TOWARD A COMPREHENSIVE VIEW OF THE ATTITUDE-BEHAVIOR RELATIONSHIP: THE USE OF MULTIPLE-SET CANONICAL ANALYSIS

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The primary purpose of this paper is to present an application of an advanced multivariate statistical technique-multiple-set canonical analysis- to a problem of current interest in consumer research - the study of the attitude-behavior relationship. M-set canonical analysis appears to offer some advantages over other multivariate techniques in treating some special problems which have arisen in the literature on consumer attitudes. Before introducing the actual problem under consideration here, it will be beneficial to briefly review past research on consumer attitudes which is directly relevant to the current investigation.

Review of the Literature

Current research in consumer psychology has as its goal the explanation of the behavior of the consumer. No longer is the consumer treated as a "black box" which mysteriously treats input from his environment and responds by purchasing some product or service. Rather, the current focus is to examine the decision processes by which the consumer transforms information into action. As might be expected, consumer researchers focusing on such internal processes, have begun to rely more and more heavily on predispositional, rather than overt, states of the organism. Because attitude is seen as a mediating variable intervening between psychological inputs and outputs, it has become a very useful construct to include in a theory of consumer decision-making. Unfortunately, a construct as rich in meaning as attitude can be a double-edged sword, creating almost as many problems as it does provide solutions. This apprehension is borne out when one reviews the psychology literature and finds that attitude as a construct has been a center of controversy for over fifty years (Fishbein, 1967). Nevertheless, the potential explanatory power of the attitude construct is certainly worth the risk of some disagreement among theorists, and attitude has become firmly entrenched as a major variable in the study of consumer behavior, if not by operational consensus (Adler and Crespi, 1968), at least by virtue of the vast amount of research effort it has stimulated (Nicosia, 1966; Sheth, 1967; Howard and Sheth, 1969).

Considerable attitude research in consumer behavior has recently began to build on the theories of Fishbein (1967) and Rosenberg (1956). While these two theories were developed independently and out of different traditions, methodological similarities between the two theories have led to a gradual merging of their applications in the marketing literature. Rather than discuss the similarities and differences between these two theories in their initial formulations, the present discussion will be limited to such applications.

The basic form of the Fishbein-Rosenberg type of model, expressed in functional form as a linear relationship between two variables, is:

$$A_{ij} = f\left(\sum_{i=1}^{n} B_{ijk} I_{ijk}\right) \quad (1)$$

where A_{ij} = consumer i's attitude toward brand j

B_{ijk} = the extent to which consumer i believes that brand j possesses some attribute k which leads to the fulfillment of some desire

I_{ijk} = the importance to consumer i that brand j possesses attribute k (i.e., the importance that brand j fulfills the desire in question)

n = the number of salient attributes

Thus, the consumer's attitude toward a brand is conceptualized within an expectancy-times-value framework,[2] where the brand is evaluated as a goal-object. Beliefs about the brand represent the degree to which the consumer expects the brand to possess attributes which will lead to satisfaction and the importance of each attribute represents how valuable each particular type of satisfaction is to the consumer of that brand. Since the belief and importance components combine multiplicatively, this interaction determines whether each attribute will be of significance in explaining attitude toward a brand. It is not enough that a brand possess a great deal of some attribute; the consumer must also consider it important to derive this type of satisfaction from that brand. Similarly, an attribute which is very important to the consumer will have little effect on attitude if none of the available brands are believed to possess an adequate level of that attribute. This particular approach to the analysis of consumer attitudes should be especially appealing to marketing researchers, who are concerned with actions which will ensure that products conform to consumers' wants and needs. Consider, for example, Kotler's (1967) definition of a product as "a bundle of physical, service, and symbolic particulars expected to yield satisfactions or benefits to the buyer" (Kotler, p. 289). Substituting the word "attributes" for Kotler's "particulars" and assuming that satisfactions and benefits have some value to the consumer completes the correspondence between the marketing product concept and the expectancy-value approach to attitude. Perhaps the large amount of research generated by this model is due in part to the intuitive appeal of the model in a marketing context.

Despite its intuitive appeal, the expectancy-value model has stirred some controversy among marketing researchers since its first application three years ago (Hansen, 1968). A review of the fifteen-odd articles employing this model which have appeared since then reveals three major issues which have confronted marketing researchers regarding the expectancy-value attitude model:

a) Would a disaggregative approach be more satisfactory than the customary summed-score form of the model?

b) What is the relative contribution of each component (i.e., beliefs or importance) in determining the consumer's attitude toward a brand?

c) How strong is the relationship between the expectancy-value attitude measure ($B \cdot I$) and subsequent measures of market performance; e.g., preference and/or purchase? In other words, what is the market significance of this means of analyzing consumer behavior?

