

# A Hierarchical Model of the Structural Relationships Between Environmental Attitudes and Beliefs

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## Abstract

*This study explores the hierarchical relationships between a selected group of environmental attitudes and beliefs. Data support the hierarchical model hypotheses that broad and specific beliefs are linked by a hierarchy of mediating beliefs and that permanent change begins at the top of the belief hierarchy.*

## Introduction

### Attitude and Attitude Structure

The importance of attitude and belief to consumer behavior is well established. Underlying attitude research is the assumption that attitudes are related to behavior -- especially in high-involvement decisions. Before 1970, marketing research focused on establishing a relationship between attitudes and behavior. Studies generally suggested that the attitude-behavior relationship was complex and held true only under certain conditions. Such findings led researchers to expand the concept of attitude and examine its underlying structure. The works of Rosenberg (1956) and Fishbein (1967) helped to focus attention on understanding and analyzing the structure of attitudes -- generally known as the multi-attribute approach to attitude analysis and measurement.

### The Attitude Hierarchy

The idea that attitudes are arranged in logical hierarchies is suggested by two major areas of research. First, several social psychologists have proposed that attitudes are hierarchically arranged. Allport (1937) described an attitudinal continuum with opinions, attitudes, interests, and values as successive points along the continuum.

McGuire (1960, 1968) made a strong argument for long-run logical consistency in belief structures. Rokeach (1969) suggested that beliefs, attitudes, and values are arranged hierarchically -- with beliefs as specific and least central, and values as general and most central.

A second source of support for the hierarchical model is found in research on human information processing. Evidence strongly suggests the hierarchical nature of storage network in semantic long-term memory (Wood, 1972; Lindsay and Norman, 1972; Collins and Quillan, 1972; Collins and Loftus, 1975). Given that one, memory often contains hierarchical structures, and two, feelings and emotions about concepts or experiences are often part of a memory trace, it follows that attitudes can be organized in the same way as the concepts are stored in memory.

### A Hierarchical Model

McGuire's (1960, 1968) cognitive consistency theory suggested that beliefs are organized logically, either by logical implication in deterministic cases or by the equivalent conditional

probability structures for probabilistic influence. Hunter, et al. (1976) synthesized this earlier research in a hierarchical model of attitudes, arranging concepts from the most concrete and specific to the most abstract and general. Based on the model of belief change consistency advocated by McGuire and others, Hunter, et al. hypothesized that causal relationships between attitudes and beliefs followed the same top-down pattern as logical inference. The top-down hypothesis was verified by Poole and Hunter (1979) for both the path model of endogenous changes among attitudes and for the direct and indirect effects of messages aimed at different points in the hierarchy.

### **Purpose**

The current research explores the relationships between a selected group of environmental attitudes and beliefs ranging from broad natural resource and conservation issues to specific issues involved in container deposit laws. As a test of the hierarchical model, the research hypothesizes that broad and specific beliefs are linked by a hierarchy of mediating specific beliefs and further that permanent belief change begins at the top of the belief hierarchy.

### **Methodology**

#### **Survey Questionnaire**

The data was collected through a survey questionnaire. Prior studies provided a general outline of environmental and other issues involved in consumer behavior in response to container deposit laws. A pilot study was conducted with ten specialists and practitioners in the field of conservation to more sharply define the issues. The hierarchical structure of environmental beliefs derived from the process seemed to differ only trivially from the one constructed from prior studies. Several questions were written to tap opinions on each issue, and these formed the basis for belief scales. The questionnaire was pretested with a representative sample of respondents. In reviewing

the survey instrument respondents were asked to be critical, especially in regard to poorly constructed or ambiguous items.

Based on the pretest, the questionnaire was revised for the final survey. The attitude questions were constructed on a five-point scale ranging from strongly disagree to strongly agree. Reliability of response was enhanced by reversing the direction of half the items and reordering the items based on random numbering.

### **Survey Respondents**

Two sample groups were selected from residents of a midwestern campus city of more than 100,000: a non-student sample of 208 and a student sample of 225. The non-student sample was a formal random sampling of residents listed in the telephone directory. The student sample was a formal random sampling of students listed in the campus telephone directory. Statistical analysis revealed no significant differences between the two samples. The two groups were then combined to form a composite sample of 433 used in subsequent statistical analyses.

