absorb information passively in the early stages of the decision process (or simply forget) and will overstate it to the extent they want to feel like they've been wise shoppers and have made informed choices in post-purchase interviews [43, Newman and Lockeman, 1975]. While it has been suggested that measures of the total amount of search are needed [3, Bettman, 1977], no practical ways of generating such data have yet emerged.

In spite of the methodological problems with consumer durables studies, the other evidence cited above strongly suggests that external search is a function of the perceived costs and benefits associated with it. Consumers may vary in their ability to process information [67, Tversky and Kahneman, 1974; 20, Grether, 1977], but most do act rationally in their response to cost-benefit trade-offs.

Evidence respecting the effects of education and income on external search is both limited and somewhat conflicting. For example,

Claxton, Fry, and Portis [8, 1974] found that buyers who used store visits as a major element of their search process had the highest income and education while Udell [68, 1966] reported the seemingly contradictory result that high income buyers were more likely to make their purchase decisions prior to visiting stores than low income buyers. Consistent with this last observation, Udell also found that buyers with a family income below \$5,000 or above \$10,000 were least likely to examine a product in a store, leave the store without purchasing, and return later to make the purchase.

A similar nonmonotonic relationship between income and external search was reported by Bruce and Dommermuth [4, 1960]. These authors divided survey respondents into three classes: lower class households were defined as those located in an area with census tract mean household incomes varying from \$2,009 to \$4,436, working class households were defined as those located in an area with census tract mean household incomes varying from \$4,299 to \$5,941, and middle class households were defined as those located in an area with census tract mean household incomes varying from \$5,009 to \$9,081. The least shopping activity was found in the lower class; 70 percent of the lower class respondents made a purchase after shopping in one store and considering one brand. The most shopping activity was found in the working class; only 45 percent made purchases after shopping in one store and considering one brand. Shopping activity in the middle class was less than that in the working class, but not so limited as in the lower class (see Table 2).

TABLE 2

SHOPPING PATTERNS: PERCENTAGE OF RESPONDENTS WITH GIVEN BRAND/STORE
ACTIVITY PATTERNS [4, BRUCE AND DOMMERMUTH, 1960, P. 5]

THE SHOPPING MATRIX
LOWER CLASS
(n=136)

Number of Brands	Stores				
	1	2	3	4	5 or more
5 or more	0	1	0	1	0
4	0	0	1	1	0
3	1	0	2	0	0
2	5	8	0	0	0
1	70	1	0	0	0

THE SHOPPING MATRIX
WORKING CLASS
(n=191)

Number of Brands	Stores				
	1	2	3	4	5 or more
5 or more	0	0	0	1	4
4	1	2	3	2	1
3	1	2	7	0	0
2	7	8	2	0	0
1	45	4	1	0	0

THE SHOPPING MATRIX
MIDDLE CLASS
(n=564)

Number of Brands	Stores				
	1	2	3	4	5 or more
5 or more	0	0	1	1	2
4	0	0	2	1	0
3	3	3	5	1	0
2	6	6	2	0	0
1	56	6	1	0	0

Some evidence suggests the relationship between education and external search is also nonmonotonic. Newman and Staelin [44, 1972] found that consumers with advanced degrees (masters, doctorates, or professional degrees) reported about the same amount of external search as consumers with less than high school educations. Consumers with intermediate amounts of education reported substantially more external search. Of course most surveys of consumer behavior do not control for income when reporting the effects of education or for education when reporting the effects of income. Since income and education are likely to be correlated, it is not surprising the evidence suggests similar relationships with external search.

5. SATISFACTORY SEARCH AND THE CHOICE PROCESS

In addition to the direct costs and benefits discussed in Section 4, a number of other factors have an indirect influence on the direction and intensity of external search. These include the availability of information, time pressure, and the difficulty of the choice task [3, Bettman, 1977]. The first two of these pose no special problems; the availability of information can be related to search costs while time pressure can be incorporated into the search strategies used by consumers. For example, a modified sequential search rule would require setting a reservation price and a time limit for search. The consumer would then search sequentially until a price which is less than the reservation price is observed or the specified amount of time is exhausted, in which case the good would be purchased

at the lowest observed price.

