INFORMATION PROCESSING IN ATTITUDE FORMATION AND CHANGE

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The purpose of this paper is to study consumer information processing within the context of attitude formation and change. Examination of the cognitive rules used by consumers in manipulating information presented in a persuasive communication seems quite relevant to understanding the impact of such communications. Persuasive communications can be viewed as presenting data to the consumer, who then manipulates and combines those data in the process of forming or changing an attitude. Like consumer behavior research, most communication research has not taken the information processing approach and has two major shortcomings. First, the dependent measures are too broad and too far removed from the specific elements constituting persuasive messages. This results in a little indication as to which data included in the message were actually used by the consumer in arriving at his new attitude. Second, there is little concern with the *processes* intervening between input and output. This paper reports a series of related studies that attempt to address these issues directly.

AUTHORS' NOTE: *The ordering of the authors' names is alphabetical. All three contributed equally to the research reported here.*

COMMUNICATION RESEARCH, Vol. 2 No. 3, July 1975

The effects of persuasive communications are often postulated to be mediated by the effects a message has on an individual's beliefs about aspects of the communication object, and the effects on the relative strength of the evaluation of each aspect. These elements form the basis for the Fishbein (1967) theory of attitude:

$$A_o = \sum_{i=1}^{n} b_i a_i$$

where A_o is an individual's attitude toward an object (brand); b_i is the strength of the i_{th} belief about the object (i.e., the likelihood that the brand possesses attribute i); a_i is the evaluative aspect (i.e., judged goodness or badness) of the i_{th} attribute; and n is the number of salient beliefs. Thus the components of the Fishbein model can be used as more detailed dependent measures in studying the impact of communications.

However, before the Fishbein model can be used in this fashion with any degree of confidence, it must be *validated*. In particular, the rules which the model assumes for the combination of components should be tested. The model implies that if a belief (b_i) is changed, then attitude will change; however, since the model is multiplicative, the amount and direction of change also depend on the evaluative aspect (a_i). The multiplication of b_i and a_i and subsequent summation of these products over all salient beliefs constitute the *model algebra* of Fishbein's attitude theory. Model algebra is merely a set of assumptions; however, the *actual* combination rules which experimental subjects seemingly utilize, called their *cognitive algebra* (Anderson, 1971), can be studied. If the cognitive algebra used by subjects agrees with the algebra postulated by the model, then the theory can be used with much more confidence in the study of communications effects. The purpose of this paper, then, is to attempt to validate the Fishbein attitude theory by examining the cognitive rules that subjects appear to use in combining beliefs and evaluative aspects. If the validity of the theory can be established, then its components can be used as dependent variables for studies of communications impact. This would remedy the first shortcoming of typical approaches discussed above by introducing more detailed dependent measures. The second shortcoming is also addressed, since the *process* of component combination is directly examined.

INFORMATION INTEGRATION THEORY

A research strategy for investigating cognitive processing and the specific combination rules employed has been developed by Anderson (1971). Labeled *information integration theory,* Anderson's method consists of presenting subjects with pieces of information which they combine into overall judgments. The pieces of information are usually presented to subjects in the form of a factorial design: each component under study defines one factor in the design. Several levels of each factor are employed, and profiles of information representing combinations of the various factor levels are developed. Subjects make judgment ratings for profiles comprised by the complete factorial design (with at least two replications, so that an individual level analysis can be performed for each subject). By submitting the resultant factorial data to analysis of variance (ANOVA), one can make inferences about the form of combination rule that each subject apparently uses in combining the components. Aiding in the interpretation of the ANOVA results is the fact that characteristic graphical forms are associated with particular combination rules when the factorial data are plotted.

The three studies reported below use information integration methodology to examine processing rules apparently used by subjects to combine components in the Fishbein attitude model. Two of the studies, one examining the multiplicative assumption (b_1a_1; Bettman, Capon, and Lutz, 1975a), and one the summative assumption ($b_1a_1 + b_2a_2$; Bettman, Capon, and Lutz, 1975b), have been previously reported and are only summarized below. The third study presents new data relating to the important issue of whether individual attributes (b_ia_i) are added or averaged to yield overall attitude (A_o).

