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J. Scott Armstrong*

David B. Montgomery†

*University of Pennsylvania, armstrong@wharton.upenn.edu

†Stanford University

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Brand Trial After a Credibility Change

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In most frequently purchased, branded product markets, the consumer has little to choose from in terms of significantly differentiated products. The staggering array of manufacturers' claims and counter claims of brand superiority seems to leave consumers somewhat bewildered or cynical.

What would happen if the credibility of the appeals made on behalf of one brand should suddenly be enhanced by a seemingly legitimate authority? More specifically, what would characterize consumers who would respond to such a change in credibility?

The American Dental Association (ADA.)'s endorsement of Crest on August 1, 1960 provides an example. The endorsement received widespread coverage. Procter and Gamble used full-page newspaper ads in several hundred markets to thank the ADA for its contribution to public service.

The joint product of heavy P&G advertising and legitimization of the brand appeal by the ADA was a dramatic gain in market share for Crest from about 12 percent in July 1960 to about 35 percent in the period after the endorsement. This gain came at the expense of virtually every brand, and it came in spite of heavy dealing activity by other brands. Thus, the dentifrice market during the period provides a case example of consumer behavior in a market undergoing substantial change.

The objectives of this study are two-fold. The first is an initial evaluation of a class of consumer panel measurements which might provide diagnostic information about market response as well as new bases for market segmentation. Data are from a social-psychological questionnaire which was designed specifically to measure several aspects of consumer behavior and which was administered to nearly 4,000 housewives in MRCA's National Consumer Panel about three months prior to the ADA endorsement. This questionnaire gathered data on buyers' self-designated interest and opinion leadership on a rather broad range of topics. It also asked the buyer to assess her likely response to seven hypothetical, but plausible, new products on a scale from "try immediately" to "never try." Data were also gathered on media habits and preferences, and social contacts. Should these measures prove useful, commercial panel operators might find it profitable to provide these measures on a continuing basis.

The second objective was to see whether it would be possible to specify, by prior reasoning, certain salient characteristics of consumers who responded to the Crest endorsement. This study represents an extension of the work first reported in Montgomery and Armstrong (1968).

Prior Theory

Even though its basic formulation did not change, Crest was probably viewed as "new" by much of the market subsequent to the endorsement in that it now had a major additional product attribute – a claim of decay prevention legitimated by a highly credible source.

The notion that Crest was probably viewed as "new" subsequent to the endorsement led to the possibility that the literature on the diffusion of innovations might yield useful insights in constructing a prior model. Since interest was centered upon response change resulting from the legitimization of the brand appeal, only those buyers who were not Crest purchasers in the period immediately preceding the endorsement were considered in this study.

It should be noted that consumer response to the legitimization of the Crest brand appeal is confounded with both the response to increased promotion of Crest and competitive response to the endorsement. These confounding effects should tend to operate in opposite directions on the response measure, trial of Crest. A further confounding aspect of this situation is the intervening variable of the family dentist. His reaction to the Crest endorsement may well have determined the response of a family in many cases. Unfortunately, the data base did not furnish this information.

Rogers (1962) has summarized research relating to the diffusion of innovations and from this research he has tried to develop a tentative theory. At the present time, the theory consists of a loosely related set of conceptual variables which have been found to be useful in distinguishing early adopters from late adopters or non-adopters.

Rogers found that the perceived characteristics of the innovation were important determinants of response. He identified the following five characteristics as being important: relative advantage, cultural compatibility, complexity, divisibility, and communicability. Of these, relative advantage seemed particularly salient in terms of predicting individual response to the ADA endorsement. The remaining four did not appear to be especially important as discriminators in the present case.

Rogers also reports that early adopters and innovators tend to rate higher in terms of opinion leadership and venturesomeness. In addition, impersonal information sources were found to be important at the awareness stage while personal sources were important at the evaluation stage.

These results suggested that the variables of relative advantage, venturesomeness, opinion leadership, and exposure to mass communication and personal sources of information ought to be incorporated within the framework of the prior model.