The remaining factor is more problematic. In a market setting the "difficulty of the choice task" is directly related to the complexity of the product. That is, if the product is characterized by a number of attributes, and if these attributes are costly to evaluate (in some appropriate sense), then the choice task (evaluating brands and selecting an acceptable one) is more difficult than the choice task associated with a homogeneous product. Thus, the more difficult the choice task, the more costly it is (by definition) to select the best from any given set of alternatives. This suggests that within a multiattribute choice environment a consumer is likely to settle for less than the best alternative, since even if direct search costs are low, evaluation costs may not be. Settling for less than the best is generally referred to as "satisficing" while holding out for the best is called "optimizing."¹⁵

This section explores the relationship between satisficing and optimizing (as defined above) and external search. Consumer researchers predict a positive relationship between a "concern for optimality" and the degree of external search [3, Bettman, 1977, p. 28]. This is based on the assumption that a consumer concerned with optimality will select a search strategy which yields a large number of observations (a large number of observations being necessary to find the best alternative). In other words, the implicit assumption is that the consumer first decides whether to optimize or not and then decides how to search. But, how to search and whether to optimize are two

aspects of the same decision; an observed positive relationship between external search and a concern for optimality simply reflects the more fundamental link between search and evaluation costs and the degree of external search.

This argument is obvious in choice environments in which there is no cost or uncertainty associated with determining the value of any particular alternative once that alternative has been "observed." If the consumer faces high information acquisition costs in the selection of alternatives for consideration, then the search strategy is likely to be satisfactory with respect to the value of the alternative selected, but it may still be optimal with respect to the net expected value of search.

To see the distinction between optimizing and satisficing when the cost of observing alternatives is positive but the cost of inspecting alternatives (to assess their "utility") once they have been selected for consideration is zero, consider the fixed sample size rule [60, Stigler, 1961] versus the sequential rule [36, McCall, 1965] as described in Section 2 of this paper. Neither requires the consumer to hold out for the very best alternative of those available, but the sequential rule minimizes the net expected cost of purchase (final purchase price minus costs of search). Thus the latter is optimal given the costs of observing alternatives, but both are satisfactory with respect to actual choices.

A more interesting case arises when it is also costly for the consumer to determine the value of alternatives (goods). That is, let

goods be described by multiple attributes with the consumers' having underlying utility functions defined over these attributes. But assume that consumers cannot costlessly observe individual attributes. Then, following Wright, two necessary elements of any choice model can be identified, "a process by which single multiattribute options are evaluated and a rule by which one option is discriminated from the others" [77, 1975, p. 60]. The two elements are called the "data combination process" and the "choice rule."

Data combination processes are classified as compensatory or noncompensatory. Compensatory processes "picture a person averaging (or adding) data so that positive and negative data have a balancing impact," while noncompensatory processes "assume a consumer combines data such that the presence (absence) of one attribute may not compensate at all for the absence (presence) of others" [77, 1975, pp. 60-61]. Standard examples of noncompensatory processes are well-known lexicographic rule, and the conjunctive and disjunctive rules [13, Einhorn, 1971]. The lexicographic rule requires first that the attributes be ordered according to relative importance. Then all options are compared on the single most important dimension. If the consumer cannot discriminate among the options on the basis of the first dimension, then a second is compared, etc. Clearly this rule requires that all options be compared on at least one dimension. With conjunctive and disjunctive rules, the consumer defines minimum cutoff (reservation) levels for each attribute. The conjunctive rule requires the consumer to reject options with any below-cutoff attributes and the

disjunctive rule requires the consumer to accept options with any above-cutoff attributes. Unlike the lexicographic rule, these rules do not necessarily require all options be inspected. In fact, a number of choice rules besides a "choose the best" can be combined with them. For example, the consumer could select a fixed number of options to inspect, apply a conjunctive rule to inspect each, and then select at random from those which pass the test. Alternatively, the consumer could use a sequential strategy, applying a conjunctive rule to inspect each option and choosing the first option which is acceptable.

Within a multiattribute choice environment, the data combination process and the choice rule are closely related. Assume the consumer attempts to maximize net benefits from purchasing the good. He or she will consider the costs of search, and of evaluating alternative goods, once they are observed, and will then choose a strategy for search and for making a final choice. If the choice rule is to satisfice, this is because the consumer has high costs of observing options, or of evaluating specific options, or both, in relation to the expected gains from purchase. If the choice rule exhibits a concern for optimizing, this reflects a different outcome of the cost-benefit calculation. But the same costs and benefits simultaneously effect external search. It is not surprising, therefore, that the observed degree of external search is positively related to a "concern" with the optimality of final choices.

Swan [64, 1969] designed an experiment to test this prediction. It consisted of a series of choice situations, each exposing subjects

to four phony brands of shirts. Color slides were shown of the shirts, four shirts per slide. Four ratings of the overall quality of each shirt were available ("good," "acceptable," or "poor") at a cost of \$.01 per rating. With all 16 ratings a subject could identify the correct alternative with certainty.