The present discussion will deal with each of these issues in turn. While most of the early applications of the expectancy-value model were strictly extensions of the basic model to a marketing situation (Hansen, 1968, 1969; Bass and Talarzyk, 1969; Bither and Miller, 1969), it was quickly recognized that using a single numerical index to represent the consumer's cognitive structure left something to be desired. The very information which had made the model so intuitively appealing to the marketer, permitting analysis on a set of underlying beliefs, was not being utilized to its fullest extent - it was being collapsed into a single value. This severely hampered the utility of the model for suggesting possible strategies for attitude change. Sheth (1970, p. 8) has expressed the shortcomings of the aggregative model while proposing a disaggregative linear model of the form:[3]

$$(2)\ A_{ij} = f(B_{ij1}I_{ij1} + B_{ij2}I_{ij2} + \text{---} + B_{ijn}I_{ijn})$$

There has been virtually no disagreement among marketing researchers that this diaggregative model is superior to the earlier version of the model. As mentioned earlier, it is of primary interest to the marketer to determine which of the attributes of a brand are most significant in contributing to the consumer's attitude and behavior with respect to that brand. The identification of these attributes enables the marketer to utilize his promotional dollar more effectively by stressing those attributes which contribute most to the consumer's preferences or purchase pattern. In some cases, there may be only one dominant belief which, if it can be changed, may lead to a substantial modification of preference or purchase.

The disaggregative approach is well-suited to these purposes, as the relative contribution of each $B_{ijk}I_{ijk}$ element can be determined through statistical estimation procedures such as multiple regression (Sheth, 1969, 1970; Cohen and Houston, 1970) or discriminant analysis (Cohen and Ahtola, 1971). Not surprisingly, the above researchers have reported much higher predictive power, whether the dependent variable is preference or purchase, when the disaggregative model is compared with the aggregative model.

The use of multivariate procedures has revealed many relationships which could not have been identified under the summed-score form of analysis. For example, Sheth (1971), in a large-scale study, used canonical analysis to show that while "taste" was the most significant attribute in determining consumer attitudes toward a convenience food product, two other attributes - "good buy" and "meal substitute" - were more significant in determining the consumer's intentions to buy the brand.

Thus, there is a consensus among marketing researchers that the disaggregative model is the more powerful one for the explanation of consumer behavior. It is at this point, however, that researchers diverge in their opinions regarding the second major issue which has been raised in the use of this attitude model in marketing.

As noted previously, when Sheth (1970) proposed the disaggregative model, he also chose to exclude the value term from the equation, creating a linear model of the form:

$$(3)\ A_{ij} = f(B_{ij1} + B_{ij2} + \text{---} + B_{ijn})$$

Several researchers have presented evidence relating to the question of the relative contribution of the belief and importance components in determining attitude under the beliefs-importance model. The results have been conflicting, with some researchers reporting the importance component to be relatively useless (Sheth and Talarzyk, 1970), while others have found it to contribute significantly to explained variance (Hansen, 1969).

Recently, two independent teams of researchers have applied multidimensional scaling to this problem. Moinpour and MacLachlan (1971) created two separate dissimilarity spaces, one using the importance measure to weight the dissimilarities of beliefs across brands of headache remedies, and the other using unweighted dissimilarities. The resultant two-dimensional configurations were practically identical, leading the researchers to conclude that the importance measure is superfluous. Hansen and Bolland (1971), using a similar procedure to compare the beliefs-only and beliefs-importance models, found that while the two measures yielded highly correlated distance scores in the case of student pub-crawling behavior, the beliefs-only model made more correct predictions. However, in the prediction of patronage of self-service car washes, the $B \cdot I$ model was clearly superior. In attempting to explain these conflicting results, Cohen and Houston (1970) and Hughes (1970) have suggested that differences in measurement procedures could have significant effects on the relative power of the models; nevertheless, the issue remains unresolved.

The controversy surrounding the importance component is, however, empirical rather than theoretical. Even the researchers who have presented negative results regarding the inclusion of the importance measure acknowledge that importance is probably implicit in the mind of the consumer (or the respondent in a survey) and thus may already be included in the belief measures (Sheth and Talarzyk, 1970). Cohen and Ahtola (1971) tested this hypothesis and found that generally the correlations between the two components were not high enough to forego the measurement of the importance component.

The final issue of interest here is the market significance of the expectancy-value attitude model. It is in this area that there has been the greatest divergence among researchers in terms of the particular means used to test the model and the statistical methods utilized to assess the relationships between the B·I measure and criterion measures of preference and/or purchase of the brand in question.