### **The Measurement Model**

Using Package (Hunter and Cohen 1969) software, correlations among the attitude items were established. Questionnaire items were then grouped according to the construct being tapped. Multiple group procedures were used to form item clusters based on content similarity, internal consistency, and external consistency or parallelism (Hunter and Gerbing 1982). These scales were tested against the data using confirmatory factor analysis and were modified where needed. The corresponding clusters were scored and correlated, and this matrix was corrected for attenuation due to less than perfect reliability (Nunnally 1967). The corrected matrix served as the input for path analysis.

### **The Causal Model**

The logical precedence rules of the hierarchical model were used to generate the causal model. The most general belief scale was placed at the top, with beliefs directly implied by the general belief placed next, and so on. When subjected to path analysis, the model produced an almost perfect fit. Path analysis was conducted on the belief correlation matrix using Pathpac (Hunter and Hunter 1977). Path coefficients were derived by ordinary least squares estimates (Heise 1975) using simple or multiple regression of each variable onto its causal antecedents. The path coefficients were used to generate a predicted correlation matrix, which was then subtracted from the observed correlation matrix. The resulting residual matrix was used to judge the goodness of fit of the proposed model.

## Results

### Distribution of Attitudes and Beliefs

Table 1 shows the means, standard deviations and reliabilities of the attitude and belief scales derived from the confirmatory factor analysis.

### Means and the Hierarchical Model

The hierarchical model predicts that beliefs at the top of the hierarchy are likely to be adopted before lower-order beliefs, and that the mean scores will steadily decline as one progresses down the hierarchy.

To test this prediction, the path model was used to form three sets of beliefs: the most abstract beliefs (505,506,504 and 507); intermediate beliefs (502,501,503,512 and 508), and the most specific beliefs (511,510 and 513). The means for the beliefs in each set were then averaged:

Abstract beliefs	3.69
Intermediate beliefs	3.34
Specific beliefs	3.20

These rankings bear out the ordering predicted

by the hierarchical model.

### Testing the Hierarchical Model

Tables 2-4 show the correlations (corrected for attenuation due to measurement error) between the different attitude and belief scales.

As predicted, the highest correlations are found between attitudes at the same level of generality. However, simple correlations between belief scales do not specify the direction of causality. A path analysis was conducted to trace the causality and specifically distinguish between direct, indirect and spurious effects. The resulting path diagram is outlined in Figure 1 on page 85.

Tables 2-4 present the statistics required to assess the goodness of fit.

Table 2 shows the observed correlations between scales corrected for attenuation). Table 2 presents the correlations predicted by the model. Table 4 indicates the differences or errors in fit. An overall chi square test shows no significant departure from the model, indicating that model fits the data quite closely.

A detailed examination of the path diagram was then used to test the mediational and network hypotheses of the hierarchical model.

### Testing the Mediational Hypotheses

According to the mediational hypotheses, the influence of higher-order environmental beliefs on lower-order beliefs is indirect and mediated by more specific environmental beliefs. Beliefs that consumers can do much (507) and that they favor container return laws (512) have a correlation of .16, while the intermediate scale that they support societal control of resource use (501) has a correlation of .41 with the first belief and .49 with the second. Similar correlations exist among 505, 506 and 507; among 504, 507, 504 and 501; and among 501, 502 and 503.

TABLE 1  
 FACTOR ANALYSIS OF  
 ATTITUDE AND BELIEF SCALES

Scale No.	Content	Mean <sup>a</sup>	SD	Reliability <sup>b</sup>
501	Society must control resource use	3.63	.63	.76
502	Resources more important than jobs	3.18	.93	.83
503	Industry will not act on their own	3.54	.89	.74
504	Consumers must conserve resources	3.88	.65	.61
505	Resource shortage is real	3.27	.78	.70
506	Resource shortage is serious	3.79	.72	.73
507	Consumers can help	3.82	.60	.65
508	Industry not doing their best	2.79	.64	.65
509	Resources used in cans significant	3.65	.79	.80
510	Prefer glass over metal containers	3.24	.64	.57
511	Beer companies prefer can containers	3.03	.78	.71
512	Favor container return	3.24	.85	.75
513	Certified bottles conserve resources	3.36	.68	.76
514	Government is doing nothing	2.62	.90	.74

<sup>a</sup> On a scale from 1 = Strongly Disagree to 5 = Strongly Agree. Category 3 is neutral.

<sup>b</sup> Coefficient Alpha.

