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LABORATORY MEASUREMENT OF RESPONSE TO CONSUMER INFORMATION

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ABSTRACT

Laboratory experimental procedures were employed in conjunction with objective measures of information adoption to study consumer responsiveness to price information. Findings suggest that information adoption is facilitated when the information is perceived as new by consumers and the information is presented in a simplified format; evidence is also presented which indicates that a situational variable, time cost, also plays a significant role in information adoption.

INTRODUCTION

The late 1960's marked the beginning of a new era of consumerism. Consumers applied their purchasing and voting power to legislate a number of activities designed to support them in dealing effectively, as individuals, with large corporations.

One of the complaints of consumer advocates is that consumers have so little information on which to base purchasing decisions. The response by Congress as well as governmental agencies (e.g., Food and Drug Administration, Federal Trade Commission) has been to require increased information disclosure by corporations and government. In the private sector, groups such as Consumers Union, publisher of Consumer Reports, distribute product tests and information. The agricultural extensions and home economists are but two of the professional groups located on university campuses which regularly provide consumer information to the public.

Despite documented evidence of consumer attention to unit pricing and nutritional labeling information [1, 5, 7], many consumers ignore the information available to them. A possible explanation of this is that the information provided is not relevant to most consumer decisions; nevertheless, it is hard to believe that the average supermarket shopper is not concerned with nutrition and prices. A more compelling argument is that information is not available in a form that is immediately useful for purchase decisions, and the context in which information is provided (imagine the time and difficulty of comparing the prices and ingredients of every item in a busy supermarket) similarly defeats the purpose for which information is intended.

Not all consumers avoid information. In fact, Thorelli [12], in his study of a Norweigan population, found a group of information elitists who not only were aware of more information, but also consulted more sources of information. This group tended to be more highly educated with larger incomes; thus it is possible to speculate that more information is used for economic reasons (higher income families buy more durables) or other reasons (e.g., more educated families can use information more easily).

Results reported by Newman and Staelin [8] suggest that the extent of information usage may not be equal across all product categories. In a study of appliance purchase, information seeking was associated with more costly items. In addition, usage of information tended to be positively related to the number of brands considered.

Past survey results, however, suffer several methodological flaws. First, the conclusions derived from these studies are only generalizable to the practices of information diffusion that were employed in the past. Thus, it is difficult to speculate regarding the efficacy of innovative methods of information transmission. In the Newman and Staelin study for example, more costly products may have more information available. In addition, all survey results suffer from a lack of control: we are not able to manipulate conditions that might be expected to facilitate information usage; although these conditions may exist in the marketplace, failure to measure them will give large within cell variance. Nevertheless, past results are somewhat suggestive of a rational use of information by consumers, and, therefore, a conceptual framework of information purchase based on normative behavior will be proposed.

To suggest new methods of information transmission, a laboratory study of consumer information adoption was designed. The premise underlying

this investigation is that consumers behave in a fashion very much congruent with a normative model as to how a manager should purchase information for decision-making purposes. One widely accepted theory of information purchase is Bayesian decision analysis (sequential decision analysis), pioneered in the work of Raiffa and Schlaifer [9, 10]. This framework suggests that the decision maker first considers the decision to collect or not to collect information. This decision is based on the possible information outcomes weighted by their prior probability of occurrence as well as the action decisions that might follow from the information outcomes. The action decision is based on the states of nature, (i.e., on other outcomes which have probabilities which, when combined with values, yield expected values):

A translated version of this says that for information to be of value, or in the consumer context, "used", the following conditions must be met:

1. The decision must be of some consequence.
2. The decision must depend heavily on known information.
3. Information which will lead to a decision other than the decision resulting from no information has a reasonably high probability of occurring.

Numerous examples of the above conditions are easily seen in the consumer decision area. For Condition 1, few people would read Consumer Reports for a report on salt, mainly because the decision is of little consequence. Few consumers (audiophiles excluded) will read High Fidelity regarding the harmonic distortion of amplifiers, because the information presented cannot be translated into a meaningful purchase decision (blocked Condition 2). Similarly, we would expect few consumers to question and research the safety of toothpaste usage (blocked Condition 3); although the decisions that would follow would be of consequence and a number of actions could be

derived, the probability of this information occurrence would be very low. In short, information is of value to the consumer when that information which affects consequential decisions has a high probability of occurrence.

Theoretically, the value of this information is then compared with the cost, and if value exceeds cost, the information will be utilized. In the managerial framework, cost may be directly translated as research costs. For the consumer, cost may be in the form of a purchase of Consumer Reports, a letter to some agency or company requesting product information, or taking time in the supermarket to read product labels.

The normative framework is quite attractive, but must be compared with past research reality. The basic question is: "Does man behave in a Bayesian decision fashion?". A number of betting games have been run (typically in which a person draws cards from a deck and elects, at a cost, to draw more in an attempt to guess the true composition of the deck), and the work of Green [3] is not unlike other attempts. Other games have been played in which students and managers have purchased survey information as an aid to marketing decision-making [4]. The conclusion is that man does, in fact, consider value of information, but only imperfectly. In game terms, most subjects either buy too much information or too little. While this may be discouraging to those hoping for normative information purchasing, there exist a number of plausible explanations for the deviation from optimality.

One obvious explanation is that man is not a perfect intuitive statistician. Edwards and Phillips [2], in a simulated military command and control game, found a plausible explanation as to why subjects may overbuy information. They attribute this to failure to extract the true certainty embodied in the new information when combined with the prior information.

Thus, because of imperfect information processing, the subject may under value (or over value) the new information.