Each subject was given a budget of \$.20 per trial. If a correct alternative was selected, the subject was allowed to keep that portion of the budget not spent on information. In the "optimal choice" treatment, the subject had to identify the one brand with the best set of ratings to receive the payoff (i.e., correct choices yielded the residual budget, incorrect choices had value zero). In the "satisfactory choice" treatment identifying either of the two best brands was acceptable.

Swan's results clearly confirm the prediction that information seeking is lower with satisfactory choice as compared to optimal choice; the mean number of ratings purchased was 6.63 under optimal choice as compared to 4.44 under satisfactory choice.

Claxton, Fry, and Portis also found support for the hypothesis that external search is positively related to a concern with optimality in their survey; "nonthorough" buyers were the least concerned about purchasing the "right" product [8, 1974, pp. 39, 41].

Of course, if choice processes derive from more fundamental cost-benefit calculations then the parameters of particular choice processes (cutoff levels, order of inspection of attributes, etc.) should not be taken as given. As Wright has put it, "consumers are

sensitive to simplifying and optimizing differences between the [choice] strategies, and could engage in covert 'cost-benefit' analysis when selecting a decisionmaking procedure" [77, 1975, p. 60]. Given this observation, it is clear that researchers should focus on the link between search costs and choice processes. Moreover, the economists' cost-benefit paradigm is likely to be very useful in this effort.¹⁶ Recent theoretical [74, Wilde, 1982] and experimental [21, Grether and Wilde, 1983] work has begun to explore these issues. These two papers focus on the conjunctive choice strategy. Wilde develops a theoretical framework in which the conjunctive choice rule can be analyzed. Specifically, his analysis is concerned with the process by which consumers using a conjunctive choice rule determine the minimum cutoff levels for each attribute. He first characterizes the "optimal" cutoff levels using a model based on expected utility maximization in which information acquisition costs appear explicitly. In particular, he assumes each attribute of the multi-attribute good sought by the consumer has an attribute-specific inspection cost. The consumer's problem is to select a set of cutoff levels, one for each attribute, which maximize expected utility net of inspection costs. The solution to this problem involves a rather complicated set of "first-order-conditions." These are derived by differentiating (mathematically speaking) the expected utility function of the consumer with respect to the various cutoff levels, one for each attribute of the good. While the mathematics are tedious, the resulting set of equations which define the optimal cutoff levels (and hence the optimal conjunctive

strategy) have a natural "expected benefit equals expected cost" interpretation. The problem is that they are still quite complicated. Yet the conjunctive rule is generally regarded as a good candidate as a simplifying strategy. In fact, a number of consumer researchers have suggested that conjunctive strategies are commonly used by decisionmakers as initial screening devices in situations where they are contrasted by a large number of choices [3, Bettman, 1979, p. 215 and the references cited therein -- see also 21, Grether and Wilde, 1983].¹⁷ This view suggests that consumers who use the conjunctive rule may not actually set the cutoff levels in an "optimal" fashion (that is, they may use a conjunctive rule, but not set the cutoff levels in a way consistent with the "expected utility net of information acquisition costs" model). The question then arises, how do they set the cutoff levels?

One way to approach this question without altogether forsaking the economic approach described above is to preserve the expected benefits equals expected costs interpretation of the so-called optimal solution but simplify the calculations involved in solving those equations by throwing out or ignoring certain kinds of information. For example, if there are n attributes, then the first-order-conditions involve n "simultaneous" equations which need to be jointly solved to determine the n cutoff levels, one for each attribute. It turns out that there is a natural way to ignore this simultaneity and treat each cutoff level as though it were independent of the other $n-1$ cutoff levels. Similarly, there is a natural way to ignore the fact that the

order in which attributes are inspected matters (if all attributes were equally costly to observe, the consumer should be more choosy on early attributes than later ones since rejecting a good on the basis of an attribute which is inspected late in the process means that the consumer has to start all over again with the first attribute -- other things equal, it is better to be more discriminating on attributes inspected early in the process than those inspected late in the process). This effect is referred to as sequentiality. Ignoring these various kinds of interactions yields a set of "nonoptimal" conjunctive rules. They all have the same form as the optimal conjunctive rule but the cutoff levels on the attributes are different. Moreover, the cutoff levels respond differently to changes in attribute-specific inspection costs depending on whether consumers use the optimal conjunctive strategy or one of the nonoptimal conjunctive strategies. This provides the basis for an empirical test of which conjunctive strategy decisionmakers actually use. Grether and Wilde [21, 1983] reports on just such a test, using laboratory experiments.

