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Consumer Assessment of Residential Energy Conserving Innovation

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To the Graduate Council:

I am submitting herewith a dissertation written by Margaret Bateman Ellison entitled "Consumer Assessment of Residential Energy Conserving Innovation." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Human Ecology.

Robbie G. Blakemore, Major Professor

We have read this dissertation and recommend its acceptance:

Lillian Clinard, Mary Jo Hitchcock, Kenneth Kenny, Jack Haskins

Accepted for the Council:

Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

To the Graduate Council:

I am submitting herewith a dissertation written by Margaret (Bateman) Ellison entitled "Consumer Assessment of Residential Energy Conserving Innovation." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy with a major in Home Economics.

[illegible]

Robbie G. Blakemore, Major Professor

We have read this dissertation
and recommend its acceptance:

Lillian A. Clinard

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Graduate Studies and Research

CONSUMER ASSESSMENT OF RESIDENTIAL ENERGY CONSERVING INNOVATION

A Dissertation

Presented for the

Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

Margaret (Bateman) Ellison

August 1980

Dedicated to Scott and Richard

and their cousins --

whose energy future will depend

upon change mangement

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ABSTRACT

This research is the product of the researcher's development in the realm of environmental design and planning and her conviction that energy conservation is an interdisciplinary challenge. The study consists of three parts: 1) a theoretical study in which writings from multi-disciplines were examined for their potential to make a contribution to the conservation of energy; 2) a methodological study to develop an instrument to evaluate consumer acceptance of energy conserving innovation, INOVAC; and 3) an experimental field study, in which an energy conservation education program was delivered to consumers and whereby they were evaluated on the meanings they then attributed to energy conserving innovative window designs as a result of the education experience.

The research was conducted as the second of four evaluation strategies within a larger study, ENERSENSE, a project undertaken jointly by The University of Tennessee Energy, Environment, and Resources Center (EERC) and the Tennessee Agricultural Extension Service (TAES), to deliver and evaluate a multi-media program within the State of Tennessee. This project was carried out under the United States Department of Energy contract No. DOE EY 76-5-05-5049.

In the fall of 1978, a subsample of 100 was selected from the TAES clientele who had responded to the questionnaire administered as Strategy I of ENERSENSE. Equal-sized control and treatment groups were interviewed using the INOVAC instrument, which combined simulations of

five innovative window concepts with semantic differential scales representative of the vernacular of the region, and question items on 1) experience with the concepts and 2) the consumer's intention to use those concepts.

Comparisons among and overall the innovative concepts were made both within each group and between the two groups. Contextual variables data supplied by both the interview and the questionnaire were examined in respect to an INOVAT index, an overall index of innovation acceptance. Space models were constructed and trends in the meaningfulness of concepts were illustrated in three-dimensional form. The treatment group indicated that it found more variety of meaningfulness among concepts; concept relationships between-groups were not uniform. The differences, however, were not found to be statistically significant. Selected attributes (k=15) and three dimensions common to all concepts were analyzed. A limited number of attributes, which were seen as being closely associated with the conservation of energy, were found to be rated more positively by the treatment group. Ratings over the three dimensions: Aesthetic Appeal, Performance Evaluation, and Economic Novelty were not significantly different between-groups, while the control group rated more within-group concept comparisons as significantly different.

The two groups did not differ significantly on the INOVAT index. Exposure to the concepts, a contextual variable, was the only variable to contribute significantly to the index. All contextual variables examined in relation to the acceptance of each window concept contributed equally to its acceptance.

The importance of this research lies both in its methodological and experimental results. INOVAC, in addition to its reliability and behavioral validity, exhibited a potential for identifying descriptive features of energy-conserving innovations. These, plus the INOVAT index, provided a multivariant means of consumer evaluation. The INOVAC included also a capacity to compare experimental groups for statistically significant differences and for relationships to contextual variables which characterize segments of consumers and their reaction to energy conserving innovation. The research findings support using the INOVAC in field experiments and acknowledge the value of the instrument as an objective means of evaluating a current and practical environmental subject, which has a definite subjective component. Further research, however, must be undertaken. Suggestions for this are discussed along with the implications for the use of the INOVAC in relation to: 1) energy policy and education; 2) design evaluation; 3) innovation diffusion; and 4) environmental planning.

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INTRODUCTION

Developmental History

The Energy Problem

The "energy crisis" precipitated by the oil embargo of 1973 was not caused by the Arabs. By placing a complete oil embargo on the United States, the Arabs merely placed the spotlight on an energy problem which had been evolving during the past century. The roots of the energy problem are embedded in the patterns of production and consumption established by Americans as they have become a "disposable society" consuming more and more of the world's limited and non-renewable resources.

Energy consumption per capita has increased 400% in the United States during the past century. Twenty-five years ago national requirements were satisfied with one-sixth of the amount of energy used today, less than half of the present energy expenditure. In the same twenty-five year period the population has increased by about 45%, consumption of electrical energy has increased by 600%, and the total consumption of energy by 250%. The energy users in the United States, 6% of the world's population, use 35% of the world's resources and its energy. If the quality of life had improved dramatically relative to the per

capita increase in energy consumption and if there were endless reserves to extend that improvement into the future, the condition which has evolved as we enter the 1980's would not be considered a crisis (Stein, 1977, pp. 1-2)

Since the "crisis" was acknowledged, in 1973, consumers have reacted in a variety of ways. To some consumers the crisis is an "emergency" indicating severe energy shortages while to others it is a "turning point," suggesting that changes in policy and behavior are required. The energy problem has continued and intensified over the past seven years. While consumers have come to recognize the energy problem, only some have made corresponding changes in their lifestyles. Other consumers refuse to acknowledge that the consumer demands on the supply of energy have been a problem and will continue to be one for some time.

Energy Conservation

In Energy Conservation in the Home (1977), Clinard et al. identify four broad strategies that could be used singly or in concert to resolve our energy problem(s):

- Strategy 1: Develop "successor sources" to replace oil and gas over the years ahead.
- Strategy 2: Develop an energy economy not based on fossil fuels.
- Strategy 3: Increase efficiency of energy generation and use.
- Strategy 4: Change from a "disposable" to a "durable" society.

The first two strategies as well as aspects of Strategy 3 would require research and development. Part of Strategy 3, however, coupled with Strategy 4 depends largely upon the wise <u>use</u> of energy. Though not an easy task, these strategies can be implemented by corporate and private decisions based upon a "conservation ethic," and thereby possibly can provide the most viable solution for the immediate future." Conservation is defined as:

> . . .the wise use of energy which results from a rational response to price changes or a shift from less to more available fuel resources. Conservation does not connote a denial of the "American dream.". . . Rather, conservation attempts to change citizens from being high energy users to low energy users by reinforcing "saver" values in pragmatic, moneysaving terms. (Clinard et al., 1977, p. 22)

Paolucci (1978) also endorses the concept of the "conservation ethic"[1] as a basis upon which to create a lifestyle that will strike a balance between people and resources. Such an ethic, she maintains, "would include reducing waste, recycling materials, adopting intermediate technology, becoming more labor-intensive, using resources prudently, and volunteering to live as simply as possible" (p. 22). Such a "conservation ethic," Paolucci believes, eventually would foster in people a sense of "joy" in being frugal. It would, however, require energy users to be mindful of how they are using energy and to relate usage to the immediate and long range gratification provided by this very finite resource--one which has been taken for granted in recent years.

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[1]<u>Conservation Ethic</u>: An ethic that supports family decisions in reaching the goal to have ample sufficiency--not poverty or abundance. (Paolucci, 1978)

Stobaugh and Yergin (1979) in a study for the Harvard Business School concluded that energy conservation and emphasis on solar energy would allow America to cut its energy use by 40%. This study echoes findings of several other studies and reinforces the need to understand the relationship between the users of energy and its conservation.

Energy Conservation Education

To what extent do consumers, particularly residential consumers, recognize the need to strive to conserve energy? What is their "eco-consciousness"?[2] What is the relationship between actual conservation and eco-consciousness? In this connection, Keith (1977) suggests not only that families' conservation practices are linked with their eco-consciousness, but that energy conservation behavior can be predicted by the degree to which they possess this kind of eco-consciousness. Thus, it appears that finding ways to increase eco-consciousness and energy conservation practices is a facet of the "energy problem" that relates to education.

Since the lineups at the gasoline pumps in 1973, there have been numerous signs of an ever increasing energy problem as well as many suggested solutions. Utility costs, for example, have increased dramatically; while, at the same time, a flood of information sponsored by various agencies and utilizing all media has been addressing and

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[2]Eco-consciousness: Interrelationships of man-nature, interlinked with earth's capacity to sustain lifestyle of man. (Hogan, 1976)

promoting both energy conservation practices and energy conserving products. While energy information has been voluminous, a 1976 survey indicated that families "did not have accurate energy knowledge" (Maas, et al., 1978, p. 18). Further, it was implied that so much information from such a wide range of sources had not increased the consumer's understanding of the energy problem. Now, to the contrary, it is suggested that the flood of information may well have contributed to the problem, or at least confounded the search for solutions.

Energy Conservation Research

If information has not been found to be a solution, how can consumers better be motivated to conserve energy? Does conservation action depend upon an understanding of the energy problem? These are two central questions in energy conservation research.

The family[3], as a primary unit of consumption in American society, needs to realize that, although the energy problem is one of international magnitude, it is also one that can be affected by the day to day decisions of the family in the home. A third question, which studies by Coveney, Hunt, and Palloh have addressed, indicates that information, by itself on how to conserve energy will not change behavior (Rudd 1978). On the other hand, it must be recognized that incentives to conserve need to be accompanied with information on how

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[3]Family: A living system, comprised of individuals bonded either socially and/or biologically, interacting with its environment. (Goodman, 1977)

to conserve energy in the home, or in any other sector of society, before behavior can change.

> Although much information is readily available, research is needed to fill in the gaps and to check the validity of commonly held beliefs. Further, we need to find ways to convey the information effectively to potential users (Rudd, 1978, p. 25).

Research is also required to identify obstacles that bar the family from making decisions that lead to conservation behavior. Rudd (1978) supported this idea when she stated,

> Identifying obstacles to conservation behavior will help us identify further research needs and needs for educational programs. It will also provide a basis for recommending policy that will either (1) create incentives to conserve,. . . or (2) provide direct help to those who cannot change or even survive without help (p. 24).

It would appear that three key areas upon which research can focus are (1) information, (2) information delivery, and (3) users. What information is needed to inform and educate consumers about the multi-faceted energy problem? Do consumers need information on energy supply, alternative sources of energy, conservation practices, the relationship of energy and man, and/or alternative technologies? Donald Watson at a Sun Utilization Now Conference (1978) stated that technology has advanced and is advancing toward meeting the demands of the energy situation, but that <u>people</u> are resisting change. This author believes that consumers have been presented with options in residential, active solar systems only to say, "So what else do you

have?" There is a belief that technology can solve the problem with no effort being made by consumers to reduce consumption (OTA Report, March 1979). This belief is also supported by M. King Hubbert (1976) who states: "Our principal impediments at present are neither lack of energy or material resources nor of essential physical and biological knowledge. Our principal constraints are cultural" (New York Times, December 1, 1976).

If that is the case, before effective information programs can be developed, research must be conducted that identifies (1) characteristics of the culture, i.e., specific energy consuming segments of the U.S. economy, and (2) the characteristics of consumers, the users of the information. What attitudes are held and what behavior is perpetuated by post depression, post war, post Watergate consumers; by rural, suburban, urban consumers; all of whom have enjoyed and/or been motivated by the "good life" possible in the United States and who are now being threatened by inflation? What information is needed? by whom? and how can it be delivered to a culture with diverse needs and characteristics? It follows that, to have an effective information program, the components in each area must be studied as a prelude to planning a program which will be in tune with both cultural and environmental needs and which, as previously listed, can optimize on delivery systems.

If Strategies 3 and 4--"Increase efficiency of energy generation and use" and "Change from a 'disposable' to a 'durable' society"--are to make an immediate contribution toward solving the energy problem,

then research directed at specific users, and providing feedback about the impact of specific types of information and ways in which it is delivered is needed. Such research could influence decision-making and planning for increased efficiency in energy use, and also provide incentives for changing--if need be--user's lifestyles. The need to evaluate the impact of information on a specific user group has been recognized by The University of Tennessee Energy, Environment, and Resources Center (UTEERC)[4] and has motivated the Center (1) to endorse the research study ENERSENSE[5] and (2) to submit that research proposal for funding to the U.S. Department of Energy.

The ENERSENSE Study

Project ENERSENSE is an outgrowth of The University of Tennessee's continuing efforts in energy-conservation education. There have been three forerunners to ENERSENSE. The first was the preparation of a curriculum guide for energy conservation education in secondary schools

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[4]UTEERC: Formerly The University of Tennessee Environment Center (UTEC).

[5]ENERSENSE: Study to deliver and evaluate RESIDENTIAL ENERGY CONSERVATION EDUCATION FOR RESIDENTIAL CONSUMERS VIA AGRICULTURAL EXTENSION SERVICE.

developed by Clinard under the aegis of UTEERC, The University of Tennessee College of Home Economics, and the Energy Research and Development Administration (ERDA) (1976). As a second effort in energy-conservation education, that curriculum guide, entitled Energy Conservation in the Home: An Energy Education/Conservation Curriculum Guide for Home Economics Teachers, was field tested by Clinard in 1977. Following the test, Clinard and Farmer, in 1977, were contracted by the Department of Energy (DOE) to engage in a third effort (Project III) to utilize Clinard's earlier work, and allow the development of multi-media materials and instructional products to be used by Agricultural Extension Agents and/or mass communication networks. The products of Project III, developed to focus on energy conservation education under the title, RESIDENTIAL ENERGY CONSERVATION EDUCATION FOR RESIDENTIAL CONSUMERS VIA AGRICULTURAL EXTENSION SERVICE, have provided the basis for Project IV. This most recent project has been undertaken jointly by UTEERC and the Tennessee Agricultural Extension Service (TAES) through funding under DOE Contract No. DOE EY 76-5-05-5049.

ENERSENSE was developed as the fourth project to deliver and evaluate the multi-media program featuring information for education on energy conservation in the home. It has been undertaken with the following purposes:

1) to ascertain how well the multi-media materials developed in Project III were delivered by the "in place" Tennessee Agricultural Extension Home Economics Program System and the State's mass communication networks, and

2) to evaluate the impact made by such a multi-media program on residential consumers reached through the media materials produced in Project III and subsequently delivered through the ENERSENSE experiment.

The need for program evaluation has been confirmed by many: Evans (1969); Rossi (1977), (1969); Rutman (1977); Zaltman (1977); Weiss (1973). Finch (1969) suggested that evaluation should be considered as the foundation for effectively implementing and judiciously changing programs. Information gained from evaluation will provide support for effective programs, strengthen weak ones, and point to those which are not fulfilling the objectives intended and therefore should be dropped.

The prime purposes of this fourth project--to promote "energy sense" and to evaluate the "sense" of the multi-media program--are emphasized in its title, ENERSENSE.

The multi-media program, delivered and evaluated through project ENERSENSE, includes residential energy conservation information and illustrations on the following topics: the physical/structural features of the house, heating and cooling the house, food and energy, and the use of energy for grooming and the care of clothing. These four topic areas are featured in the media-message content and the

features of each area are presented to emphasize the philosophy of an energy-conservation ethic within the context of the overall theme ENERGY CONSERVATION IN THE HOME. The communication program, as a result, includes the following media-message treatments[6]:

Treatment I	Agent (AES Home Economics Agent)-delivered live audio-visual programs for individual and group audiences (five different audio-slide-cassette programs)
Treatment II	Booklets (five different, deliverable by a variety of means including agent delivery to home, agent delivery at audio-visual program, direct mail)
Treatment III	Radio public service announcements (PSA's) (20 different PSA's of 30 seconds each)
Treatment IV	Radio programs (12 different PSA's of 5 minutes each)
Treatment V	Television PSA's (22 different PSA's of 30 seconds each)
Treatment VI	Television programs (two different programs of 30 minutes each)

[6]Information on media materials and content is available from The University of Tennessee Energy, Environment, and Resources Center.

Statement of the Problem

In a time when residential energy consumption is 22% of total United States' consumption, when energy costs are soaring, and fuels are becoming scarce, the potential for mass communications as a force in improving the human situation needs to be investigated. The problem to be considered in this study rests upon the question: "Can mass communications transfer energy conservation information effectively?" Or, in operationalized form, to what extent can energy conservation information delivered via television, radio, or individual and group presentations alter consumer attitudes, increase knowledge and/or encourage conservation behavior?

The very little research being performed on mass media and communications does not adequately measure their real effects in society. What are the effects of mass communications on attitude, knowledge, practices, and acceptance of new ideas and technologies? Mass communications are being directed at a broad range of topics, but are people "tightening their belts," buying less "brand X," and becoming more aware of their rights, privileges and responsibilities? Are they "changing their lifestyles" and "altering spending" in response to mass communcations efforts? A review of research shows that only a few studies have been conducted to determine the effects of mass communications efforts on society. This appears to be true also of the range of communications campaigns, including educational or public-awareness campaigns directed toward the public in general.

Communications campaigns aimed at improving various consumer, health and safety practices, i.e., social marketing, pervade the media. Mass communications campaigns have reached an almost sacred status as one of the countermeasures that must be employed in any program of prevention and/or control. Such common usage stems from an assumption that such mass communications campaigns are a positive force, or at the least can do no harm. Is there evidence to support this assumption? Does the use of mass communications educate and/or encourage a desired behavior? How are media messages perceived? What relationship is there between media perception and behavior? Before embarking on a national mass communications effort, a campaign promoter should answer these questions to avoid a possible negative effect or lack of positive effect, either of which would result in waste of money and effort.

To understand the potential that may be realized for affecting perceptions and behavior, through employing a communications campaign, it seems appropriate to examine and utilize insights from the environmental planning field to provide direction for the problem being studied. This body of knowledge has evolved in the last decade as a result of combining the concerns of behavioral and social sciences with those in the disciplines of marketing design and planning.

The environmental planning field has been concerned for some time about the role of communications in human-environment relations. Many researchers in the field are particularly interested in the relationships between communication, perception and behavior (Delong, 1972; Sommer, 1969, 1972; Saarinen, 1976; Hall, 1977). Saarinen (1976)

notes, for example, that "decisions to modify or change the environment are based not so much on the environment as it is, but rather on the environment as it is perceived or conceived by the decision maker" (p. xi).

Saarinen, Delong, and other investigators focus on how communications can influence perceptions of the total environment or aspects of it. This is certainly a concern that needs to be addressed. The current study was designed to gain understanding of the relationships between communications and one specific aspect, energy conservation. The ENERSENSE Study has attempted to research the question: "How can a multi-media energy conservation commuications campaign influence residential consumers (decision makers), who are actually experiencing and/or influencing an environmental change in specific and general dimensions of the housing sector, to perceive more clearly their role in energy conservation?"

Within the problem identified for study there is a challenge to develop a research design which will evaluate consumer perception(s) of a multi-media communications program. To allow communications to be delivered in a naturalistic manner into real settings and to facilitate recognition of the plausible relationship between cause and effect, the need for a controlled field experiment has been recognized. Haskins (1977) has stated that:

> In the field experiment, one can infer that the treatment caused any differences in measurement between the two groups, and further that the effect can be generalized to the real world, within the limits of the kind of population sampled and other field conditions present (p. 25).

