JAMES R. BETTMAN*

Comparing different information processing models of the same consumers' decisions and utilizing findings from clinical judgment studies give information about the structure of consumer choice processes. Cue consistency and conditional models are discussed and a general paradigm for choice under uncertainty is proposed.

The Structure of Consumer Choice Processes

BACKGROUND

Clinical Judgment Research

Certain findings in clinical judgments are relevant for understanding consumer decision processes. The experimental paradigm underlying this research is as follows: judges, provided with sets of cues or variables for each case, are asked to make quantitative judgments on many hypothetical cases. The experimenter attempts to fit the judges' responses by some mathematical function of the cues. Typical situations examined are diagnoses of benign or malignant gastric ulcers [10], where the cues are diagnostic signs such as X-ray findings; diagnoses of psychotic or neurotic patients, where cues are Minnesota Multiphasic Personality Inventory (MMPI) profile scores [8] and judgments of intelligence based on high school grades, study habits, scores on English effectiveness tests, and the like [19].

According to the judges, their subjectively held models used the cues nonlinearly, and, more importantly, configurally; that is, attention is given to patterns of cues so that a cue's effect on judgment depends on the value of another cue or set of cues. For example, a judge of intelligence would be using cues configurally if he stated the rule that study habits influence rating of a subject's intelligence only if high school grades are high, and have no influence otherwise.

The surprising finding of many clinical judgment studies is that if a simple linear regression model, using the cues as predictor variables and the quantitative judgment as the dependent variable, is fit to the data, the model's accuracy is at approximately the same level as the reliability of the judgments. Adding interactive configural terms did not improve prediction. For example, Hoffman's study on ulcer diagnoses, chosen specifically to yield configural judgments, found approximately 90% of the reliable variance in response could have been predicted by a simple linear model [10]. For summary results of other studies, see [8, 10, 19]. Judgment researchers have made many attempts to explain the so-called "linear vs. configural models" problem illustrated by these findings. This article will examine these explanations.

Consumer Decision Process Research

The Newell, Shaw, and Simon postulates for an information processing theory of problem solving [15] were used in an earlier article to construct models for two individual consumers' choices of grocery products [3]. The models were complex discrimination nets, inferred from protocols obtained during several shopping trips for each consumer. For one of these models, see [3, p. 371].

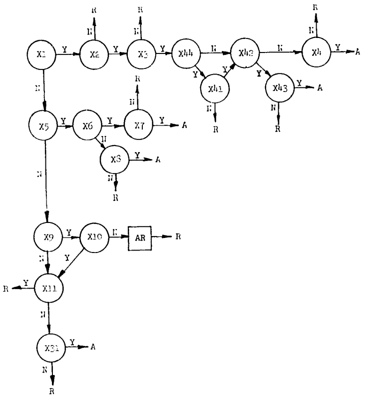
After defining and attempting to treat problems of data coding for the various cues specified at the nodes of the models, the models were tested against two sets of actual data, the original set from which the models were inferred, and a validation set. Overall, the models correctly matched over 87% of the consumers' accept/reject decisions.

Simpler information processing models of these same two consumers' decision mechanisms were then considered. Figure 1 shows the simple model corresponding to the complex model shown in [3, p. 371]. A comparison of the two figures shows that the simple model is less configural, employing a "buy the cheapest" decision rule for most cases. The simple and complex models for the second consumer are similar—one highly complex, and the other much simpler and less configural.

* James R. Bettman is Assistant Professor of Business Administration, University of California, Los Angeles. A modified version of this study was presented at the Association for Consumer Research's Annual Meeting, 1970.