The following prior model draws upon Rogers' summary of salient variables in the diffusion of innovations. Interest centers upon ascertaining whether conceptual variables developed in other behavioral disciplines would prove useful in predicting response to the Crest endorsement.

Prior Model

The first step was to identify a set of conceptual variables which seem relevant, a priori, to the identification of triers of Crest subsequent to the ADA endorsement. These variables are:

- R: Relative Advantage: What advantage does the product have for the consumer?
- I: Interest: How interested is the consumer in products of this type?
- V: Venturesomeness: Is the consumer willing to experiment with products of this type?
- OL: Opinion Leadership: Do others ask the consumer for information on the product class?
- G: Gregariousness: Does the consumer have a lot of social contacts?
- M: Exposure to Mass Communication: How much contact does the consumer have with the mass media?

Notice that interest has been added to the conceptual variables drawn from Rogers. It seemed that in cases of enhanced appeal credibility, interest might also have an important effect on consumer response.

The preceding conceptual variables form the basis for a rather primitive model. Taking each variable separately, a high level on each variable should be positively related to the trial of Crest after the ADA endorsement.

Operational Measures

Operational measures of the purchase response and the conceptual variables are required before the prior model may be tested. Many of the measures are rather crude indices which combine answers to several questions. This approach was followed because, first, the tree analysis discussed later requires that a parsimonious set of predictor variables be used (due to sample size problems) and, second, it was felt that the questions which were combined all reflected some operational aspects of the underlying conceptual variable.

In this paper, attention is focused upon buyers who tried Crest subsequent to the endorsement. A "trier" is any buyer who purchased Crest at least once after the endorsement. This purchase had to occur within her first 25 purchases or within the purchase records available from her diary, whichever was less. The great majority of triers purchased Crest within a few purchases after the endorsement.

In the case of Crest, it seemed that the presence of children would give Crest a relative advantage for that family. It was felt that the critical years for tooth decay occur during childhood and adolescence and, further, that adults are more likely to be concerned with the question of tooth decay for their children than for themselves. Thus, the operational measure of relative advantage was taken to be the presence of children (through age 17) in the household.

In the following discussion, several indices are developed as weighted combinations of certain measures. The weights, while ad hoc, represent prior notions about the relative contribution of these measures. The procedure used to develop these prior weights was first to agree on the measures to use and then for each author to assess independently the rank order importance of these measures to the indices. The rankings were in agreement and were used as the weights in the indices.

Interest and opinion leadership measures were developed from a weighting of response to questions on health, raising children, and buying food. The housewife was asked to rate her interest in each of these three topics in terms of whether she saw herself as less interested, as interested, or more interested than most other women she knew. The three response alternatives were coded 1, 2, and 3, respectively, with the highest response number signifying the greatest topical interest. The interest index was then taken as:

$$I = (3) (\text{Interest Score on Health}) + (2) (\text{Interest Score on Raising Children}) + (1) (\text{Interest Score on Buying Food}).$$

The opinion leadership index was developed in a similar fashion.

The venturesomeness measure was the result of the housewife's response to the following question:

An effective pill for the prevention of colds and minor respiratory ailments is about to come on the market. Would you:

1. Try it as soon as possible.
2. Wait until a few friends have tried it.
3. Wait until it is in common use.
4. Probably never try it.

This measure was used to ascertain a housewife's self-perceived "venturesomeness" in a health related product. Her score on the venturesomeness index is the number which corresponds to her response to this question. Note that a score of 1 corresponds to maximum venturesomeness while a score of 4 corresponds to the least.

The conceptual variable "gregariousness" relates to the number of social contacts which the housewife has. Operationally, this was defined as a weighted combination of the following measures: (1) the number of persons, excluding immediate family, with whom she had a telephone conversation during the preceding three days; (2) the

number of times she had visitors at her house the past seven days; (3) the number of times she was invited out for an evening visit or dinner with friends.

$$G^2 = (1) \text{ (Telephone calls in the past three days)} \\ + (2) \text{ (Visitors during past seven days)} \\ + (2) \text{ (Evening invitations to visit during past seven days)}$$

The square root, G, was used in the regression analysis.