TABLE 2  
OBSERVED SCALE CORRELATIONS

Reordered R-Matrix

	505	506	504	507	501	503	508	512	509	510	513	502	511
505	100	70	41	40	42	8	7	47	20	13	6	15	3
506	70	100	59	58	48	21	21	28	28	24	5	15	25
504	41	59	100	45	60	37	3	40	38	7	-1	31	4
507	40	58	45	100	41	-9	-24	16	24	2	3	19	-1
501	42	48	60	41	100	43	26	49	32	14	11	35	21
503	8	21	37	-9	43	100	62	25	23	33	4	29	22
508	71	21	3	-24	26	62	100	7	2	34	-3	15	30
512	47	28	40	16	49	25	7	100	43	27	15	20	21
509	20	28	38	24	32	23	2	43	100	46	28	15	17
510	13	24	7	2	14	33	34	27	46	100	25	6	50
513	6	5	-1	3	11	4	-3	15	28	25	100	13	-5
502	15	15	31	19	35	29	15	20	15	6	13	100	5
511	3	25	4	-1	21	22	30	21	17	50	-5	5	100

TABLE 3  
PREDICTED SCALE CORRELATIONS

	505	506	504	507	501	503	508	512	509	510	513	502	511
505	100	70	41	41	29	12	8	14	6	5	1	12	3
506	70	100	59	58	41	18	11	20	9	8	2	17	5
504	41	59	100	34	58	25	15	28	12	11	3	29	7
507	41	58	34	100	35	15	9	17	7	7	2	11	4
501	29	41	58	35	100	43	27	49	21	18	5	22	12
503	12	18	25	15	43	100	62	21	9	25	6	26	20
508	8	11	15	9	27	62	100	13	6	36	9	16	31
512	14	20	28	17	49	21	13	100	43	24	6	11	13
509	6	9	12	7	21	9	6	43	100	47	12	5	22
510	5	8	11	7	18	25	36	24	47	100	25	8	50
513	1	2	3	2	5	6	9	6	12	25	100	2	13
502	12	17	29	11	22	26	16	11	5	8	2	100	6
511	3	5	7	4	12	20	31	13	22	50	13	6	100

TABLE 4  
DIFFERENCES BETWEEN OBSERVED AND PREDICTED SCALE CORRELATIONS\*

	505	506	504	507	501	503	508	512	509	510	513	502	511
505	0	0	0	-1	13	-4	-1	33	14	8	5	3	0
506	0	0	0	0	7	3	10	8	19	16	3	-2	20
504	0	0	0	11	2	12	-12	12	26	-4	-4	2	-3
507	-1	0	11	0	6	-24	-33	-1	17	-5	1	8	-5
501	13	7	2	6	0	0	-1	0	11	-4	6	13	9
503	-4	3	12	-24	0	0	0	4	14	8	-2	3	2
508	-1	10	-12	-33	-1	0	0	-6	-4	-2	-12	-1	-1
512	33	8	12	-1	0	4	-6	0	0	3	9	9	8
509	14	19	26	17	11	14	-4	0	0	-1	16	10	-5
510	8	16	-4	-5	-4	8	-2	3	-1	0	0	-2	0
513	5	3	-4	1	6	-2	-12	9	16	0	0	11	-18
502	3	-2	2	8	13	3	-1	9	10	-2	11	0	-1
511	0	20	-3	-5	9	2	-1	8	-5	0	-18	-1	0

\*The sum of squared deviations is .86

The path diagram shows the mediational effects as causal chains. These chains extend from general beliefs to specific behavior and thus confirm the predicted mediation of causal influence. For example, looking at scales 505, 504 and 507, it is not enough for consumers to believe that a resource shortage exists. They must also appreciate the seriousness of the shortage (506) before they are inclined to take action to conserve resources.

### Testing the Network Hypotheses

Two major propositions are advanced by the hierarchical network hypotheses: One, causal relationships between environmental beliefs are hierarchically structured and two, the causal structure is ordered from the abstract and general to the concrete and specific.

Both propositions are confirmed by path analysis. The causally predominant belief that resource shortage is real (505) should appear at the top of the model, and it does. Other beliefs follow as predicted in order of generality, with specific behaviors appearing at the bottom of the path diagram.

The hierarchical model not only predicts that environmental beliefs are layered, but also suggests that the causal linkages are unidirectional. All causal arrows in the path diagram in Figure 1 point from general to more specific beliefs. The path diagram is thus consistent with the model's assumption of top-down causal flow.

### Implications

The current study is a significant validation of the hierarchical model of attitudes (Hunter, et al., 1976) and of both the mediational and network hypotheses underlying the model.

The causal influence between environmental beliefs is top-down. General environmental beliefs form the basis for intermediate beliefs, which in turn lay the foundation for more

specific beliefs. changes in specific environmental beliefs cannot be expected to move upward through the belief hierarchy.