Since the summed-score form of the model did not allow the use of powerful multivariate statistical techniques, the earliest evaluations of this form ofthe model used tests of independence (e.g., chi-square and other nonparametric tests) relative to such criteria as brand "appeal" (Bither and Miller, 1969) and actual choice behavior in an experimental situation (Hansen, 1968). Bass and Talarzyk (1969) used the computed beliefs-importance scores to attempt to reproduce the preference ranking of brands within six product classes, adopting a "confusion matrix" of conditional probabilities to present their results. Sheth and Talarzyk (1970) used a simple linear regression model in which brand preference served as the criterion variable and the B·I score was the predictor variable. Results of these studies indicated that the expectancy-value framework was probably a valuable one from which to analyze consumer behavior, but at the same time, the predictions based on the model were not as good as marketing researchers desired. It was at this point that the disaggregative approach was initiated, along with the use of more sophisticated analytical procedures.

Sheth (1969) introduced the use of multiple regression into this research area. A measure of overall liking for the brand (affect) was used as the dependent measure; and separate belief measures were used as predictors, as in Equation (3) above. This analysis yielded better predictive power and also enabled the researcher to identify exactly which attributes were the primary contributors to the explained variance in liking for a brand. Cohen and Houston (1970) used the same approach with similar good results, relating the disaggregative B·I measure to a retrospective report of purchase frequency. Since their analysis included a measure of importance, it represents an application of Equation (2) above. Sheth (1970), in an extension of the basic model to account for situational factors and to better conceptualize the entire decision-making process of the consumer, performed a multiple regression on data gathered in a longitudinal study of consumer attitudes and purchase behavior with respect to three different brands of instant breakfast. The data were gathered at three separate points in time. Sheth used intention to purchase as the criterion variable and belief measures as predictor variables. In eight out of nine cases, a significant R^2 was obtained. Lutz (1971), in a similar analysis performed on a different population and with respect to a service rather than a product, found that the belief measures explained a substantial amount of variance in purchase intentions.

While the multiple regression approach proved to be very useful in predicting affect and behavioral intention from a set of belief and/or importance measures, the prediction of actual purchase behavior seemed more closely related to a discriminant analysis problem, as noted by Cohen and Ahtola (1971). Using a consumer's overall purchase pattern to classify him as loyal to one of three leading brands of toothpaste, they were able to explain 67% of the variance in purchase behavior using the belief-times-importance measures as the predictor variables in a multiple discriminant analysis. The model using only belief measures did only slightly worse, while the aggregative form of the model was able to account for only about 44% of the variance in purchase behavior. While it must be borne in mind that the purchase measure was retrospective in this case, the results of the Cohen and Ahtola study are very encouraging. The discriminant model not only yielded a much better behavioral prediction than did the multiple regression model on the same data, but as in multiple regression, discriminant weights enable the researcher to ascertain exactly which attributes are instrumental in determining differences among consumers' purchase behavior.

Since there are numerous measures of market response which may be of interest to the marketer at a point in time, Sheth (1971) set up another test of the expectancy-value model, using seven belief measures as the predictor set in a canonical analysis. The criterion set consisted of affect, intention, and actual purchase behavior. The first two canonical variates accounted for approximately 60% of the variance in the criterion set. This form of analysis has the particular advantage that it is able to show, within the same framework, which attributes are instrumental in explaining specific measures of market response.

Multiple-Set Canonical Analysis

M-set canonical analysis was proposed as an extension of traditional (2-set) canonical analysis by Horst (1961) as a method for examining the relationships among three or more set of variables. In the 2-set case, the objective of canonical analysis is to derive linear combinations of the two sets of variables such that the correlation between the two sets is maximized; under m-set analysis, the linear combinations of the m sets of variables are derived such that the sum of the intercorrelations among the m sets is maximized. For example, if there were three sets of variables to be considered, m-set canonical analysis would yield a 3x3 matrix of canonical correlations as shown below:

$$\begin{matrix} 1.00 & .78 & .63 \\ .78 & 1.00 & .41 \\ .63 & .41 & 1.00 \end{matrix}$$

As seen above, the canonical correlations matrix is symmetric and has diagonal values of unity. Just as in 2-set canonical analysis, as many canonical variates can be derived as there are variables in the smallest of the m sets; all of the m possible canonical variates are mutually orthogonal. Also similar to the 2-set case, the solution under m-set analysis provides a weight for each variable in the total set of variables. Thus, m-set canonical analysis performs the same functions and provides the same type of information as does 2-set canonical analysis, but with the distinct advantage of being able to accommodate more than two sets of variables simultaneously.

Horst (1961) suggests several possible applications of m-set canonical analysis:

a) Testing the congruence of factor structures among more than two subpopulations which have responded to the same profile of test batteries.

b) Testing the similarity of response patterns when subjects are exposed to three or more treatment conditions.

c) Testing the similarities among three or more independent test batteries administered to the same population.

Considering only these three categories of problems, many potential marketing applications can be derived. In the area of segmentation analysis, m-set canonical analysis would allow the researcher to split the population into homogeneous groups on the basis of several different demographic and socio-economic variables and then simultaneously compare the groups on the basis of their response patterns to a battery of attitudinal or personality measures.