Media exposure data for the panel households were available from a previous study run in the Spring of 1959. In this study, households kept weekly diaries of their magazine, daytime television, and evening television exposure. A household's score on one of these indices, say, daytime television, was determined by the quartile of the entire sample group of households into which it fell. The operational definition of exposure to mass communication channels was taken as:

$$M = (2) \text{ (Magazine Quartile)} + (1) \text{ (Daytime TV Quartile)} + (1) \text{ (Evening TV Quartile)}.$$

Since those having the greatest exposure will be in the first quartile, the smaller the M for a family, the greater is its exposure to mass communications. Hence, the operational measure M would be expected to be negatively related to trial of Crest.

Other Variables

It was postulated that the impact of the conceptual variables would show up more clearly in cases where the buyers were brand loyal. If brand choice is viewed as a probabilistic process, loyal buyers of some other brand should be less likely to purchase Crest by "chance," rather than response to the ADA endorsement. In a sense, loyal buyers should provide a more reliable sample on which to test the model.

The operational measure of brand loyalty was the proportion of purchases devoted to the household's most frequently purchased brand in the period prior to the endorsement. This measure was expected to relate negatively to trying Crest.

In a similar manner, a measure of dealing behavior was defined as the proportion of purchases the buyer made on a deal in the period before the endorsement. A buyer having a relatively high proportion of deal purchases might be considered "deal prone." If Crest were available on a deal, such a "deal prone" consumer might purchase Crest merely to take advantage of the deal. This measure was expected to relate positively to trying Crest.

Household Inclusion Criteria

The households used in the analysis should have been active in the MRCA panel during 1960, should provide some minimal number of dentifrice purchase records in both the before and after ADA periods, and should not have been Crest users immediately preceding the endorsement (since trial response to the endorsement is the response of interest).

Accordingly, in order to be included in the analysis, a household had to meet the following criteria: (1) it had to have been on the active list of the National Consumer Panel every month in 1960; (2) it had to have at least two purchases of dentifrice in the period before the ADA endorsement and at least four purchases after; and (3) it must not have purchased Crest on the two purchases immediately preceding the endorsement.

Empirical Results

The total sample of households was split into two subsamples, an analysis sample and a test sample. The primary reasons for splitting the sample were to allow for some test of reliability of the results in the tree analysis and to allow for the possibility that some manipulation of both the data and the model might have been necessary for the analysis sample. A total of 998 households out of 1,918 satisfied the inclusion criteria in the analysis sample, while 993 out of 1,917 did so in the test sample.

Regression Analysis

The prior model specifies that the operational measures of relative advantage (R), interest (I), opinion leadership (OL), gregariousness (G), and dealing (D) should all be positively related to trial of Crest in the post ADA period. It also specifies that the operational measures of brand loyalty (L), venturesomeness (V), and mass communications (M) should be negatively related to trial.

Regression results for both the analysis and the test samples are presented in Table 1. The dependent variable in these regressions was a dichotomous variable which equals one for a household which tried Crest after the endorsement and zero for a household which did not try. The t statistics may be treated as normally distributed with zero mean and unit variance for both samples since the sample sizes are very large.

Table 1. Regression Results

Variable	Analysis Sample		Test Sample		Difference	
	Coeff.	t	Coeff.	t	Absolute Diff. ^a	Standard Error
D	.055	.82	1.04	1.59 ^d	.049	.094
L	-.503	-7.88 ^b	-.440	-6.92 ^b	.063	.091
U	.010	1.10	.003	.29	.007	.014
OL	-.009	-1.10	-.014	-1.74 ^c	.005	.011
R	.135	4.16	.174	5.37 ^b	.039	.045
G	.002	.12	.007	3.09 ^b	.005	.017
V	-.008	.52	-.025	-1.68 ^c	.017	.056
M	-.004	-.87	-.007	-1.67 ^c	.003	.006
Intercept	.814		.927			
Adj. R ²	.088		.098			

^a Absolute value of the difference between the coefficient estimates for the two samples.

^b P < .01, one-tailed.

^c P < .05, one-tailed.

^d P < .10, one-tailed.