STUDY I

A major purpose of this study (see Bettman, Capon, and Lutz, 1975a, for more detail) was to examine whether subjects appeared to multiply the a_i and b_i components of the Fishbein model.[1] Five levels were defined for each component in the model, thus allowing construction of a 5 x 5 factorial design of 25 different profiles. Each profile contained component (b_i and a_i) ratings for a single hypothetical brand attribute, and subjects were asked to rate their affect toward the brand, using only information on the single attribute. Seventy-seven subjects provided ratings for 2 replications of the 5 x 5 design, thus yielding attitudinal responses to 50 profiles for each subject. In this design attitude formation was studied as a process, for subjects were required to actually *combine* pieces of information to obtain a rating. For a discussion of the advantages and disadvantages of the task relative to other approaches, see Bettman, Capon, and Lutz (1975a, 1975b).

Given the factorial rating data, the combination rules apparently utilized by subjects could be assessed. Since each subject rated 2 complete replications of the 5 x 5 design, individual level analyses were performed. Classification criteria were developed for various possible combination rules and applied to the data.

The results showed that the Fishbein model rating task yielded a high degree of homogeneity of response across subjects. In particular, the model algebra of the Fishbein theory, which implies a crossover data pattern with the major portion of the variance accounted for by the interaction term, was generally supported.[2] Of the subjects, 69% appeared to multiply the b_i and a_i terms in arriving at an overall affect judgment. A major limitation of this study was that only one attribute was used; therefore, the summation assumption could not be examined. This assumption was examined in a second study.

STUDY II

The simple 2-attribute case was chosen to examine the summation assumption, but even so a more complex design was required than in Study I (for more detail on Study II, see Bettman, Capon, and Lutz, 1975b). Profiles presenting data on two attributes were constructed, with four components in total, a_1, b_1, a_2, and b_2. Each component corresponded to a factor in a 4-way factorial ANOVA design. Three levels were used for a_1 and b_1 and 2 levels for a_2 and b_2, yielding a 3 x 3 x 2 x 2 design. Subjects were 73 undergraduate psychology students who each rated 2 replicates of the design, a total of 72 profiles. Affect toward the brand was rated assuming only the information on the two attributes in the profile was available.

Once again ANOVA results were used to classify the combination rules used by individual subjects. Of the subjects, 89% appeared to multiply b_i and a_i terms, and 33% of the subjects both appeared to multiply b_i and a_i and then add across attributes. Another 28% of the subjects appeared to multiply b_i and a_i and displayed very small, but statistically significant, deviations from additivity. Within both of these groups the Fishbein model assumptions are reasonably well supported by analysis of the subjects' cognitive algebra. However, this is misleading. The ANOVA results cannot distinguish between an *adding* effect for two attributes and equal-weight *averaging*. This is an important distinction, particularly in the analysis of attitude change.

For example, suppose a consumer holds a highly favorable attitude toward a particular brand. For purposes of simplicity, assume that the attitude is based on only one belief (e.g., the consumer believes that it is *very likely,* +3, that the brand possesses a *very good,* +3, attribute). Then the consumer discovers that the brand is *somewhat likely* (+2) to possess another attribute that the consumer feels is *somewhat good* (+2). This new information should theoretically lead to a change in the consumer's attitude toward the brand—but in which direction? *Cognitive summation theory would predict an increase in attitude*, since another positive thing about the brand has been learned. In contrast, *cognitive averaging theory would predict a decrease in attitude*, because the new information is less positive than is the old information underlying the attitude.

Although the two studies were *not* designed to test this distinction, a comparison of data from Studies I and II was used to examine the adding-averaging issue indirectly. The results suggested that averaging was being used rather than adding. Because of the importance of the issue, a third study was designed to examine specifically the averaging and adding combination rules.

STUDY III

Anderson (1974) has carried out many studies which support averaging, as opposed to adding, as a combination rule. The basic design of his studies has been an impression-formation paradigm, in which moderately polarized stimulus information is added to highly polarized information. Under these conditions, as discussed above, adding and averaging make different predictions about the *direction* of attitude change. If a moderately positive attribute is added to a highly positive attribute, for example, adding predicts an increase in attitude and averaging a decrease. Fishbein and Hunter (1964) tested Fishbein's model against balance theory, which posits an averaging rule, and found support for the Fishbein additive model. However, Anderson (1971: 192) has attacked this result on methodological grounds. Thus, further study of adding and averaging in the context of the Fishbein model is necessary.