The experiments run by Grether and Wilde were designed in such a way that subjects were forced to use conjunctive strategies in selecting items from some set of alternatives. Alternatives were described simply by some vector of numbers. For example, a three attribute alternative might be a set of three numbers (x_1, x_2, x_3) where each number x_i was drawn from some distribution $f_i(x_i)$ defined on $[x_i^L, x_i^H]$. Subjects were informed of the distribution f_i and its range (in these experiments f_i was always uniform on some interval $[x_i^L, x_i^H]$).

Each attribute had an attribute specific inspection cost c_i . Utility functions were linear; that is, if the final choice of a subject was (x_1, x_2, x_3) , the gross payoff (in dollars) was $x_1 + x_2 + x_3$. Net payoffs were equal to the gross payoff minus any inspection costs incurred in obtaining it. The problem facing the subjects was simple, pick a set of cutoff levels, one for each attribute, given that final choices would be determined by random draws for each attribute, using the conjunctive rule -- i.e., an alternative would be acceptable only if it exceeded the cutoff level selected by the subject on each attribute. The treatment variable in the experiments was inspection costs; holding utility functions and the distributions of attributes constant, inspection costs were varied in such a way as to be able to test whether subjects conformed to the optimal conjunctive rule or one of the nonoptimal conjunctive rules.

The results of this experiment were rather surprising. It turned out that subjects did not conform to the optimal conjunctive rule. In fact, in two tests each of four relatively different subject populations, all conformed to the nonoptimal conjunctive rule in which both simultaneity and sequentiality were ignored. What this meant in terms of the response to changes in inspection costs is that an increase in the cost of inspecting attribute i lowered the cutoff level on that attribute, but had no effect on the cutoff levels of other attributes (in the aggregate). Put in economic jargon, "own-effects" responded as in the optimal rule, but "cross-effects" were zero. Thus subjects picked up on the "first-order" expected benefit-expected cost

trade-offs resulting from changes in inspection costs, but in the aggregate they ignored the "second-order" trade-offs which get incorporated into the optimal conjunctive strategy.

6. INFORMATION OVERLOAD

Consumer researchers, and lately policymakers, have been concerned with how much information a consumer needs to make intelligent choices in product markets. In particular, since consumers can only process a limited amount of information in a given time period, the potential danger of "information overload" has attracted a great deal of attention recently. For example, many of the recent debates over revising the Truth in Lending Act, as well as those concerning new disclosure legislation, have relied heavily on this notion. Information overload, at least as used by consumer researchers, generally seems to refer to the proposition that excess information may be dysfunctional. This is a much stronger statement than saying that more information may not be better. It suggests that too much information can lead to confused, irrational choice behavior. The purpose of this section is to review the evidence advanced to support the existence of such a phenomenon.

A recent series of studies conducted by Jacoby and his associates [27, 1974; 28, 1974; 29, 1975] concluded that decisionmakers display the greatest accuracy in their choices when "moderate" amounts of information are available. While these studies provide the primary source of supporting evidence for proponents of the overload

hypothesis, they have been extensively criticized [75, Wilkie, 1974; 63, Summers, 1974; 50, Russo, 1974]. In fact, in reanalyzing the data generated in the Jacoby experiments, Staelin and Payne [59, 1976] conclude that more information may well be associated with more accuracy in choice, not less.

The experimental design was basically the same in all of the Jacoby experiments. First each subject was asked to indicate the importance of each attribute associated with the product being used (a "weighting factor"), and to specify an "ideal" brand. These were used to provide a base against which accuracy of choices could be measured. Next, each subject was given x brands to choose from, each brand described by y attributes. The objective was to evaluate the information provided and choose the "best" brand in the set. The best brand was defined as the brand least distant from the ideal brand, where distance was measured linearly using the attribute weights elicited at the outset of the experiment. Across the three experiments, x (the number of brands) ranged from 4 to 16, and y (the number of attributes about which information was provided) ranged from 2 to 6. Using $x \cdot y$ as a measure of the total information available, and plotting the number of correct choices against it, the experimenters concluded that "providing substantial amounts of package information can result in poorer purchase decision" [27, 1974, p. 40] and that increasing the information load tends to produce "dysfunctional consequences in terms of the consumer's ability to pick the brand which was best for him" [28, 1974, p. 6].