In Table 1, consider the results for the analysis sample. The sign predictions hold for all variables except opinion leadership. The chance probability of seven out of eight correct sign predictions is less than five per cent. The t statistics for brand loyalty (L) and relative advantage (R) are highly significant, while the results for the other variables are much poorer. The adjusted R² of 8.8 per cent, while statistically significant, is scarcely overwhelming. It might be noted that R²'s of this order of magnitude are fairly common in studies using household level data (for a recent example, see Massy, Frank, and Lodahl, 1968). In summary, the regression results on the analysis sample seem to indicate some support for the prior model, but a great deal of unexplained variation remains.

The test sample lends somewhat stronger support to the prior model. Once again the sign predictions are correct with the exception of opinion leadership. The t statistics for brand loyalty (L) and relative advantage (R) are highly significant, as in the analysis sample. In contrast to the analysis sample, however, gregariousness is now significant at beyond the .01 level, while venturesomeness (V) and mass communications (M) are significant beyond

the 0.05 level. Dealing (D) nearly reaches the 0.05 level in this case. The adjusted R^2 of 9.8 per cent is slightly higher than that for the analysis sample.

The question then arises as to whether the results of the two regression analyses are consistent. In each sample, the regression coefficient of each variable will be approximately normally distributed with a mean and standard error given by the coefficient estimate and its corresponding standard error, respectively. Since the samples are independent, the difference in the coefficient values between the samples will have a variance equal to the sum of the variance of the individual coefficient estimates. The absolute value of these differences and their corresponding standard errors are given in the last two columns of Table 1.

Note that in no case does the magnitude of the difference exceed one standard error. Consequently, the results of the two regressions are consistent within the limits of the errors of estimation in the two samples. Thus, the consistency of both the sign predictions and the magnitude of effects between the samples provides reasonable support for the prior analysis.

Tree Analysis

In a tree analysis (or multi-level cross classification analysis), the sample is successively split into a set of mutually exclusive and exhaustive cells based upon the magnitudes of the predictor variables. Since this process of splitting the sample places heavy demands upon sample size, it is necessary to limit the number of predictor variables. Based upon the regression results for the analysis sample, the sample was split on brand loyalty, relative advantage, interest, and opinion leadership. Venturesomeness was also included. The sample was first split into high and low brand loyal groups. Then these two groups were further split into high and low relative advantage groups, yielding four groups in all. The process was continued until the sample had been split into high and low groups on all five predictor variables, yielding a total of 32 cells (or groups of households) in all. The criterion score for splitting on each variable was at about the mean response for that variable in the analysis sample. Once the sample had been divided into these 32 separate cells, the proportion of triers in each cell was computed. The test sample was also split into 32 cells using the same predictor variables and criterion scores as had been used in the analysis sample. More detailed discussion of tree analysis may be found in Armstrong and Andress (1970) and Montgomery and Armstrong (1968).

Each cell in the tree analysis contains households which are similar to one another in terms of being high or low on each of the predictor variables. Consider two cells which are comparable on all but one of the predictor variables. To be specific, let cell i contain households which are high on L, R, I, and V and low on OL. Let cell j contain those households which are high on L, I, and V and low on R and OL.

Since the prior model predicts that R (Relative Advantage) should relate positively to trial of Crest, the prior analysis would predict that cell i should contain a higher proportion of triers than cell j since the only difference between the cells in terms of the predictor variables is that cell i contains households which are high on R while cell j contains households which are low on R. If the empirical proportion of triers in cell i is higher than for cell j , then the data are consistent with the prior model in the sense that the directional prediction is correct. For each predictor variable, there are 16 possible pairwise comparisons of this type.

Results of the pairwise comparison of the predictor variables are given in Table 2. The results for L and R are strong and consistent between the two samples. The results for I are somewhat weaker, while the results for V and OL are weak and unstable. In assessing these results, it should be noted that the test is a rather crude one. It tests for direction of effect only and does not account for either magnitude or sample size considerations.