The features of a controlled field experiment seemed to indicate that such an experiment would be an appropriate experimental format to include in the study. Among its advantages are: being in the field or a real world setting, using statistical randomization, and providing a strong causal link betwen the input and the output variables (Haskins, 1977; Selltiz, et al., 1976; Zaltman, 1972). The controlled field-experiment has become increasingly more widely used as a means of conducting evaluative research (Rossi, 1977). However, Babbie (1975) cautioned that definite evaluation goals should be specified at the onset as a basis for determining, upon program evaluation, whether or not the agreed-upon criteria for success have been met. He has also stated that, as this form of social research usually involves personnel from a variety of disciplines and deals directly with people in "real world situations," political and psychological problems may enter the experiment. In addition, as in all human experiments, the subjects' normal perception and behavior can be affected by the experiment. Accordingly, the relationship between the experiment and the evaluation should be as unobtrusive as possible (Haskins, 1968).

Considering all of the above features of using a controlled field experiment for evaluation research, one sees that an additional object of the ENERSENSE Study becomes one of taking into account in desiging an experiment those features that would allow a real world multi-media energy conservation communications campaign to be delivered to residential consumers, while, at the same time, making it possible to utilize evaluation strategy(ies) to assess the impact of such a multi-media program on both energy consciousness and energy conservation practices.

Purpose of the Study

The goal of the research study was to evaluate energy conservation awareness and consumer conservation practices fostered among residential consumers through a multi-media RESIDENTIAL ENERGY CONSERVATION EDUCATION PROGRAM after this program had been delivered via Tennessee Agricultural Extension Agents and Tennessee mass communication networks.

In order to do this, research objectives were formulated in four specific areas:

1. Energy Conservation Awareness
   a. To deliver the multi-media program.
   b. To assess the attitudes of consumers in relation to their perceived need to conserve energy.
   c. To identify what consumers are doing and have done to conserve energy.
   d. To identify what consumers are planning to do to conserve energy in the future.
   e. To gather subjective data on energy conservation from AESHE agents and their clientele.
2. Instructional Product Research
   a. To assess the effectiveness of a multi-media educational instructional product approach to energy conservation.
   b. To assess the attitude of the AESHE agents toward the program initially, as well as after the delivery of the program.

c. To contribute to the arena of "instructional product research" through the development, implementation, and evaluation of an experimental research design.

d. To develop a research design that will identify the degree of generalizability of the data collected.

3. Environmental Planning

a. To conduct an experiment that will contribute to the scope of this interdisciplinary field of study.

b. To investigate consumer perceptions about energy conservation relative to environmental decision making.

c. To investigate consumer acceptance of design alternatives and innovations for energy conservation.

4. Evaluation Research

a. To design and conduct a controlled field experiment (CFX).

b. To identify the advantages and problems connected with this controlled field-experiment.

Purpose of the Substudy

The research study goal and general objectives, as outlined in the preceeding section, provide an opportunity to conduct a substudy within the greater ENERSENSE Study. Those objectives presented in the third area under Environmental Planning, provide the incentive to design an evaluation strategy that could investigate consumer perceptions of innovative residential energy conservation design concepts as well as

the consumer acceptance of such innovations. Strategy II, which will be described in Chapter III, has been designed for this purpose. However, in addition to its substantive reason for being, the Strategy II substudy was used for methodological research. Hence, an evaluation instrument using innovation, simulation, and semantics was conceived and tested. The substudy was designed with a dual focus. It has both a substantive and methodological purpose within the context of realizing the goal of investigating the relationship between energy conservation and environmental decision making--decision making which would have the potential of being affected by an energy conservation communications campaign. Thus it was this dual focus that was the foundation for the empirical research included in the substudy presented.

Point of View

The scope and direction of this study have been influenced by many factors, assumptions, and biases. Consequently, it is appropriate to outline and discuss them at the outset so as to place the various features of the research in their proper perspective. Through doing this it will be possible to facilitate a greater understanding of project ENERSENSE as a study that has contributed to the scope of environmental planning, since the latter is concerned with energy conservation and its relationship to perception, communications, residential design, government information policy and program development, and consumer education, attitudes and practices.

Assumption and Biases

Energy Conservation Education. Although conservation is not a new concept to the American consumer, the concept of energy conservation is new. It is a great change for the population entering family formation and first-house stages of the family life cycle, because these people have grown up in affluent times. They have been accustomed not only to making life's jobs easier through using electrically-supported gadgetry but also to flipping switches and dialing thermostats with little thought to energy utilization. As a consequence, conservation consciousness "know-how" should not be taken for granted. Energy conservation education is necessary to create awareness of how human habits interface with the energy supply, to illustrate conservation practices, and to promote an energy conservation ethic. Because education is needed by the adult population the conventional classroom approach of formal education is not the most expedient means to follow. Consequently, other innovative methods must be considered if an energy conservation education program is to reach the desired target audience in the near future. Some aspects of these methods are discussed forthwith.

Social Marketing. Marketing of products and lifestyles have encouraged consumers to use increasing amounts of energy. Therefore, in order to reduce energy use, a reverse action is required. Energy conservation needs to be marketed for the social good, and it is logical to believe that this can be marketed just as effectively as

practices and products which use energy have been marketed in the past. The "know how" of advertising can be coupled with the "know-how" of education to develop a program that will use multi-media and the mass communication networks to reach a large fraction of the population through addressing segments within our society.

Multi-media. Audio and/or visual media for delivery by mail, group session, press, radio and television can be developed to deliver energy conservation messages. All types of media are required if varied segments of society, with diverse media habits, are to be reached. In-place delivery systems can be an effective means of media dissemination. Since mass media is more popular than formal school education, we need to cultivate its potential as a vehicle for education.

Evaluation Research. If programs are to be sensibly altered or terminated, continued or expanded, there must be evidence of how effective and efficient the programs have been in the real world. A multi-media program can be field tested and features evaluated for expansion to the larger part of the population. Objective, empirical evaluations are required. Such questions as the following need to be answered: (1) Does the program meet the needs of the target audience? (2) Does the program reach the intended population? (3) Does the program achieve its objectives? (4) How do the benefits from the program compare with its cost? Evaluation strategies should be designed with the purpose of providing the answers to such questions.

Perception. The perception of any communications campaign is related to the environment as the consumer perceives or conceives it to be, not necessarily as the environment really is (Saarinen, 1976). Perception, attitudes, and behavior are related and can be influenced by the stimuli disseminated through a communications campaign.

Meaning. People bring meaning to words and to architectural structures. Consumers attribute meaning to what they experience based upon previous experience and their level of knowledge. Understanding the meaning attributed to specific forms, spaces, etc., can facilitate acceptance of architectural concepts and assist in the diffusion of innovation.

Pragmatics. Meanings are believed to exist only in people, not in objects; therefore, the study of the relation of signs to interpreters, pragmatics, is a beginning to understanding the meaning of architecture (Morris, 1938).

Semantics. To further understand the meaning of architectural objects the study of semantics provides insight into the relation of signs to objects to which the signs are applicable (Morris, 1938).

Lawfulness. Groups of people with common experience with specific forms will attribute common meanings to those forms. Such commonness allows meaning for certain forms to be predicted by certain people. This belief provides the basis for such an experimental study as that designed and conducted in the Strategy II Evaluation (Tannenbaum, 1958, pp. 53-54)

Simulation. Simulation offers a means of communicating between designer and user to pretest the degree of match between a design concept and its perceived attributes. One of its major purposes is to enable the designer to predict how an hypothesized environment or environmental component operates under certain conditions. It may be used to test attributes of a concept or to identify characteristics of individuals who accept or reject specific attributes and/or design concepts.

Diffusion of Innovation. This process involves promotion, time, and the acceptance of an item, concept, or practice into a given system of values within a social structure. Innovation can be influenced by channels of communication (Katz et al., 1972).

Need for Acceptance of Energy Conserving Innovations. Consumer involvement in energy conservation is required. Greater understanding of the components influencing innovation diffusion would facilitate the planning to promote a range of energy conserving innovations, and thus enable consumers, through accepting and implementing innovations, to make decisions which would be more energy efficient. The process of innovation is crucial to integrating energy-conserving features that are not in common practice. Any energy-conserving practice in the building sector needs to be evaluated in terms of acceptance by users as well as by the trades and financiers (Watson, 1979). This study focuses upon the user, as a means of supplying information that will be helpful to designers and planners.

Environmental Planning. The understanding of people-environment relationships is necessary to avoid inadvertent side effects of our actions as we meet the challenge of diminishing natural resources. As Saarien has pointed out: "To create an improved world, it is essential that this people-environment relationship be examined directly and understood so that we can make wise decisions in planning future alterations of ourselves and our environment" (Saarinen, 1976, p. 2). Investigation of specific people-environment relationships can provide the basis for planning and should be a prelude to environmental planning and program development, whether at the behavioral or the geographic level.

The Research Model

The following model, Figure I-1, illustrates the overall plan followed in the ENERSENSE Study. Through the use of this plan, the researcher identified the problem, reviewed the literature, considered the environmental influences, and launched a communications campaign experiment. In a campaign that was organized as a controlled field experiment (CFX), six multi-media treatments were delivered to a control-and-treatment group and the total campaign's effect was evaluated. The evaluation included four evaluation strategies. It attempted to address: (1) the effect of the multi-media program on consumers; (2) the reaction of AESHE agents to the multi-media program; (3) the effectiveness of "in place" delivery channels, i.e., AESHE agents,

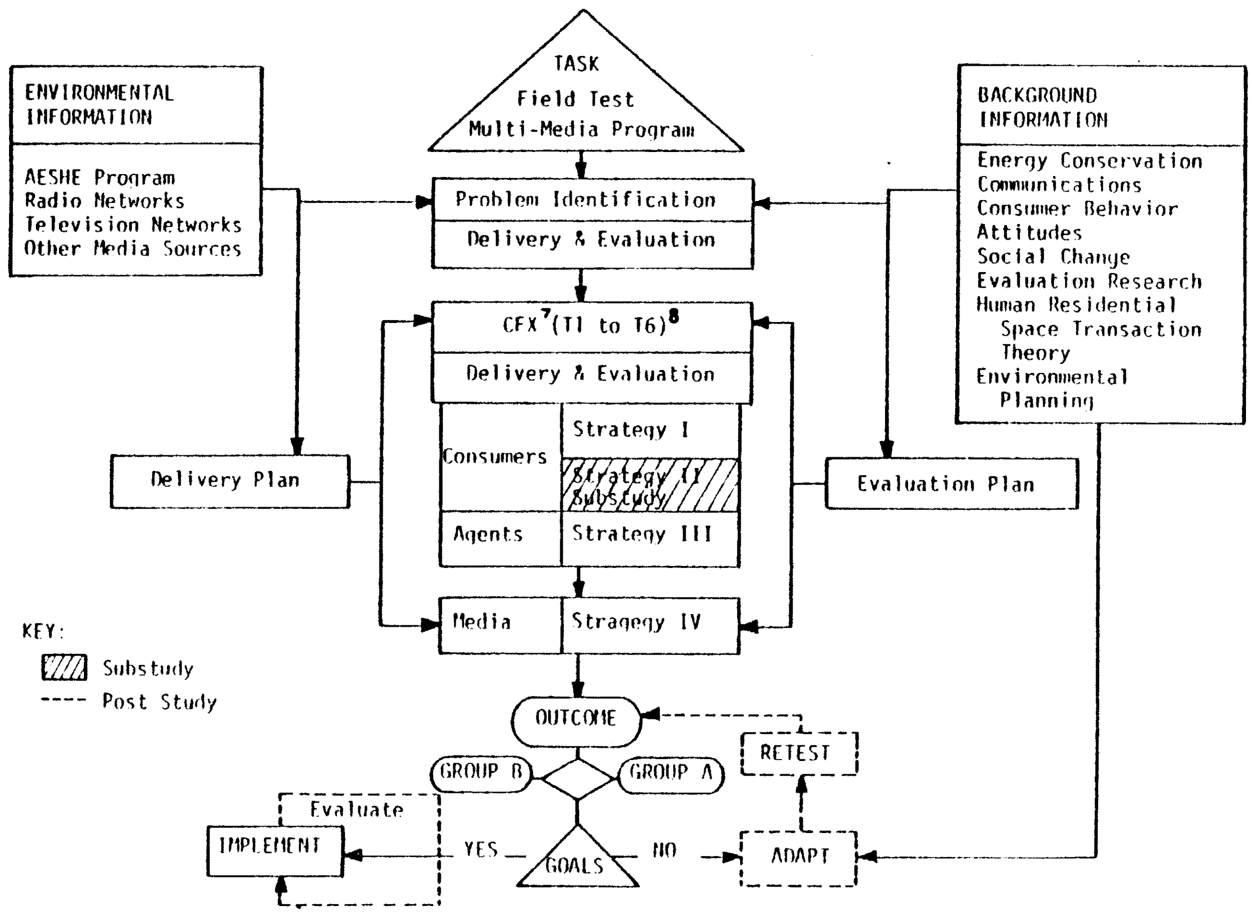

Figure I-1. Model of ENERSENSE Plan

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[7] CFX: Controlled Field Experiment
[8] T1 to T6: Treatments one to six, multi-media program

radio and television networks; (4) the influences of other sources of energy conservation media not included in the CFX but recognized as possibly exerting an influence on the experiment.

The program delivery and evaluation conducted in the ENERSENSE Study is just the beginning of developing a multi-media program that can be adapted and/or expanded. For that reason future steps which should be considered in the program's evolution are outlined by a broken line in Figure I-1.

Overview of the Substudy: Consumer Assessment of Residential Energy Conservation Innovation

Chapter I consists of an introduction which establishes the ENERSENSE Study in its historical perspective, outlines the substudy's role in contributing to environmental planning, and sets forth the factors which have influenced the substudy and the ENERSENSE Study. More specifically this initial chapter encompasses the description of the problem, a justification for the research approach taken, and the significance of this experiment to communication, to energy conservation, and, most importantly, to energy conservation education.

Chapter II reviews literature related to the study. In view of the interdisciplinary nature of the research, the review covers a wide range of topics. It includes: energy conservation as it relates to consumer behavior, education, and residential conservation; communications research; consumer behavior and attitudes; social change and the diffusion of innovation; evaluation research, specifically, the

controlled field experiment; energy conservation alternatives in the residential sphere; human residential space transaction theory and research; environmental planning, perception, behavior, and assessment.

Chapter III details the scope of the ENERSENSE Study and explains the selection of the target population and the comparison groups. The research design (Figure I-1, p. 24) is presented and the six media treatments used in the CFX as well as its four evaluation strategies are described in order to provide the context within which the Strategy II Substudy occurred.

Chapter IV presents the methodology, research design and procedures used in the Strategy II segment of the CFX. The Strategy II segment, included as a substudy within the ENERSENSE study, is described and the development of an instrument to measure consumer assessment of innovation via simulation and semantics is introduced and outlined. The chapter presents the hypotheses that were tested--hypotheses which will allow the substudy to make both methodological and substantive research contributions--as well as the assumptions made in the analysis and the limitations which were acknowledged.

Chapter V is comprised of the findings and discussion for each of the hypotheses tested relative to the evaluation instrument, concept, and group comparisons and in relationships with contextual variables. Chapter VI summarizes the methodological and experimental results and presents conclusions and implications for additional research, energy conservation education, and environmental design, evaluation, and planning.

CHAPTER II

REVIEW OF LITERATURE

Introduction

The ENERSENSE research study was concerned with the delivery and evluation of a multi-media energy conservation information program developed for residential energy consumers. The interdisciplinary nature of the task was recognized and related literature from several disciplines was reviewed. To assist in making a comprehensive presentation of the review, the content has been assembled into six sections:

1. Energy conservation as it relates to the nation, the residential consumer, and consumer education.
2. Communications research, in general, and that related to energy conservation in particular.
3. Attitudes and behavior research, in general, and that relative to social marketing for substantive and methodological concepts.
4. Social change for insight into creating and evaluating such programs.
5. Human residential space transaction theory and research for concepts and evaluation methods related to understanding consumer perception of the residential environment and its relationships to energy conservation.
6. Environmental planning for concepts to consider in man-energy-conservation-education-communication-environment planning.

Energy Conservation: A National Priority

Between 1950 and 1970 the consumption of energy resources grew at a rate of 3.5% (U.S. Bureau of Mines, 1972). As the 1970's continued, the United States distinguished itself (1) by consuming more total energy than other countries and (2) by using more energy per capita than any other country (Clinard et al., 1977, p. 7). Total residential energy use grew at a rate of 4.0%/year between 1950 and 1974. Prices for all fuels were declining or stable until 1970 (Hirst, 1977, p. 1); in the past nine years prices for all fuels have risen. "The cost of securing electricity, natural gas, and fuel oil used by homes increased an average of 65% between 1970 and 1974" (Dillman et al., 1977, p. 2). Since 1973-74 there has been only a partial acknowledgement, by householders, that the supply is finite. As the decade drew to a close, price, supply, and demand for energy became major national issues for all sectors of the economy, not just the residential sector. These issues were emphasized as a national priority, in April 1977, by the President's energy message; the national and international activities initiated in the spring of 1979 leave little doubt that the United States is confronted with an energy crisis of long range magnitude.

The residential energy conservation strategies proposed in April 1977 were estimated to save households $27 billion between then and the year 2000 (Hirst, 1977, p. 1). Which strategies can facilitate the conservation of energy by households? Hannon (1973, 1975), Schumacher (1973), Morrison (1976), and Hirst (1977) have debated the

implementation of such ideas as: "government regulation via economic incentives and taxes, higher prices, equitable distribution of resources, and socialization to produce value/behavior changes" (Keith, 1977, p. 20). In 1974, the federal government, under the leadership of the Federal Energy Administration, developed the Project Independence Report in which they included a plan for self-sufficiency which called for an energy conservation and information transmission strategy (Clinard, 1977).

The Carter Energy Plan of 1977 acknowledged the federal government's commitment to energy conservation and provided strategies to benefit households. Time and research will tell which of those strategies, if any, will be effective--it will depend upon whether or not the strategies are relevant and whether or not household energy conservation is a priority for more than the White House. As the events of 1979 unfolded, and projections for 1980 were pessimistic about the availability and affordability of fuel for the residential sector, the federal government was grasping for alternatives. The decade ended emphasizing the need for energy conservation to be a priority throughout the nation and, as outlined in Chapter I, energy conservation is the most immediate and probable solution component in the continued national and international "energy crisis."

Residential Energy Conservation

Empirical Studies. There have been three major projects in the United States, and one in Britain, which have provided considerable insight into household energy consumption and how to study the phenomenon:

1. The United States' national study of households and habits affecting energy use was conducted by the Washington Center for Metropolitan Studies. Newman and Day (1975) and Cohen (1976) have reported on the 1972 and 1973 initial survey; Grier (1976) and Williams, Kruvant, and Newman (1976) have reported the national followup survey conducted in 1974.
2. The Twin Rivers Project, a longitudinal study of technology and inhabitant behavior related to household energy consumption, was initiated by Princeton University during the spring of 1972.
3. The Family Energy Project (FEP) is funded by the Michigan Agricultural Experiment Station. Hogan (1976) and Keith (1977), using data provided by the project, have made unique contributions towards understanding residential energy consumption under the project's theme "Functioning of the Family Ecosystem in a World of Changing Energy Availability."

Several experimental studies have occurred since 1973 covering a broad range which includes: physical, economic, and social dimensions of the relationship between consumers, their lifestyle, and energy. In the physical category, the experiments range from owner-builder prototype residences, demonstration houses, and retrofitting, to agencies and university laboratory controlled experiments with components and systems, e.g. passive and active solar systems, insulation, fenestration, and building materials (Watson, 1979, 1977; Dubin, 1978; Shurcliff, 1978, 1977; Newbold, 1978; Ewenstein, 1978;

National Bureau of Standards, 1977; Nicholson, 1977; Anderson, 1977, 1973). Many of the cases in this category are "living" experiments for which the results are not as yet final.