The raw data from the first of these experiments is given in Table 3 [27, 1974, p. 65]. Casual inspection of Table 3 is rather interesting in light of the claims of Jacoby, et al. First, ignoring chance (the fact that random decisions are less likely to yield a "best" choice as the number of brands increases), it appears that, holding the number of brands constant, more "information" per brand is "better" when the number of brands is 4 or 8 and is "neutral" when the number of brands is 12. Similarly, ignoring chance, it appears that, holding "information" per brand constant, more brands to choose from is "better" for two items per brand, "neutral" for four items per brand, and "worse" for six items per brand. It is rather hard to conclude from this interpretation of the data that more information is bad and it's rather ambiguous whether even more choice is bad: So how did the experimenters reach their conclusions? Consider measuring total "information load" by multiplying items/brand time the number of brands. Plotting the number of correct choices against this variable gives Figure 1. The inverted u-shaped curve in Figure 1 is the source of the rather strong conclusions of Jacoby et al. Plotting the number of "correct" choices against the total number of "bits" of information provided subjects, suggests that as the latter rises, performances increases initially, but eventually it peaks and for increases in the "amount" of information provided beyond that, performance falls!

Taking the basic experimental design as given (this, by itself, requiring a great leap of faith), the transition from Table 3 to Figure 1, a necessary move to be able to conclude that increasing information

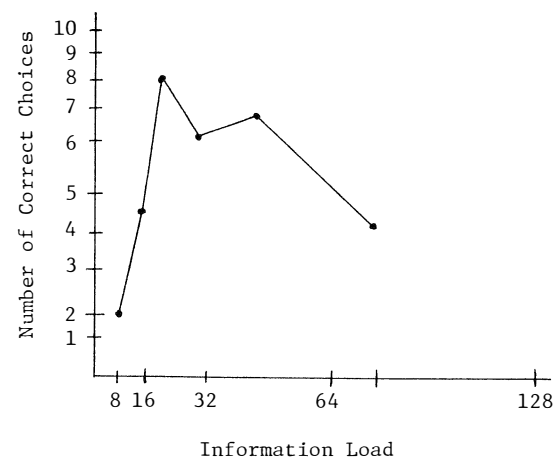
TABLE 3

NUMBER OF SUBJECTS (OUT OF 17 IN EACH CELL) CORRECTLY
CHOOSING THEIR "BEST" BRAND

Number of items/brand revealed	Number of brands				Total
	4	8	12		
2	2	3	5		10
4	6	6	5		17
6	11	8	4		23
Total	19	17	14		

FIGURE 1

PERFORMANCE AS A FUNCTION OF INFORMATION LOAD



load tends to produce dysfunctional consequences, requires two implicit assumptions. First, it must be the case that choice accuracy can be compared across the cells of Table 3 with different numbers of brands -- the fact that accuracy should fall purely as a matter of chance as the number of brands increases must not matter. Second, there is a one-to-one trade-off between brands and attributes -- it is only the total number of "bits" of information confronting the consumer that matters as far as choice accuracy is concerned. These two assumptions are rather problematic, and, in fact, they provide the basis for the critiques of the Jacoby et al experiments mentioned above. Staelin and Payne [59, 1976] represent the most sophisticated of these.

Staelin and Payne take the basic design of the Jacoby, et al. experiments as given. They avoid the first of the two assumptions needed to yield Figure 1 by adjusting Table 3 for random choices. That is, they measure performance by comparing the actual number of correct choices to those based on chance alone for each cell. They then perform a simple regression analysis in which adjusted accuracy is the dependent variable and the independent variables are the product class (one for each of the Jacoby, et al experiments -- three in total), the number of brands, and the number of attributes per brand. They conclude that

. . . as more information is provided the accuracy increases markedly up to and including six pieces of information. However, when the consumer is given eight pieces of information per

alternative, there seems to be a sharp decrease in accuracy, after which more information seems to improve the consumers accuracy . . . it seems that more information is associated with more accuracy at least within small ranges [59, p. 189].

Since Jacoby and his associates also found that their subjects felt more satisfied and less confused with more information, as revealed in a post-experiment questionnaire, the overall conclusion one is led to draw from the project (based on Staelin and Payne) is that increasing consumer information is a good idea whenever it is feasible. This conclusion is polar to that drawn by the original researchers, yet it nevertheless appears to be inescapable.

Perhaps it is not so inescapable though. After all, it is still based on the presumption that the basic experimental design of the Jacoby et al experiments was valid. Given the manner in which performance was measured (distance from an "ideal" brand using subjective weights for attributes), there remains some uncertainty as to whether the so-called information overload phenomenon is real or not.