Table 2. Pairwise Comparison of Predictor Variables

Variable	Analysis Sample			Test Sample		
	Number ^a	Correct	Prob. ^b	Number ^a	Correct	Prob. ^b
Brand Loyalty (L)	15	14	.001	16	14	.002
Relative Advantage (R)	16	13	.011	16	15	.000
Interest (I)	16	10	.227	16	9	.402
Venturesomeness (V)	16	6	.895	16	10	.227
Opinion Leadership (OL)	15	10	.151	16	5	.962

^a Number of comparisons excluding ties.

^b This is the probability of observing at least this many correct predictions by chance when the chances of a correct prediction are 50/50.

Maximum Contrast Cells

Within each brand loyalty group, the maximum contrast cells are those cells for which all households are either high on all the other (R, I, V, and OL) predictor variables or low on all the other predictor variables. It is important to note that the maximum contrast cells were chosen on the basis of extreme values of the predictor variables and not upon how they happen to relate to the chances of a Crest trial in the data.

The behavioral hypothesis that *Relative advantage*, *Interest*, *Venturesomeness*, and *Opinion Leadership* should relate to trial of Crest is termed the RIVOL hypothesis. The cells in which households are all high on these variables will be termed High RIVOL, while the cells which are low are termed Low RIVOL.

The first rather simple analysis is to compare the proportion of a High RIVOL cell which tried Crest to that of a Low RIVOL cell. For the high brand loyals in the analysis sample:

$$P(\text{Trial} \mid \text{High RIVOL}) = 0.72 \text{ on } n = 25 \text{ households}$$

$$P(\text{Trial} \mid \text{Low RIVOL}) = 0.37 \text{ on } n = 71 \text{ households}$$

Thus, for the high brand loyal group, households who were high RIVOL were about twice as likely to try Crest as low RIVOL households.

This result would seem to indicate rather strong support for the prior model. In the case of the low brand loyals in the analysis sample, the results were:

$$P(\text{Trial} \mid \text{High RIVOL}) = 0.72 \text{ on } n = 43$$

$$P(\text{Trial} \mid \text{Low RIVOL}) = 0.46 \text{ on } n = 69$$

Note that the effect of the RIVOL variables shows up more clearly for the high brand loyals than for the low brand loyals, as had been anticipated. In the test sample, the corresponding results were:

$$P(\text{Trial} \mid \text{High RIVOL}) = 0.44 \text{ on } n = 27$$

$$P(\text{Trial} \mid \text{Low RIVOL}) = 0.28 \text{ on } n = 78$$

for the high brand loyals and

$$P(\text{Trial} \mid \text{High RIVOL}) = 0.64 \text{ on } n = 36$$

$$P(\text{Trial} \mid \text{Low RIVOL}) = 0.57 \text{ on } n = 72$$

for the low brand loyals. Again, the effect of the RIVOL variables seems to show up more clearly for the high brand loyals.

These results seem to indicate some real effect of the RIVOL variables on brand trial. While the general direction of the effect was consistent in the two samples, the levels of the effects clearly were not stable. This is due in part to the sample sizes in the maximum contrast cells. Other sources of error are the crude nature of the operational measures and the rather gross state of the prior theory which can be brought to bear on such an analysis. Continued empirical research should help to rectify these problems.

The final analysis of the maximum contrast cells was a two-way analysis of variance on the proportion of triers. The analysis follows Snedecor and Cochran (1967). Table 3 presents the results.

Table 3. Analysis of Variance of Proportion of Triers Maximum Contrast Cells

<i>Sample</i>	<i>Source of Variation</i>	<i>Estimated Effect</i>	<i>Estimated Standard Error</i>
Analysis	RIVOL	0.295	0.069
	Brand Loyalty	-0.060	0.065
	Interaction	0.090	0.138
Test	RIVOL	0.112	0.073
	Brand Loyalty	-0.260	0.066
	Interaction	0.092	0.147

For the analysis sample, the results indicated a substantial positive effect from RIVOL which is several times larger than its standard error. Brand loyalty has the expected negative effect, but the effect was smaller than its standard error. While the interaction term had the anticipated positive sign, the effect was again smaller than its standard error. Once again, the directions of effects predicted by the prior analysis were substantiated, but only RIVOL appeared to be statistically significant for this sample.