Another important application of m-set analysis lies in the study of consumer decision processes. There are many classes of variables which have been shown to have significant effects upon the consumer (Sheth, 1967); among these are demographic variables, social class, group influence, interpersonal interaction, marketing communications, attitudes, personality, etc. M-set canonical analysis would allow each of these classes of variables to be included as a separate predictor set for one or more sets of market response variables. Thus, in one global analysis, the researcher could investigate not only the effects of the predictor variables on the criterion set, but also the interrelations among the various classes of predictors. This can be viewed as a type of exploratory procedure at the macro level in that it deals with several different classes of variables simultaneously.

M-set canonical analysis can also be useful at a more molecular level of the study of consumer decision processes for sorting out relationships within a particular class of explanatory variables. It is a problem of this type on which this research focuses.

Definition of the Problem

While more familiar multivariate methods have been used to compare the differential results when one or the other of the two disaggregative forms of the expectancy-value model were employed, m-set canonical analysis can be used to test the effectiveness of both models in the same analysis. Therefore one aspect of the problem to be treated here is to include both forms of the beliefs-importance model as presented in Equations (2) and (3) in an m-set canonical analysis. This will reveal simultaneously the relationship of each model to the criterion variables and also the nature of the relationships between the two alternative models.

The importance of utilizing multiple rather than isolated criterion measures to increase reliability has been articulated by Fishbein (1967). Since previous research in the study of consumer decision processes has focused on two different sets of criterion variables - preferences and purchase behavior - it seems appropriate to include multiple measures of each set of variables in the m-set canonical analysis. This treatment will reveal the relationships between the two sets of criterion variables, as well as identifying their separate relationships with the predictor variables.

Thus the current problem is to investigate simultaneously the relationships among four sets of variables:

1) A set of belief-importance scores
2) A set of beliefs
3) A set of brand preference measures
4) A set of purchase measures

Following are some general hypotheses regarding the relative magnitudes of the canonical correlations among the various sets of variables.

Hypothesis 1: The set of B·I measures will be slightly more related to both criterion sets than will be the set of beliefs-only measures.

Hypothesis 2: Both sets of belief measures will be more closely related to the set of preference measures than to the set of purchase measures.

Hypothesis 3: The set of preference measures will be more closely related to the set of purchase measures than will either of the sets of belief measures.

The first hypothesis is based on previous empirical results which, in general, have shown the beliefs-importance model to be slightly superior to the beliefs-only model. The latter two hypotheses derive from the proposition that consumer preferences intervene between beliefs and actual purchase behavior in the decision process (Lavidge and Steiner, 1961; Howard and Sheth, 1969). The more closely related two sets of variables are in the decision process, the stronger should be the empirical relationship between them (Sheth, 1970). Thus, beliefs should be more closely related to preference than to purchase, and preference should be a better predictor of purchase than beliefs.

The Data[4]

The data used in this analysis were collected as part of the Buyer Behavior Project under the direction of Professor John A. Howard at the Columbia University Graduate School of Business in 1966. A longitudinal panel of housewives was formed through the use of standard probability sampling procedures. Initial contact was made through a mail questionnaire, which was followed at approximately 1-month intervals by three telephone interviews. In addition to responding to a variety of attitudinal and socio-economic questions, each panel member recorded her purchases of a convenience food product over the entire duration of the panel. Since the specific information required in the current study was gathered for only one brand - here called CIB - it is the only brand which will be analyzed. All of the beliefs, importance and preference measures were taken from the mail questionnaire, while the purchase measures were taken from panel diaries.

The beliefs-only measures consisted of the respondent's ratings of CIB on twelve 7-point bipolar scales. The positive ends of these scales are shown in Table 1. A value of 1 represented the most favorable rating and a value of 7 the least favorable rating.

The same twelve beliefs, weighted by importance, were used to form the set of B·I measures. Each belief rating was multiplied with its corresponding importance, which was measured on a 3-point scale from "very important" to not at all important." Thus, each of the B·I measures had a potential range of values from 1 to 21, with a lower score representing a more favorable response. See Table 1 for the actual beliefs included in this set.