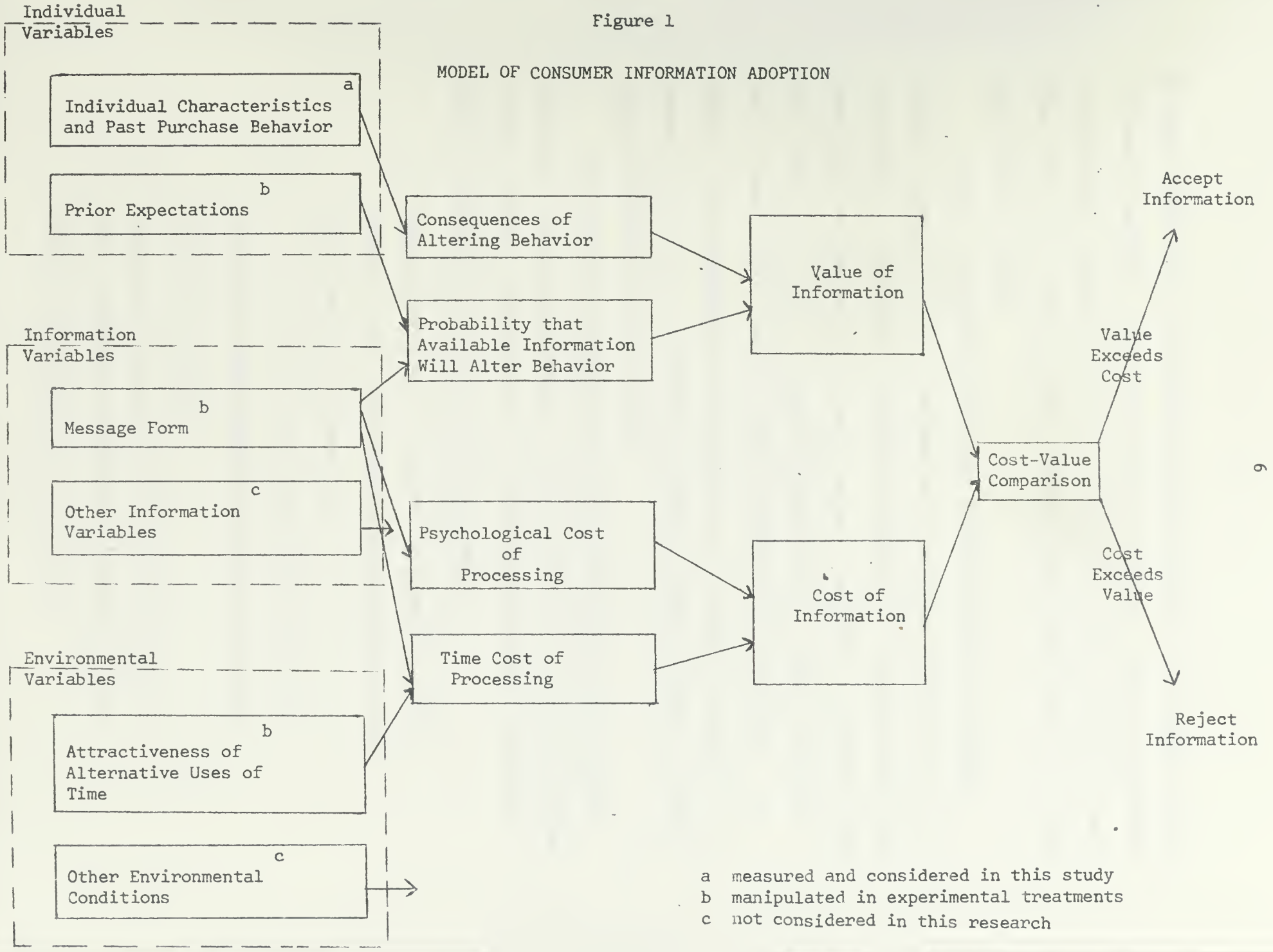
Another key factor is the cost of information acquisition and processing. Typically, we recognize the acquisition cost by specifying in the game that the survey costs $36,000 or the additional card drawing costs 20¢. What is not taken into account, however, is the mental complexity and punishment of updating probabilities, computing expected values, and other similarily tedious calculations. It is not surprising that the psychological demand cost may well exceed the typical $5 jackpot or satisfaction of a game well played. The net result may be easier, less than theoretically optimal, but totally rational in the game context, decision rules. Jacoby, Speller, and Kohn [6] found definite information overload effects that led to fewer "correct" decisions in an experimental purchase simulation. What must be recognized, however, is that this less than optimal strategy may well be a rational choice by the harassed consumer or game player.

The existence of deviations from normative behavior may, in fact, suggest conditions which can be simulated in the laboratory. As Shuford [11] states, it is useful to take a well-defined situation with the accompanying "strictly optimal strategy". Recognizing that subjects may face various constraints (perceptual limits, costs, etc.) leads the researcher to consider "constrained optimal strategies" in which subjects search for optimality under their particular constraints. In this research, various constraints have been imposed, and the resulting strategies will be investigated.

Although Bayesian revision of probabilities are not at issue here, the issue of cost-value comparisons of information is. Figure 1 indicates the working model of information adoption considered in this study. As can

Figure 1

MODEL OF CONSUMER INFORMATION ADOPTION



a measured and considered in this study
b manipulated in experimental treatments
c not considered in this research

be seen, three types of variables are being considered: individual variables, information variables, and an environmental variable. Although environmental or situational variables have not been considered in past simulations, variables that relate to time cost may be particularly appropriate in the information adoption process.

A number of differences from past research efforts are apparent. Firstly, consumer adoption of information is not being compared with a normative model. To do so would require the imposition of the same artificial constraints (or game rules) for every subject. Secondly, the model is somewhat "black box" in that it assumes probabilities have been modified but does not have to fit a specific model of revision (e.g., Bayesian). In summary, only directional hypotheses such as, "as cost of information increases and/or value of information decreases, consumer adoption of information will decrease" will be tested.

The laboratory setting was such that consumers were given product prices from four area supermarkets. Their abilities to recall these prices is then considered a function of th three laboratory induced treatments. Specific hypotheses to be tested are the following:

H_1: Consumers who are told that area supermarkets differ greatly in price (individual prior expectations) will absorb more price information.

H_2: In a situation where alternative uses of time are unattractive (environmental variable), more information will be absorbed.

H_3: Summarized information (message form) will lead to greater information absorption if the loss of data resulting from aggregation is not large.