A broad understanding of how consumers relate to energy has been provided by experimental studies conducted by Peck and Doering (1974); Heberlein (1975); Winett and Nietgel (1975); Seaver and Patterson (1976); Philips and Nelson (1976); Kohlenberg, Philips, and Proctor (1976); Craig and McCann (1977, 1978); and Zuiches (1977). (Selected studies related specifically to communication research will follow.) The review of literature supports Craig and McCann (1978), who acknowledge the fact that the quantity of experimental research is increasing and that research on residential consumers and energy is no longer only descriptive research.

> The National Research Committee on Measurement of Energy Consumption (1977) has recommended that field experiments be carried out to assess the effects of time-of-day pricing, the impact of feedback systems such as appliance labeling and metering devices, the impact of information campaigns upon retrofitting of buildings and the effect of government regulatory strategies (Keith, 1977, pp. 32-33).

Experimental activity increased during the 1970's but there is an even greater challenge for the future to develop research designs to investigate old and new topics, to extend the present knowledge and theory base, and to replicate past experiments. There is an interdisciplinary challenge unlike any other in time. Such a challenge brings with it the monumental task of data storage which provides ease of retrieval through organized classification. The literature at present is widely dispersed and manual search reaps more results than does data retrieval through computer search.

As the quantity of experimental results continues to increase and the energy situation becomes more volatile, the results need to be considered within the context of the political and economic forces operative during the study. Social behavior dimensions need to be recognized as being as important to the energy situation as are the technological aspects.

Social Behavior Dimensions. Warkov (1977) contends that there is now sufficient work published from which to identify the place of social and behavioral sciences in the field of energy conservation and to depict trends for the production of social science knowledge on the topic.

The bibliography compiled by Denton Morrison (1975 and 1976) is a valuable resource, which has categorized publications prior to 1976 and suggests avenues to be searched for more recent writings. There is evidence of a greater quantity and variety of social science disciplines becoming involved in energy topics. No longer is the energy question being examined only by political science. This state of affairs, plus the frequency of publications, in both the popular and professional press, supports Warkov's statement that "inquiry into the sociocultural and institutional context of energy production, distribution, and consumption has emerged as a new focus of academic and policy research" (Warkov, 1977, p. xv).

Additional information and theory related to the social and behavioral dimensions of energy policy in the United States may be obtained within the proceedings of the 1977 conference at the Energy

Institute and the College of Social Sciences, University of Houston. The proceedings edited by S. Warkov and entitled Energy Policy in the United States: Social and Behavioral Dimensions, present a range of views from a diverse group of social scientists, who have contributed to an "emerging discipline" that places energy, and its problems, in a behavioral and social perspective.

Related Surveys. Surveys selected from the review of literature illustrate the variables and indicators which have been selected as survey measures, as well as the variety of research methods and designs utilized in the quest for information on residential energy consumption and conservation. In the Warren (1974) study, as reported by Hogan (1976), 766 households were interviewed in the suburbs of Detroit. It was found that 83 percent of the respondents lowered home thermostats and turned out lights; 9 percent installed home insulation; and 2 percent had adopted no household energy conservation practices. The overall energy conservation behavior identified through the study exceeded government policy- makers' expectations.

Kilkeary and Thompson (1975), (Hogan, 1976), selected a random sample from two communities in New York City to determine the characteristics of families with high energy knowledge and who practiced an above-average number of energy conservation measures. This study supported the idea that there was a positive relationship between energy knowledge and car ownership, education, income and family composition. It concluded that higher socioeconomic families who could well afford to pay energy bills were not as conserving as moderate income families.

Newman and Day (1975) through using the Washington Center for Metropolitan Studies project data documented that less energy is used by: (1) the poor, (2) renters, (3) families with less than two employed, (4) Blacks, and (5) those households headed by a person over 65 years of age. In addition, they reported the presence of energy using equipment and energy conserving household features. Cohen's (1976) analysis of a sample subset attempted to explain consumption variance by (1) the number of rooms, (2) number of persons in the household, and (3) climatic conditions (Keith, 1977, pp. 23-24). A followup survey conducted and reported by Grier (1976) and Williams, Kruvant, and Newman (1976) provided an annual record of consumption data on selected demographic variables. It was noted that: (1) apartment dwellers are the most conserving, (2) poorer households increase consumption by 10 percent or more, and (3) central city and older households' consumption decreased by about 7 percent.

The Twin Rivers Project, Princeton University, "has identified the necessity for the combination of environment, technological and social-psychological dimensions for household energy research" (Keith, 1977, p. 26). This project allowed power distributors' consumption records (1972) to be correlated with house size, design, outside temperature, energy conserved, resulting price increases, and retrofits. Physical and human environmental factors were monitored and experiments have been developed to study adjustment and retrofitting relative to several physical and social variables. For example, it has been found that a 10 percent saving in heat loss could be realized with double glass

windows, and a 5 percent to 10 percent heat loss can be related to the position of a dwelling unit. Socolow (1975) acknowledges that the project has shown that energy consumption is influenced by both technology and the behavior of the occupants (Keith, 1977).

"The General Public Attitudes and Behavior Toward Energy Saving" survey contracted by the Federal Energy Administration in 1974 used several national waves of interviews to generate data which supported:

1. the idea that news media are credible delivery systems for energy information
2. reasons for the energy shortage
3. how much thermostat adjustment was occurring
4. consumer's knowledge and attitudes in areas affecting Energy Administration policies, i.e., home lighting, home heating, and insulation--only 53 percent related lower wattage with lower energy consumption and only about 50 percent of the seven in ten eastern respondents, who lived in single family homes, could "guesstimate" their heating costs. (Rappeport and Labow, 1974).

Through the Family Energy Project, a longitudinal study in the College of Human Ecology at Michigan State University, which focused upon the family's use of energy, several researchers have provided findings related to a variety of aspects of the family and residential energy. Work done by Morrison (1975), Eichenberger (1975), Gladhart (1976), Keith (1977), under the direction of Paolucci, has produced findings on: physical housing characteristics; family characteristics;

socio-demographic characteristics; high fuel prices related to levels of consumption and conservation practices; public energy policies and energy consumption awareness. Variables and indicators have been studied within the ecosystem approach to the family, and these provide understanding of the family decision-making process in relation to the consumption of energy.

Hannold and Nelson (1977) conducted a public opinion survey during the two weeks following the April 1977 "energy proposals," focusing on the breadth, depth, and form of support for President Carter's policy proposals in the local dialing area of a Southern city. The results from those who responded were as follows:

> More than one-third indicated that the probability that they would insulate by next winter, would increase with a 20% tax credit. Forty-two percent of high income families would be responsive to tax credit as compared to 26% of low income families. Over one-half (55%) of the respondents reported that their homes were very well insulated (p. 26).

Solar heating, encouraged by the proposals, was seen as a possible alternative if there was a 30 percent tax credit. The research team introduced its report by saying "Public awareness of energy-related policy issues was heightened during 1977 by both the severe weather conditions prevailing in several regions of the United States and by widely publicized development of an energy policy by the Carter Administration" (p. 20). Acknowledging these influences on the public assists in allowing for a more comprehensive interpretation of the results of such a survey to be made. The example set would be one well worth following as more research is conducted in the pursuit of solutions to a very complex environmental problem.

Dillman, Dillman, and Tremblay (1977) conducted an extensive survey in the State of Washington. A proportional sample (n = 45,000) (drawn from telephone directories throughout the state) was surveyed to evaluate the acceptability of specific "policies" to reduce household energy consumption. Consumers were asked to consider such policies as: (1) maintaining strict temperature controls, (2) installing heavy insulation, (3) building homes underground, and (4) reducing the number of rooms in the house. The policies enumerated in the questionnaire ran counter to American housing norms. Knowledge of acceptance of specific policies was seen as a means of assisting "decision-makers in formulating a comprehensive energy program" (p. 3).

Marvin Olsen, in his presentation "Public Acceptance of Energy Conservation" at a conference held at the University of Houston in 1977, gave the following overview of empirical contributions to the understanding of people's acceptance of energy conservation and supported his generalizations through citations from specific studies. A few of his remarks were as follows:

> Most people understand the essence of the energy problem. A national survey conducted in April 1976 found that 58 percent of the population responded to the question, "What is your understanding of what the energy problem is all about?" with responses such as, "Demand is greater than supply," "Natural resources are being used up," "Energy is being used wastefully," or "U.S. is dependent on foreign oil supply." In addition, another 23 percent of the people gave relevant but less precise responses such as "Need to conserve energy," "High costs of energy," or "Haven't developed alternative fuels" (Milstein 1976).

> Belief in the reality of the energy crisis is fairly widespread. Although figures for the percentage of people believing in the reality of the energy crisis have varied widely among studies, there is growing consensus (substantiated by a national Roper poll in April 1977) that approximately half the U.S. population believes that this country faces a serious long-term energy problem (Barnaby 1974; Gottlieb and Matre 1976; Lopreato and Meriweather 1976; Thompson and MacTavish 1976; Zuiches 1976). Of these believers, roughly half view the energy situation as an immediate and permanent problem, while the other half do not consider it to be a problem now but expect it to become a serious crisis by the end of the century.
>
> Most people have taken a few minimal conservation actions. Following the 1973-74 oil embargo, at least three-fourths of the public reduced their levels of home lighting and heating somewhat, and about two-thirds of the population drove less, although the actual amounts of reduction were not specified in most of these studies (Bartell 1974; Bultena 1976; Curtin 1975; Cottlieb and Matre 1976; Murray et al. 1976; Perlman and Warren 1975; Stearns 1975; Warren 1974). In general, these conservation actions required minimal effort and expense, and did not significantly alter people's usual lifestyles. More recent data, meanwhile, indicate that these minimal conservation efforts are still being made, but by a somewhat smaller proportion of the population. A national survey conducted in January 1976 discovered, for instance, that 55 percent of the people were making an effort to turn out lights when leaving a room, and that 48 percent were turning down their thermostats to 68° or lower during the day (Milstein 1976). Again, however, these practices produce only minimal energy savings.
>
> Relatively few people have taken major conservation actions. Only small proportions of the population say that they have adopted any energy conserving practices that save significant expenses or changes in lifestyle or that save significant amounts of energy (pp. 94-95).

In summary, the surveys conducted since 1973 have looked at numerous aspects of the energy/consumer relationship in the residential sector. They were initially descriptive in nature but experimental studies are increasing. Warkov's comment in 1975 was that the studies "have not attempted extensive or intensive analyses. . . .this research displays a regrettable lack of depth and breadth" (p. 93). Possibly this is understandable in a "new" field of inquiry.

Experimental studies are on the increase as findings are required for (1) information and education programs, (2) design development, (3) the development of housing policy and programs, and (4) social and economic policy and planning. The leadership challenge that has been presented to researchers in the social and physical sciences by the "energy crisis" has increased during the past decade. The literature shows that efforts have been made to meet this challenge, but researchers and policy makers need to be mindful of the quality of guidance forthcoming. If quality can be encouraged in the attempts to conserve energy, there would seem to be some indication that the energy crisis could be "a vehicle for introducing fundamental social changes into American society that in the long run might greatly improve the quality of social life of all persons" (Warkov, 1978, p. 106).

Conservation Measures. Energy conservation is defined by Olsen (1977) "as a reduction in the rate of energy consumption, as a consequence of either more technically efficient use of energy or decreased demands for energy" (p. 92). A great deal of attention has been given to conservation in the residential sector--it has been reinforced by the popular and professional literature and by President Carter's energy policy.

Several issues to encourage energy conservation have been considered and/or implemented. These measures have been both at the policy level as well as at the decision-making level of the individual user.

Strategies at the policy level promoted by Olsen (1977) include such measures as:

1. Energy taxes--in order to avoid regressive impacts on the energy users the primary energy sources are taxed (Hannon, 1975a; Donie and Duncombe, 1975).
2. Inverted utility rate structures--consideration should be given to spatial characteristics of customers, thus reducing sprawl (Feldman and Gonen, 1975).

As well as those highlighted by Morrison (1977):

3. Tax incentives--regressive in that the affluent can afford to adopt energy-efficient technology--but provides employment opportunities, e.g., household insulation.
4. Mandated energy efficiency standards--burden of innovation and risk lies with firms not families, costs are passed on to consumer.
5. Conservation education--appealing but may not be directed at appropriate segment of the population, should hit higher economic levels.
6. Energy rationing--politically unacceptable in a free-market system.

Strategies to promote conservation measures that effect household decision-making have ranged from the promotion of "conserving behavior" (turning off the lights, limiting the use of hot water, off-peak period usage to retrofitting existing housing, building a new "Super Saver" home, or integrating active or passive solar systems). The list goes on, reinforced by economic incentives. A survey of promotional and

technical literature completed by Ellison (1978) documented the increasing abundance and variety of products on the market that are being promoted to consumers as measures to conserve energy. With so many choices of action, are consumers informed or confused? Running on the heels of product development is the potential for fraudulent practices--a category of consumer protection that is in need of research and policy development. Consumers are accustomed to having available tested, standardized products. They take for granted that products made available will provide the conservation measures they are promoted to provide. Consumer education, well-publicized standards, and effective enforcement are needed.

An agency that is contributing to energy standards[1] is ASHRAE (American Society for Heating, Refrigerating, and Air Conditioning Engineers). These standards, however, have to be adopted as law by individual states. Consumers then require information relative to their state about the status of such standards; for example, Standard 90-75, Conservation Criteria for New Building Design.

In the process of evaluating conservation measures, the consumer should consider three concepts: (1) <u>net energy</u> (Odum, 1973)--Does it require more energy to save less? (2) <u>energy intensity</u>--How much energy is consumed per unit of output? and (3) <u>energy efficiency</u>--How does this measure compare with others in energy intensity? Such evaluation will allow consumers to select "ways to enable unimpaired provisions of goods and services while economizing on the use of energy resources" (Schipper and Darmstadter, 1977, p. 69).

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[1]standard--an accredited practice or level of performance, or method of test.

Consumer Education

Consumer education is not just information dissemination but also a vehicle for providing opportunities whereby consumers, in "decision making," learn how to apply the information they have. It should be realized, however, that consumers search relatively little for information (Maynes, 1976, p. 20). This pinpoints the challenge of motivating consumers to want information before the educational process can commence.

Consumer Segmentation. How to convince consumers of the need to conserve energy and what can be done to conserve energy is an educational challenge. Gilly and Gelb (1978) suggest employing marketing strategies to promote understanding and commitment. "Selling" the idea of energy conservation to consumers they maintain will motivate these consumers to integrate conservation concepts and practices into their decision making. One "social marketing" approach that can be employed in the process of consumer education is market segmentation. The population may be segmented upon the following bases: (1) state of being, (2) state of mind, (3) usage, and (4) benefit (Kotler, 1976).

The examples of segmentation for the purposes of energy conservation presented by Gilly and Gelb (1978) are catalysts for defining arenas to be explored. For example, state-of-being segmentation would allow dividing a market into geographic regions, or would allow focusing upon a demographic characteristic such as age, e.g., children. State-of-mind segmentation on the other hand would allow looking at all consumers who are concerned about energy conservation and then categorizing them by various characteristics. A study conducted by

Houston Lighting and Power Company, which exemplified this form of segmentation, indicated that "people most concerned with the energy problem tend to be younger, more educated, and earn higher incomes than those unconcerned with energy issues" (Gilly and Gelb, 1978, p. 32).

Market research has shown that one market program may not work for all groups. Thus the need to identify the segments of household consumers becomes imperative if relevant social information/education programs to "market" energy conservation are to be developed.

Energy is a commodity which is jointly consumed by the members of a household. Hence, the household should be considered as a decision making unit when one is developing any energy information program. Research, however, has shown that family members' involvement in the decision-making process varies in degree in respect to the stage at which the decision-making process is at that time. For example, the wife makes the final decision on interior components. She may be involved in the price considerations and whether or not to move, but ultimately the husband makes the final decision on these two areas (Davis, 1976, p. 241). Consequently, the household itself is comprised of market segments. Those segments, along with segments defined by such characteristics as race, age, socio-economic level, education, community mindedness, information seeking tendencies, and mobility contribute to the complexity of tailoring mass communications efforts for target audiences (Pember, 1977, p. 340). An understanding of the interrelationships is necessary before effective consumer education to encourage residential energy conservation can be developed.

Delivery Channels. Once the segments have been identified they may be reached directly or indirectly as shown:

1) the Department of Health Education and Welfare (HEW) in 1976 developed "an Experimental Learning Package for Participants in the Home Building Industry with Regard to Energy Conservation." Through an education program for builders and financiers, HEW hoped to have energy-saving design features promoted to home buyers (Gilly and Gelb, 1978). (More details of this program are given on p. 62.)

2) The curriculum guide, Energy Conservation in the Home, developed for ERDA and field tested by Clinard (1977), used classroom teachers to implement concepts and activities within home economics classes throughout Tennessee.

3) In the aerospace experiments conducted by Arthur P. Annis and Associates in Atlanta, tenants in the Bankhead and Carver Homes projects volunteered for an educational/motivational program--the limited study produced positive results.

4) A conservation manual prepared by the University of Kentucky Department of Agriculture was given to residential consumers who volunteered for a study conducted by Winett and Nietzel (1975).

5) The Tennessee Valley Authority uses a multi-channel-media approach to work through Power Distributors and with consumers directly. They offer a "hot line" and develop educational and promotional materials which are delivered via T.V., radio, mail, newspaper, exhibits, group workshops and personal demonstrations to reach the "residents of the valley" (Edwards, 1978).

From these selected examples it is evident that there are many delivery channels to be considered in consumer education, direct and indirect; human and mechanical. Each choice, however, much be considered in relation to the target audience, i.e., market segment, involved.

Instructional Product Development. Instructional products are viewed as organized materials and procedures that are used to accomplish specific goals (Baker and Schutz, 1972). In recent years many media materials on a variety of topics have been developed for educational purposes. The boundaries of education have expanded beyond the traditional formal sphere of the school room into nonformal education via the mass media. Energy conservation falls into this category. Have the media materials developed for energy conservation education been instructional? Have they worked outside a formal educational setting? Research to provide answers is appropriate especially when public monies are allocated for instructional products. One approach to providing the answers is to apply the Research and Development (R&D) model, Table II-1, presented by Baker and Shutz (1972) for formal school instruction.

As the "student population" will not be one reached in a traditional school setting the marketing stage would vary from the usual type. The product would, however, have to be promoted via some other delivery channel. Hence, the instructional product developed should be appropriate in order to facilitate its acceptance for dissemination by whatever channel is selected.

TABLE II-1

INSTRUCTIONAL PRODUCT DEVELOPMENT STAGES

Stage	Activity	Uncertainty Focus	Typical Duration of Tryout
Formulation	Specifying the desired instructional outcomes, identifying the skills required to achieve the outcomes, and designing strategies for teaching the skills	Specification parameters	One to serveral experimental sessions
Prototype	Testing instructional strategies by empirically investigating variations of materials and methods and by assessing the impact of each variation	Product specifications	One day to a few weeks
Component	Producing a segment of instruction and trying it out with a single learner or groups of learners in a natural setting to determine whether the instruction accomplishes its objectives	Instruction parameters	One day to a few months
Product	Successively trying out and revising a combination of components in a natural setting until acceptable levels of performance have been attained	Instructional effectiveness	One to serveral "semester" units
Installation	Integrating a product into programs combined with existing school instruction in order to determine procedures for operational use of a program without direct assistance of the developing agency	User training and program management	One to several "semerster" units
Manufacturing	Involving the agency which will assume direct editorial and production responsibility for a commercially manufactured program	Program integrity and list cost	One editorial cycle
Marketing	Integrating a program into a licensee's extant portfolio and involving its sales force in the operational use of the training systems without direct assistance of the developing agency	Communication and distribution	One to several years

Source: Robert L. Baker and Richard E. Schutz, eds., Instructional Product Research (New York: American Book Company, 1972).