The set of preference measures, seen in the table, consisted of three measures of liking for a brand. The measure of affect was obtained through the use of a 7-point bipolar scale, ranging from "In general, I like CIB very much" to, "In general, I do not like CIB at all." The semantic differential measure was derived from four beliefs about CIB which were shown to load on the evaluative factor of a factor analysis (Osgood, Suci, and Tannenbaum, 1957). These four scales include "snack," "low in price," "good buy," and "real flavor." The ratings on these four scales were summed to obtain the semantic differential attitude score, which had a range of possible values from 4 to 28. The Likert scale attitude measure was derived from the respondent's agreement-disagreement ratings on a series of projective-type questions regarding the type of person who would use CIB. After standard item analysis procedures, five scales were selected to represent the Likert score. These scales included "people trying to gain weight," "people who are health conscious," "people who have a health problem," "people who want a quick energy lift," and "people who like snacks." Since the extent of agreement was measured on a 5-point scale, the Likert scale attitude score had a range of possible values from 5 to 25, with lower scores representing more favorable attitudes.[5]

The set of purchase measures, as shown in Table 1, consisted of 3 continuous variables and two dichotomous variables. All of the measures are sound from a conceptual viewpoint as alternative measures of purchase behavior. The only possible drawback is that the inclusion of dichotomous variables in traditional 2-set canonical analysis violates certain assumptions which are necessary to perform tests of significance on the canonical correlations obtained (Green and Tull, 1966). However, in this case, this shortcoming seems to be of minimal importance since traditional 2-set significance tests do not hold for m-set canonical analysis (Horst, 1961). While it is recognized that dichotomous variables are not the most satisfactory measures to use in m-set canonical analysis, these deficiencies are not judged to be critical.

A total of 583 respondents whose data were complete for the scales used in the study constituted the initial sample. One hundred of these respondents were randomly selected to form the subsample which was used to construct the semantic differential and Likert scale on a post hoc basis. This left a total of 483 respondents in the test sample which was used in the main analysis.

Data Analysis[6]

The first step in m-set canonical analysis is to create a supermatrix, G, of correlations from the raw data. Using Horst's notation, this supermatrix appears as:

$$\begin{bmatrix} G_{11} & G_{12} & G_{13} & G_{14} \\ G_{21} & G_{22} & G_{23} & G_{24} \\ G_{31} & G_{32} & G_{33} & G_{34} \\ G_{41} & G_{42} & G_{43} & G_{44} \end{bmatrix}$$

Next, each diagonal submatrix, G_{ii}, is decomposed into the product of two triangular matrices, such that

(4) $$t_i t_i' = G_{ii}.$$

This procedure orthogenalizes the variables within each set included in the analysis.

(5) $$R_{ij} = t_i^{-1} G_{ij} t_j'^{-1}$$

Using equation (5), another supermatrix, R, is created representing the correlations among the now orthogonalized variables. As such, the diagonal submatrices of R become identity matrices:

$$\left[\begin{array}{c|c|c|c} I_1 & R_{12} & R_{13} & R_{14} \\ \hline R_{21} & I_2 & R_{23} & R_{24} \\ \hline R_{31} & R_{32} & I_3 & R_{34} \\ \hline R_{41} & R_{42} & R_{43} & I_4 \end{array}\right]$$

Subtracting an identity matrix of order 32 (since there are a total of 32 variables in this analysis) yields the supermatrix ${}_1P$.

$$\left[\begin{array}{c|c|c|c} 0 & {}_1P_{12} & {}_1P_{13} & {}_1P_{14} \\ \hline {}_1P_{21} & 0 & {}_1P_{23} & {}_1P_{24} \\ \hline {}_1P_{31} & {}_1P_{31} & 0 & {}_1P_{34} \\ \hline {}_1P_{41} & {}_1P_{42} & {}_1P_{43} & 0 \end{array}\right]$$

The objective of m-set canonical analysis is to derive a linear combination of the variables for each of the four sets such that the function

(6) $$\phi_1 = 1'\,{}_1\rho 1 - m$$

is maximized. 1 is a unit vector of m elements; ρ is the matrix of canonical correlations; and m is the number of sets in the analysis. The solution for this problem is:

(7) $${}_1P\, D_{\beta.1}\, 1 = D_{\beta.1}\, {}_1\lambda$$

where $D_{\beta.1}$ is a supervector of length 1, representing canonical weights; 1 is a unit vector; and

(8) $${}_1\lambda = {}_1\rho 1 - 1.$$

Thus ${}_1\lambda$ represents the sum of the elements in each row of the canonical correlations matrix minus the main diagonal element.

It is interesting to note that the notation Horst chose to use in setting up Equation (7) resembles the classic eigenvalue-eigenvector solution so pervasive in traditional multivariate statistics. However, m-set canonical analysis does not rely on the eigenvalue-eigenvector solution. Instead of dealing directly with the variance in the data, Horst chooses to deal with it in an indirect manner, through his maximization of the sum of the elements in the correlation matrix. Horst claims that this procedure yields results analogous to Hotelling's for the 2-set case, and relies on an intuitive proof to extend his solution to m sets of variates. Whether this technique is truly appropriate remains a question for mathematical statisticians.