Method

To examine the adding versus averaging issue, a 2-part design is necessary. First, it must be demonstrated that subjects satisfy the other

Fishbein model assumptions: b_i and a_i should multiply, thus yielding significant interactions within attributes; and there should be no significant interactions (or perhaps interactions of very small magnitude) other than between a_1 and b_1 and between a_2 and b_2 in a 4-way design like that used in Study II.[3] Second, a design is needed in which moderate attributes are added to polarized attributes. Thus a pseudo-attitude-change process is examined.

The following set of 3 designs meets the above specifications: subjects were asked to rate profiles for a 2 x 2 single attribute design, with the 2 levels being +2 and −2 on a 7-point +3 to −3 scale; for a 2 x 2 x 2 x 2 two-attribute design, with the same levels as above; and for a 4 x 3 design, where the 4 levels of the first factor correspond to (a_1,b_1) pairs or (+2,−2), (−2,+2), (−2,−2), and (+2,+2) and the 3 levels of the second factor correspond to (a_2,b_2) pairs of (+1,+1), (0,0), and (−1,+1).[4] The first design allows the multiplicative assumption to be checked. The second design allows the Fishbein assumption about interaction patterns to be checked. The third design adds moderate attributes to more polarized attributes and thus allows a test of adding/averaging. A sample profile from the third design is shown below (the [−2,+2] and [+1,+1] pair):

> You believe that Brand X is very likely _:X:_:_:_:_:_ very unlikely to possess a quality which *you* feel is very good _:_:_:_:_:X:_ very bad, ***AND ALSO*** is very likely _:_:X:_:_:_:_ very unlikely to possess a quality which you feel is very good _:_:X:_:_:_:_ very bad. In this case, how would you feel about using Brand X?
>
> very favorable _:_ very unfavorable

Subjects were 167 undergraduate students, each of whom rated two replicates of all designs. Including filler pairs, each subject rated 82 profiles. Subjects were run in groups, with the profiles presented in questionnaires. Affect (A_o) was rated on a 21-point scale ranging from very unfavorable to very favorable. This scale length was used to reduce possible end anchor effects observed in Study II. Warm-up tasks and other procedures were similar to those used in Studies I and II.

Analysis

Using identical classification rules to those developed in Study I, researchers first classified subjects based on their data from the 2 x 2 design, and second, on the basis of the results of the 2 x 2 x 2 x 2 design. Here a slight modification was made based on the results of Study II. Subjects were assumed to meet the Fishbein assumptions if the variance accounted for as measured by ω^2 (Hays, 1963) was concentrated in the $a_1 \times b_1$ and $a_2 \times b_2$ interactions and there were either no other significant interactions or the sum of the ω^2 for the other significant interactions was less than 25% of the sum of the ω^2 for the $a_1 \times b_1$ and $a_2 \times b_2$ interactions. These criteria were used since the results of Study II had shown that small, but statistically significant, interactions often arose, but that no readily interpretable pattern for the interactions was discernible. The 25% figure is clearly arbitrary, but the results did not differ substantially when other figures were used.

From these classifications only those subjects satisfying the Fishbein assumptions *both* for the first and second designs were selected for further analysis. The rationale for this decision was that adding versus averaging in the Fishbein model should be tested only if the other assumptions of the Fishbein model had been shown to hold.

To test adding versus averaging at the group level, a 4 x 4 design was developed by arraying the entries in the 2 x 2 single-attribute design as a fourth column added to the 4 x 3 design discussed above. The adding and averaging assumptions make differential predictions for the 4 x 4 design. If the stimulus values assumed above are used to plot the expected mean values for adding and equal-weight averaging, the results would appear as in Figure 1a and Figure 1b.[5] Note that there is a clear prediction; a significant interaction supports averaging, and, since the lines in Figure 1a are parallel, a nonsignificant interaction supports adding. Furthermore, the original 4 x 3 design should have no interaction for either adding or averaging. While Anderson (1974) has typically tested for averaging versus adding by comparing specific pairs of stimuli, such as (+2,+2) and (+2,+2, +1,+1), the ANOVA test is used here because the Fishbein model is slightly more complicated, due to the 2 terms in the model, than are the stimuli used by Anderson. The ANOVA allows examination of the entire pattern of interactions among the b_i and a_i pairs, rather than just single relationships between stimuli. In addition, the ANOVA test is more readily generalized to tests at the individual level.