Instructional product development is a cyclical process which may be diagrammed as illustrated by Figure II-1.

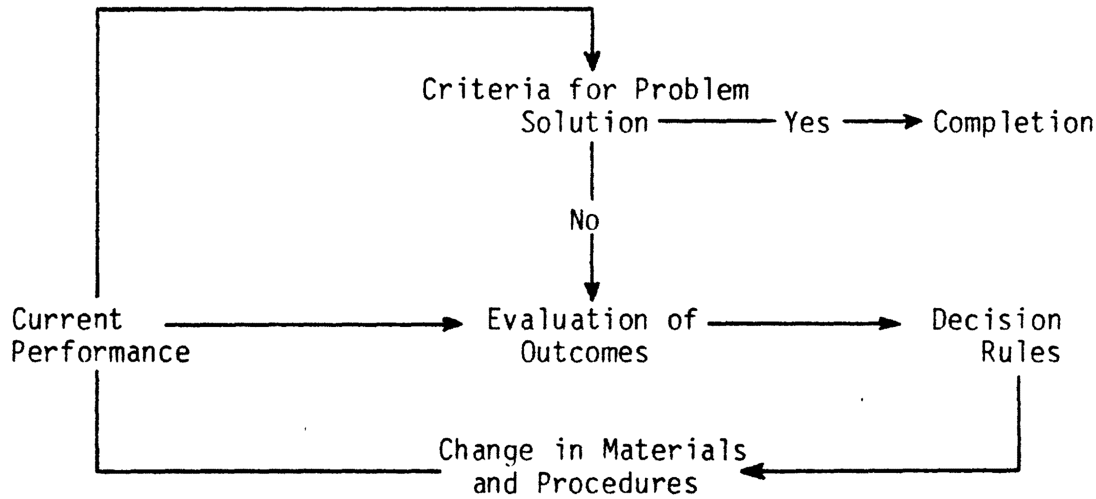


Figure II-1. Research and Development Cycle for Instructional Products

Source: Robert L. Baker and Richard E. Schutz, eds., Instructional Product Research.

In the process materials and/or procedures are evaluated, changed, re-evaluated until a product meets the criteria that realize the prescribed goals.

As cited by Clinard (1977), the historical reviews of the educational literature indicate a significant lack of instructional product research. Cronback and Suppes (1969) suggest two reasons for this: (1) product development is mission oriented--one time or narrowly-focused materials are common, (2) there are few models for product research, and (3) product development is "formative research," and as findings are incorporated into the product, there is no need to report their origins. If this is true for formal education, it is even more likely to be true in the arena of energy conservation education

Instructional product research is a means of increasing the scientific and technological base upon which to develop products for instruction toward a specific goal. McGuire (1976) presents the view that there is a series of steps involved in evaluating consumers' response to information--affective, connotative, and cognitive. Any or all of those steps provide opportunities to be studied which can contribute toward understanding the relationship between energy conservation information (products) and the success of these steps in achieving their goal to educate consumers to conserve energy.

Craig and McCann (1978) suggested that our understanding of how consumers respond to specific appeals to reduce their consumption of electricity is limited. The "appeal" is not a conventional instructional product, in the formal education sense, but appeals do provide information and can educate. An understanding of the impact that appeals may have can be gained through applying the R&D model outlined in Table II-1.

By combining instructional product research and development techniques with communication evaluation research methodology it should be possible to develop educational instructional products and delivery procedures deemed to generate a greater understanding of the energy problem and to motivate consumers to be more disposed to practicing wise energy conservation.

Communications Research

Mashburn and Pusey (1977) in their paper "Public Education in Energy Conservation" argue:

> The media services should not be overlooked as a source for both publicizing upcoming programs and as a method of actually getting information to the general public through such things as newspaper articles and T.V. programs. All T.V. and radio stations are required by law to devote a percentage of their time to public interest programs. Therefore, most are very receptive to good programming that falls in this category. (p. 300)

In looking to the media as a method of disseminating energy conservation information, the question of how to use it _effectively_ must be raised. What _does_ constitute _acceptable_ programming that will be utilized for public interest programs? The Gallup Poll in 1974 documented that people are spending less time reading. If that is the case, should printed media be used to promote energy conservation? Such questions can be answered by looking into the body of kowledge provided through communications research.

In General

Agee et al. (1976) define communication as "the act of transmitting information and attitudes, from one person to another" (p. 4). As society grew more complex it ceased to function primarily through direct communication between individuals. It became necessary to deliver information and ideas to large and diversified audiences

through specially devloped "media." This involved the rise of the mass communicator whose task then became one of knowing not only "what" to communicate but "how" to deliver the message. Thus, in our present circumstance, communications research can be defined as:

> The scientific study of the mass communications behavior of human beings, usually in current situations requiring the gathering of primary quantitative information. It also includes the study of the communicators, their media, and the content of their message (Agee et al., 1976, p. 391).

Research over the years has delved into each of the four aspects of the communication process: 1) the communicator, 2) the message, 3) the channel, and 4) the audience. The object of mass communications is to affect human behavior, knowledge, and attitudes. "The object of communications research is to find out how and to what degree human behavior and attitudes are affected by mass communications" (Agee et al., 1976, p. 393). To accomplish its objective communications research has drawn from behavioral science methodology. Survey research has been used with the scientific sample to gather factual information, opinions and attitudes. The "field study" and "field experiment" have been adopted in an attempt to establish causal relationships between independent and dependent variables, while the laboratory experiment has been employed to control variables in order to study the independent variable (Agee et al., 1976). Recent trends in mass communications research have been involved with understanding "what people seek in the media, what happens when they use them, and

what they get out of them" (Agee et al., 1976, p. 398). Agee et al. (1976) present the following examples of current research trends:

- community media systems--they may either support controversial issues or be socially supportive.
- information diffusion--"those who rely on print media--newspapers, magazines, and books--tend to be more knowledgable than those who rely mainly on radio and television for their information" (p. 398).
- media socialization--children if encouraged to explore new ideas have been found to spend more time watching public affairs programs.
- political communication--the media may not often be successful in telling people what to think, but they have had success in telling people what to think about.
- children and television--are real acts of violence and T.V. violence related?
- motives, uses--and gratifications--"specific information, a chance to relax, favourite programs, and so on" (p. 400).

For investigators to accomplish such research, it is required that they remain familiar with findings and theories in other fields, and apply these to communication studies in order to realize a synergistic affect (Agee et al., 1976).

Pember (1977) presents the problem that must be faced by "masscom" in the future, i.e., a plan for media development. "Few people consider the mass media in this country as a communications system" (p. 327). Too many people consider the media as a social luxury, not a need. Pember (1977)continues by stating that "Planning would, hopefully, put man in command of the communications system, and not vice versa." (p. 372). Many of the media actors despair how much efforts are controlled by the "system." "You can't broadcast cultural fare regularly on commercial television because of the rating system" (p. 373). This could provide an additional research question, How does the "system" influence "what" is aired and "when"?

"Media saturation" has increased in recent years possibly causing people to erect shields to prevent receiving many of the incoming messages or to reject those that aren't wanted. Are people turning off and tuning out to promotional campaigns? "People are becoming less and less responsive to advertising. . .we are developing what Stan Freberg calls 'cauliflowerreceptivity'--from being beaten about the eyes and ears with too many commercial punches--and we are beginning to turn off and tune out" (Pember 1977, p. 374). In addition, many contend that the mass media is a cultural flatiron that has created standardization and regimentation (Pember 1977).

Energy Conservation

Energy conservation as a social program has only recently been recognized. Yet, its apparent necessity has several implications for the future. How does energy conservation relate to communications? Can it be marketed by mass media campaigns? Some of the energy studies have involved energy conservation and communication. Often, however, the foci for the studies have been behavioral realtionships rather than the effectiveness of the media materials, the message, the communicator, or the delivery channel. Selected examples of studies reviewed are presented to illustrate specific features of communications which have been present in energy conservation studies.

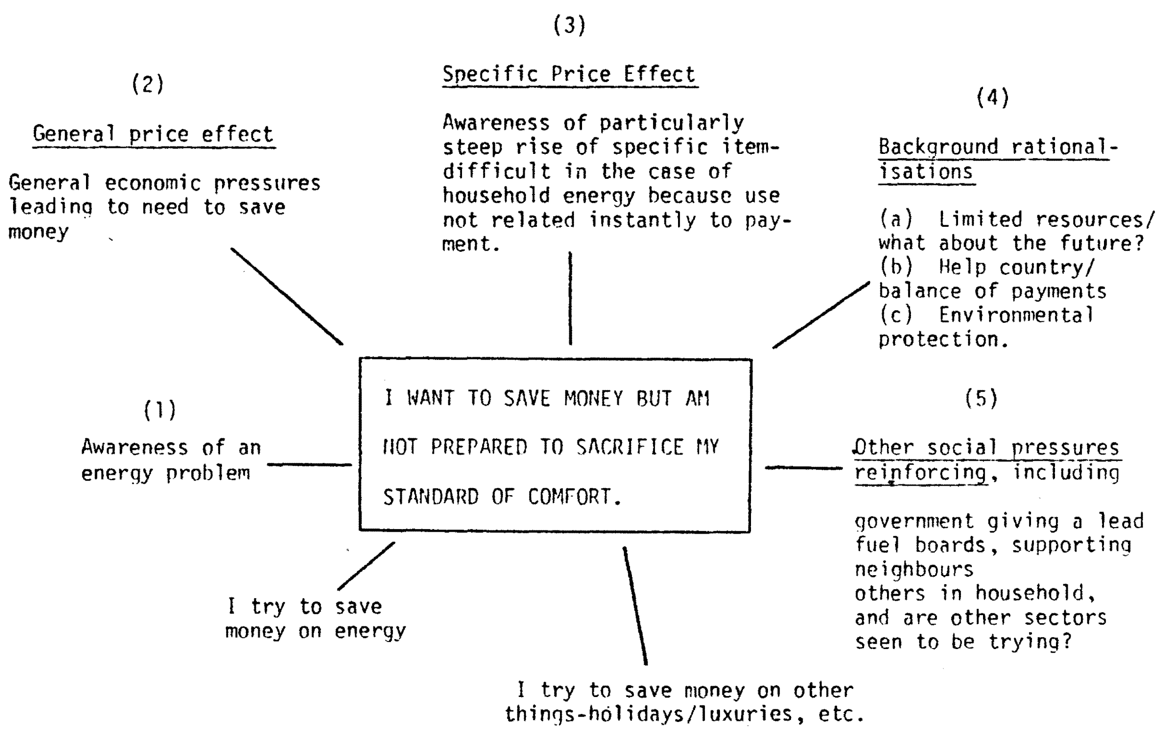
The two year "Save it" campaign launched in Britain in 1975 was an integrated communications campaign which sought to "secure short term reductions in the use of energy, and longer term changes in public attitudes and habits which will produce a permanent and continuing economy" (Phillips and Nelson 1976, p. 181). This was the most comprehensive study reviewed and it provided both substantive and methodological direction for the ENERSENSE study.

The campaign included a number of media--press and television advertising, leaflets, posters, displays and exhibitions, radio broadcasts, syndicated newspaper articles, and the fuel industries' own publicity campaigns. Eleven surveys were carried out utilizing complementary research techniques which included: indepth interviews, structured attitude surveys, re-interviews to establish association between attitudes and behavior, consumer panels and trade surveys (Phillips and Nelson 1976).

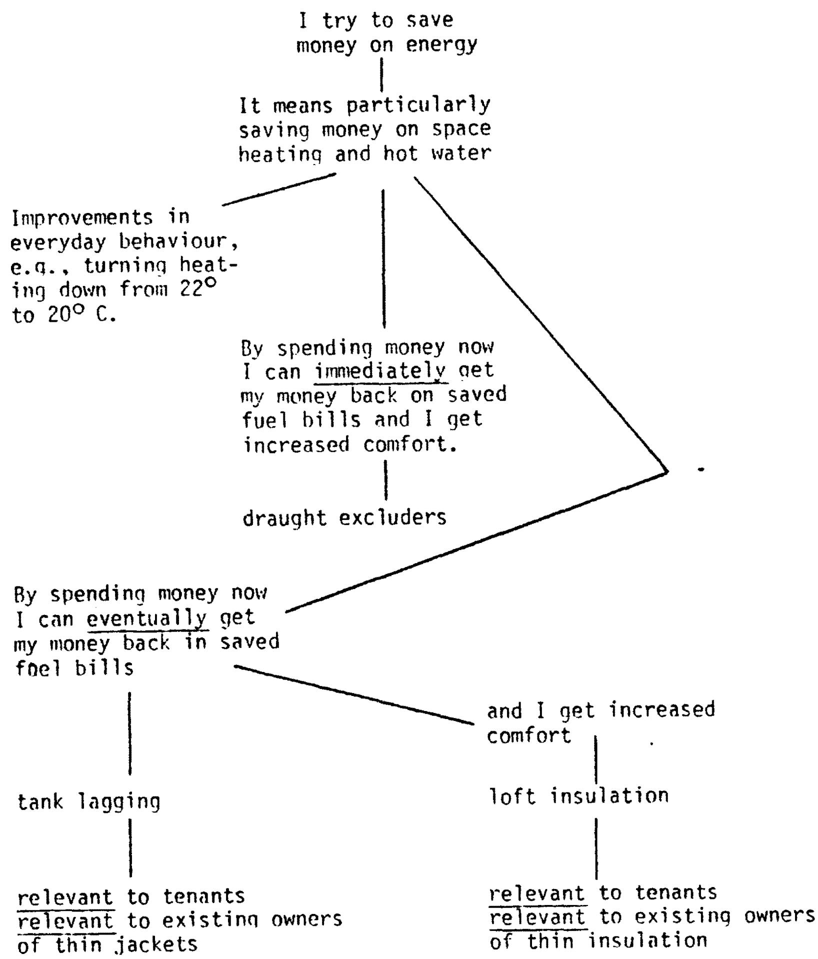
The evaluation measures utilized in the surveys included: recall of energy-saving messages, source of energy-saving messages, expected sources of advice on energy-saving, claimed behavior with regard to energy-saving, perceived relative cost of different uses of energy within the household, reasons given for starting to save energy, perceived price rises in energy compared with that of other goods and services, and the manner in which people cope with price rises. All were intermediate indicators associated with the ultimate goal of conserving energy.

Through identifying the key factors in the saving of household energy Phillips and Nelson were able to develop a (nonmathematical) model (See Figure II-2) to illustrate the process. Although it is based upon the United Kingdom experience it would appear to have applications in other nations. As the study was of "real life situations" and not a controlled experiment, Phillips and Nelson have made a contribution to understanding the relationship to information, experience, attitudes and behavior, through creating a nonmathematical model that is the result of subjective judgement and insight plus inference and deduction.

After the series of surveys, Phillips and Nelson drew several conclusions. The pre-campaign suggested (1) most people believed energy saving was important; (2) government and industry were wasting energy, and individuals did not see how individuals could make any difference; (3) there was a lack of knowledge on how to save energy. Based upon those findings, an advertising campaign was developed to persuade



a. Motivation and General Persuasion



b. Installation Behavior

Figure II-2. Model of Energy Saving and Installation Behavior in Private Households Based on U.K. Experience

Source: Phillips and Nelson, Energy Saving in Private Households: An Integrated Research Program, London, England: Central Ticket Office of Information, 1976

householders of the necessity to save and "how" to save. The January 1975 study concluded (1) "that respondents needed to be made aware of the seriousness of the energy problem, its effects on the country and its relevance to themselves" (p. 185); and (2) that consumers' prime interest in energy saving was to save money, and that "no one was supposed to sacrifice their standards of comfort" (p. 186). The third quantitative survey (March 1975) indicated favorable reported response to the advertising campaign. The fourth quantitative survey (July 1975) also indicated positive changes as did the fifth survey (January 1976) when respondents showed an accurate idea of the relative costs of different energy uses within the household. Table II-2 summarized some changes noted between July 1975 and January 1976.

TABLE II-2

SOME CHANGES IN UNITED KINGDOM SAVE IT STUDY
(Based on all households)

		July 1975 (%)	January 1976 (%)
Claiming to be doing something to save energy		71	81
Claiming to have started to save recently		42	55
Loft insulation (attic)	--- installed in last year	11	16
Tank lagging		8	14
Drought excluders		21	35

Source: (Phillips and Nelson 1976, p. 187)

In the claims of good-housekeeping, "lighting" was mentioned most frequently, while mentions of saving on heating and hot water were increasing. Subgroups noted as being more energy-saving-conscious were: 1) owner occupiers, 2) those in middle class occupational groups; 3) those in more modern houses; 4) those with central heating. These segments were identified as targets for the "Save It" campaign. Nelson and Phillips concluded that the segments to consider in marketing energy saving are: 1) the home itself; 2) household composition, 3) household circumstances (socio-demographic characteristics or contextual variables).

Through the means of personal re-interviews and study, the predictive value of plans to install each of three energy saving devices was tested and the question was found to be predictive of behavior. After the campaign respondents, who had appeared fairly sensible about what items took up most energy, were able to place the different uses in the correct order, i.e., space heating, water heating, cooling, other applicance, lighting.

In summary the "Save It" study shows the progress the campaign made in ascending the "ladder of social marketing" through measuring four kinds of change[2].

> "cognitive change" (e.g., awareness or knowledge regarding a campaign and for its substantive message; and attitudes towards the organization/cause/idea); "action change" (e.g., a specific action during a period such as donation to a charity); "behavioral change" (e.g., people giving up smoking); and "value change" (altering a deeply held belief, such as modifying racial or sexist prejudice, views on abortions, etc.) (p. 194)

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[2]Hierarchy offered by Professor Philip Kotler or Northwestern University in Marketing for Nonprofit Organizations, Prentice Hall: 1975.

The marketing and research conclusions derived from the "Save It" campaign study were presented by Phillips and Nelson as follows:

> Marketing conclusions: (i) Economic pricing is a prerequisite of a credible conservation policy, but price alone will not lead directly to efficient energy saving; (ii) Paid advertising needs to be supported by other publicity activity; (iii) For a programme to achieve credibility the support and cooperation in publicity by the fuel industries is essential; (iv) The campaign needs to be followed through to the point-of-sale if one of the objectives is to stimulate purchase of energy-saving durables; (v) Different households will have different priorities in interpreting the energy-saving message. These differences will be partly subjective (such as council tenants rejection of the relevance of loft insulation) and partly objective according to type of property, space heating needs etc. These factors may lead to a very segmented approach in the communication along the lines of the Swedish household booklet. (pp. 195-196)
>
> Research conclusions: (i) In monitoring domestic conservation programmes, researchers should focus on a number of relevant intermediate indicators--in the UK this has particularly meant the rate of acquisition of certain energysaving devices; (ii) Where the intermediate indicators are attitudinal their relevance may be uncertain a priori and should be checked; (iii) A research programme may include a number of different jigsaw surveys which together build up a coherent picture; (iv) Both quantitative and qualitative techniques of attitude research are recommended; the latter add valuable insight to more structured surveys; (v) Where the researcher seeks to monitor movements in behaviour, panels should be used; however where cognitive changes are likely to be substantial, separate ad hoc surveys should be employed for measuring attitudes. If some re-interviews are undertaken in addition to these separate surveys, it is possible to gain understanding of links between attitudes and behavior; (vi) If there are dangers of conditioning as well, then ad hoc surveys based on independent samples are better than panels; there is however, no evidence of conditioning in the small scale re-interviewing which forms a part of this research programme; (vii) In the case of certain energy-saving devices (particularly tank lagging) statements of behavioural intention are likely to be more predictive than in many consumer durable markets; (viii) The market for energy-saving is segmented in a number of ways. The segmentation relates to home itself, to household composition--and to household circumstances. Energy savings is highest among owner occupiers, owners of central heating, those in detached houses and newish property, the higher social grades and younger households. The more attitudinal differences are reflected in different objective priorities for different households in energy-saving, the greater need for a

segmented approach to the marketing and research of energy-saving; (ix) The model of motivations to save energy and of installation behavior, while based on United Kingdom experience, is likely to have general applicability to other countries (p. 196).