Before continuing, and in light of the above discussion, it will be useful to retreat momentarily and discuss briefly the background of the "information overload" hypothesis. The original notion of information overload, due to psychologists, was related to information acquisition (in particular, external search), not the quality of final choices. As Bettman summarizes the literature, "several researchers have argued that as task difficulty (measured as

the total amount of information, or information load) increases, there will first be increases in search, but then eventually decreases as too high an information load is imposed" [3, 1979, p. 126]. Studies in the psychology literature which support this conclusion include Sieber and Lanzeth [57, 1964], Streufert, Svedfeld and Driver [62, 1965] and Schroder, Driver, Streufert [54, 1967]. Information overload in this case refers to the fact that information acquisition (i.e., external search) eventually decreases as the total amount of information available to the decisionmaker passes some critical level. Of course, this does not imply performance falls as information load increases. In fact, quite the opposite is likely to occur.

Consider the following scenario. Suppose that a decisionmaker has to choose an alternative from some set of multi-attribute items. Suppose further that the decisionmaker only feels strongly about one or two attributes. Now a random sample of, say, two attributes is not likely to provide information about these crucial attributes. Hence the decisionmaker will be forced to utilize information on both available attributes in order to make a choice. A random sample of, say, four attributes will occasionally include one or both of the crucial attributes. When this is the case, the decisionmaker can base a decision on these and need not utilize the information available on the other two attributes. When it is not the case, however, the decisionmaker might again be forced to utilize information on all four available attributes in order to make a choice. The larger is the sample of attributes, the more likely it is that the crucial attributes

are included. Thus, on average, as the set of available attributes increases, we would expect the number utilized in making decisions to increase initially, eventually peak, and thereafter fall. But the quality of choices should increase monotonically over the entire range.

The scenario just described seems to be consistent with the observations of psychologists studying information load, although it should be noted that their experiments were designed to focus on information acquisition, not performance. The problem with the way Jacoby and his associates interpret the results of their experiments is that they seem to have assumed that the inverted u-shaped curve which describes the relationship between information load and external search holds also for the relationship between information load and performance. Adjusting Table 3 for chance yields Table 4 and Figure 2. One can interpret Figure 2 as an inverted u-shaped curve but it is just as plausible to argue that it is rising on the range [0,24] and roughly constant after that. Moreover, as Table 4 indicates, the only time subjects did significantly worse than random behavior would have predicted is in the low information treatments.

In any case, it is clear that further research is needed on the information overload issue. This research should distinguish between information acquisition and performance and it should attempt to identify relevant measures of information load -- it is not obvious that total "bits" of information (number of brands times items per brand) is very meaningful.

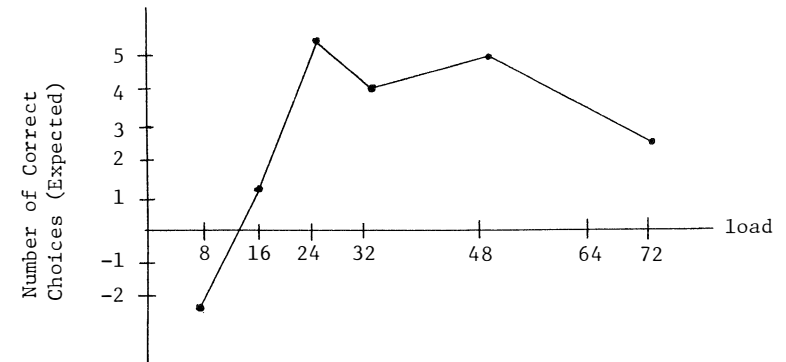
TABLE 4

NUMBER OF CORRECT CHOICES OUT OF 17 MINUS THE EXPECTED
NUMBER GIVEN RANDOM CHOICE

Number of brands		4	8	12
Random choice		4.25	2.125	1.06
Number of items/brand revealed	2	-2.25	.875	3.94
	4	1.75	3.875	3.94
	6	6.75	5.875	2.93

FIGURE 2

ADJUSTED PERFORMANCE AS A FUNCTION OF INFORMATION LOAD



A recent set of experiments by Grether and Wilde [22, 1982] began to explore some of these issues. The initial purpose of these experiments was to explore the extent to which "bits" measure cognitive load, using an experimental design that was free of many of the problems which marred the Jacoby, et al., experiments. Their results suggest that individuals are quite good at making certain types of rather complicated choices. Moreover, while the design included tasks which clearly varied in complexity, the degree of difficulty or "cognitive load" was not well described by simply counting the number of bits of information available. In fact, subjects in these experiments acted as if they were quite capable of ignoring irrelevant information.