Equation (7) is used iteratively to reach the solution for the first canonical variate. Using a first approximation to the canonical weights of $1/\sqrt{n_i}$, where n_i is the number of variables included in the ith set, ensures that each ${}_iD_{\beta.1}$ is of unit length. Thus

(9) $${}_1P_1 D_{\beta.1}\, 1 = D_{B.1}\, 1$$

where $D_{B.1}$ is a supervector of calculated canonical weights. Since

(10) $${}_1\rho = D'_{\beta.1} R D_{\beta.1},$$

and

(11) $${}_2D_{\beta.1} = {}_1D_{B.1}\, {}_1D_{\lambda}^{-1},$$

where

(12) $${}_1D^2_{1\lambda} = {}_1D'_{B.1}\, {}_1D_{B.1}\ .$$

${}_1\lambda$ can be calculated from equation (8) after each iteration. The iterative process continues until ${}_1\lambda$ stabilizes to some specified degree of decimal accuracy.

To compute the second canonical variate, it is first necessary to derive the supermatrix ${}_2P$.

(13) $${}_2P = [I - D_{B.1}D'_{B.1}]\ {}_1P[I - D_{B.1}D'_{B.1}].$$

This ensures that the second canonical variate will be orthogonal to the first one. Then the same iterative procedure is followed until ${}_2\lambda$ stabilizes.

Results

The results of the analysis are shown in Tables 2 through 7. Since the canonical correlations with the purchase measures were of such small magnitude for the second canonical variate (see Table 6), it was decided not to compute the remaining two possible canonical variates.

As can be seen in both Tables 3 and 4, the iterative procedure proposed by Horst did lead to a set of stable λ values. Also, as can be seen from the values of ϕ in the two tables, ϕ is at a maximum when the λ values stabilize.

Tables 5 and 6 show the canonical correlations among the four sets of measures. On the basis of the first set of correlations, only one of the hypotheses is supported - that both sets of beliefs will be more closely related to preference than to purchase. Both sets correlate in excess of .80 with preference, while correlating less than .40 with purchase, for the first canonical variate. The same relationship also appears for the second variate.

Contrary to the first hypothesis, the set of beliefs-only measures correlated more strongly (.92) with preference than did the set of B·I measures (.81), for the first canonical variate, and similarly for the second variate (.47 to .41). In addition, the two sets were approximately equally correlated with the set of behavioral measures. The third hypothesis was similarly rejected, since all three sets of predictor measures (beliefs, B·I scores, and preferences) correlated almost identically with the set of purchase measures on both canonical variates.

The calculated canonical weights are shown in Table 7. For the first variate, three beliefs appear to dominate in the relationship between both sets of beliefs and the criterion measures. "Ease of use," "Meal substitute," and "Delicious" exhibit the three largest weights in both belief sets. Of secondary importance are the beliefs "Snack," "Good buy," and "Real Flavor," again for both sets. This result would tend to suggest that either form of belief measure (B-only or B·I) will yield the same pattern of relationships with criterion variables, even though the magnitude of the relationships may be different.

For the preference set, affect exhibited the highest weight on the first variate, while the semantic differential was weighted highly on both of the variates. Although some of the explanatory power attributed to the semantic differential is artifactual due to the beliefs included in its construction, this artifact does not show up on the first variate. Rather, it seems to dominate the beliefs-preference relationship on the second variate. The three scales which overlap between the semantic differential and the belief measures have the highest weights for both belief sets, while the three weights which had been highest on the first variate have negative weights on the second variate. It is obvious that future research should in some part be directed at obtaining independent measures of preference.

Finally, the negative weights shown by the purchase measures on the first variate were not surprising, since these measures had previously exhibited an inverse relationship with all the other variables in the analysis (see Table 2). Fortunately, this inverse relationship is due only to the direction of the scales used to measure the phenomena. The purchase measure which is most closely related to the other sets of measures is "% of CIB/Total units instant breakfast purchased." This result is interesting in that it suggests that it may not be appropriate to examine a consumer's purchase behavior with respect to any one brand, but rather look at his purchase behavior relative to other brands in the product class. Thus, there may be many influences which determine the absolute amount of any product which will be purchased by a household, but beliefs and attitudes may be instrumental in determining which brand within that product class will be purchased by the consumer. The relatively small correlations between the purchase measures and the other three sets of measures are disappointing, but not unexpected. There are certainly many influences other than beliefs about the brand and liking for the brand which affect a consumer's purchase behavior.