Results

Application of the criteria for meeting the Fishbein assumptions left 90 subjects of the original 167 who satisfied both the multiplication and

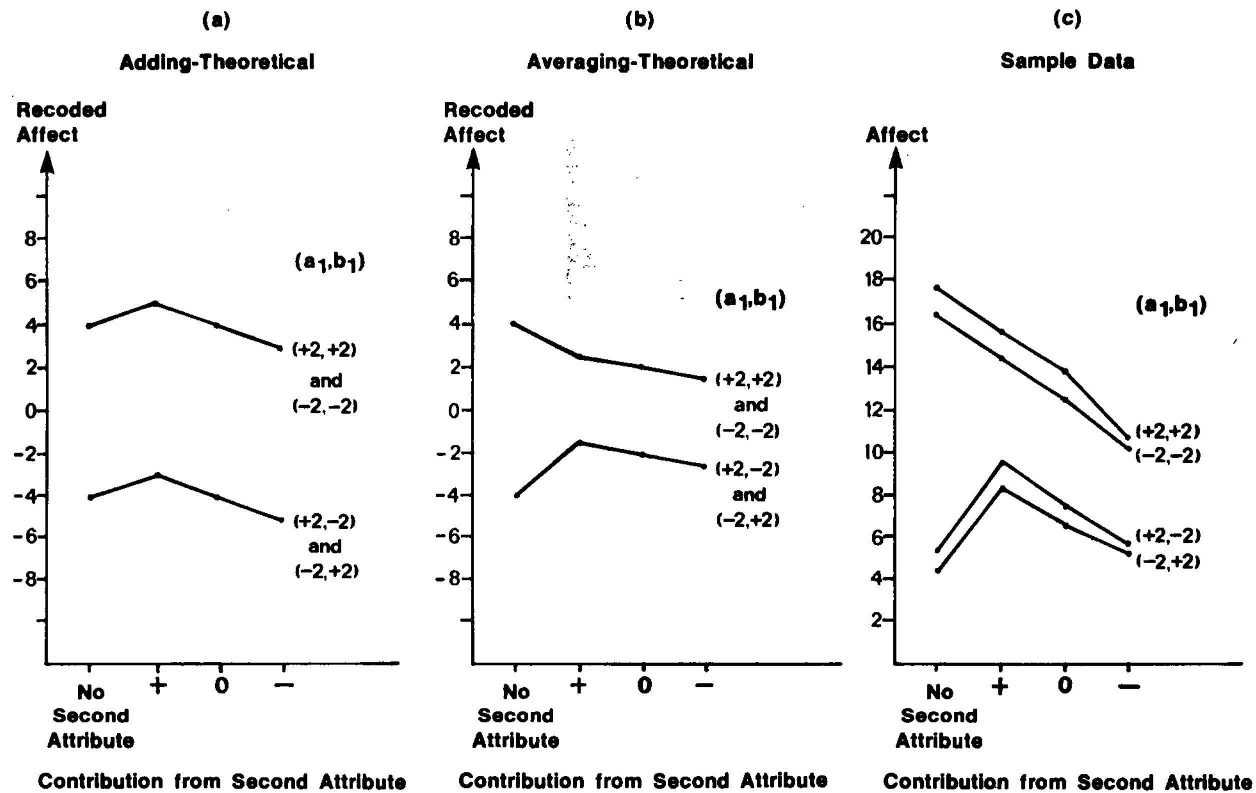

Figure 1: THEORETICAL AND EMPIRICAL DATA PATTERNS—ADDING VS. AVERAGING

interaction pattern assumptions. The data for these 90 subjects are plotted in Figure 1c. The graphical form appears to support averaging rather than adding. There is also a slight divergence from expectations in that the 2 lines theoretically giving +4 evaluations ([+2,+2] and [−2,−2]) do not coincide, and neither do the 2 lines theoretically giving −4 evaluations. It appears that a negative a_i rating pulls down the affect rating; there is a differential effect for negative information (see Kanouse and Hanson, 1971, for similar findings.) Finally, the directional predictions for all of the 12 two-attribute pairs compared to the single-attribute rating are in the direction predicted by averaging (i.e., the theoretically negatively evaluated single-attribute profiles have increased ratings in all pairs where a second attribute has been added, and so on).