METHODOLOGY

Within the broad framework of consumer adoption of information, a wide variety of topics are available for study. These range from truth-in-lending studies to experiments in nutrient labeling. To aid interpretation of the results, however, several criteria were selected as necessary to the validity of the study:

1. The topic must be one that is salient and potentially useful to all consumers.
2. The area should provide an objective measure of information absorption.
3. The information should be extensive enough for consumers to selectively use subjects of the information.

With these criteria in mind, it was decided to provide consumers with local supermarket prices. In addition to meeting the above guidelines, the topic was especially timely with respect to skyrocketing food costs. Furthermore, it was felt that the results derived from this research would be generalizable to other forms of information such as nutrient labeling, product safety, brand quality, etc.

An experimental setting was dictated by the variables of interest. The laboratory was used to control for outside influences, and randomization could be expected to eliminate the effects of individual variables such as prior shopping experiences. Because the participants were highly involved and interested in the information presented to them, this study can be expected to reflect high external validity.

Participants in the study were members of church, philanthropic, and politically affiliated groups in the Champaign-Urbana area. Compensation of $3 was paid to their respective organizations for successful completion of the experiment. Subjects spanned broad demographic ranges but the average

subject had a family annual income of about $15,000 and was approximately 45 years old. More than 60% of the subjects were married and the other participants were generally either widowed or divorced. All subjects were female.

The Experimental Treatments

The experiment was essentially one in which participants routinely provided questionnaire information and then were given one of two "previews" of information. This was then followed by the information (two possible forms) under conditions where they were forced to allocate time between reading the information and what they expected to be an alternative task (labelled "Phase II", this was the attractive or unattractive alternative use of time).

The experiment was conducted with four individuals simultaneously. Subjects met initially in a small room where Phase II of the experiment was supposed to take place. Depending upon the attractive-unattractive (time cost) manipulation, the room was decorated in one of two decors:

1. Unattractive alternative use of time treatment--the room contained large piles of questionnaires that were labeled "motor oil questionnaire", "spark-plug questionnaire", "automobile maintenance questionnaire".

2. Attractive alternative use of time treatment--the room contained tables with carpet swatches, fabric samples, and empty coffee cups next to a coffee pot, as well as food taste testing cues such as plates covered with aluminum foil and empty plates with crumbs and plastic forks. In all cases, the samples were labeled (e.g., "Food Product A", "Food Product B", "Carpet Sample A", etc.).

Subjects were then given the following instructions:

1. Participants would be taken to four separate rooms down a hallway where they would be asked to respond to a questionnaire regarding their supermarket shopping habits.

2. Following this, they would be given some price information which they could look over if they wished ("The last time we conducted this survey, many of the participants were interested in supermarket prices. At the time, we didn't have any prices but since then we have computerized the local supermarket price information. You're welcome to look at it if you wish.").

3. After filling out the survey and looking over the price information to their satisfaction, subjects would then leave the smaller rooms and proceed back to the original room to begin another study, either the attractive (food and fabric) or unattractive (motor oil and spark plugs) study.

Subjects were told that the supermarket questionnaire was really the most important study and that if time permitted they could being Phase II. They were also instructed that under no circumstances could they leave before one hour and that they could not stay beyond the hour time limit as a new group was scheduled to begin participation. It was suggested that the real reason for their participation was the initial questionnaire and that they could then allocate the remainder of the hour between the price information and the Phase II study. Thus each participant knew at the beginning of the hour that, after completing the initial questionnaire, she could budget her time between the price information and the Phase II study.

It was necessary to use individualized rooms so that one subject leaving to begin Phase II would not influence other subjects. The price information was concealed in an envelope that was not to be opened until the first questionnaire was completed. At the end of the questionnaire was a page that reiterated the task, reminding the participant of either the attractive or unattractive situation which awaited her after she finished examining the price information. To manipulate perceived savings (large versus small price variance between stores) subjects received treatments in the form of one of the following statements:

1. Small price variance-" . . . as the computer price information will show, prices between area supermarkets are very similar (often less than a 5% difference). What this means is that typical supermarket expenditures for a family of four can vary anywhere between $44.27 and $46.31. Thus, the careful shopper will save very little more than the average shopper . . .".

2. Large price variance-" . . . as the computer information will show, prices do vary substantially (often more than 30%) between area supermarkets. What this means is that typical supermarket expenditures for a family of four can vary anywhere from $34.29 to $56.41. Thus, there are substantial savings that can be realized by shopping wisely . . .".

Subjects were then instructed to complete a short questionnaire (manipulation check of attractiveness of Phase II and perceived price variances). Subsequent analysis indicated that subjects randomly assigned to "attractive" Phase II cells were considerably more interested in the anticipated Phase II than their "unattractive" counterparts; furthermore the price variance treatment was significantly related to perceived savings by careful shopping and to homogeneity of area supermarket prices.

Following this, subjects opened the sealed envelopes and began an examination of the "computerized" price information. The price information was presented in one of two forms:

1. Unprocessed information - this included prices for over 160 commonly purchased supermarket items in 9 product categories (produce, dairy products, meat, canned goods, frozen foods, paper products, beverages, delicatessen items, and "other products"). The prices were listed for four area supermarkets that account for well over 95% of the supermarket expenditures in this retail area (Eisner, IGA, Kroger, A & P).

2. Index information - on the basis of the raw price information (see above), indices of price for the 9 categories were calculated such that 100 represented average prices, below 100 reflected below average prices, and above 100 indicated above average prices. A sample of the data might indicate:

	Store A	Store B	Store C	Store D
Produce	101.5	96.4	101.2	101.0

These indices were simple calculated on the basis of average costs of the approximately 18 items in each category. No attempt was made to weight the individual items by average usage.

In all cases, the computer printouts were listed with official looking labels, numbers and code names such as "Market Basket Submix #472461-2BX".

Following the initial questionnaire and reading of the price information, subjects left individual rooms and proceeded to the "Phase II" room. Respondents then provided the following additional information:

1. Questions about the information (complexity, usefulness, ease of recollection, etc.)
2. Demographic measures and 51 attitude, interest, and opinion questions.
3. Test measures of consumers perception of the lowest price store for 25 items randomly selected from a list of 160 items.
4. Estimates of total monthly purchases for the 25 randomly selected items.