As the results of this analysis suggest, it will be necessary in the future study of consumer behavior to look at the effects of more than one class of variables simultaneously. Multiple-set canonical analysis should be an invaluable tool in that task. The consumer researcher can include not only product-specific attitudes and beliefs as explanatory variables, but also more general influences on the consumer-social class, personality, group interaction, family roles, etc. - and examine the interactions of these variables in their influence on purchase behavior. This, then, will present a more comprehensive view of the attitude-behavior relationship.[7]

Conclusion

An attempt was made to apply multiple-set canonical analysis to the study of the attitude-behavior relationship in consumer psychology. The method is mathematically tractable and yields results which are unobtainable from traditional forms of multivariate analysis. Currently, the primary advantages of m-set analysis seem to be at the exploratory stages of a scientific investigation. In the future, as tests of significance are developed and the precise meaning of canonical weights is determined, m-set canonical analysis should prove to be an even more valuable tool in the continuing study of consumer psychology.

TABLE 1

Variable Set 1: Beliefs only - Equation (3)

CIB is easy to use
CIB is a good substitute for a meal
CIB is low in calories
CIB is delicious tasting
CIB is nutricious
CIB is a good snack
CIB is filling
CIB dissolves easily
CIB is a good energy source
CIB is a good buy for the money
CIB has a "real" (as opposed to artificial) flavor
CIB is a good source of protein

Variable Set 2: B·I (Belief x Importance) scores - Equation (2)

Ease of use
Meal substitute
Low in calories
Delicious
Nutricious
Snack
Filling
Dissolves easily
Energy source
Good Buy
Real flavor
Protein source

Variable Set 3: Preference Measures

Affect
Semantic Differential
Likert Scale

Variable Set 4: Purchase Measures

% CIB purchased of total units of instant breakfast purchased
Purchase - No Purchase (Dichotomous)
Repeat Purchase (Dichotomous)
Number of units of CIB purchased
Number of purchases of CIB

TABLE 3

Iterations for the First Canonical Variate

Iteration	${}_1\lambda_1$	${}_2\lambda_1$	${}_3\lambda_1$	${}_4\lambda_1$	ϕ_1
1	1.940	1.666	1.882	0.710	5.498
2	2.114	1.958	2.083	0.917	7.072
3	2.153	2.000	2.091	0.974	7.218
4	2.155	2.007	2.086	1.000	7.248
5	2.155	2.010	2.080	1.011	7.256
6	2.154	2.010	2.076	1.019	7.259
7	2.154	2.011	2.076	1.020	7.261
8	2.154	2.012	2.075	1.021	7.262

TABLE 4

Iterations for the Second Canonical Variate

Iteration	${}_1\lambda_1$	${}_2\lambda_2$	${}_3\lambda_2$	${}_4\lambda_2$	ϕ_2
1	1.004	0.995	0.563	0.163	2.725
2	1.156	1.152	0.792	0.228	3.328
3	1.239	1.221	0.913	0.261	3.634
4	1.280	1.254	0.958	0.284	3.776
5	1.298	1.270	0.977	0.295	3.860
6	1.308	1.276	0.982	0.304	3.870
7	1.313	1.278	0.984	0.309	3.884
8	1.316	1.279	0.984	0.313	3.892
9	1.317	1.281	0.983	0.316	3.897
10	1.319	1.280	0.982	0.319	3.900
11	1.320	1.280	0.981	0.321	3.902

TABLE 2

SUPERMATRIX G OF CORRELATIONS

(Decimal points omitted)

100																															
09	100																														
15	12	100																													
41	35	24	100																												
03	35	-05	09	100																											
27	19	14	48	11	100																										
28	33	20	47	20	32	100																									
29	22	07	23	17	20	20	100																								
27	38	18	45	20	35	50	21	100																							
19	40	22	50	17	33	43	15	46	100																						
36	32	20	68	08	44	45	20	46	48	100																					
33	32	20	46	21	36	44	19	60	45	46	100																				
85	13	13	38	04	26	27	27	25	22	31	28	100																			
08	84	11	32	25	20	30	21	33	35	29	25	17	100																		
09	19	67	16	04	06	20	08	21	17	15	22	12	22	100																	
29	32	14	83	09	43	41	17	35	43	55	39	34	33	12	100																
06	34	-04	11	82	17	20	20	23	15	10	26	10	29	12	18	100															
22	14	09	38	06	84	27	19	22	21	34	25	25	18	02	40	13	100														
21	35	15	41	18	26	81	16	42	38	40	34	26	38	21	40	25	27	100													
21	19	00	18	10	20	17	80	19	14	19	19	24	19	05	20	18	24	18	100												
21	33	12	35	18	28	41	13	80	37	36	50	21	33	21	31	28	23	44	21	100											
17	33	15	40	16	30	36	14	40	74	36	40	19	30	16	42	22	23	39	21	39	100										
25	29	09	54	04	41	37	17	34	40	83	38	26	28	11	59	12	39	39	23	34	39	100									
25	31	12	37	18	29	38	16	50	38	40	81	25	31	26	34	36	23	39	21	58	44	42	100								
35	39	22	70	15	46	49	23	50	51	65	45	35	37	16	61	17	37	42	19	38	37	50	38	100							
30	38	28	67	13	69	49	18	51	81	75	52	30	35	21	57	15	53	42	18	40	59	63	43	66	100						
09	20	-04	23	18	34	22	16	21	22	31	24	11	21	03	29	21	38	21	20	28	26	35	27	30	34	100					
-11	-24	-06	-23	-13	-16	-13	-05	-16	-23	-19	-13	-16	-23	-07	-21	-11	-11	-15	-04	-16	-16	-15	-13	-33	-24	-16	100				
-11	-26	-05	-24	-15	-16	-14	-04	-17	-24	-21	-14	-17	-25	-05	-22	-15	-11	-17	-05	-17	-17	-17	-14	-35	-24	-15	96	100			
-06	-27	-03	-19	-15	-10	-07	-07	-09	-18	-15	-11	-14	-26	-05	-20	-16	-07	-12	-07	-09	-12	-14	-11	-29	-16	-12	68	72	100		
-13	-30	-13	-25	-15	-20	-17	-08	-15	-21	-20	-15	-20	-28	-09	-23	-14	-16	-18	-07	-13	-14	-17	-13	-32	-22	-16	59	62	72	100	
-12	-28	-08	-23	-14	-17	-15	-08	-13	-20	-20	-14	-18	-26	-05	-22	-12	-14	-17	-07	-12	-14	-17	-12	-31	-20	-16	60	64	75	94	100