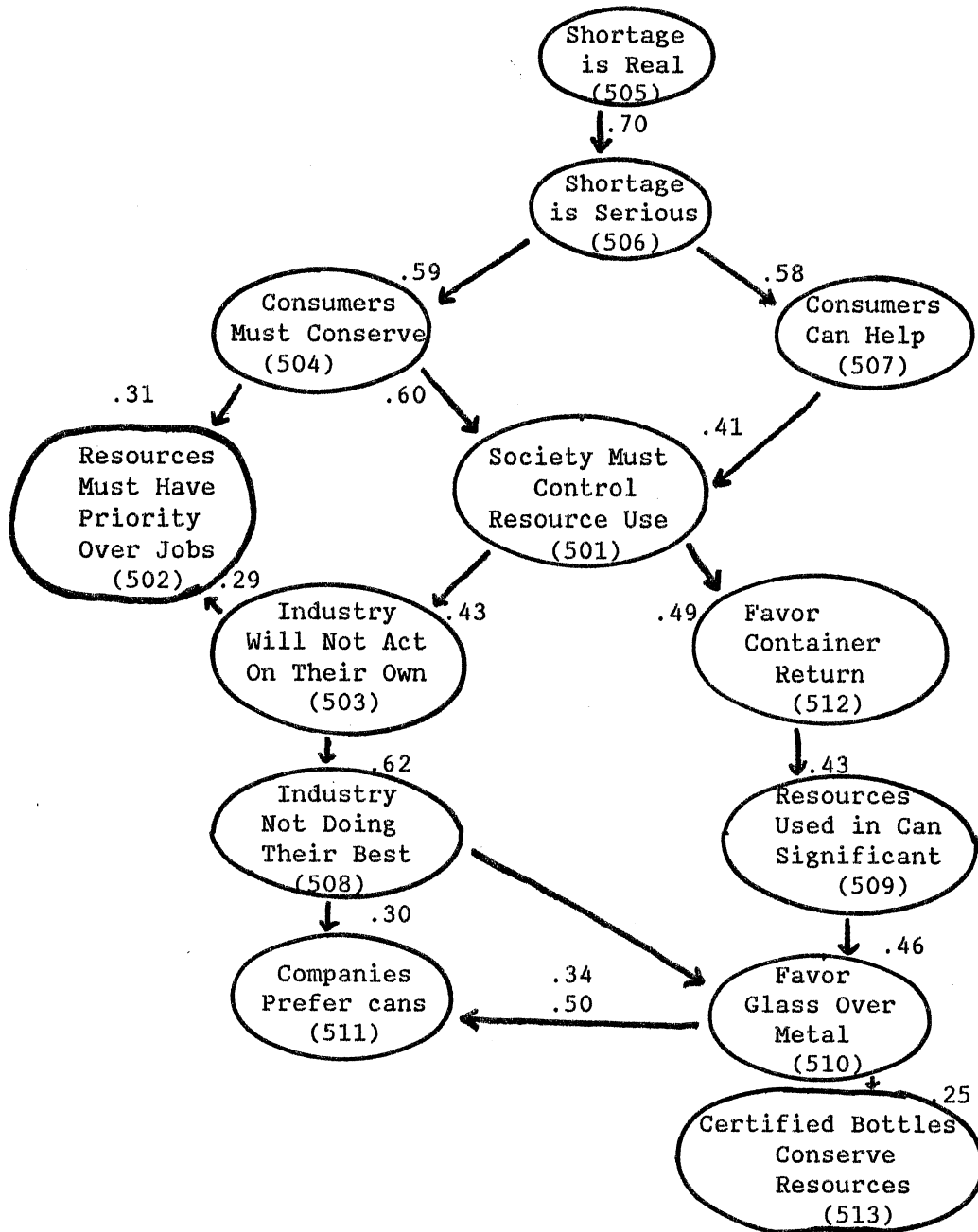
Permanent belief change can occur only at the top of the hierarchy. Short-lived awareness campaigns that promote a specific environmental belief or behavior will only temporarily modify that belief or behavior, leaving predominant, higher-order beliefs unchanged. Once the campaign is over, the lower-order beliefs will drift back to conform with higher-order beliefs that have not changed.

In designing a successful environmental awareness program, advocates must help consumers move from one level of belief structure to another. The first thrust of the campaign must be aimed at gaining adoption of the most general belief--consumers must first understand the seriousness of the resource shortage.