Craig and McCann (1978) conducted a field experiment in the United States that examined factors in consumer information processing as a means of understanding the problem of communicating energy conservation information to consumers. The experiment's main elements were the communications and their presentation to consumers. Communications and an information request card were prepared and enclosed in the monthly bills from Con Edison and the New York State Public Service Commission. Certain consumers received the "communication" in two consecutive billings. Consumer electricity consumption was monitored pre and post commuication distribution. The hypotheses tested were:

H_1: Messages identified as originating from a high credibility source result in more requests for energy conservation information than those originating from a low credibility source.

H_2: Repetition of the message results in more requests for energy conservation information.

H_3: Messages identified as originating from a high credibility source result in greater conservation of electricity than those originating from a low credibility source.

H_4: Repetition of the message results in greater conservation of electricity.

H_5: Subjects receiving a message exhibit greater conservation on electricity than those receiving no message. (p. 84)

The conclusions reached were: (1) a source of greater credibility can enhance the effectiveness of an energy conservation communication; (2) receiving some sort of message resulted in greater compliance; (3) repetition of the message had no effect--question here being: Are nonconservation prone individuals largely immune to repeated measures and "must they first undergo an attitude change before changing their behavior" (Craig and McCann, 1978, p. 87).

An educational/motivational study was conducted at Bankhead Courts and Carver Homes in Atlanta (1976). Aerospace contracted Arthur P. Annis and Associates, Inc. to conduct voluntary training sessions. The sessions provided instruction on energy practices in relation to gas and electric bills, and methods of conserving energy were described. The tenants received direct feedback on any attempts to conserve through self-explanatory monthly utility billings. This study appears to indicate that the education of tenants, reinforced by submetering and excess-energy charges as motivators, can play a part in energy conservation through reducing energy consumption.

Newbold (1978) when reporting the Atlanta (1976) study stresses that more study into the behavioral and motivational aspects of energy conservation in public housing is required. The educational/communication program components, in particular, need to be considered as a means of understanding behavior and motivation.

Ranjit K. Bonergi in his paper to the National Symposium on Energy Conservation Education, October 1977, reported on the HEW project introduced earlier in this chapter, "A Learning Package in Energy

Conservation for Participants in the Home Building Industry." (See page 44). The development process discussed contained five major steps:

1. Determining the specific attitude of the target population, so that the knowledge content as well as the delivery system for transmitting the knowledge could be designed to be most effective.
2. Identifying the educational program needs which were to be met by the instructional delivery system.
3. Designing the instructional delivery system and materials which would be most effective for meeting educational needs.
4. Implementing the instructional delivery system.
5. Evaluating the effectiveness of the program (p. 97).

A few of the selected significant findings were:

1. Forty-three percent of the builders believed there was an energy shortage.
2. Forty-three percent of the builders rated houses as extremely or very important in consuming energy.
3. Eighty-three percent of the buiders rated energy saving design features as important to consumers.
4. Eighty-eight percent of the builders rated insulation as important; ventilation of attic space and size, amount, and location of window space were considered important by majority of the sample.

5. Four factors rated as unimportant by builders were: natural ventilation of rooms, light colored exterior walls, proper lighting design, and window space that can be shaded/exposed.
6. Thirty-four percent of the builders knew that horizontal shading devices protect more efficiently around southern exposures (p. 100).

After builders, financiers, and consumers were surveyed, four categories of instructional need were identified: 1) Energy and People, 2) Energy and Site, 3) Energy and Building, and 4) Energy Conservation and Marketing.

Audio-visual presentations and take-home materials were developed for a series of workshop sessions. The program was delivered by a three-person team: a representative from Education, one from Architecture, and another from Marketing. Minor changes in format and directions were made as the workshops progressed. A Follow-up Service was offered in the form of economic evaluation of energy-conserving design features under consideration for structures being developed. The effectiveness of the program was to be evaluated by comparing a control and treatment group in four stages--three having been completed in 1977 appear in Table II-3.

TABLE II-3

RESEARCH DESIGN BUILDER STUDY

	Before Workshop Session	Sessions	Post Session	3-4 months Post Session	8-9 months Post Session
Treatment Group	M1 at session	T1	M2 at session	M3 mail	M4 mail
Control Group	-----	To	M2 mail	M3 mail	M4 mail

Key:
M = measurement (questionnaire)
T1 = treatment in form of educational sessions
To = no treatment

The hypotheses tested were:

1. There will be no gain in knowledge of energy conservation practices in home building exhibited by participants as a result of participation in the Home Energy Conservation workshops.
2. There will be no gain in attitude favorable toward energy conservation in home building exhibited by participants as a result of participation in the Home Energy Conservation workshops.
3. There will be no gain in disposition to behave favorably toward energy conservation in home building exhibited by participants as a result of participation in the Home Energy Conservation workshops.

The conclusion reached after the third measurement was that the program had been more effective in educating the builders and in changing their attitudes than in influencing their actions. Questions not answered in the 1977 report were: (1) Was the workshop format an effective delivery channel? (2) Was the content meaningful? and (3) How effective were the "take home materials?"

All of the studies reviewed indicate that more evaluative research could be done in the area of the energy conservation instructional product and the delivery procedures. Indeed it would appear that researchers could benefit from applying evaluation methods used in education, communication and marketing to enhance such programs.

Consumer Behavior and Attitude

Consumer Behavior

The study of consumer behavior is crucial to decisions being made daily by business and public agencies, nonprofit organizations, and officials elected by the public. Rather than policies being developed upon personal interpretations of consumer behavior, this frontier of the social sciences needs to continue to be systematically developed and empirically verified. Decisions which affect the consumption of energy require such an approach, and energy consumption is yet another topic within the field of consumer behavior which dictates interdisciplinary study. For one to gain an understanding of the

relationships between consumers and energy, a person needs to study both the theoretical and empirical work of a number of disciplines which have contributed to the development of the field of consumer behavior--and then apply this newly-acquired knowledge to the consumer decision making process as it is related to energy alternatives.

The direct study of people as consumers in several roles is required to gain understanding of the phenomenon of energy consumption. Zaltman (1975) suggested that four distinct role types should be considered: (a) users, (b) buyers, (c) decision makers, and (d) influencers. The characteristics of each of these roles are outlined in Table II-4.

TABLE II-4

RELEVANT ROLES FOR RESEARCH ANALYSIS

Role	Characteristic
User	The person most directly involved in the consumption (or use) of the product or service of interest.
Buyer	The individual who actually makes the purchase [or takes some action (Cox 1978)].
Decision Maker	The person who decides that the satisfaction of needs requires a purchase and has the authority to direct the expenditure of funds.
Influencer	A person who, by word or action, deliberately or not, exerts some influence on the decision to buy, the actual purchase, and the use of some product or service.

Source: Zaltman et al. Marketing Research. Hinsdale, IL: The Dryden Press, a Division of Holt, Rinehart and Winston, Inc., 1975.

To understand what influences people's roles--their energy consumption now and their energy consumption in the future--one may turn to the marketing literature as well as to that of the social sciences. Marketing has studied behavior in the applied context through building upon social science theory. There have been five principal interdisciplinary contributions to marketing thought and its study of people, i.e., consumer behavior. Those contributions have come from: (1) Learning Theory - the relationship of the concept's drive, cue, response, and reinforcement, i.e., the S-R (stimulus-response) model of "behaviorism"; (2) Clinical or Psychoanalytical Theory - a theory which has overcome the major limitation of the behavioristic model by introducing intervening variables of id, ego, superego, and libido; (3) The Gestalt Model - the physical perception of stimuli originally, which later was expanded to include men and environment through special attention being paid to the meaning of stimuli gained via perception through the five senses; (4) Cognitive Theory - an extension of the Gestalt approach whereby social psychology has focused upon the organization of values, attitudes, and information stored in an individual's memory, along with providing the basis for studying the impact of information and the motivating force for change introduced by contradictory information; (5) Theories of Social Influence - (a) group theory, e.g., the influence of reference group and the sociology of the family in the household decision-making process, (b) social class, and (c) diffusion of innovations (Engel et al, 1973).

The melding of theories has allowed marketing to evolve until it has become, as Engel (1975) explains:

> the process in a society by which the demand structure for economic goods and services is anticipated or enlarged and satisfied through the conception, promotion, exchange, and physical distribution of such goods and services (p. 10).

He goes on to explain consumer behavior as:

> the acts of individuals directly involved in obtaining and using economic goods and services, including the decision processes that precede and determine these acts" (p. 5) . . . to be realistic (the study of consumer behavior) must be based upon an understanding of social, individual and institutional variables as they influence and constrain consumer decisions (p. 7).

Glock and Nicosia reinforce the activity emphasis describing consumer behavior as:

> . . . the decision processes of the individual consumer or consuming unit, such as the family. It includes the effort to describe and explain one or more acts of choice either at a given time or over a period of time (Cox, 1978, p. 9).

Cox (1978) veers from the traditional treatment of consumer behavior and takes behavior out of the purchase act context. He expands it to include <u>any</u> consumer action that reflects evaluation of a firm, its product or services.

Numerous models have been developed to aid in understanding the consumer decision and behavior process [Barnaby and Reizenstein (1974); Howard and Sheth (1969); Nicosia (1966); Andreason (1965)]. It is, however, the <u>Multimediation Model of Consumer Behavior</u> introduced by Engel, Kollat and Blackwell in 1966 and revised in 1968 and 1973, which was used in the ENERSENSE study. This model (Figure II-3) was felt to illustrate most clearly the many processes which intervene or "mediate" between the introduction of a stimulus and the final response in behavior.

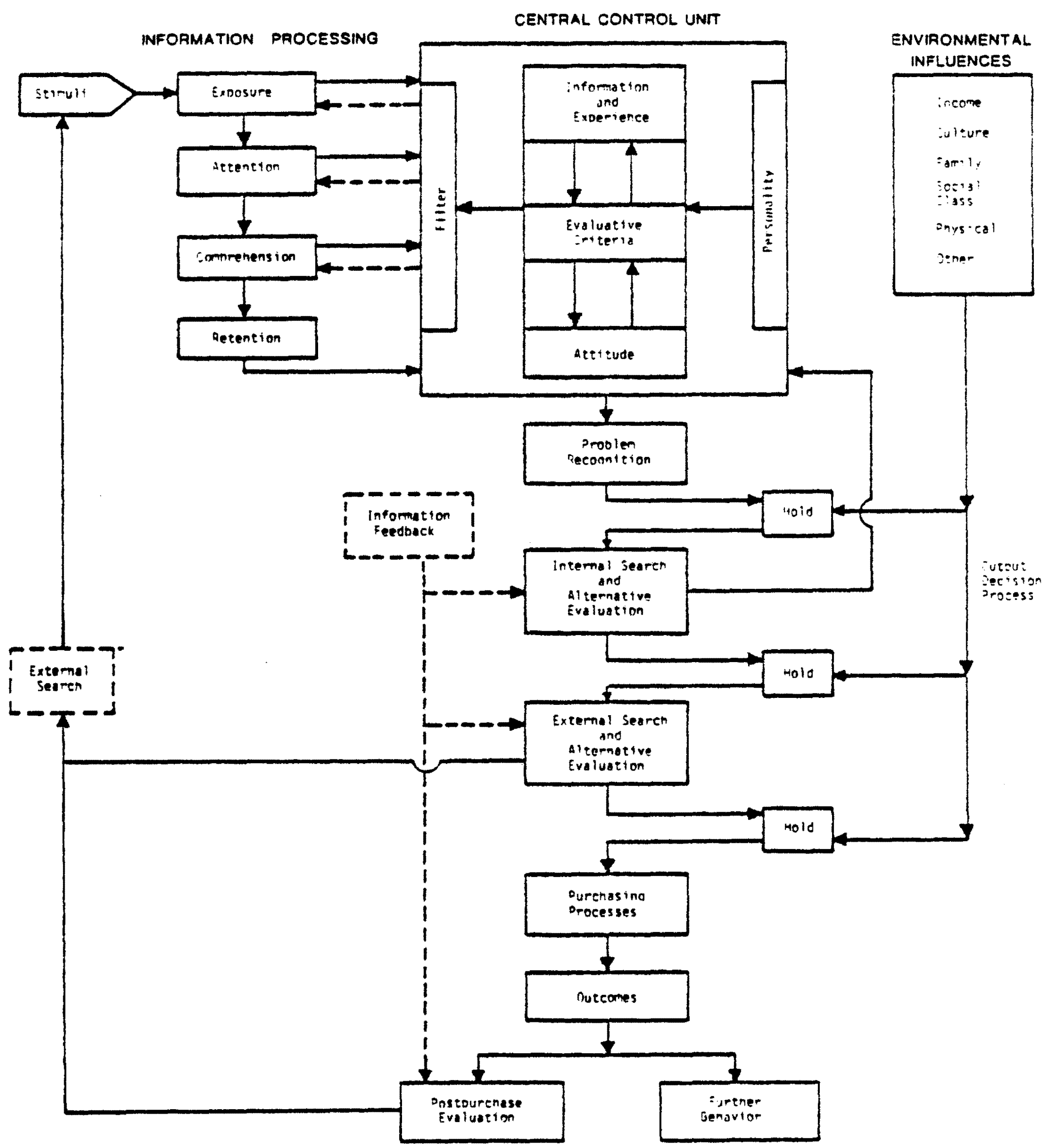

Figure II-3. Complete Model of Consumer Behavior Showing Purchasing Processes and Outcomes (Multimediation Model)

Source: Engel, Kollat, and Blackwell, Consumer Behavior, 2nd Edition. Hinsdale, IL: Dryden Press, 1973.

The model identifies the many variables present in the decision process but its creators emphasize that not every condition is present in every decision process. Kotler and Zaltman (1971) comment that products which are of value to society; such as, free medical care, pollution control, or public transportation, must be mindful of consumer behavior and utilize sophistication in marketing programs, if such products are to gain acceptance from the society's consumers. It would appear that any energy conservation program would require similar considerations. It is for this reason that several variables illustrated in the Multimediation Model have been considered in the ENERSENSE study.

The Multimediation Model was built upon the relationship of the important components of the individual's "black box" or psychological makeup, which are presented in Figure II-4.

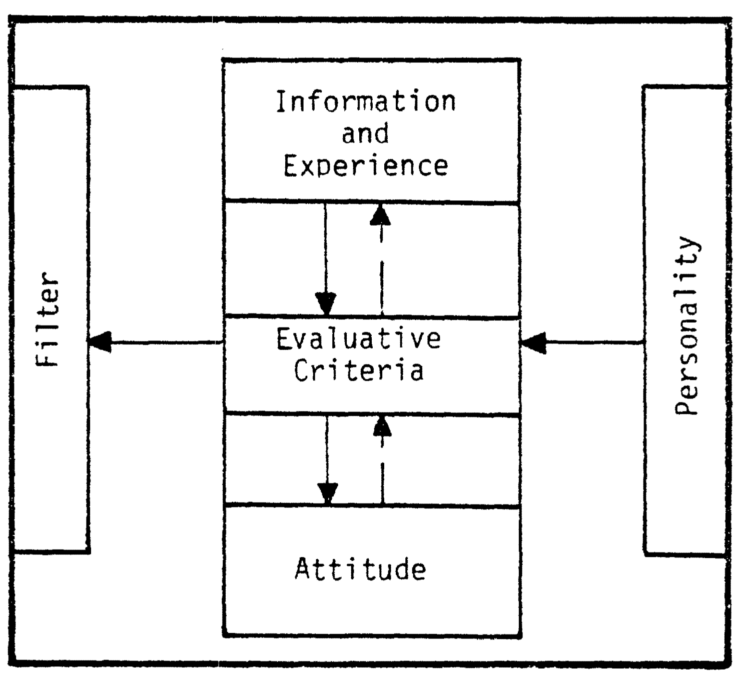

Figure II-4. Central Control Unit

Source: Engel, Kollat, and Blackwell, Consumer Behavior, 2nd Edition. Hinsdale, IL: Dryden Press, 1973.

"The central control unit (CCU) is the psychological command center . . . it includes memory and the basic facilities for thinking and directing behavior" (Engel, Kollat and Blackwell, 1973, p. 50).

Information and experience, evaluative criteria, and attitude is each, in turn, affected by personality. These components are primary to understanding consumer behavior as each has specific functions in addition to interacting in concert to filter incoming stimuli. The consumer can learn from experience and store the information. "Thus the individual learns to respond to stimuli of all types in consistent and predictable ways . . . . The memory content of consumers, in a target market segment, is of relevance to marketing strategy" (Engel, et al., 1973, p. 50). It is this concept which provides the basis for developing campaigns to increase product awareness.

The evaluative criteria component is the criterion, or specification used by the consumer to compare alternatives. The criteria are the result of social influences, personality and stored information and need to be understood if change is to be encouraged. (Engel, et al., 1973)

Allport (1935) defined an attitude as "a mental and neural state of readiness which is organized through experience and exerts a directive and/or dynamic influence on behavior" (pp. 798-884). Later Allport (1967), after reviewing over 100 expressions of attitude, defined a concept as "a learned predisposition to respond to an object or class of objects in a consistently favorable or unfavorable way" (p. 3-13). The model illustrates then that evaluative criteria and stored information are conceived as components of attitude.

Personality is the sum total of each person's unique way of thinking, behaving, and responding. The personality component is seen as directly influencing evaluative criteria.

A filter is formed by the interaction of all the variables in the CCU. Initial filtration is made on the properties of stimuli, e.g., loudness and pitch, followed by stimuli pertinence. There appears to be no agreement on the exact details of which stimuli are admitted and those which are rejected (Engel, et al., 1973).

In addition to the CCU, the model depicts the four distinct stages of information processing: (1) exposure, (2) attention, (3) comprehension, and (4) retention. The phases, however, do not necessarily function in a sequential relationship. The exposure phase may be either physical or social. The attention phase begins the processing of the stimulus and has been defined by James (1890) as ". . . the taking possession by the mind, in clear and vivid form, of one out of what seems several simultaneously possible objects or trains of thought" (Engel, et al., 1973, p. 53). The CCU filter amplifies some attributes of stimuli while diminishing or ignoring others. This selective perception process leads to comprehension which may be on target or contrariwise facilitate meaning which was never intended. Persuasive communication consequently may, or may not, be correctly perceived. The third level of selection in the information process involves retention. Only a portion of the information set is stored in working memory . . . "there is a known tendency to retain those stimuli which are consonant with CCU dispositions" (Engel, et al., 1973, p. 54).