A small debriefing session followed these final measures. Subjects clearly indicated that they did not expect to be tested on the price information and that they did expect to participate in a second study. They also indicated genuine interest in the information.

Summary of Data Collected

The data relevant to this study can be summarized in the following manner:

A. Initial shopping data

1. Total amount spent on supermarket items
2. Monthly expenditures in 9 product categories
3. Distribution of category expenditures among stores
4. Importance of price to store selection for the 9 product categories

B. Treatment levels

1. High versus low price variance
2. "Unattractive" Phase I versus "Attractive" Phase II
3. Unprocessed price information versus index price information

C. Manipulation check variables

1. Comparability of supermarket prices
2. Anticipated interest and enjoyment in Phase II
3. Perceived usefulness, specificity, and recollection of price information

D. General information

1. Demographic information
2. Attitude, interest, and opinion measures

E. Dependent variable measures

1. Perceived store with lowest price for each of 25 supermarket items
2. Monthly usage of 25 test items

Dependent Variables

Given the dependent measure will be related to ability to find the lowest priced store for each of the 25 test items, a number of alternatives summary indices are available. The first index is the sum of price deviations for the 25 test items. The term "price deviation" is simply the difference between the price at the lowest priced store and the price at the store perceived by the subject to have the lowest price. Using algebraic notation,

$$IDS = \sum_{i=1}^{25} (Deviation_{ij})$$

where,

$Deviation_{ij}$ = price of supermarket item i at store j minus price of supermarket item i at minimum price store.

j = store perceived by subject to be minimum price for item i

The advantage of such an index is its simplicity and lack of any subjectivity on the part of the researcher. Although it weights each of the 25 items equally, the variance of the deviations across stores does play some spurious role in weighting.

It might be argued, however, that respondents could not be expected to focus on information that is irrelevant. The final two indices consider relevant information by adding consideration of amount spent on the item and importance of price to store selection. The second index weights the deviation by the quantity used divided by the total amount spent for the 25 items:

$$\text{UWIDS} = \sum_{i=1}^{25} (\text{Deviation}_{ij})\ (UW_i)$$

where,

UW_i = usage weight for item i

$$= \frac{\text{monthly quantity of i used}}{\sum_{k=1}^{25} (\text{Average price}_k)\ (\text{Monthly quantity used of k})}$$

and $\text{Average price}_k = \dfrac{\sum_{j=1}^{4} \text{Price}_{kj}}{4}$

Thus the interpretation of UWIDS is the percent of the food budget (for 25 items) attributable to the respondent's ignorance of the lowest price store.

A final index for consideration takes the second index and, in addition, multiplies each item by the relative importance of price to the shopper. In selecting grocery stores, a number of considerations such as parking, quality of merchandise, service, etc. are appropriate; the third index attempts to reduce the impact of the deviations for items where price is of minor importance. Algebraically the index is the following:

$$UPWIDS = \sum_{i=1}^{25} (Deviation_{ij})\ (UW_i)\ (PW_i)$$

where,

PW_i = Importance of price in category L of which item i is a subset divided by the sum of importances across the 9 categories

$$= \frac{IP_{L \mid i \in L}}{\sum_{m=1}^{9} IP_m}$$

A decision was made to consider relative importance (importance divided by the sum of importances). While this type of measure does reduce response bias across subjects, the measure does fail to consider that some subjects may be price sensitive or insensitive across all categories. The decision to reduce response bias was considered a major factor given the subjective nature of the price importance measure. Another difficulty in using an importance price weight is double counting: the measured importance of price may well be a function of the variance of the deviations across stores and the level of usage.

The three indices are intended as measures of consumer information absorption. The first index is perhaps the least useful as a measure of information absorption to a potential provider of information while the third index raises serious questions about the subjective inputs to the index. The second index is somewhere between the first two on the relevance and subjectivity continuums. While these indices do not exhaust the possibilities of the data, it is believed that they do represent different, divergent alternatives.

During data collection, a number of other possible measures were considered. It would have been possible to ask subjects to indicate their

preference for information or perhaps even record time spent with the information. From an external validity standpoint, however, price deviations (or the ability to get a good test score) are more closely related to the objectives of a provider of information.

RESULTS

The Research Approach

The data analysis has been designed to examine four fundamental questions:

1. To what extent is information absorption influenced by experimentally induced environmental information and individual variables?

2. What demographic or psychographic factors account for some of the unexplained variance in information absorption (i.e., relative under versus over-buying)?

3. Are economic variables (e.g., amount spent on grocery products, income, estimated savings, etc.) related to information absorption and do they interact with the experimental treatments?

4. Assuming that consumers do utilize information, are they "selective" (i.e., are some bits of information used more extensively than others?)?

The previous section discussed the three indices of information absorption which have been used. Although it would be possible (and hazardous) to speculate why different empirical finding might result from different indices, this type of comparison will not be attempted. Instead, the three indices will be considered as alternative criteria upon which providers of information to consumers might focus. The issue of selectivity of information, the heart of a multiple index comparison, will be considered separately.

Effect of Experimental Treatments on Information Absorption

Table 1 is a 2 X 2 X 2 factorial analysis of variance reporting the effects of the three experimental treatments on the unweighted information deviation score. Results indicate that the only significant treatment was that of information form. Of the two information modes, the unprocessed form (detailed information of the prices of more than 160 items) resulted in better test scores than an index of prices for supermarket categories. It is important to recognize that deviation scores are calculated such that zero is a perfect score; therefore the smaller the deviation, the more information absorption.

The mean results of two control groups are also shown in Table 1. The no information group participated in the exact same experiment as the experimental groups except no information was available for study. As can be seen, information absorption was essentially the same for both the index and the no information groups. This result could occur because: (1) the index information receivers may have paid little or no attention to the information, or (2) the information presented by the index may have in some way been misleading in terms of its relevance for the decision makers weekly purchases. This issue will be resolved, in part, by a future analysis.