The part of the Grether and Wilde experiments most germane to the discussion here involved choices over sets of compound lotteries. For example, Figure 3 displays a problem in which there are two items to choose from (A or B), each described by three binary lotteries. If a subject chose A, then his or her reward would be based on the sum of the outcomes of the three simple lotteries, each determined by a separate random draw from a bingo cage containing balls numbered 1-100. In the first simple lottery, the subject would earn \$7.60 if 1-35 was drawn and \$3.70 if 36-100 was drawn, in the second he or she would lose \$.45 if 1-25 was drawn and earn \$.10 if 26-100 was drawn, in the third a draw of 1-60 would have earned the subject \$4.50 while 61-100 would have paid \$7.75. Hence if the sequence of draws were 27, 4, and 50, the subject would earn $\$7.60 + (-\$0.45) + \$4.50$, or \$11.65.

FIGURE 3
EXAMPLE OF CHOICE TASK IN GREETHER-WILDE EXPERIMENTS

	Prospect 1	Prospect 2	Prospect 3
Item A	\$7.60 if 1-35 \$3.70 if 36-100	-\$0.45 if 1-25 \$.10 if 26-100	\$4.50 if 1-60 \$7.75 if 61-100
Item B	\$.30 if 1-75 -\$0.25 if 76-100	\$8.00 if 1-40 \$5.00 if 41-100	\$3.50 if 1-65 \$7.40 if 66-100

Choice tasks varied in size from 2 items each consisting of 2 simple lotteries up to 5 items each consisting of 5 simple lotteries. Besides varying according to the number of items and the number of simple lotteries, choice tasks varied according to how many of the simple lotteries "mattered." For example, in Figure 3, each item includes one simple lottery which involves very low payoffs compared to the other two. Thus an "informed" choice for this task would require the subject to consider only two of the three simple lotteries making up each item. The number of such "crucial" simple lotteries in a choice task is called the "difficulty" of the task. Finally, correct choices were defined using the dominance criterion. In other words, for each choice task there existed a unique item which dominated all other items in the sense that it placed higher probability on high payoffs than any other item. For example, in Figure 3, a compound gamble consisting of A.1 and A.2 is equivalent to one consisting of B.1 and B.3. But B.2 dominates A.3 so that item B dominates item A. Table 5 presents the percent of correct responses by task size and difficulty.

Looking down any column in Table 5, it is clear that whatever determined the degree of difficulty of a task, it was not the total number of bits of information available alone. Furthermore, two other results emerged from these experiments which should be useful in providing some direction for future research in this area. First, the Table suggests that the most important factor was the number of "crucial" simple lotteries. Second, it also suggests that subjects were generally quite capable of ignoring irrelevant information. In

TABLE 5
PERCENT CORRECT RESPONSES

Difficulty*	Number of Items/Number of Simple Lotteries				
	2/2	2/3	3/3	4/4	5/5
1	.81	.80	.64	.58	.58
2	.58	.74	.62		
3		.58	.39		
4				.28	

*Difficulty refers to the number of "crucial" simple lotteries in a choice task.

only two of the eleven tasks did the percentage of correct choices fall below approximately 60 percent, one with 9 component lotteries and one with 16 component lotteries. Behavior approached random only when the degree of difficulty (the number of crucial simple lotteries) and the number of alternatives increased simultaneously.

7. CONCLUSION

One theme of this survey has been that we can go a long way toward understanding consumer behavior under imperfect information by using variations on the economist's cost-benefit model. Examples of this approach include the basic homogeneous goods models of Stigler and McCall (discussed in Section 3), extensions to heterogeneous goods by Nelson and Wilde (discussed in Section 4), and Wilde's formal model of conjunctive choice (discussed in Section 5). While the evidence reviewed provides some support for this position, it also raises some questions. Regarding the former, it seems clear that consumers generally respond as predicted to changes in the perceived benefits and costs of search. Regarding the latter, there are two stylized facts which seem inconsistent with the predictions of the existing search models. First, there appears to be a positive relationship between external search and product price. Second, consumers appear to engage in relatively little shopping for durables. Whether a purely economic model can explain these anomalies is an open question.

The survey also discussed two areas in which much more research is needed, satisfactory search and information overload. The major

problem with the former is that it lacks a unifying theoretical foundation. It is here that the cost-benefit paradigm could turn out to be extremely useful. An illustration of how this might be done was discussed briefly in Section 5. Wilde's model of conjunctive choice [74, 1982] was outlined there and a series of experiments related to it summarized [21, Grether and Wilde, 1983]. While the approach worked well for the conjunctive rule, a useful research effort would be to try applying it to other choice-models.