Understanding the CCU and its relationships to information processing precedes the decision process. That process, as outlined in the model, commences with problem recognition and then proceeds through four additional stages: (1) internal search and alternative evaluation, (2) external search and alternative evaluation, (3) purchasing processes, and (4) outcomes -- all stages are not necessarily present in every purchase decision or consumer act.

Hunt (1963) sees the awareness of an external stimulus as one initiating influence in problem recognition, while Hebb (1949) believes that problem recognition can occur through need activation. Problem recognition, however, will not result from every perceived difference between the actual and the ideal.

The Multimediation Model outlines the external forces which may intervene to place a hold on the decision-making process. Action is post-poned to solve the problem until the constraints are removed. The interventions could include such things as income, cultural practices, family norms, social class norms, physical constraints such as lack of resources and climatic and/or geographic factors.

The remaining components of the model include two phases of alternative evaluation, the resulting consumer action, its outcomes, post-action evaluation and further behavior. Hence, this model illustrates a process which relates attitudes to behavior within the context of many intervening variables and presents a framework within which to study consumer motivation and behavior. Barnaby and Reizenstein (1974)

illustrated its adaptation potential to the study of energy and the consumer when they developed their model Consumer Decision Process Framework: Energy Conservation/Consumption (Figure II-5). Because attitude is fundamental to working within such a framework for studying consumer behavior, and as a basis for the ENERSENSE study, it is essential to focus upon (1) the nature and function of attitudes, (2) attitude measurement, (3) fundamental considerations in attitude change, and (4) the use of persuasive communications to bring about attitude change. Engel, Kollat and Blackwell (1973) use attitude in a narrower context than that of the Allport (1967) definition offered on page 70. They use attitude to "refer to a consumer's assessment of the ability of an alternative to satisfy his purchasing and consumption requirements as expressed in evaluative criteria" (p. 267). They see attitude as the central variable of the CCU, as consumer assessments (ratings) utilize stored information in the evaluative process. It is this interpretation of attitude which has been utilized in the ENERSENSE study.

The definition rests upon three traditionally accepted components of attitude: "(1) cognitive -- the manner in which the attitude object is perceived, (2) affective -- feelings of like or dislike, and (3) behavioral -- action tendencies toward the attitude object" (Engel, et al., p. 267). The affective dimension is measured through ratings on a scale of alternatives along the cognitive dimension. The behavioral dimension in the definition is conceived as corresponding to behavioral intentions. Studies within the past few years by: Azzian and

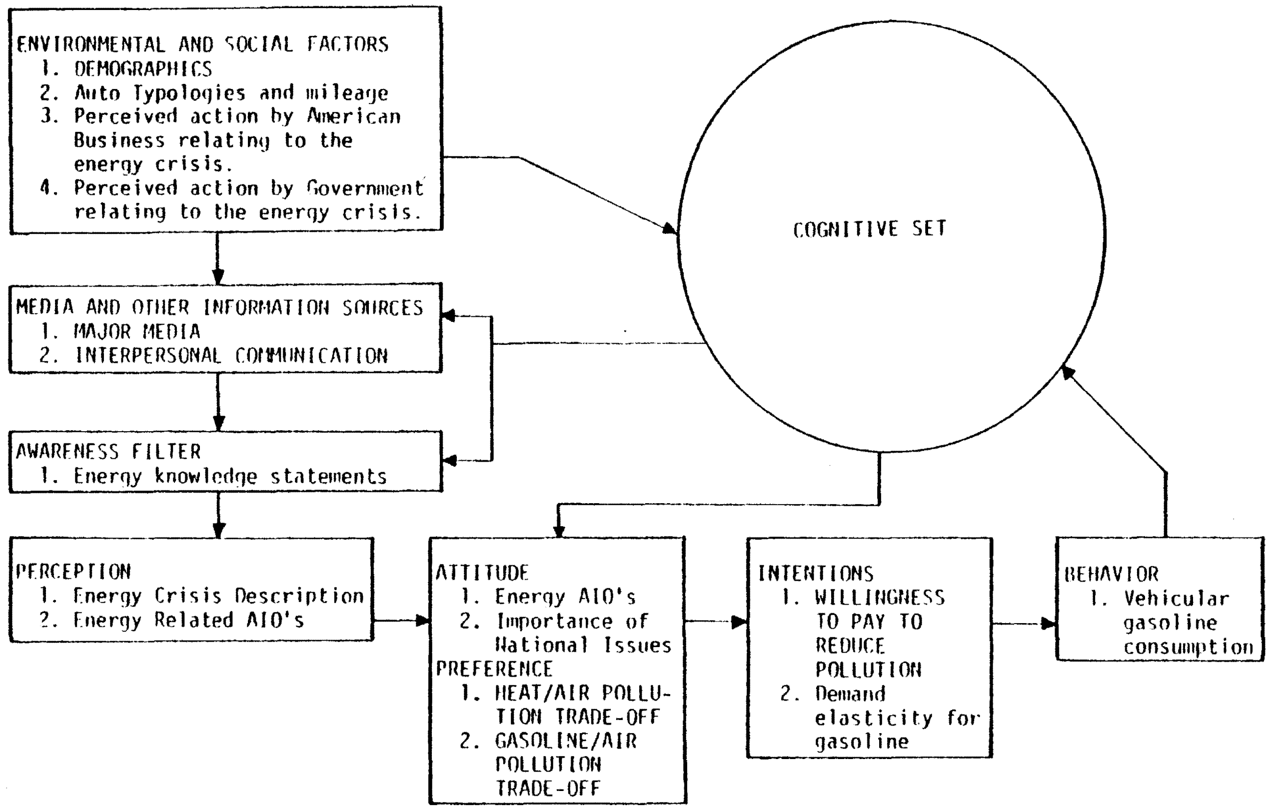

Figure II-5. Framework for Energy Conservation Decision Process

Source: Barnaby and Reizenstein. "Profiling the Energy Consumers: A Discriminant Analysis Approach". Knoxville: University of Tennessee, 1975, mimeographed copy

Fishbein (1968); Sheth (1970); and Cox (1978) have supported the idea that consumer action related to consumption can be predicted from intentions. Phillips and Nelson (1976) have documented, through their study of the British "Save It" campaign, that a positive correlation was found between intention to procure energy consuming products and their actual purchase.

The organization of attitude, as presented by Engel, et al., (1973) is seen as having evolved around three principles: (1) internal consistency, (2) interattitude structure, and (3) strength. Rosenberg (1965) stated that an inconsistency or imbalance between the affective and cognitive components is not likely to be tolerated by most individuals (p. 123-124). The attitude will become unstable and undergo reorganization when the threshold for inconsistency is exceeded. A person's self concept and basic values influence attitude organization. A change in an attitude that is central to self concept and basic attitudes can upset the balance as one change usually initiates changes in the attitude system.

Change in attitude is directly related to attitude strength, the probability for change being influenced by (1) the amount of information stored and (2) past experience. Newcombe, et al., (1965) emphasized that: "Attitudes about an object are more subject to change through contradictory incoming information when the existing mass of stored information about the object is smaller" (Engel, et al., 1973, pp. 268-269).

Attitudes are acknowledged as serving four functions: (1) adjustment, (2) ego defense, (3) value expression, and (4) knowlege (Katz, 1960). That is, first-desired goals are reached and undesired ones are avoided relative to attitudes held by a person as he or she strives to maximize satisfaction. Second, the ego is protected and enhanced by attitudes. Third, basic values are realized through attitude formation. Finally, a person is able to adopt and adjust to the world through the frame of reference provided by attitudes.

The Attitude/Behavior Link. "Attitudes affect both information processing and behavior" (Engel, et al., 1973, p. 270). This assumption provided the foundation upon which the ENERSENSE multi-media program was built. Through program content, media and delivery, it was hoped that it would be possible to change attitudes and ultimately to change consumer behavior in the area of energy conservation. There is, however, inconclusive evidence in the literature in favor of such an eventuality. Both negative and positive evidence is presented on the link between attitude and behavior.

The La Pierre studies in the 1930's indicated that behavior was not predicted from written statements which presumably reflected attitudes (Kiesler, et al., 1969). Festinger (1964) and Deutscher (1966) also drew negative conclusions. Fishbein (1967) concluded that:

> After more than 70-75 years of attitude research, there is still little, if any, consistent evidence supporting the hypothesis that knowledge of an individual's attitude toward some object will allow one to predict the way he will behave with respect to that object. Indeed, what little evidence there is to support any relationship between attitude and behavior comes from studies which show that a person tends to bring his attitude into line with his behavior rather than from studies demonstrating that behavior is a function of attitude. (p. 477)

That statement then leads to the questions: "When and to what extent do attitude changes precede behavior change?" or "How and to what extent does behavior change attitudes?" Pinson and Roberts (1973) suggest that the question to be answered is rather "Under what conditions is there change in attitudes and/or behavior?"

It would appear that the areas of consumer behavior have provided arenas for more frequent testing of the attitude/behavior relationship due to varied conditions with potential for "point-at-able events" e.g., amount of fuel used. It is from these arenas that positive evidence has been gathered to demonstrate that behavior and attitude are related (Zaltman and Burger, 1975) (Bauer, 1966).

For example, Lair (1965) reported that good commercials affect both attitude and behavior; Fendrick (1967) stressed that attitudes will predict behavior if attention is paid to measurement; DuBois (1968) supported the idea that "the better the level of attitude, the more users you hold and the more nonusers you attract" (Engel, et al., p. 271). But research conducted by Grey Advertising led to the conclusion that:

> More and more psychologists are coming to the conclusion that to result in a sale an advertisement must bring about a positive change in attitude of the reader or viewer. . . .That there is a definite relationship between change of attitude toward a brand and buying action is not only a logical conclusion but is supported by a preponderance of evidence (Engel, et al., 1973, p. 271)

The problem of the linkage, however, is still debated. Pinson and Roberts (1973) in their analysis of the pro and con arguments developed the following propositions:

> (1) the theoritical basis of the controversy suffers from the fallacy of division, and (2) that the empirical arguments exchanged are obscured by terminological and methodological ambiguities, failure to take account of third factors, and the unbounded nature of the proposition empirically tested (p. 241)

Cox (1978) suggests that the problem is the result of faulty research design involving conceptual and methodological considerations. While Engel, et al., (1973) feel the problem has three dimensions, 1) the measurement instruments, 2) the conceptualization of attitude, and 3) lack of attention given to interventions that can affect behavior. Therein lies the basis for their suggestion that the linkage can be made by using "intention" as an intervening variable between attitude and behavior. The relationship can be depicted as illustrated in Figure II-6 which was developed, in part, upon research by Sheth (1970).

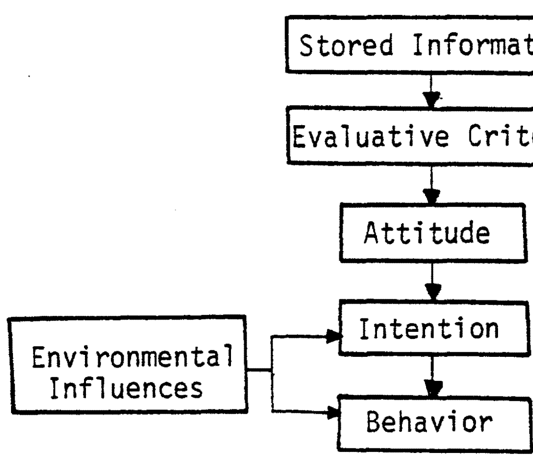

Figure II-6. Relationships Between Attitude, Intention and Behavior

Source: Engel, Killat, and Blackwell, Consumer Behavior, 2nd Edition. Hinsdale, IL: Dryden Press, 1979.

Sheth (1970) reported that attitude can be estimated from ratings along evaluative criteria; intentions can be predicted from explicit

measurement of enduring environmental factors; finally, behavior can be predicted from intentions if potential, temporary environmental influences are considered (Engel, et al., 1973).

Douglas and Wind (1971) also provided evidence for the usefulness of measuring intentions. They concluded that:

> (1) Purchase intentions are a good predictor of fashion behavior, and a five-point scale was found to have the highest predictive ability.
>
> (2) Purchase intentions for novel fashion items proved to be more accurate than stated intentions to purchase more common items.
>
> (3) Measures of specific intentions were less accurate than measures of general intentions as predictors of behavior over a long period of time, but they proved more accurate than general measures as predictors of immediately subsequent behavior.

Phillips and Nelson (1976) in the British "Save It" study concluded, through followup interviews, that intention to procure or install energy conserving products was positively correlated with actual behavior. This was felt to be a direct result of the awareness of a need to conserve energy, a current environmental influence. In summary the literature documents the fact that intentions predict behavior relative to the extent that outside environmental, moderating forces such as climate, economics, and social factors influence such behavior.

Attitude and Behavior Measurement

Attitude Measurement. Most attitude measurement is accomplished through measuring several attributes of a product. The collective results are then used as a basis for behavioral inferences. The attributes, or evaluative criteria, are rated individually by respondents; and, from the ratings, the researcher is able to determine the degree of importance each respondent holds in attitudes used in the decision process (Cox 1978, Engel et al., 1973). The attributes of a product or service are identified through a variety of techniques ranging from subjective reasoning to factor analysis. In factor analysis salient attributes or dimensions are determined and the researcher has the option of using only the most salient in an analysis of attitudes.

When attitude is defined specifically as a measure of the perceived value of alternatives for purchase or consumption along evaluative criteria, i.e., attributes, it is possible to represent the rating of alternatives through a model. Rosenberg (1956) and Fishbein (1967) developed models which have been used increasingly in recent years for this purpose (Cox 1978; Engel et al., 1973). The following formula shows how these models have been adapted to consumer behavior research:

$$AB = \sum_{i=1}^{n} WiBib$$

where

Ab = attitude toward a particular alternative b
Wi = weight or importance of the evaluative criterion i
Bib = evaluative aspect or belief with respect to utility of alternative b to satisfy evaluative criterion i
N = number of evaluative criteria important in selection of an alternative in category under consideration.

This rating is performed for each evaluative criterion, and the summed score is attitude toward the alternative. (Engel et al., 1973, p. 275)

Kiesler, Collins and Miller's (1969) review of measurement techniques suggests that paper and pencil measures are common, but elegant measurement techniques are not, even though testing techniques have become more sophisticated. Usually, simple unpretested questions are used in laboratory investigations of attitude change. However, experiments in natural settings, where all variables cannot be entirely controlled, require more rigorous forms of measurement. Five general categories of attitude measures, which hold potential for experiments testing attitude change, have been identified:

1. Measures in which inferences are drawn from self-reports of beliefs, behaviors, etc.
2. Measures in which inferences are drawn from the observation of ongoing behavior in a natural setting.
3. Measures in which inferences are drawn from individual's reaction to, or interpretation of, partially structured stimuli.
4. Measures in which inferences are drawn from performance of "objective" tasks.
5. Measures in which inferences are drawn from physiological reactions to the attitudinal object or representations of it (Kiesler, Collins, and Miller, 1969, pp. 9-10).

Categories one, two, and three gave direction to the overall design of the present study, and the evaluative criteria to be rated were developed from the content areas incorporated in the ENERSENSE media material.

Behavior Measurement. Studies by Cox (1978), Fishbein and Ajzen (1974), Fishbein (1967c), Tittle and Hill (1967) and Potter and Klein (1957) indicate that the behavioral variable should be measured and subjected to analysis in order to complete the study of attitudes. Evaluative criteria designed to assess multiple acts need to be incorporated into measurements. Tittle and Hill (1967) concluded "that higher correlations with attitude could be achieved when a wider range of behavior, with respect to the attitude object, is utilized as the criterion" (Cox 1978, p. 37). According to Tittle and Hill (1967) three aspects contribute to the correlation of attitudes and behavioral criteria:

1. the measurement techniques employed.

2. the degree to which criterion behavior constitutes action within the individual's common range of experience, and

3. the degree to which the criterion behavior represents a repetitive behavioral configuration (Cox 1978, p. 37).

Significant findings have resulted when the concept of a multiple-act criterion has been used in a nonmarketing context. Until recently, the concept was not commonly used in a marketing-based study of consumer attitudes. The study by Cox (1978) was the only one found for review. In his study the operationalization of the concept provided opportunities to assess several dimensions of behavior, not in just the purchase act. Cox further classified behavior variables as static and dynamic, making the point that home energy decisions involve the past

and the future. Hence, the criterion developed for the behavioral varibles could reflect a broader view of an individual's attitude.

The conceptualization is illustrated in Figure II-7 where behavioral processes that have evaluative possibilities are outlined.

In the present study two behavioral dimensions are considered "static," and two are seen as relatively "dynamic."

Static Behavioral Variables	Dynamic Behavioral Variables
Purchase behavior	Future behavioral intentions
Use behavior	Information processing

> As attitudes change, the dynamic behavioral variables should be immediate indicators of these changes, while we might expect some lag in the static variables...the dynamic variables as a group are a better indicator of overall attitude than the static variables as a group. (Cox 1978, pp. 91-92)

As stated previously, this approach has not been widely used in the study of consumer behavior but as the empirical study conducted by Cox (1978) also dealt with the home and energy, this concept appeared particularly relevant to the present study. This fact coupled with the fact that the literature supported the logic of using multiple-act criteria greatly influenced the evaluative criteria used in the ENERSENSE study.

In summary, the review of studies dealing with attitude measurement research supported the theory that multi-attribute attitude measures could be linked with multi-dimensional behavioral variables to gain understanding of the part an attitudinal object plays in the

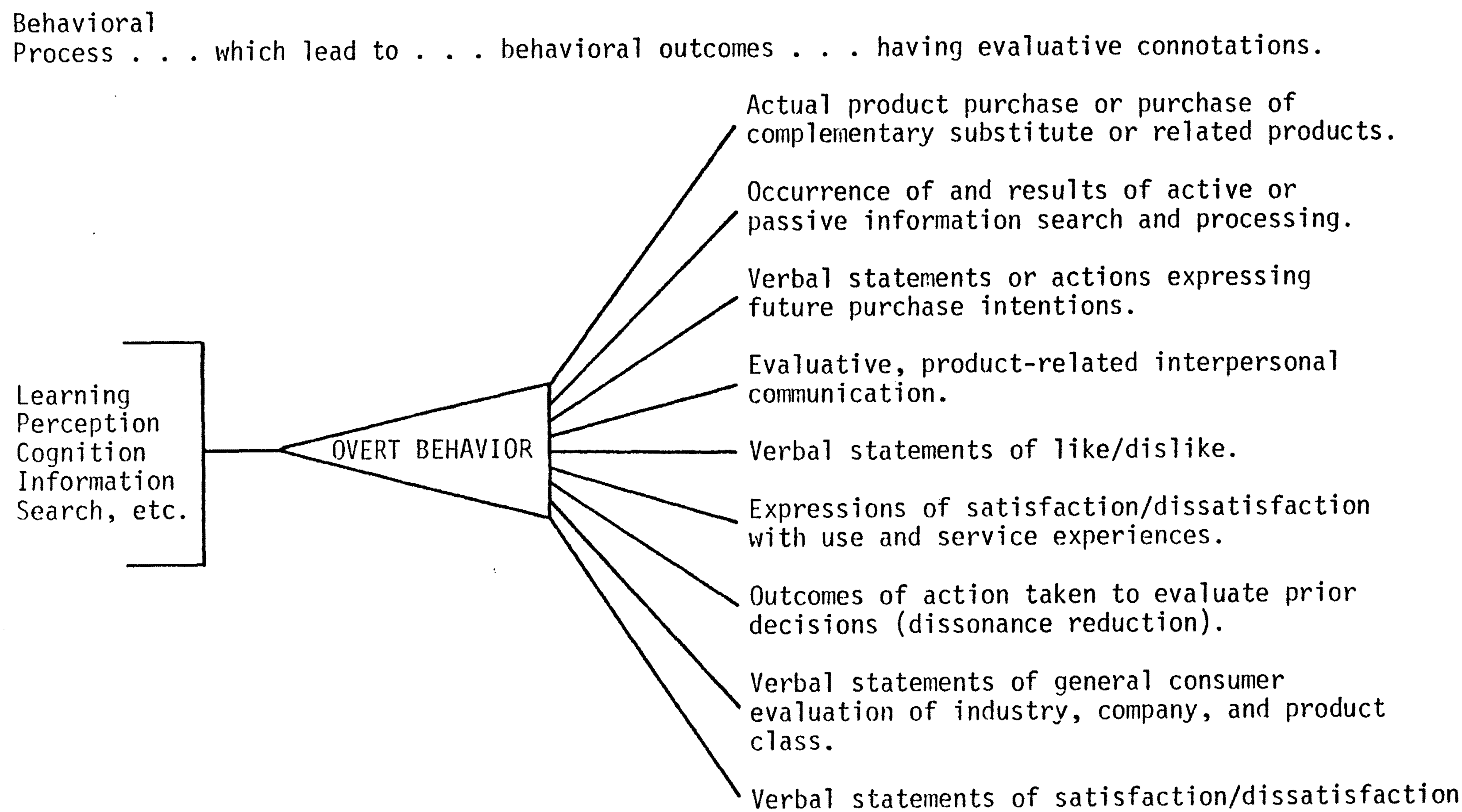

Figure II-7. A Conceptualization of Consumer Behavior as the End Result of Behavioral Processes

Source: Cox, C. <u>An Investigation of an Alternative Conceptualization of the Dependent Variable in Attitudinal Research</u>. D.B.A. dissertation, The University of Tennessee, 1978.

decision process. Further, Cox (1978) stressed that the behavioral side of the equation has been considered a given and consequently has been ignored. His study, however, illustrated an approach that addressed the other side of the equation. His conceptualization provided a way to gain understanding about how and why attitudes influence behavior in the consumer decision process, relative to energy as an attitude object.