Journal of Marketing Research,
Vol. VIII (November 1971), 465-71

Figure 1
A SIMPLE MODEL FOR CONSUMER C_1



KEY TO FIGURE 1

Dictionary: A: Accept
R: Reject
AR: Associate risk (bad experience) with this product
Y: Yes
N: No

X1: Is this meat or produce?
X2: Is price below "justified level"?
X3: Is color satisfactory?
X4: Is this the biggest "okay" one?
X5: Is this eggs?
X6: Is the price of extra large more than 5¢ more than the price of large?
X7: Is this the large size?
X8: Is this the extra large size?
X9: Was this product (brand) bought the last time a purchase in this class was made?
X10: Was experience with it okay?
X11: Is risk associated with this product (bad experience)?
X31: Is this cheapest (that they have in stock)?
X41: Does this feel okay?
X42: Is this for a specific use?
X43: Is this size okay for that?
X44: Is this produce?

These simple choice models, when applied to the data, did surprisingly well. The percentages of correct predictions, compared to those of the complex models, were:[1]

	Complex model	*Simple model*
Consumer 1	87.2	82.4
Consumer 2	87.5	70.8

INTERPRETING THE RESULTS

Since simpler models predict well,[2] what guarantees that all processes stated in the protocols are really used? The findings are like those from the clinical judgment studies, that subjectively complex decision processes can be approximated fairly well by much simpler models. The simple consumer decision models are certainly not linear. However, examination of the problem of linear vs. configural models in clinical judgment may aid in solving the similar problem of comparing complex and simple models.

Three hypotheses have been advanced to explain the linear findings in clinical judgment studies [8, p. 488]:

1. Human judges behave in fact remarkably like linear data processors, but somehow they believe that they are more complex than they really are.
2. Human judges behave in fact in a rather configural fashion, but the power of the linear regression model is so great that it serves to obscure the real configural processes in judgment.
3. Human judges behave in fact in a decidedly linear fashion on most judgmental tasks (their reports notwithstanding), but for some kinds of tasks they use more complex judgmental processes.

The major problem considered here is analysis of consumer information processing models as it relates to these hypotheses. After briefly discussing the technique used in analyzing the models, inferences about decision process structure will be examined in some detail.

Analysis of the Models

The simple and complex consumer information processing models are represented as graphs or as a set of nodes (points) with arcs (lines) connecting pairs of nodes. Each node represents a test on a particular cue (e.g., is perceived risk high?), and the arcs represent the processing sequence taken, depending on the values the cues assume. For example, Figure 1 has nodes X1, X2, X3 and so forth, and arcs representing yes or no branches. The initial flow of processing is as follows: if the product is meat or produce, first check price, then color, and so on. Otherwise check to see if the product is eggs, and so forth.

The main idea developed in analyzing these models is that of a conditional decision process graph. Suppose a configuration or set of cues were given, with the cues assuming certain *given* values (e.g., high risk and cheapest price). For that particular set of cues, since the arcs to be taken out of the nodes representing those cues

[1] Certainly the predictive power of simpler models needs to be tested over more subjects and more shopping choices for each subject.

[2] It is possible that the protocol methodology itself encourages development of models of spurious complexity. Findings in the cognitive process models literature have not supported this contention, however.

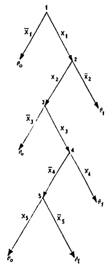
would then be known, the graph conditional on that knowledge will be simpler than the original graph.

As an example, postulate a decision process with just two outcomes, θ_0 and θ_1. Also, let X_i represent a "yes" response to the test on cue i, and $\bar{X}_i$ a "no" response. Then Figure 2 is an abstract decision process graph with five cues. If X_2 and X_4 hold as a given cue configuration, the graph of Figure 2 can be collapsed to the simpler Figure 3, because of the certainty of following the arcs corresponding to X_2 and X_4.

A formal mathematical technique can be developed for carrying out this type of collapsing for any particular given cue configuration [2]. The process is trivial for the simple case shown above, but for complex decision process graphs the mathematical technique is necessary.

With this idea of a decision process conditioned on the values of a set of cues, it can be shown [2] that both simple consumer models can be obtained from the complex models by *conditioning those complex models on given cue configurations*, where the conditioning sets of cues are very plausible for the persons modeled.[3] It is important to note that a less configural model can be viewed as a complex model conditioned by a given cue configuration: thus complex models can be collapsed as outlined above, given known values for cues.