The directional results were strengthened by the test sample results. The signs were again those anticipated in the prior analysis. However, in this sample the estimated RIVOL effect was considerably diminished. Brand loyalty was estimated to have a much larger effect and was statistically significant. While the directional results were consistent between the samples, the levels (or magnitudes) of the effects differed rather substantially. This suggests that there is considerable room for sharpening the measures and the theory. The interaction term was once again positive, but smaller than its standard error. Note that its magnitude is essentially the same in both samples.

In summary, this examination of the maximum contrast cells has provided support for the relevance of the variables. It has not provided a strong indication of the magnitudes of the effects.

Conclusion

This study examined certain characteristics of households which responded to a significant change in the credibility of the appeals made on behalf of a brand. The empirical situation was that of the legitimization of Crest's claim of decay prevention by the American Dental Association.

A prior model was specified which indicated how certain behavioral variables should affect trial of Crest subsequent to the ADA endorsement. The prior model received modest support from a variety of different analyses, and for two independent samples. The fact that several analyses over two independent samples yielded a substantial amount of agreement strengthens the case for the prior model somewhat.

The strongest support for the prior model comes from the directional predictions. By and large these predictions were correct and were consistent between the analysis and test samples. Measurement of the magnitude of the effect of each variable was more problematical. While the regression results were quite consistent between the samples, the tree and maximum contrast cell analyses provided less consistent findings related to the magnitudes of effects. The overall ability to predict Crest trial, while statistically significant, was rather modest. Clearly there is substantial room for improvement and refinement.

Brand loyalty and relative advantage were consistently important across analyses and samples. These are variables which may be obtained from the standard types of data available from consumer panels. The results for the other, less standard variables are not so clear cut. While the test sample regression and the maximum contrast cell analysis provide some suggestive results, it cannot be suggested that these additional variables be routinely collected by panel operators on the basis of the analysis to date. What does seem worthwhile is further evaluation of these measures for other product classes and for other market response measures such as brand and store loyalty and dealing activity.

References

- Armstrong, J. S. and J. G. Andress (1970), "Exploratory Analysis of Marketing Data: Trees vs. Regression," *Journal of Marketing Research*, 7, 487-492.
- Blalock, H. M., Jr. (1961), *Causal Inferences in Nonexperimental Research*. Chapel Hill: University of North Carolina Press, 1961.
- Bliven, B., Jr. (1963), "And Now a Word from Our Sponsor," *New Yorker*, March 23, p. 83.
- Katz, E. and P. Lazarsfeld (1955), *Personal Influence*. New York: The Free Press.
- Magazine Advertising Bureau of the Magazine Publishers Association. *The Profitable Difference*, New York: undated.
- Magazine Advertising Bureau of the Magazine Publishers Association. *A Study of the Magazine Market – Part II*. New York: undated.
- Massy, W. F., R. E. Frank and T. Lodahl (1962), *Personality Attributes and Purchasing Behavior*. Philadelphia: The University of Pennsylvania Press.
- Montgomery, D. B. and J. S. Armstrong (1968), "Consumer Response to a Legitimated Brand Appeal," in J. Arndt (ed.), *Insights into Consumer Behavior*. Boston: Allyn and Bacon.
- Montgomery, D. B. and A. J. Silk (1969), "Patterns of Overlap in Opinion Leadership and Interest for Selected Categories of Purchasing Activity," *Proceedings of the AMA. Educators' Conferen.*: Chicago.
- Morgan, J., V. and J. A. Sonquist (1963), "Problems in the Analysis of Survey Data and a Proposal," *Journal of the American Statistical Association*, 58 (June), 415-435.
- Rogers, E. M. (1962), *Diffusion of Innovations*. New York: The Free Press.
- Sonquist, J. A. and J. N. Morgan (1964), *The Detection of Interaction Effect.*, Monograph No. 35. Survey Research Center, Ann Arbor: University of Michigan.
- Snedecor, G. W. and W. G. Cochran (1967), *Statistical Methods* (6th Ed.). Ames, IA: The Iowa State University Press.