More work is also needed on information overload. The consumer research literature related to information overload is small but it has had a large impact -- many policymakers are concerned about information overload and there seems to be a general belief that the phenomenon has been well-documented. Yet Section 6 showed that there is a great deal of confusion on this issue and that no real evidence exists which links increases in information load to decreases in performance. This is an unfortunate state of affairs, but hopefully one that will be corrected in future research.

FOOTNOTES

1. Direct comparison shopping is to be contrasted with "sequential" shopping rules. The difference between the two is discussed in Section 2 below. See also Wilde [69, 1977] and especially Wilde and Schwartz [70, 1979] for a more complete discussion of these points.
2. For a brief discussion of information and the labor market see Rees [47, 1966] or Stigler [60, 1962]. A more detailed analysis is provided by Yavitz, et al. [78, 1973].
3. For a further discussion of imperfect information and market structure see Rothschild's survey [48, 1973]. See also Satterthwaite [52, 1977] and Schmalensee [53, 1977] for additional specific examples.
4. For a comprehensive critique of studies based on survey data see Newman and Lockeman [43, 1976].
5. In addition, there is a well-known positive externality associated with shopping activity: an increase in any individual consumer's search efforts results in a better distribution of prices for everyone else. Since this social return is not fully appropriable by the individual, there may be a resultant underinvestment in

- search [40, Rothschild, 1973; p. 1289]. See Wilde [69, 1977] for a formal demonstration of this externality in the labor market.
6. Information is "sufficient" if the expected marginal gain (in utility) from the acquisition of additional information is less than the marginal cost. Operationally this simply means the consumer can optimally base a decision on stored information. For example, if conflicting information such as disparate reports on durability is present, information in memory may still be "sufficient" if the value of a more precise estimate of durability is not worth its cost.
 7. Stigler, in fact, acknowledged the optimality of a sequential rule [60, 1961, p. 219]. He also devoted some attention to the sources of dispersion [60, 1961, pp. 219-20], but never constructed a formal market model.
 8. The optimality of purely sequential search rules is also sensitive to assumptions regarding the nature of search costs and the timing of observations. See, for example, Benhabib and Bull [2, 1982], Gal, Landsberger and Levykson [16, 1981] or Morgan [39, 1982].
 9. Pitz' paper considers several rules including a sequential one. Related work by Pitz is referenced in Slovic and Lichtenstein [58, 1968].

10. Nelson never exploited fully the distinction between search goods and experience goods in any formal way. For such an analysis see Wilde [71, 1981] and Hey and McKenna [24, 1981]. The implications of the distinction for advertising are explored in Schmalensee [53, 1928]. For a general discussion of all these models see Wilde [72, 1980].
11. See Thaler [66, 1977] for further discussion of these results.
12. Bucklin surveyed 506 female heads of household in the area of Oakland, California in the fall of 1962. Numbers in parenthesis in Table 1 give number of respondents in each category.
13. This apparent empirical regularity remains as one of the primary challenges to the economic approach to consumer information acquisition. Thaler [66, 1977] suggests an analogy to the Weber-Fedner law of psycho-physics in which the "just noticeable difference in any stimulus is proportional to the stimulus." This is an intriguing possibility, the importance of which is unknown at this time. Stigler [60, 1961], it should be noted, did predict that greater expenditure implies more external search. However, he related this to changes in the frequency of purchase, not price changes. Pure shifts in the distribution of prices should have no effect on external search, either with fixed sample size rules or

sequential rules (see text, supra note 11).

14. This effect is derived formally in Wilde [71, 1977].
15. In their classic discussion of optimal versus satisfactory strategies, March and Simon define an alternative as "optimal if: (1) there exists a set of criteria that permits all alternatives to be compared, and (2) the alternative in question is preferred, by these criteria, to all other alternatives. An alternative is satisfactory if: (1) there exists a set of criteria that describes minimally satisfactory alternatives, and (2) the alternative in question meets or exceeds all these criteria" [35, 1958, p. 140].
16. There has been very little formal (i.e., theoretical) analysis of this problem. Shugan [55, 1980; 56, 1981] and Johnson [30, 1979] provide initial attacks on it from a consumer research perspective, but much work remains to be done.
17. For a critique of this literature see Lynch [34, 1981].
18. Wilde [75, 1974] also raised the first objection and Russo [50, 1974] suggested both factors cast doubt on the conclusions of Jacoby, et al.

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