TABLE 5

Canonical Correlations - First Variate

1.000	.879	.924	.351
.879	1.000	.807	.326
.924	.807	1.000	.344
.351	.326	.344	1.000

TABLE 6

Canonical Correlations - Second Variate

1.000	.751	.473	.096
.751	1.000	.406	.123
.473	.406	1.000	.102
.096	.123	.102	1.000

TABLE 7

Canonical Weights for the First Two Canonical Variates

Variable Set	Canonical Weights	
Beliefs Only	$D_{B.1}$	$D_{B.2}$
Ease of Use	0.87	-0.22
Meal Substitute	1.19	-0.51
Low in Calories	0.34	0.33
Delicious	1.13	-0.31
Nutricious	0.15	-0.13
Snack	0.72	0.89
Filling	0.25	0.03
Solubility	0.14	-0.21
Energy Source	0.17	0.03
Good Buy	0.52	0.58
"Real" Flavor	0.37	0.22
Protein Source	-0.05	-0.01
B·I Scores		
Ease of Use	0.95	-0.25
Meal Substitute	1.05	-0.41
Low in Calories	0.19	0.26
Delicious	1.07	-0.27
Nutricious	0.13	-0.18
Snack	0.59	0.86
Filling	0.27	0.01
Solubility	-0.11	-0.19
Energy Source	0.30	0.08
Good Buy	0.44	0.61
"Real" Flavor	0.38	0.27
Protein Source	-0.01	0.04
Preference Measures		
Affect	1.78	-0.50
Semantic Differential	1.05	0.84
Likert Scale	0.23	0.05
Purchase Measures		
% CIB/Total units of Instant Breakfast	-0.85	0.01
Purchase - No Purchase	-0.29	0.15
Repeat Purchase	-0.07	0.24
#Units CIB purchased	-0.46	-0.13
#Purchases CIB	0.08	0.06

FOOTNOTES

[1]The author is both indebted and grateful to Professor Jagdish N. Sheth of the University of Illinois for providing the opportunity and impetus for this paper. The research reported here is one of a series of studies which has been conducted under the guidance of Professor Sheth, and as such, is closely related to much of his work in the attitude-behavior area.

[2]See Cohen and Houston (1970). Fishbein, working from a behavioral orientation, would probably take issue with the nomenclature used here to classify his theory. Cohen and Ahtola (1971) provide a rationale for including Fishbein's model under an expectancy-value framework.

[3]It should be noted that Sheth's formulation did not actually include the importance component since he had concluded from earlier studies that the importance component offered little predictive power (Howard and Sheth, 1969; Sheth, 1969). Nevertheless, the importance component is included here for the sake of comparison with Equation (1).

[4]The author expresses his appreciation to Professors John A. Howard of Columbia University and Jagdish N. Sheth for the use of the Columbia panel data.

[5]For a more detailed treatment of the construction of the semantic differential and Likert scale used in this analysis, the reader is referred to a paper currently in preparation by the author and Professor Jagdish N. Sheth, "A Multimode Investigation of the Attitude-Behavior Relationship."

[6]The author expresses his thanks to Professor Charles Lewis of the Psychology Department of the University of Illinois for his invaluable insights into the analysis proposed by Horst. While Professor Lewis was instrumental in enabling the analysis to be carried out, the author assumes full responsibility for any errors or shortcomings in this research.

[7]The author is grateful to Professors Joel B. Cohen and Paul E. Green for their comments on an earlier version of this paper.

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