Another control group utilized in this study was a group that was asked to study the price information because they would be tested on their ability to recall the store with the least expensive offerings. The data indicate that the group that received the unprocessed information came very close in results to this baseline group. This high utilization of information might have been predicted from the experiment; participants indicated a genuine interest in the information and many asked if the computer printouts

Table 1

EFFECT OF EXPERIMENTAL VARIABLES ON UNWEIGHTED INFORMATION DEVIATION SCORE (IDS)

Source of Variation	d.f.	M.S.	F	P
Large vs. small price variance (A)	1	1.981×10^{-2}	.100	NS
Attractive vs. unattractive alternative use of time (B)	1	7.755×10^{-2}	.392	NS
Index vs. unprocessed information (C)	1	1.754	8.867	.003
A x B	1	1.002×10^{-2}	.051	NS
A x C	1	1.555×10^{-2}	.079	NS
B x C	1	$7\ 578 \times 10^{-2}$	.383	NS
A x B x C	1	3.530×10^{-2}	.179	NS
Within Cells	154	1.978×10^{-1}		

Group	$\overline{DS}$	n
Index	1.850	83
Unprocessed information	1.641	79
No information (control)	1.834	21
Study information group (control)	1.618	19

could be taken home. Several subjects were observed to be copying down some of the price information, presumably for future reference.

Table 2 indicates an identical treatment of the data with the exception that the dependent variable is a usage weighted price deviation score. The loss of one observation was due to a subject not completing the usage section of the questionnaire. Two main effects were significant: (1) the effect of the environmental setting (an attractive versus unattractive alternative use of the subject's time) and (2) the information form. Conclusions regarding the better mode of information are essentially the same as those discussed from Table 1; it is interesting to note, however, that on this index of price absorption, the unprocessed information experimental group did better than the study information control group. This may be because the experimental group was utilizing information of high importance to them (e.g., information regarding purchases they often make) while the study information group was less discriminating in their use of the information bits.

As expected, the group with the unattractive alternative use of time absorbed more information than the group that faced an attractive alternative to studying price information. This suggests that the environmental setting under which information is provided may play a major role in information absorption.

Table 3 illustrates the results of using the third index of information absorption, usage and price importance weighted price deviations. As before, main effects of the environmental variable and the information mode were significant. The directionality of the effects is as before.

New to the previous conclusions is a significant interaction term between large versus small price variance and index versus unprocessed

Table 2

EFFECT OF EXPERIMENTAL VARIABLES ON USAGE WEIGHTED INFORMATION TEST DEVIATION SCORES (UWIDS)

Source of variation	d.f.	M.S.	F	P
Large vs. small price variance (A)	1	2.162×10^{-3}	1.384	NS
Attractive vs. unattractive alternative use of time (B)	1	7.185×10^{-3}	4.599	.034
Index vs. unprocessed information (C)	1	9.245×10^{-3}	5.917	.016
A x B	1	1.373×10^{-3}	.879	NS
A x C	1	2.411×10^{-3}	1.543	NS
B x C	1	6.814×10^{-4}	.436	NS
A x B x C	1	4.443×10^{-5}	.028	NS
Within cells	153	1.562×10^{-3}		

Group	$\overline{\text{UWIDS}}$	n
Attractive	7.830×10^{-2}	77
Unattractive	6.485×10^{-2}	84
Index	7.920×10^{-2}	82
Unprocessed information	6.395×10^{-2}	79
No information (control)	8.76×10^{-2}	21
Study information (control)	6.74×10^{-2}	19

Table 3

EFFECT OF EXPERIMENTAL VARIABLES ON USAGE, PRICE IMPORTANCE WEIGHTED INFORMATION TEST DEVIATION SCORES (UPWIDS)

Source of variation	d.f.	M.S.	F	P
Large vs. small price variance (A)	1	1.099×10^{-6}	.524	NS
Attractive vs. unattractive alternative use of time (B)	1	6.662×10^{-6}	3.191	.077
Index vs. unprocessed information (C)	1	1.408×10^{-5}	6.744	.011
A x B	1	2.539×10^{-8}	.012	NS
A x C	1	8.678×10^{-6}	4.157	.044
B x C	1	2.738×10^{-6}	1.312	NS
A x B x C	1	5.702×10^{-7}	.273	NS
Within cells	120	2.088×10^{-6}		

Group	$\overline{\text{UPWIDS}}$	n
Attractive	2.761×10^{-3}	56
Unattractive	2.298×10^{-3}	72
Large price variance, Index	2.696×10^{-3}	29
Large price variance, Unprocessed	2.551×10^{-3}	31
Small price variance, Index	3.037×10^{-3}	38
Small price variance, Unprocessed	1.835×10^{-3}	30
No information (control)	3.729×10^{-3}	16
Study information group (control)	Not available	--

information. The group means indicate that within the group that received index information, the individuals who were also told that prices varied greatly from store to store absorbed more information than those who were told that prices were very similar among stores. The finding was expected; obviously, there is more motivation to study price information if one thinks he can save money by shopping more wisely.

What is unexpected, however, is the reversal of the price variance information effect within the unprocessed information group. In this case, the group with the highest information absorption was told prices did not vary among stores (. . . "less than a 5% difference . . . typical supermarket expenditures for a family of four can vary anywhere between $44.27 and $46.31. Thus, the careful shopper will save very little more than the average shopper.") One possible explanation is that information of this type was probably counter to expectations prior to the treatment. In this case, information (unprocessed) was available in which the respondent could verify the price similarities. Respondents who shop at many stores or contemplate multiple store purchase may find this prior probability treatment very motivating. It is information which could very easily alter decisions regarding where to shop. In the case of the index information, the price variance statement would be impossible to verify and, therefore, the consumer must accept the small price variance statement as being not motivating to look for more price information.

The question of index versus unprocessed information leading to information absorption is an interesting one. All results reported suggest that unprocessed information leads to greater use of information. Nevertheless, only two modes of information have been used and one might argue that there is some index which would be better than the index used for this

study. Ideally an index would capture all the information contained in unprocessed information (i.e., little information loss) and yet be simpler and easier to absorb and remember. Previously discussed analyses therefore confound the effects of information overload and information loss.