The decision-process approach described provides a frame of reference and can direct the analysis of relevant factors which could be considered. It also allows one to move beyond merely describing observable behavior. If a systematic framework were not used, no such accumulation of knowledge would occur. By identifying and defining structural variables involved in energy consumption behavior, and by indicating relationships among variables, the measurement and prediction of consumer behavior is not based upon intuition. It is therefore evident that concentrated study, such as that made possible through utilizing the decision-approach process and its components, can provide an understanding of the macromarketing[3] problems pertinent to allocating energy, as well as energy related products, services, and programs.

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[3]macromarketing--How a society meets the needs of its people as an aggregate (Block and Roering, 1976, p. 13).

Social Change

Introduction

> The present decade is as critical as it is unique. It is critical because of the extreme pervasiveness of the social change process affecting the structure and functioning of our society. The course that these changes follow and the end results during the 1970's will mold the character of life in this country and abroad for decades to come (Zaltman et al., 1972, p. ix).

A statement made prior to 1973 which is probably truer today than when it originated. The events of the past decade, however, have evolved and changed society without there always being a clear understanding of our ability to improve action-oriented social change programs or even how to mount an appropriate program to assist society in meeting its needs. In promoting energy conservation one must recognize that social changes, both individually and collectively, are being encouraged. To accomplish such changes requires an understanding of the concept of social change and its management processes. "Because the consequences of social change, as well as the consequences of no social change, can have great impact, there is great interest in managing change to maximize its benefits and minimize its unfortunate effects" (Zaltman and Duncan 1977, p. 4).

Social Change Defined. Everett Rogers (1969) defined "social change" as "the process by which alteration occurs in the structure and function of a social system" (Zaltman et al., 1972, p. 1). Zaltman and Duncan (1977), however, stress that an adequate definition of social change is possibly the most difficult conceptual issue in studying social change. As things are always changing, and the case

can be made that human behavior and attitudes fluctuate, . . . what differentiates change from the status quo? What constitutes the significant modification or alteration in attitudes and/or behavior that we can call change? This latter question involves the notion of a critical threshold and the question, "when does more become different?" It is known, for example, that, as stimulus ambiguity is changed in a monotonic fashion, both the degree of felt information need and the information seeking behavior changes nonmonotonically. In most cases, nonmonotonicity results from qualitative alterations occurring as change in strength take place. For instance, "as the perceived threat posed by an instance of social change increases in salience to an individual, different psychological mechanisms (attributes) of resistance are called into play" (Zaltman, Pinson, and Angelmar, 1973). Thus, as familiarity with an advocated change increases, not only may resistance (acceptance) increase, but different forms of resistance (acceptance) may be displayed or experienced (Zaltman, Duncan, and Holbek, 1973). (pp. 6, 7)

As reported by Zaltman and Duncan (1977), formal definitions of the social change concept are few, although there are several process theories. Examples of selected definitions as reported by Zaltman and Duncan (1977) are presented in Table II-5.

TABLE II-5

SAMPLE DEFINITIONS OF SOCIAL CHANGE

Gerlach and Hines	Developmental social change is change within an ongoing social system, adding to it or improving it rather than replacing some of its key elements (p. 2). Revolutionary social change is change that replaced existing goals with an entirely different set of goals, steering society in a very different direction (p. 14).
Hamblin, Jacobsen, Miller	Quantitative processes that occur through time.
Abcarian	Structural tensions that result in widespread patterns of deviant norms and behavior.
Rogers	Alteration in the structure and function of a social system.
Etzioni	Reformulation of a social structure involving disequilibrium, forces for establishing equilibrium, and the occurrence of a new equilibrium.
Lippit	Any planned or unplanned alteration in the status quo in an organism, situation, or process.
Smith	Differentiation, reintegration, and adaptation.
Triandis	A new set of social relationships and social behavior that is most likely to lead to rewards.
Lenski	Innovation through discovery or invention or diffusion or alteration.
Dobny, Boskoff, Pendleton	Alterations in the patterns of interactions or social behavior among individuals and groups within a society.
Niehoff	The implementation of a plan as mediated by actions of change agents and reactions of the community of (potential) adopters.
Schien	The induction of new patterns of action, belief, and attitudes among substantial segments of a population.

Source: Zaltman and Duncan, Strategies for Planned Change. New York: John Wiley & Sons, 1977.

Considering the above definitions but basing their approach more closely on definitions of innovation by Rogers and Shoemaker (1971), Zaltman and Stiff (1973), and Zaltman and Duncan (1977) define individual and group change "as an alteration in the way an individual or group of individuals behave as a result of an alteration in their definition of the situation" (p. 9). They then go on to state that "change is defined as the relearning on the part of an individual or group (1) in response to newly perceived requirements of a given situation requiring action and (2) which results in a change in the structure and/or functioning of social systems" (p. 10). Such an approach to change can provide direction to understanding social change and its relationship to society's energy consumption, in general, and does provide a starting point for the exploration of concepts pertinent to the management of social change.

Pertinent Concepts. Change may be "planned" or "unplanned." Planned change is initiated by the declaration of objectives, its purpose to alter the social consequences ensuing from the free play of demographic, physiographic and technological change (Halpin 1969). Unplanned change then may be stated as the inadvertent consequence of the interaction of social forces (Halpin 1969).

Zaltman et al. (1972) suggest that the study of unplanned change is a prerequisite for identifying types of social change and should be included as the first step in effective planning for change. Types of change which may be identified include: (1) changes in attitudes and behavior; (2) inter-generational mobility; (3) changes in group norms,

values, and memberships; (4) change in group structure and function; (5) change due to invention, innovation or revolution; and (6) longterm ramifications of invention.

In addition to the planned-unplanned continuum, social change may also be categorized on the dimension of time and on the level of society that is the change target. (Zaltman et al., 1972) Table II-6 illustrates the micro to macro level and the interrelationship with the short and long term dimension of time, providing six types of change for consideration.

TABLE II-6

TYPES OF SOCIAL CHANGE

Time Dimension	Level of Society		
	Micro (Individual)	Intermdiate (Group)	Macro (Society)
Short term	Type 1 (1) Attitude Change (2) Behavior change	Type 3 (1) Normative change (2) Administrative change	Type 5 (1) Invention-innovation (2) Revolution
Long term	Type 2 Life-cycle change	Type 4 Organizational change	Type 6 Sociocultural evolution

Source: Zaltman, et al., Creating Social Change. New York: Holt, Rinehart and Winston, Inc., 1972.

Furthermore, when considering change, it is necessary to differentiate between "change" and "innovation."

> An innovation is any idea, practice, or material artifact perceived to be new by the relevant unit of adoption. The innovation is the change object. A change is the alteration in the structure of a system that requires or could be required by relearning on the part of the actor(s) in response to a given situation (Zaltman and Duncan, 1977, p. 12).

New requirements often produce an opportunity for innovation but, although innovations imply change, not all change includes innovation. (Zaltman and Duncan, 1977)

Change, in addition to being routine or radical, instrumental or ultimate, and either with a physical manifestation, or on the conceptual level only, is always multi-dimensional. Dimensions discussed by Zaltman and Duncan (1977)[4] include:

- Relative Advantage - the unique benefit provided by change over other alternatives.
- Impact on Social Relations - the persuasive impact on social relationships within and between the target system.
- Divisibility - the extent to which a change can be involved on a limited scale making possible the trial use of a change.
- Reversibility - the ease with which pre change status can be reestablished if a change is rejected.
- Complexity - the degree of difficulty in "using" and "understanding" a change -- the two concepts need to be distinguished.

---

[4]A more detailed discussion is presented in Zaltman and Duncan (1977), Chapter I, pp. 13-16.

- Compatability - the "goodness of fit" in relation to psychological, sociological, and cultural factors involved in the situation.
- Communicability - the ease of information dissemination, content and process.
- Time - the speed of introduction to optimize on the appropriate rate of change.
- Other Dimensions - risk and uncertainty, commitment, and susceptibility to successive modification.

There are three groups involved in the change process. Zaltman and Duncan (1977) broadly define them as:

- Change Agent - any individual or group operating to change the status quo in a system such that the individual or individuals must relearn how to perform their role(s) (p. 18).
- Change Target System - the unit in which the change agent(s) is trying to alter the status quo such that the individual, group, or organization must relearn how to perform its activities (p. 18).
- Change Client System - the individual or group requesting assistance from a change agent in altering the status quo . . . (p. 18). There is also the instance where no client system is requesting or seeking assistance to change (p. 19). (In that instance, the change agent is operating under greater constraints)

Zaltman and Duncan (1977) contributed further to understanding the concept of social change by supporting a few of the pitfalls identified

by Bennis which can be encountered in social change programs. Of these, the initial one is the belief that change will occur if information is presented to the target system. Bennis (1966) emphasizes that such an approach is overly simplistic and that change requires more than knowledge i.e., familiarity gained from experience. A process for the implementation of change is required in addition to commitment by the change target to accept the change. Consequently, techniques in addition to information, education, and communication should be considered. (Zaltman and Duncan, 1977)

A second pitfall commonly found is inadequate goal definition. It may affect both program implementation and evaluation. Thus, implementation and evaluation strategies rest upon clear objectives. Simply "changing things" is not sufficient goal statement for those strategies and may permit the creation of programs with indeterminant effectiveness as well as an uncertainty that those objectives will be effected by the change. Studies by Cock and French (1948) and Gross et al. (1971) indicate that if the objective of change is clear, and if there is participation in the change process, members of the change target system are more receptive to the change itself. Hence, impact and acceptance rest upon adequate goal(s) definition. (Zaltman and Duncan, 1977)

Failing to distinguish between symptoms and causes of a problem can lead to a third pitfall. Diagnosis is often done from one particular vantage point, rather than in the greater context of the larger environment. (Zaltman and Duncan, 1977)

A fourth pitfall is to assume that individuals behave in a vacuum. Change strategies, when one is considering key individuals, should also

be considered in the social, economic, and physical context. Otherwise, change will not permeate the system. Lastly, Bennis (1966) suggests that technocratic bias has led to developing change programs without adequate planning for implementation. Trunball (1974) cautions that possession of a product, or official acceptance of an idea, does not necessarily mean either will be put to use. (Zaltman and Duncan, 1977)

The "stimuli" for social change occur "when there is a perceived discrepancy between how the change target is performing and how the change target or someone else believes it ought to be performing" (Zaltman and Duncan, 1977, p. 23). Downs (1976) calls such a discrepancy a "performance gap." It serves as a stimulus, which may be recognized by the change target system, or someone outside, to be used to identify possible ways of responding (Zaltman and Duncan, 1977). Performance gaps may occur for a variety of reasons: (1) high expectations; (2) upward adjustment of satisfaction criteria; (3) changes in the external environment--lower demand technological changes, power position adjustment, political activity; and (4) need for innovation--technical and social (Zaltman and Duncan, 1977).

"Goals," an essential concept to planned social change, include goals focused upon change in (1) attitudes, (2) change in behavior, or (3) change in both attitude and behavior. "Changes in attitude and/or behavior are the means or instruments by which higher-level objectives and goals such as client or change agent well-being are established" (Zaltman and Duncan, 1977, p. 26).

Change Management

Kaufman (1972) developed a "model of change management", Figure II-8. This model builds upon four management activities: (1) organizing and analyzing, (2) planning, (3) implementing, and (4) evaluation-controlling, and has been integrated with both a microbehavioral and macrobehavioral approach to the process. The definition of "change management" which provides the thrust for Kaufman's model states that change management is "the organization, planning, implementation, and evaluation of social programs whose ultimate goal is social change" (p. 23).

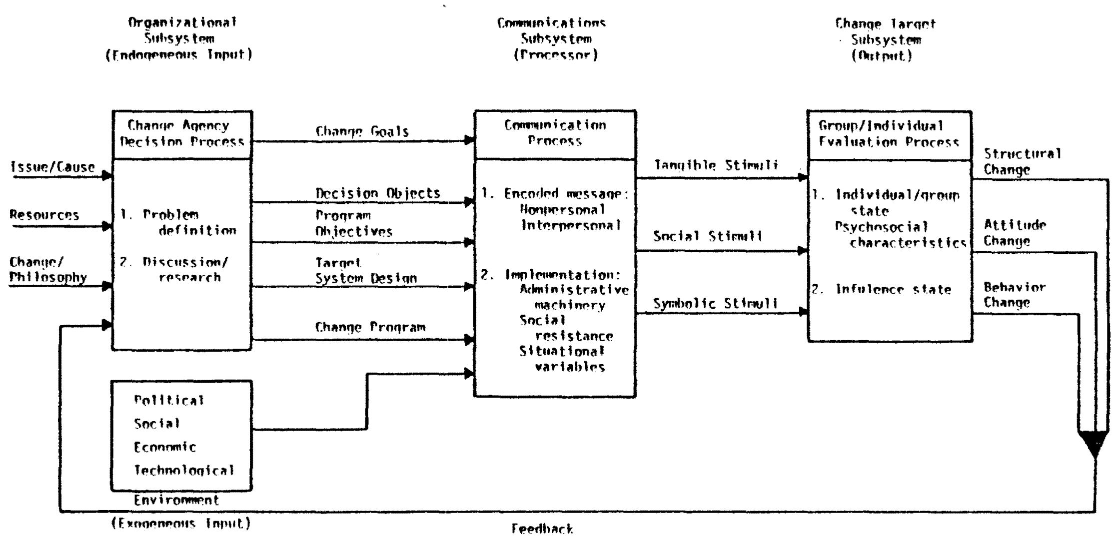

Figure II-8. Change Management System

Source: Kaufman, Ira. "Change Management: The Process and the System" in Creating Social Change, Zaltman et al., NY: Holt, Rinehart and Winston, Inc. pp. 22-39, 1972.

Through three interrelated subsystems: organizational, communications, and change target, the four management activities are achieved and the change process is integrated throughout the entire system. Kaufman's model functions around the assumption that power, persuasion, and/or education strategies form the basis for changing people. Also, in any change program people are influenced in the following respects: complying with the change; identifying with external rewards related to the change; and seeing the change as relevant, and consequently, internalizing it. Influence structures plus cost, and channels are the basic change variables operative in a change program. An influence structure is the means which influences a change target. The cost is the amount of resources required by an individual to change his behavior--financial outlay, psychic cost, and effort. The channels, whose effectiveness is characterized by availability, adequacy, and location, are the "where and how" by which persons may positively respond to a message. The communications subsystem functions to transmit and encode the change agency's and environment's messages to the target population. To achieve any degree of success, the change agency must manage the communication process and take into account three elements: administrative machinery, social resistance, and environmental variables. Finally, the change target subsystem (individual and group) receives and evaluates stimuli received from the communications subsystem. Kaufman (1972) believes that this is a dynamic process and that an individual evaluates each stimulus in the process of either consciously or unconsciously adopting or rejecting the message being transmitted.

The change management system presented in Kaufman's model clearly depicts elements which need to be considered in the change process and outlines a framework within which to examine the linkages between theory and application. Consequently, the model offers a planning structure for social change, i.e., energy conservation, which can be utilized by a change agency to analyze, plan, administer, implement, and evaluate either individual or group programs without divorcing them from their environment.

Social Marketing

Planned social change has been referred to as social planning, planned change, social communication engineering, change management, and "social marketing" (Zaltman, et al., 1972). Kotler and Zaltman (1972) express their belief that social causes can be "advanced more successfully through the principles of marketing analysis, planning, and control" (p. 554). Hence, they have defined social marketing as follows:

> Social marketing is the design, implementation, and control of programs calculated to influence the acceptability of social ideas and involving considerations of product planning, pricing, communication, distribution, and marketing research (p. 557).

Marketing techniques are thought to be "the bridging mechanisms between the simple possession of knowledge and the socially useful implementation of what knowledge allows" (p. 557).

Kotler and Zaltman (1972) have examined the four P's, the key variables in the marketing mix in relationship to social issues and they continue to view the problem as being "one of developing the right product backed by the right promotion and put in the right place at the right price" (p. 559). The social idea must be "packaged" so that it is "buyable," otherwise, in this instance, the social cause, i.e., energy conservation, will not be served. To accomplish this the social marketer has to define the change sought and segment the target markets. Second, he or she needs to organize communication-persuasion strategy and tactics to promote the product by making it familiar, acceptable, and ultimately desirable. Third, adequate and compatible distribution and response channels are necessary. "The poor results of many social campaigns can be attributed in part to their failure to suggest clear action outlets for those motivated to acquire the product" (p. 562). In this respect, Kotler and Zaltman (1972) emphasize that "place means arranging for accessible outlets so that motivations can be translated into actions" (p. 562). Finally, price must be planned. This includes energy costs, phychic costs, opportunity costs, as well as money costs. The principal incentive to the social marketer is to find a mix of product, promotion, place, and price that will both reduce costs and increase rewards.

The Social Market Planning System suggested by Kotler and Zaltman is illustrated in Figure II-9.