The graphical results thus support averaging. The statistical results are now examined. A group level analysis of variance was performed at this preliminary stage of the investigation. For the 4 x 4 analysis of variance, the effect of the (a_1,b_1) pair ($F [3,267] = 1013$, $p < .001$) and of contribution from the second attribute ($F [3,267] = 270$, $p < .001$) was statistically significant, as was the interaction ($F [9,801] = 86.4$, $p < .001$).[6] This supports the averaging hypothesis. However, the results of the 4 x 3 ANOVA should show a nonsignificant interaction. The result ($F [6,171] = 9.5$, $p < .001$) does not strictly support averaging, therefore. However, compared to the magnitude of the other effects, the interaction effect is small: the ω^2 values for the 2 main effects in the 4 x 3 design are .168 (contribution from second attribute) and .491 (effect of the [a_1,b_1] pair), while the ω^2 for the interaction is only .009. In contrast, the corresponding ω^2 values in the 4 x 4 design were .097, .578, and .089, respectively. Also, although there is a slight indication of convergence when a negative attribute is added, the deviations from parallelism are not substantial nor easily interpretable. Hence, averaging is reasonably supported by the data, although future studies should attempt to look at the obtained interaction more directly.

DISCUSSION

Processes of attitude formation (Studies I and II) and a process akin to attitude change (Study III) have now been examined in detail with information integration methodology. Specific combination rules have been examined and compared to those assumed by the Fishbein attitude theory. Based on these studies, there is ample evidence to support the assumption that b_i and a_i combine by multiplying. However, the evidence of the present study clearly rejects the assumption that individual attribute combinations summate to yield overall attitude. Rather, subjects appear to average these contributions.

The studies reported above which have led to the support for an averaging process have all used the same methodology, based on responses to hypothetical profiles. This is a limitation, in that the factorial rating task is probably low in realism and involvement for subjects. Hence, there are serious questions about external validity. This might lead to suspicion that the averaging results are due to biases in the task itself; e.g., low involvement might cause simple strategies to appear as a quick way of finishing the task. Consistency of responses might also be a function of the systematic nature of the factorial data structure itself. Research is needed utilizing more realistic and involving designs, although dispensing with the factorial data structure would cause some problems in analyzing combination rules. In defense of the procedures used, subjects did display great individual differences, so that the task did not totally dominate the form of the responses. Also, Anderson (1971) has verified theoretical models in diverse substantive areas using a factorial task, and these models have had *different* cognitive algebra: multiplying, adding, and averaging, ratio rules, and so on. Thus the task does not seem to bias the form of the cognitive algebra, although there may be an upward bias in the consistency of subjects. Despite problems with the tasks, these latter results argue that there is some external validity.

The support for averaging rather than adding has substantial implications for research on communication effects and attitude change. For example, in an adding model, the addition of a new attribute has a clearly predictable effect on change in overall attitude: if the contribution (i.e., b_ia_i) is positive, attitude will increase; if the contribution is negative, overall attitude will decrease. This is *independent* of the values of the contributions from other attributes. However, in an averaging model this is no longer true. Effects of adding a new attribute depend on the values of the existing attributes—thus the attitude change model is configural. For example, adding an attribute with a contribution of +2 will increase attitude if the other attributes have an average of +2 or less, and will decrease attitude if the average is already greater than +2.

This configurality introduces more complexity into the use of Fishbein model components as dependent variables in communication research. In fact, Lutz (1975) has shown that communications directed at a particular attribute have effects not only on that attribute, but "second-order" effects thoughout cognitive structure, which must also be considered in examining attitude change predictions. These complications point out the value of using the Fishbein components as more detailed dependent variables, however. Without measuring the impact of a communication at this more detailed level, there would be no understanding of why the overall impact resulted. All the detailed effects must be examined in order to determine whether averaging processes, second-order effects, or something else are leading to the particular overall effect. Merely knowing an overall attitude change score is not sufficient.