Figure 2
ABSTRACT DECISION PROCESS WITH FIVE CUES



[a] θ_0 and θ_1 represent outputs of the decision process.

Implications of the Model Analysis

It can now be argued that perhaps persons often perceive the external world in terms of cue patterns or configurations, rather than in terms of separate cues. And, if perceptual structure is such that many products are characterized by a certain given configuration of cues, then a simple conditional model using only a small set of cues may be invoked a large proportion of the time. That is, the conditional decision process given that particular frequently perceived cue configuration is *simple* and is used a *large part of the time*. The analysis of the consumer models bore out this argument.

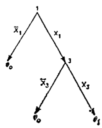
Carrying the argument a step further, perhaps it is these configurations of conditioning cues which are most expected by the decision maker. Consistency of cues may then be defined in terms of expectations. Those cue inputs that are expected and are coded normally into configurations are seen as consistent; those that are unexpected, and hence coded differently, are seen as inconsistent. Inconsistent configurations thus call up more complex subprocesses and make the entire decision process seem more configural. Under this interpretation of cue consistency as fulfilled perceptual expectations, a two-step process is postulated: cue consistency is assessed and then the relevant subprocesses are invoked. If cues are consistent, habitual simple decision rules are invoked. Since such consistent cue combinations occur rather frequently (one tends to see the world as he expects to), the simple rules will account for many decisions, leading to a good fit for a simple and less configural model. If cues are not consistent, however, problem-solving processes and hence more configural models are in order. The configural processes outlined by decision makers in their protocols may very well be true, therefore, since problem solving would imply more consciousness of what processes are being used.

This two-step process of consistency assessment and decision subprocess application has been postulated by other experimenters, although consistency measurement techniques have not all been uniform. Hoffman discussed several clinical judgment experiments of this type and concluded that "Such experiments imply a sequential utilization of cues, the second stage process being governed by the presence or absence of such discrepancies between relevant cues" [10, p. 80]. Slovic carried out similar experiments on a judgment task of predicting grade point ratings, where scores for high school grade rating and English effectiveness were varied to produce differing amounts of inconsistency [19]. Finally, some work on impression formation is relevant. The basic paradigm is to present a subject with a set of adjectives describing a hypothetical person and to ask the subject to judge how much he likes that person. The sets of adjectives can be varied to be either consistent or inconsistent among themselves. Work by Anderson and his colleagues in this area has led to some similar findings of interaction between discrepant cues (although most of Anderson's work has been directed to showing the adequacy of the linear model) [1, 14, 18]. These findings add weight to the inferences made above from the consumer behavior models.

Thus, where Goldberg concludes that his second hypothesis is the most likely explanation of the linear-

[3] For the consumer represented in the complex and simple models, these configurations represented product types that were seen as not risky or situations where no brand was preferred by family members. These perceptions were very typical for this consumer.

Figure 3
A SIMPLER MODEL OF FIGURE 2



configural problem [8, p. 491; 9] (and it definitely seems to be a large contributing factor), the present analysis infers that perhaps a modified version of the third hypothesis is relevant. Of course, given the clinical nature of the models and data, such inferences must be speculative.

Also, it seems as though a more complex model can be justified even if a simple model predicts nearly as well for a given set of data. Indeed, if the above perceptual arguments are valid, then the problem with replacing a complex process model by its more simple conditional model would be that one must assume there will be no changes in the decision maker's perceptions of the distribution of coded configurations in the environment. Different sets of cues may become the expected sets, and the balance of habitual simple processes and more complex and configural problem-solving processes may be altered.

IMPLICATIONS FOR A GENERAL DECISION AND CHOICE MODEL

One important use of the analyses for researchers of consumer behavior would be in attempting to formulate a general model of the structure of consumer decision processes. Such a model could provide a framework for research and also yield hypotheses about marketing management applications. In this section an attempt is made to integrate many strands of research on decision models seen as cue processing schemes and, in particular, the preceding speculations on the structure of consumer decision processes. At this stage of development this model will be very abstract.