Table 4 attempts to address itself to the issue of simplicity versus information loss. On all three indices employed, mean information test deviations are shown for the three information conditions (index, unprocessed, and no information). The table adds, however, deviation* scores that would result if the index captured most of the unprocessed information. Assume that the index for one product category such as dairy products is the following: Store A - 103.2; Store B - 99.9; Store C - 103.5; Store D - 93.4. This indicates that Store D had the lowest prices followed by Stores B, A, C, respectively. Now the normal price deviations (used in previous analyses) from the unprocessed information for sliced American cheese is: Store A - 04; Store B - 02; Store C - 00; Store D - 08. If, however, the index was ordinally related to each of the individual items, the adjusted or deviation* would be: Store A - 04; Store B - 02; Store C - 08; Store D - 00. In a sense, all the asterisked deviation totals are computed as if the individual items in a category conformed ordinally to the index results.

The analysis in Table 4 suggests that for all three indices, the deviation* total for the index group is significantly lower than the deviation total for the unprocessed group; only for the unweighted total, however, was the deviation* total for the index group significantly lower from the deviation* total for the unprocessed information group. The analysis indicates that simplified information, if it is accompanied by little information loss, may result in greater information absorption.

Table 4

MEAN INFORMATION TEST DEVIATION
SCORES FOR THREE INFORMATION CONDITIONS

	IDS	IDS*	UWIDS	UWIDS*	UPIWDS	UPIWDS*
Index Group	1.850 (83)	1.289[abc] (83)	.0799 (82)	.0518[ab] (82)	.0029 (67)	.0019[ab] (67)
Unprocessed information group	1.641[a] (79)	1.612[c] (79)	.0635[a] (79)	.0604 (79)	.0021[a] (61)	.0019 (61)
No information group	1.834 (21)	1.638[b] (21)	.0876 (21)	.0764[b] (21)	.0037 (16)	.0031[b] (16)

[a] Significant ($\leq .03$) differences between deviation * for index group and deviation for unprocessed information group

[b] Significant ($\leq .03$) differences between deviation * for index group and deviation * for no information group

[c] Significant ($\leq .01$) differences between deviation * for index group and deviation * for unprocessed information group

It could be argued that consumers intuitively processed past shopping experiences in index form, and that the new index information had no real effect. In all cases, however, the deviation* total was significantly lower for the index information group when compared with the no information group.

Effect of Demographic Variables on Over or Under Absorption

To investigate whether some demographic groups are relatively higher or lower purchasers of information, residuals from the predicted information score were calculated for each individual. This was simply done by subtracting the mean score of an individual's cell from her score. Residuals of positive value indicate relative under-absorption and negative values indicate relative over-absorption. Table 5 provides a summary of the findings that consider the residuals as functions of demographic variables. In general, the experimental treatments far outweighed the effect of the demographic variables. Marital status, a dummy variable, provides some explanatory power and suggests, for the unweighted analysis, that married participants tended to absorb more information. In the case of the usage-price importance index, employment status was significant. The direction of the coefficient indicated that working shoppers tended to absorb less (either in the experiment or over the past shopping experiences) than their unemployed counterparts. One might expect working women to have such little time for shopping and price comparisons (or more attractive alternative uses of time) that they might be conditioned to paying little attention to price information.

TABLE 5

ESTIMATES OF INFORMATION TEST DEVIATION RESIDUAL FUNCTIONS - DEMOGRAPHIC FACTORS

Independent Variables	Coefficients IDS	Coefficients UWIDS	Coefficients UPWIDS
Marital Status	-.19515 (.08694)[a]	N.S.[b]	N.S.
Age	N.S.	N.S.	N.S.
Number shopped for	N.S.	N.S.	N.S.
Education	N.S.	N.S.	N.S.
Employment Status	N.S.	N.S.	.00042 (.00019)
R	.216	___	.231
N	116	115	89

[a]Values in parentheses represent the standard errors of the estimated coefficients.

[b]Variable is not significant at the .10 level.

Effect of Attitudinal Factors on Over or Under Absorption

In addition to demographic variables, the influence of attitude, interest, and opinion variables on information score residuals has been considered. From an initial set of 51 AIO measures, the data were reduced to 18 factors using principle components--varimax rotation factor analysis. Factor loadings greater than .5 and the derived factor names for factors of interest appear in Table 6. The empirical regression estimates using residuals as a function of factor scores appear in Table 7. In general, information absorbers appear to be relatively high in price sensitivity, fashion consciousness, and financial conservation; in addition, they tend to be relatively satisfied with prices and new product innovators. The direction of the effect of the "financial constraints" variable runs counter to intuition; part of this may be attributable to the difficulty of naming the variable (i.e., the attitude "you get what you pay for" is correlated with "on a tight food budget"). Nevertheless, the finding that those who utilize the least amount of information also tend to be those least able to afford ignorance of the information is not totally incompatible with the results of the next section.

Individual Economic Factors and Information Absorption

Measures of economic-demographic variables which may relate a priori to information absorption are also available for each subject. These include measures of income, estimated savings by careful shopping (prior to manipulation), amount spent on groceries, and a measure of the dispersion of supermarket expenditures across area supermarkets. Because these are highly related to possible behavior toward price information, these variables were considered in an interactive sense with regard to the experimentally manipulated variables.

Table 6

SUPERMARKET SHOPPING RELATED FACTORS

AIO variables with loadings >.5	Factor number	Factor name
Use coupons, read supermarket ads, consider dayold bread a value, believe beef prices have dropped	1	Price sensitivity
Use cosmetics, clothes conscious, fashion conscious	2	Fashion conscious
You get what you pay for, on a tight food budget, difficult to live on income	6	Financial constraint
Pay cash for all merchandise	9	Financial conservation
Food prices not too high, convenience food are not to expensive	10	Satisfaction with Price
Try new brands before friends	15	Innovativeness