To motivate consumers to act, the campaign must next incorporate mediating beliefs, for example, that industry is not likely to take environmentally sound action on its own. Mediating beliefs in turn induce a change in lower-level beliefs that consumers can put into action (such as supporting container return legislation, recycling efforts, etc). When the specific belief is accepted, it is then helpful to give consumers concrete examples of how they can and should conserve resources.

The current research also demonstrates the value of path analysis in applying the hierarchical model. Simply examining the correlations in a family of beliefs can be misleading. A less significant correlation between a predominant belief and a lower-order belief does not indicate that the higher-order belief is irrelevant. It merely indicates that some intermediate belief linkages are missing from the model. Subjecting first-order correlations to path analysis can help sort out the direct, indirect and spurious effects of each belief. The hierarchical model further suggests that a belief not only governs behavior at its equivalent level, but also acts as an agent

FIGURE 1  
PATH DIAGRAM



of change at lower levels.

Designing an optimal campaign to change consumer beliefs requires knowledge of the hierarchy in which the targeted belief operates. Constructing this hierarchy is partly a matter of logic and partly one of experience. The first step is deducing the list of beliefs that are logically antecedent to the target belief. Once part of the hierarchy has been mapped out, the rest can be filled in by talking with the advocates who are most likely to have developed their own belief structures. Surveys of the general populations can help further refine this hierarchy before it becomes the basis for launch of a consumer awareness campaign.

## References

- 1 Allport, G.W., Personality: A Psychological Interpretation, New York, Holt, 1937.
- 2 Collins, A. and E. Loftus, "A Spreading Activation Theory of Semantic Processing," Psychological Review, 82, 407-28, 1975.
- 3 Collins, A. and R. Quillian, "How to Make a Language User," in E. Tulving and W. Donaldson, eds., Organization of Memory, New York, Academic Press, 1972.
- 4 Fishbein, Martin, "A Behavior Theory Approach to the Relations Between Beliefs About an Object and the Attitude Toward the Object," In Martin Fishbein, ed., Readings in Attitude Theory and Measurement, N.Y., John Wiley, p. 389-400, 1967.
- 5 Heise, D.R., Causal Analysis, New York, Wiley-Interscience, 1975.
- 6 Hunter, John E. and S.H. Cohen (1969), "Package: A System of Computer Routines for the Analysis of Correlational Data," Educational and Psychological Measurement, 29, 1969, 697-700.
- 7 Hunter, John E. and D.W. Gerbing, "Unidimensional Measurement, Second Order Factor Analysis and Causal Models," In Barry M. Staw and L.L. Cummings, eds., Research in Organizational Behavior, Vol. IV, Greenwich, Conn., JAI Press, Inc., 1982.
- 8 Hunter, John E. and R.F. Hunter, "Pathpac: A program for path analysis for recursive systems using either given coefficients or using calculated OLS path coefficients from given causal influence indicators or using path coefficients calculated from given causal influence indicators by a new Procrustes least squares method," East Lansing, Michigan State University, 1977.
- 9 Hunter, John E., Ralph L. Levine, and Scott E. Sayers, "Attitude Change in Hierarchical Belief Systems and Its Relationship to Persuasibility, Dogmatism, and Rigidity," Human Communications Research, 3, 3-28, 1976.
- 10 Jessen, Raymond J., Statistical Survey Techniques, New York, John Wiley and Sons, 1978.
- 11 Lindsay, P. and D. Norman, Human Information Processing: An Introduction to Psychology, New York, Academic Press, 1972.
- 12 McGuire, W.J., "A Syllogistic Analysis of Cognitive Relationships," In M.J. Rosenberg, et al, eds., Attitude Organization and Change, New Haven, Yale University Press, 1960.
- 13 McGuire, W.J., "Theory of the Structure of Human Thought," In R.P. Abelson, ed., Attitude Organization and Change, Chicago, Rand McNally, 1968.
- 14 Nunnally, Jum C., Psychometric Theory, 2nd ed., New York, McGraw-Hill Book Company, 1978.
- 15 Poole, Marshall Scott and J.E. Hunter, "Behavior and Hierarchies of Attitudes: A Deterministic Model," In Message-Attitude Behavior Relationship: Theory, Methodology, and Applications, New York, Academic Press, 1980.
- 16 Rokeach, M., Beliefs, Attitudes and Values, San Francisco, Jossey-Bass, 1969.
- 17 Rosenberg, Milton J. , "Cognitive Structure and Attitudinal Affect," Journal of Abnormal and Social Psychology, 53, (November) 1956, 367-72.
- 18 Wood, G., "Organization Processes and Free Recall," in E. Tulving and W. Donaldson, ed., The Organization of Memory, New York, Academic Press, 1972.