One concept used in the general scheme is an integration of cognitive motivation theory [6, p. 59]:

> It is suggested that individuals develop general adaptation levels concerning the amount of incongruity they expect in their environments. The GIAL [general incongruity adaptation level] would represent an optimum incongruity level within an organism. It is proposed that as incongruity falls below the optimum, cognitive action will produce more input (e.g., exploration, novelty seeking, etc.). As incongruity increases beyond the optimum, cognitive action will attempt to reduce or simplify input (as in dissonance reduction).

The paradigm for the general model is outlined in Figure 4.

Aspects of the General Model

Block 2: Incongruity level as a goal. The goal of the decision maker is to attain his incongruity adaptation level through choice of behavior. An incongruity adaptation level specific to a decision area (IAL) is considered here, rather than a generalized level [6, p. 57].

Blocks 3 through 5: The cue manipulation process. The inferences discussed earlier bear on this portion of the scheme. In Block 4, it is further assumed that use of a dominant decision mode tends to reduce incongruity. Continued use of a simple decision rule may lead to a level below the IAL—boredom will set in. This is seen later in Block 7.

Block 6: Process dynamics. Block 6 represents learning, which was not considered in the consumer models above. However, speculations about processes conditional upon cue configurations lead one to infer that a dynamic process is at work, with nodes becoming combined into learned cue configurations which invoke subprocesses.

It is hypothesized that the more problem-solving processes are used, the more expected and hence more consistent are the associated sets of cues. At a level peculiar to the individual, these cues are learned as consistent, and the decision net collapses into a process conditional on that learned cue configuration. The process is no longer a problem-solving process, but is now a simple standard decision rule. This learning process would lead to a switch of decision processes from Block 5 to Block 4.[4] As an example of this process, consider Figures 2 and 3. Figure 2's abstract decision process has five cues. After this decision process has been used several times, suppose Cues 2 and 4 were combined into a learned configuration. Then the process would collapse to the conditional process shown in Figure 3.

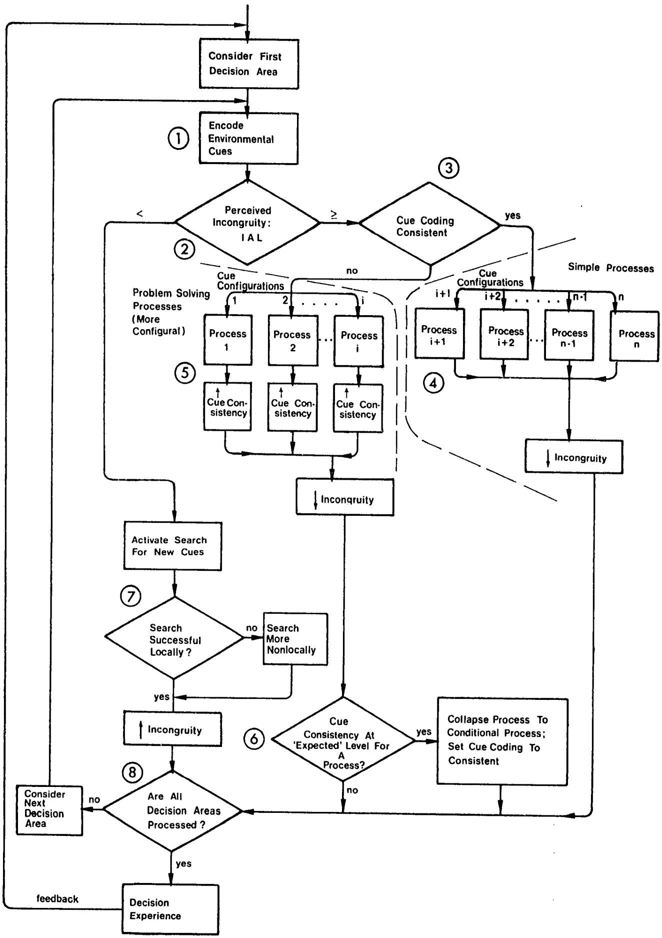
The idea of a monitor process which controls the collapsing of decision process graphs has been implemented with varying specificity by other researchers, e.g., [4]. However, growth of decision nets has not been considered in the general scheme, although some information processing models have considered decision net growth [4, 7]. This is definitely a shortcoming, since decision nets obviously do not spring into existence in all their complexity. More research is needed on the development of decision nets (perhaps similar to Sheth's research on foreign students [17]).