Table 7

ESTIMATES OF INFORMATION TEST DEVIATION RESIDUAL

FUNCTIONS-PSYCHOGRAPHIC FACTORS

Factor	Coefficients IDS Residual Analysis	Coefficients UWIDS Residual Analysis	Coefficients UPWIDS Residual Analysis
Price sensitivity(F1)	-.09720 (.03765)[a]	n.s.[b]	n.s.
Fashion conscious(F2)	-.08009 (.03765)	n.s.	n.s.
Financial constraints(F6)	.70989 (.03765)	n.s.	n.s.
Financial conservation(F9)	-.06866 (.03765)	-.00784 (.00380)	-.00360 (.00149)
Satisfaction with Prices(F10)	.07981 (.03765)	n.s.	n.s.
Innovativeness(F15)	.06583 (.03765)	n.s.	n.s.
R	.460	.202	.310
N	102	102	83

a Values in parantheses represent the standard errors of the estimated coefficients

b Variable is not significant at the .10 level

The data used for analysis consisted of each of the above mentioned variables and the addition of $\sigma_{\text{store purchases/total purchases}}$. The variable $\sigma_{\text{store purchases}}$ is essentially the standard deviation of dollars spent at each store (4 named stores and 1 "other" category). This variable was then divided by the total dollars spent to reflect variability of store purchase relative to the dollar amount spent. Each of these five variables was then considered alone as well as interactively with the experimental treatments (dummy variables). Results of the stepwise regression analysis appear in Table 8. New additions to the previous findings are the interactions between relative store purchase variability and information mode as well as income and attractiveness of alternative uses of time. The inclusion of relative store purchase variability suggests that individuals who shop at a number of stores were particularly information conscious when faced with information that would indicate whether they should continue the multiple store practice or perhaps narrow activity down to one store. The inclusion of income interacting with attractiveness is less easy to explain although this finding is not new [12]. The data suggests that under attractive circumstances, all consumers behave alike (do not utilize information). However, when conditions are conducive (unattractive), the higher income levels utilize information more extensively.

Selective Use of Consumer Information

Analyses previously discussed have focussed on thos individuals who adopt information and those conditions under which information adoption can be expected. A final issue is the possibility that generalizations can be made regarding bits of information to which consumers particularly respond.

Table 8

STEPWISE REGRESSION ESTIMATES OF
INFORMATION TEST DEVIATION SCORES USING
EXPERIMENTAL AND INDIVIDUAL ECONOMIC FACTORS

Independent Variables	Coefficients IDS Analysis	Coefficients UWIDS Analysis	Coefficients UPWIDS Analysis
Attractive vs. unattractive alternative use of time	n.s.[b]	-.0113 (.0062)	n.s.
Index vs. unprocessed information	n.s.	n.s.	-.0009 (.0003)
$\frac{\sigma_{\text{Store purchase}}}{\text{Total Purchase}}$ x (Index vs. Unprocessed)	-.0357 (.0084)[a]	-.0021 (.0008)	n.s.
Income x (attractive vs. unattractive)	n.s.	n.s.	-.00000004 (.00000002)
R	.3177	.2600	.3368
N	162	161	90

[a] Values in parantheses represent the standard errors of the estimated coefficients

[b] Variable is not significant at the .10 level

The differing results for each index suggest that importance of price as well as usage may relate to information usage and Table 9 is an attempt to explore this hypothesis.

In Table 9, each individual's 25 item price deviations were considered as a function of the average price of the item, the stated importance of price for the category in which the item is classified, the monthly amount spent on the item, the variance of prices across the four stores, the total amount spent on groceries (a cross-sectional effect constant for the 25 observations for each individual) as well as interaction between total amount spent and amount spent on the item. All observations were pooled for each of the three indicated information modes: no information, index information, and unprocessed information. Under all three conditions, variance across stores of item prices was highly related to deviations; this is as expected. Only in the cases of index information and unprocessed information was there some suggestion that individuals focussed on those items that accounted for substantial amounts of their monthly food budgets. In the case of the unprocessed information treatment, subjects absorbed more information for high expenditure items; the interactions with total amount spent indicates this effect to be larger for those who spend large total amounts at supermarkets. In the case of the index information group, the same condition is observed except for the positive interaction term. The positive effect is most likely a correction term for individuals with large total expenditures; the per item expenditure probably exaggerates this effect (this is plausible since total amount spent is the sum of the amounts spent for the 25 items). In any event, the net effect of amount spent per item is negative since the mean of total amount spent is not large.

Table 9

CROSS-SECTIONAL, WITHIN INDIVIDUAL REGRESSION ANALYSIS

OF ITEM INFORMATION TEST DEVIATIONS

Independent variable	Coefficients No information group	Coefficents index information group	Coefficients unprocessed information group
Item average price	n.s.[b]	n.s.	n.s.
Importance of price for item category	n.s.	n.s.	n.s.
Amount spent on item	n.s.	-.0096 (.0027)	n.s.
Variance of item prices across stores	1.1415 (.0525)[a]	1.3325 (.0276)	.9212 (.0294)
Total amount spent	n.s.	n.s.	n.s.
Total amount spent x amount spent on item	n.s.	.00016 (.00005)	-.00010 (.00002)
R	.7368	.7792	.6283
N	400	1675	1525

[a]values in parantheses represent the standard error of the estimated coefficients

[b]variable is not significant at .05 level

Part of the problem of interpreting Table 9 is that two effects are present: a cross-sectional effect across consumers and a within individual effect across the 25 test items. Table 10 is an attempt to overcome this deficiency. In this case, individual regression analyses were run for each of the 144 individuals. The means of the standardized regression coefficients are shown in Table 10. Standardized coefficients were used to facilitate comparison across individuals.

In the case of the no information group, only the average price of the item and variability of prices across stores was significant. The data suggests that without new information, consumers tend to remember high priced items. In the use of the indexed information, the regression coefficients of amount spent on the item as well as price variability were significant. From the previous analyses of Table 9, no strong support for "economic rationality" could be found. In general the indices were not seen to be functions of economic type variables such as total amount spent for groceries, etc. Utilizing the results of Table 10, however, it becomes apparent that consumers do selectively seek information regarding those items that absorb large quantities of their grocery dollars. The ability to be selective is hampered, however, when comparing only indices based on 160 grocery store items.

In the case of unprocessed information, another parameter appears significant: the importance of price for the category (e.g., produce, dairy products, etc.) in which the item is classified. Although one would expect this variable to be correlated with the other independent variables, consumers seem to be able to recognize that price trade-offs do occur with store cleanliness, quality of merchandise, convenience of shopping, etc. Thus, as the importance of price increases, one sees more consumer concentration on price information.