Given the present support for an averaging process, more research needs to be carried out to determine the implications for the Fishbein model formulation itself. Several possibilities for reformulation should be investigated, including normalization (Bass and Wilkie, 1973), which can be viewed as a form of averaging, and disaggregated regression approaches (Cohen and Ahtola, 1971), which can be seen as differential-weight averaging if the weights are constrained to sum to one. These alternatives and others need to be investigated in attitude change situations, since that is where the adding versus averaging issue is of critical importance.

Finally, information integration methodology appears to have much to offer communication research. For example, communications could be constructed which vary source and message elements in factorial designs. Such designs could be used to examine combination rules for these effects, determining, for instance, whether source effects multiply, add to, or average with message effects. In addition, the methodology of functional measurement (Anderson, 1971: 174), although not stressed in this study, could be used to scale message and source effects. Information integration theory has had great success in many substantive areas, and it appears very promising for research on communications' effects as well.

NOTES

1. This study also investigated the adequacy-importance model. The interested reader is referred to Bettman, Capon, and Lutz (1975a).

2. Most researchers have assumed that the scaling of each component of the Fishbein model is bipolar (e.g., -3 to $+3$).

3. This follows from the fact that both addition and equal-weight averaging would predict no other significant interactions. Hence, only those subjects whose data satisfied this property should be examined to distinguish between adding and averaging.

4. Note that this coding scheme is used here and later in the paper strictly as an example of typical previous coding practices. The figures below are labeled using these codes strictly for convenience. These codes are not used in data analyses; codes for the independent variables are not needed to analyze the ANOVA data. The only assumption needed is that the dependent variable of affect be at least interval-scaled. As Anderson (1971, 1974) points out, a functional measurement approach, not necessary for the present discussion, can be used to derive stimulus values, so that it becomes unnecessary and inappropriate to assume such values a priori.

5. A simple averaging model is used here for simplicity. Anderson (1971: 181) points out that an initial impression is necessary to account for the set-size effect, where adding information of the same value makes the response more extreme. This complication of the simple averaging model is not necessary for the present analysis.

6. The interaction of each effect with a subject's factor was used as the error term for that effect.

REFERENCES

ANDERSON, N. (1974) "Basic experiments in person perception." Technical Report 44, Center for Human Information Processing, University of California, San Diego.

——— (1971) "Integration theory and attitude change." Psych. Rev. 78 (May): 171-206.

BASS, F. and W. WILKIE (1973) "A comparative analysis of attitudinal predictions of brand preference." J. of Marketing Research 10 (August): 262-269.

BETTMAN, J., N. CAPON, and R. LUTZ (1975a) "Cognitive algebra in multi-attribute attitude models." J. of Marketing Research 12 (May).

——— (1975b) "Multiattribute measurement models and multiattribute attitude theory: a test of construct validity." J. of Consumer Research 1 (March).

COHEN, J. and O. AHTOLA (1971) "An expectancy X value analysis of the relationship between consumer attitudes and behavior," pp. 344-364 in D. Gardner (ed.) Proceedings of the Second Annual Conference of the Association for Consumer Research.

FISHBEIN, M. (1967) "A behavior theory approach to the relations between beliefs about an object and the attitude toward the object," pp. 257-266 in M. Fishbein (ed.) Readings in Attitude Theory and Measurement. New York: John Wiley.

——— and R. HUNTER (1964) "Summation versus balance in attitude organization and change." J. of Abnormal and Social Psychology 69 (October): 505-510.

HAYS, W. (1963) Statistics for Psychologists. New York: Holt, Rinehart & Winston.

KANOUSE, D. and L. HANSON (1971) "Negativity in evaluations," pp. 47-62 in E. Jones et al. (eds.) Attribution: Perceiving the Causes of Behavior. Morristown, N.J.: General Learning Press.

LUTZ, R. (1975) "First-order and second-order cognitive effects in attitude change." Communication Research 2, 3 (July).