Block 7: Exploratory behavior or novelty seeking. This aspect of decision processes embraces the consumer who "just wanted to try something new." As incongruity

[4] To build an unambiguous model of consumer information processing, one would need to explicitly model how the process of collapsing based on cue configurations occurs. That process has not been formally modeled in this article, and further research is certainly needed to specify what conditions lead to learning of consistent cue configurations.

Figure 4

A GENERAL DECISION AND CHOICE MODEL



decreases from Block 4, eventually it may become so low (below the IAL) that boredom sets in. At this point, Block 2 would lead to Block 7, and a search for new and more incongruous alternatives would begin. This search would be local at first—that is, for consumer decisions, for example, it might be for a different brand of the same type. However, if this search were not successful, more nonlocal search, such as for a new, exciting, or unfamiliar product might ensue.[5]

Relation to Other General Models

The model, although developed entirely independently, is in some aspects similar to Howard and Sheth's theory of buyer behavior [11]. Their notions of the "psychology of simplification" and the "psychology of complication" are mirrored in Blocks 3 to 5, Block 6, and Block 7. In addition, Howard and Sheth use Berlyne's theory of cognitive motivation, which is very similar to Driver and Streufert's position (based heavily on Hunt's earlier integration [12], which in turn is based on Berlyne [6, pp. 42–6]). Finally, the decision processes imbedded in Blocks 3 to 5 are very similar to Howard and Sheth's plans with inhibitors [11, pp. 132–43]. However, the paradigm above was derived circuitously from cognitive process models, a very different approach from that of Howard and Sheth. Finally, the paradigm also has close parallels with the framework outlined by Cyert and March for organizational decision processes [5, p. 126].

These substantial parallels between paradigms imply that decision under uncertainty can be modeled in broad strokes in a similar manner over many complex decision scenarios. This gives more evidence to support these general schemes as representations of the structure of decision processes in general, and of the structure of consumer choice processes in particular.

CONCLUSIONS

Findings from both clinical judgment studies and information processing models of consumer behavior show that complex decision process models can often be approximated quite well by simple models. Using the notion of a conditional decision process for a given set of cues, a process of cue consistency assessment and decision subprocess use was postulated. Finally, an attempt was made to develop an overall paradigm outlining a structure for consumer choice processes.

From these findings one might be tempted to draw the conclusion that the approximation of complex models by simple models is a general finding, and hence a collection of rather simple decision process types could be used to model consumers' decisions. If this were true, then market researchers could use such a set of simple models to develop predictions of product demand based on more behavioral models than those based on time series analysis or stochastic consumer models. However, the mechanisms which lead to collapsing complex models into simple models are not well understood. This collapsing process itself needs to be specified in much more detail before such confident use of simple models would be justified. One cannot draw the conclusion that consumers' subjectively reported complexity of their choice processes is spurious.

Also, changes in the decision maker's perceptions about configurations may alter the balance of simple and complex processes. If such perceptual changes are likely, as in consumer choice processes, then the complex model retains the flexibility to predict over more situations than a simple model tailored to one set of perceptions about configurations.