Table 10

WITHIN INDIVIDUAL REGRESSION ANALYSIS OF ITEM

INFORMATION TEST DEVIATIONS

Indepent variable	Average coefficients[a] No information group	Average coefficients[a] Index information group	Average coefficients[a] Unprocessed information group
Item average price [c]	-.1507[b]	.0305	-.0249
Importance of price of item category	-.0352	-.0212	-.0794[b]
Amount spent on item[c]	.0717	-.0816[b]	-.1226[b]
Variance of item prices across stores[c]	.7144[b]	.7503[b]	.5946[b]

[a] coefficients are standardized regression coefficients

[b] significantly different from zero at .01 level

[c] significant differences on this variable between information groups at the .05 level

DISCUSSION

Empirical results suggest that the experimental manipulations of individual, informational, and environmental variables played a significant role in consumer adoption of supermarket price information. In general, unattractive alternative uses of time favor information usage. Thus, information media should be designed to reach the shopper during times of inactivity. Cable television and take-home price booklets (as utilized by a large drug store chain in the author's area) undoubtedly offer promise when compared with in-store information such as unit pricing on shelf displays. As interesting comparison would be a study of the place where cereal box nutritional information is absorbed; it is hypothesized that the breakfast table is a more likely time for this type of reading than during the actual shopping experience. The result that employed shoppers tended to absorb less information also supports the hypothesis that lack of available time prohibits information adoption and that possibly this behavior is learned over time.

The issue of unprocessed versus processed (index) information is complex and not immediately resolvable. One of the problems is that the initial finding that unprocessed information favors information absorption, is, in part, sensitive to the simple index that was used in this study. Evidence was presented that indicated the index did have a positive effect, but that the information lost by aggregation misled the consumers. What might be possible is to design subaggregated indices. For example, instead of a "Meat Price Index", it might be possible to have a "Beef Price Index", "Poultry Price Index", "Seafood Price Index", "Fancy Cuts Index", etc. It may well be that mere calculation of the indices on the basis of average

per capita usage of the individual items could solve the problem. One additional cautionary note is required: supermarket chains may recognize the composition of the index and price selected items accordingly. This is not unlike racing yacht designs where designers attempt to design the fastest boat within the constraints of a formula. Recognition of game theory, or at least basing the index on unknown randomly selected components may, in part, offer viable solutions.

It was expected that consumers who were told that prices varied greatly would absorb the most information; this effect was not significant. What may be the critical dimension, however, is one of information newness. In other words, providers of information need to be aware of current perceptions, educate the consumer that his perceptions are not congruent with fact, and then offer information that allows the consumer to validate the claim.

In spite of the low explained variance, the effects described above are real and significant. When one considers the diversity of past experiences, biases, and constraints that each participant brought with her to the experiment, this is not surprising. Attempts to explain the residual effects with demographic, attitudinal, and economic factors were partially successful. In general, the above average user of information was unemployed, price sensitive, financially conservative, dissatisfied with prices, not innovative, a multi-store shopper, and from a higher income bracket. While the additional explanatory power of these variables is low, the effects were significant and help to confirm some of the past research findings in this area.

Consumers were selective in the bits of information upon which they focussed. Indications are provided that of most concern are those items

that absorb a major part of the food dollar. In addition, shoppers tend to ignore price information for those items where price is relatively unimportant compared to quality of merchandise, store cleanliness, etc. These findings are totally congruent with an economic man hypothesis.

CONCLUSIONS

A laboratory study was used to measure consumer usage of information regarding prices at four area supermarkets. It is believed that a setting psychologically similar to an actual information purchase environment was created in the laboratory.

Results suggest that information absorption is facilitated when consumers are persuaded that information exists which is contrary to their expectations, and that information is available to allow confirmation or rejection of this contention. Simplified information increases comprehension only if information lost during simplification is not large. Because information processing does involve a time cost (other costs such as purchase dollars or psychological costs are important but were not considered in this research), providers of information should insure that information reaches their targets when the utility of time is low. Although a Bayesian theory of information purchase per se is not being tested, there are strong indications that parameters to this type of decision-making process do have relevance for providers of consumer information; deviations from this process do appear to have some component of rationality.

The variables selected for manipulation in this research were somewhat arbitrary as a number of conditions can be expected to relate to information adoption; nevertheless, they are representative of the large number of individual, informational, and environmental variables that

influence consumer use of information. Hopefully, future research will continue to probe for additional considerations in this complex process.

Perhaps the main contribution of this study is methodological. The response of a number of indices of consumer information were reported, and these measures range from the very objective to measures that have subjectivity included. In any event, they are much more direct and relevant than highly subjective measures such as time spent reading information, interest in more information, etc. It would not be difficult to apply these same procedures to studies of cereal nutrition labeling, automobile safety information, or truth-in-lending figures, for example.

Researchers in this area are encouraged to state specifically what objectives the information is designed to accomplish. For example, in this experiment, the sole purpose of the information was to educate consumers to the different prices charged by area supermarkets. Whether consumers use the information to actually alter purchase behavior is another interesting, unanswered question. If information providers are interested in behavioral change then it is clear that different forms of communication must be used; it may be found that legislation is actually the most effective way to get consumers to purchase inexpensive, nutritious food or purchase safe automobiles. Specification of information objectives may also recognize that some subsegments of the market warrant more protection than others [13]. There is the suggestion that, in this study, high income groups responded most positively to the information provided. Thus, researchers may want to consider information forms and environments to which special interest groups (e.g., low income) are particularly responsive.

All the manipulations used in this experiment have real world counterpart strategies that could be employed. Future research dictates that these findings be tested in a field environment. While the laboratory provided the necessary controls and met the budget constraints of this research, the question remains as to the potential strength of these manipulations in actual purchase situations.

In summary, information provision procedures such as unit pricing do cost money [7], and one is well advised to be aware of the extent of individual usage. Prior to design and measurement, however, is the necessity to determine objectives and pretest the strategies to assess the likelihood of meeting these objectives.

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