At the present stage of abstraction of the general model for decision and choice, it would be gratuitous to list several specific implications. Some specific implications of the individual consumer choice models themselves are given in [3]. However, the very abstractness of the general model implies that it can only suggest broad approaches at this stage. For example, in characterizing consumers more willing to try new products, Blocks 2 and 7 imply that search for new products may be much more likely for people whose optimal level of incongruity is fairly high. By measuring this optimal level for a sample of consumers using tests of stimulus seeking [16] and attempting to relate this level to other consumer characteristics, one may be able to develop correlates of high search activity that would allow differential promotion of new products to such consumers.

[5] Although animal exploratory behavior has been well researched, much more work is needed on styles of incongruity seeking as imbedded in human decision processes. For a stimulus variation-seeking scale, see [16].

REFERENCES

1. Anderson, Norman and Ann Jacobson. "Effect of Stimulus Inconsistency and Discounting Instructions in Personality Impression Formation," *Journal of Personality and Social Psychology*, 2 (October 1965), 531–9.
2. Bettman, James. "Applying a New Methodological Approach to a Problem of Information Processing Model Validation," Working Paper No. 152, Western Management Science Institute, University of California, Los Angeles, 1969.
3. ———. "Information Processing Models of Consumer Behavior," *Journal of Marketing Research*, 7 (August 1970), 370–6.
4. Clarkson, Geoffrey. "Decision Making in Small Groups—A Simulation Study," *Behavioral Science*, 13 (July 1968), 288–305.
5. Cyert, Richard M. and James March. *A Behavioral Theory of the Firm*. Englewood Cliffs, N.J.: Prentice-Hall, 1963.
6. Driver, Michael and Siegfried Streufert. "The 'General Incongruity Adaptation Level' (GIAL) Hypothesis—An Analysis and Integration of Cognitive Approaches to Motivation," Institute Paper No. 114, Krannert School of Industrial Administration, Purdue University, 1964.
7. Feigenbaum, Edward. "The Simulation of Verbal Learning Behavior," in Edward Feigenbaum and Julian Feldman, eds., *Computers and Thought*. New York: McGraw-Hill, 1963, 297–309.
8. Goldberg, Lewis. "Simple Models or Simple Processes?

Some Research on Clinical Judgments," *American Psychologist,* 23 (July 1968), 483–96.
9. Green, Bert. "Descriptions and Explanations: A Comment on Papers by Hoffman and Edwards," in [13], 91–8.
10. Hoffman, Paul. "Cue Consistency and Configurality in Human Judgment," in [13], 53–90.
11. Howard, John and Jagdish Sheth. *The Theory of Buyer Behavior.* New York: John Wiley & Sons, 1969.
12. Hunt, Joseph McVicker. "Motivation Inherent in Information Processing and Action," in O. J. Harvey, ed., *Motivation and Social Interaction—Cognitive Determinants.* New York: Ronald Press, 1963, 35–94.
13. Kleinmuntz, Benjamin, ed. *Formal Representation of Human Judgment.* New York: John Wiley & Sons, 1968.
14. Lampel, Anita and Norman Anderson. "Combining Visual and Verbal Information in an Impression Formation Task," *Journal of Personality and Social Psychology,* 9 (May 1968), 1–6.
15. Newell, Alan, J. Shaw, and Herbert Simon. "Elements of a Theory of Human Problem Solving," *Psychological Review,* 65 (May 1958), 151–66.
16. Penney, Ronald and Robert Reinehr. "Development of a Stimulus-Variation Seeking Scale for Adults," *Psychological Reports,* 18 (April 1966), 631–8.
17. Sheth, Jagdish. "How Adults Learn Brand Preference," *Journal of Advertising Research,* 8 (September 1968), 25–36.
18. Sidowski, Joseph and Norman Anderson. "Judgments of City-Occupation Combinations," *Psychonomic Science,* 7 (March 15, 1967), 279–80.
19. Slovic, Paul. "Cue-Consistency and Cue-Utilization in Judgment," *American Journal of Psychology,* 79 (September 1966), 427–34.