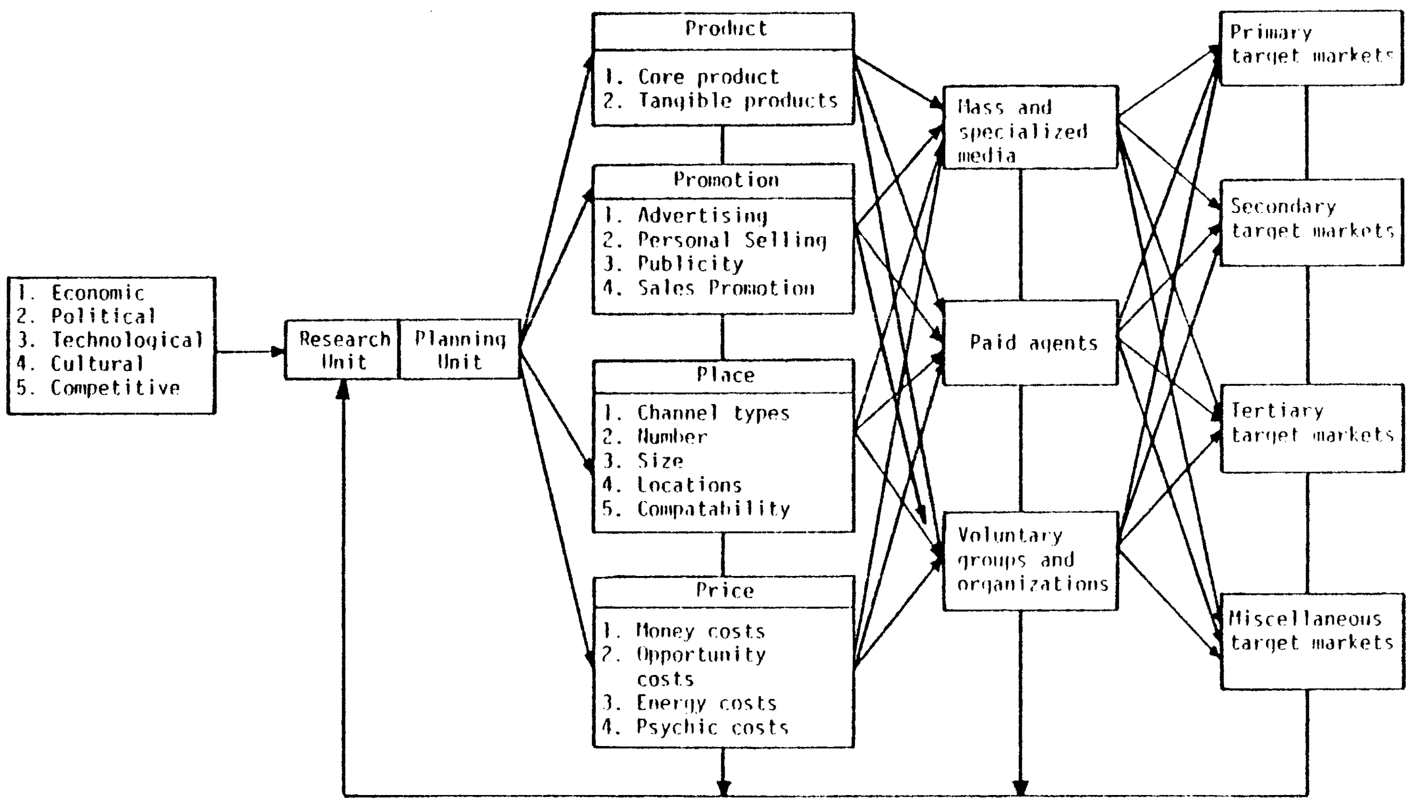

Figure II-9. Social Marketing Planning System

Source: Zaltman, et al., Creating Social Change. New York: Holt, Rhinehart and Winston, Inc., 1972

In this system, the change agency receives information and influences from the environment, sends plans and messages through channels to audiences, and monitors results. Research is an integral part of agency planning, as it is conducted to provide environmental information and evaluate program effectiveness.

In applying marketing planning to social causes, Kotler and Zaltman (1972) acknowledge its differences from business marketing. Social marketing deals with core beliefs, not superficial preferences and opinions. Social marketing has a more difficult task in gaining the acceptance or adoption of products and/or intangible concepts. Social marketing has to work with less definite channel systems. Social marketing may be resented and resisted. It may even be charged with being "manipulative" and with causing increased "promotional noise." Lastly, it may be seen as disfunctional because it is felt to "increase the costs of promoting social causes beyond the point of net gain either to the specific cause or the society as a whole" (p. 566).

In spite of the disfunctional aspects outlined, social marketing is presented as an approach which can link the behavioral scientist's knowledge of human behavior to relevant social issues. It is seen by this author as a framework for effective planning in relation to "marketing energy conservation," an intangible concept with tangible benefits for society.

Innovation Diffusion

Innovation is a sociological and psychological phenomenon which involves both social and technical items--an idea or practice. For years the diffusion of innovation has been recognized as one of the major mechanisms of social and technical change. Katz et al., (1959) define the process of diffusion as follows:

> the (1) acceptance, (2) over time, (3) of some specific item--an idea or practice, (4) by individuals, groups or other adopting units, linked to (5) specific channels of communication, (6) to a social structure, and (7) to a given system of values, or culture (p. 93).

Diffusion research has evolved almost independently in several traditions: sociology, anthropology, rural sociology, mass communication, and education with each emphasizing different variables and different approaches. The Katz et al. (1959) definition, however, presents elements which form an "accounting scheme" for understanding diffusion. Research studies have stressed different elements and few, if any, have examined all of the components (Katz et al., 1959).

Acceptance and time-of-acceptance studies have looked at "first-use," "trial," "adoption," "sustained use," "ever use," "rate of acceptance," and "form-meaning-function," i.e., level of acceptance. Such questions as "Does function travel with form?" should be suggestive of hypotheses. It has been suggested that

> "inner" changes precede "outer" changes in the sense that the diffusion of an idea precedes the diffusion of the tangible manifestation of that idea or, in other words, that there is a "material lag" rather than a "cultural lag" in the transfer of items across societal boundaries (Katz et al., 1963).

Therefore, research should possibly pay attention to the relationship between the two rather than only study "mere diffusion."

Diffusion does not occur instantly. Hence, <u>time</u> is a primary element in the process. Recall, records, and reference have been used to collect data to establish characteristics common to early-adopting individuals. Dodd (1955), for example, suggested that there will be a similarity in diffusion curves for similar innovations (Katz et al., 1963).

Is it possible to ascertain whether the meaning of a <u>specific item</u> for one individual is the same as it is for another? What dimensions of an item are relevant? Barnett and others have considered material vs. non-material items and suggested that natural items are more readily accepted because

(1) they are more readily communicated

(2) their utility is more readily demonstrable

(3) typically, they are perceived as having fewer ramifications in other spheres of personal and social life. (Katz et al., p. 101)

Menzel (1960), subsequently, classified medical innovations in terms of their "1) communicability, 2) risk, and 3) persuasiveness, hypothesizing that early adopters of each item would have certain characteristics" (p. 704). Both approaches suggest direction(s) which might be researched in relation to energy conservation and energy conserving innovations.

Innovations may be adopted by individuals and/or groups. Marketing, sociology and rural sociology have primarily considered adoption of items by individuals. Group-oriented innovations, however, need to be considered since "the adopting unit functions as a variable to facilitate or block the flow of acceptance of innovation" (Katz et al., 1963, p. 102). In addition, knowing the right adopting unit towards which to direct promotion campaigns can facilitate acceptance of the item--as when residential energy conservation campaigns aim at, say, the wife, but the culture "prescribes" agreement by the husband, or the conservation process requires the cooperation of the family.

Information and influence concerning an innovation are transmitted via mass communications and interpersonal relations. Both need to be included when considering the channels of diffusion Katz et al. (1963) called for

> a wedding of studies of the channels of decision-making and the social-structure approach to the study of diffusion so that influence and innovation can be traced as to how they make their way into a social structure from "outside" as they diffuse through the networks of communication "inside" (p. 104).

The social structure functions in several ways in relation to diffusion. First, to set the boundaries, second to delineate the major channels of person-to-person communication, third, to determine characteristic patterns of interaction dependent upon status roles. Research has examined social relations across and within boundaries. Studies reported by Katz et al (1963) illustrate that various ideas about innovation acceptance and boundaries have evolved.

Social-structural factors also have been used to classify "individuals" and, although factors such as age and education have been related to the prediction of innovation acceptance, surprises do occur. For example, older or less educated persons have been shown to be more likely to accept certain items (Katz et al., 1963).

Cultural dimensions which should be considered include: (1) "functional fit," the compatibility between the culture or personality and the characteristics of the proposed innovation; (2) "a general orientation toward innovation," i.e., ethnic attitudes and early/late adopters, adopters/non-adopters relative to sacred-secular, scientific-traditional, cosmopolitan-local orientations (Katz et al., 1963).

Earlier research studies have identified and investigated several elements to be considered in understanding innovation diffusion. Now, as society is faced with diffusing both social and technical innovation in answer to the energy problem(s), the implications for an interdisciplinary approach to innovation diffusion should be recognized.

Evaluation

Evaluation has become critical to the success of programs. Empirical evaluation and rational analysis can be signficant inputs in the decision-making process. Those sentiments which were held by John Evans (Assistant Commissioner for Planning and Evaluation of U.S. Office of Education) in 1969 led him to comment on the future of evaluation research. At that time he stressed that decisions were made in the absence of information. Accordingly, timely and relevant

evaluation studies in the real world, though not methodologically perfect, should improve decisions. He saw the task as one of bringing the best possible information to the decision- making point. Social science research and evaluation techniques can be applied to making evaluation an integral part of the program management process. It must be realized, however, that objective empirical evaluations that are relevant to applied social action settings, and not based only on theoretical and discipline oriented research, are required (Evans, 1969).

During the 1970's evaluation research has evolved to the point where it is recognized as "any scientifically based activity undertaken to assess the operation and impact of public policies and the action programs introduced to implement these policies (Bernstein and Freeman 1975). Nunnally (1975) stressed that evaluation research was intimately related to the study of change. Rossi (1977) emphasized that evaluation research differs from other judgements of public policy and programs in that it draws upon the research techniques of the social sciences and attempts to contribute a rational component to the policy-making process. Evaluation studies can provide empirical evidence of a program's utility, relative effectiveness, and cost-benefit. Recognition of possible contributions that can be realized plus the policy-maker's understanding of the activity, however, have been retarded by several obstacles. These have included: the "problem of the problem"--competing claims on commercial resources--since applied research is "difficult to conduct at a high level of technical

proficiency" (p. 6); also, findings are often ambiguous; and it is necessary to have designed research that is capable of answering questions asked by policy-makers.

Evaluation research is seen by this author as an essential part of the social change management process related to the promotion of energy conservation and the idea of an energy conservation ethic. To overcome the obstacles which impinge upon evaluation and to do evaluation research relevant to energy conservation programs several features and concepts need to be considered as a precursor to planning and conducting a study.

Most studies originate with the question: "Does the program work?" To answer that question requires determining at which of numerous levels the evaluation may take place. It can range from simple monitoring and accounting to a study of the delivery process, or to an assessment of the program's outcome, since effective evaluation is dependent upon clearly stated goals and the criteria for the program's success.

> All research, of course, demands precise definition and operationalization. "One distinctive feature of evaluation research is that this precision, in most cases, cannot be supplied by the researcher;" rather, it must be supplied by the policy-makers themselves (Rossi, 1977, p. 8).

The second distinctive feature to consider is that evaluation research takes place in the "action setting" (Weiss, 1972). This feature limits the researchers freedom to decide how to perform the research, how to design the study, and what variables to consider. ". . .the dependent and independent variables of evaluation research

are determined by the policy-makers and the problem being addressed, not by the researcher" (Rossi et al., 1979, p. 8). The researcher, however, is responsible for anticipating unknown or obscure results and should be able to recognize secondary effects and unintended consequences. Such action settings also curtail the researcher's control over sample selection and variables to be studied. In addition, the research report on such a setting will be directed to a different audience. Its form and style must be understood by policy makers and their staffs; statistical significance and substantive significance need to be distinguished. Finally, the time frame is usually more restricted and rigid than that for basic research. Rossi et al. (1979) summarizes differences between "action setting" and basic research by saying the differences may be found in: (1) how research problems are defined, (2) how variables are chosen, (3) how hypotheses are formulated, (4) of what consequence are errors of inference, and (5) how results should be reported. But, he states, no differences usually exist in the logic, methods, and techniques employed.

Rossi (1977) presented the argument that the major problems of evaluation research are vague goals, strong promises, and weak effects. That combination, he feels, requires robust methodology and powerful designs. "The decision requirements often mean that the research must be developed as part of the implementation plan for the program itself" (Rossi et al., 1979, p. 10). The most powerful designs, including randomized experiments and careful before-and-after studies, should be utilized.

Opportunities to conduct randomized controlled field experiments have been confined to specialized types of treatments or programs. The vast bulk of evaluation has utilized quasi-experimental designs and cross-sectional studies (Rossi et al., 1979).

> The design issue centers around the problem of discerning the effects of a policy that are "net" of other possible causes of such effects . . . an energy conservation campaign may appear to succeed because an exceptionally mild winter made it possible to use less fuel in heating homes and offices. It is the exceptional ability of the randomized controlled experiment to rule out competing explanations of effects that makes it so attractive as a research design (Rossi, 1977, p. 14).

Based upon the well-established laws of probability the randomized assignment determines that the control and experimental group differ initially only through the operation of change factors. Differences noted after treatment then can reflect two possible factors: chance factors or the effects of the treatment. "If the first can be ruled out through statistical inference, then the effect remains the only plausible explanation of the difference" (p. 14).

In the extensive literature which now exists documenting the rationale, strengths, and desirability for experimental field evaluation, practical problems in executing such research are described (see Anderson 1976; Cook and Campbell 1975). Problems encountered include (1) attrition, (2) maintaining uncontaminated controls, (3) political or ethical conditions that limit the study's application or prevent it entirely, and (4) high costs. Experience indicates that field experimentation is not without technical problems, and rarely can it be conducted on such a scale as to allow confident generalization.

Plus (1) there may not be adequate time to allow a well-conducted experiment and (2) there is the possibility that the treatment administered may be more than that which was intended for the experimental group (Rossi and Wright 1977). Even recognizing these problems the investigator is encouraged to use the experimental design model. Rutman (1977) states: "In those situations where it is both administratively feasible and relevant to the type of information desired, the model of a controlled experiment represents the ideal design for evaluative studies" (p. 35). Whereas the model safeguards against threats to internal validity, it should be noted that it may decrease external validity. But as the main concern is to establish causal relationship, internal validity is given priority over external validity. That does not mean external validity is ignored. Rather, the researcher can increase external validity by conducting the experiment in a natural setting and under natural conditions, to which the results will be generalized, and by including replications at different times with different people across settings.

With the advent of evaluation for accountability purposes, most programs are evaluated. But there is "evaluation" and there is "evaluation." Rutman (1977) even stresses that sometimes it would be more appropriate not to evaluate a program. He sees the evaluator having the responsibility of determining whether or not a program is evaluable, what type of evaluation is required and at what point in the life-time of the program any type of evaluation is appropriate. Because evaluation is seen as a basis for program development, policy

making, budget submissions and management, not just as a process to determine the program's "success," Rutman (1977) suggests that evaluation should be conducted at three stages. At the precondition or first stage, program goals and/or effects, and causal assumptions--components of the program--should be assessed to determine whether or not evaluation would be premature. This "evaluability assessment" can provide direction for the second possible stage at which evaluation could occur, i.e., "formative research." Formative research can both verify the components of the program components which can be evaluated and identify other concerns basic to acquiring a clearer understanding of the program and its effects. The emphasis is on discovery, a forerunner to the "effectiveness evaluation" stage. The effectiveness stage then aims to verify the program through measuring its effects (Rutman, 1977).

Formative evaluation can be used, according to Rutman, to identify both intended and unintended side effects, to identify negative effects, and to provide insight into characteristics of the population in question. In addition to establishing whether or not the program meets the preconditions of evaluability, he maintains that formative evaluation can be used to increase a program's evaluability. Through collecting data on program personnel, organizational structure, and climate, policy, and the context within which a program operates, factors can be identified which influence the program's operation and effects. This knowledge then can be used by program managers as a basis for various methods of implementation. Thus, formative evaluation

should be viewed as a preparatory stage for effectiveness evaluation (Rutman 1977).

Using the three stage approach defined by Rutman (1977): (1) evaluatory assessment, 2) formative evaluation, and 3) effectiveness evaluation--or summative as it is labeled by some (Edwards et al., 1975)--a researcher has options for integrating evaluation into the social change management process. Formative evaluation is most similar to the "feedback" depicted in the model introduced in Figure II.8, p. 95. It would provide ongoing evaluation but there would be times in the life cycle of a social change program in which either of the other two stages would be an appropriate form of evaluation. Thus, the logic of the three stage approach is seen as a model which should be considered seriously by program evaluators.

Human Residential Space Transaction

A General Perspective

The necessity to combine environmental, technological, and social-psychological dimensions in household energy research has been identified (Keith 1977, Warkov 1978, Roske 1975, Socolow 1975). To accomplish a unification of these relevant factors and concepts, which are dispersed through multidisciplines, requires an organizational framework within which to search, identify, relate, delete, and evolve related concepts and theories. Such a framework was introduced by Roske (1975) when she sought first, to "identify factors relevant to

understanding human transaction with residential space" (p. 1) and second "to develop a matrix based on relationship categories. . .," which "allowed comparisons to be made of factors derived at different times, through different methods within different disciplines" (p. 3).

The matrix developed by Roske (1975), Table II-7, provided an organization model for reviewing the multidisciplinary literature related to human residential transaction and highlighted specific concepts and categories which should be considered in relationship to energy conservation and possible human residential space transactions. Roske's matrix and an explanation of its utility to this study follows.

This overview of categories presented on p. 114 acknowledges prevailing themes which are relevant to human space transaction in general and illustrates the fallacy of attempting to study residential energy conservation as an independent phenomenon. Topic areas identified within the residential space transaction area which should be considered when proceeding with any energy related study include:

- general trends - cultural acceptance, availability, production methods
- spatial relationships - spatial innovations, functional architecture, space needs, use, distribution, and standards
- evolving types of residential space - solar communities, demonstration projects
- societal concerns - housing problems, family needs, production location, quality and need for change seen as parts of larger social issues

TABLE II-7

MATRIX OF HUMAN RESIDENTIAL SPACE TRANSACTION THEORY AND RESEARCH

Source: Roske, M. "Analysis and Organization of Human Residential Space Transaction Theory and Research As a Foundation for Education." Dissertation, University of Oregon, 1975

	General Trends	Residential Space The development of the Physical Context	Residential Space Societal Concerns	Residential Space Values	Human Residential Space Transaction: Fundamental Processes	Human Residential Space Transaction Theory	Human Residential Space Transaction Research
SUBJECT CATEGORIES	I	II	III	IV	V	VI	VII
RELATIONSHIP CATEGORIES							
Aesthetics	●	●	●	●	●	●	●
Crowding & Density	●	●	●	●	●	●	●
Human Needs in Residential Space	●	●	●	●	●	●	●
Individuals, Families, and Housing Choice	●	●	●	●	●	●	●
Interdependency of Residential Space on other Systems	●	●	●	●	●	●	●
Residential Space Experience	●	●	●	●	●	●	●
Suburbanization	●	●	●	●	●	●	●
What We Do Not Know	●	●	●	●	●	●	●
What We Have Not Accomplished	●	●	●	●	●	●	●

- current issues - implications of residential space patterns, the use of energy and resources, and the changing role of women
- values - defined, implied, related to types of residential space and components
- fundamental processes - perception, cognition, and behavior
- theory - specialists in such disciplines as environmental psychology, social sciences and architecture are reaching beyond discipline boundaries and can contribute to solving a complex problem such as energy conservation
- environmental psychology - it has contributed to the understanding of the human transaction with space--including residential space, as well as affective components, modes of analysis, models of environment and behavior, environment, and design
- interdisciplinary approaches - sociologists, planners, geographers and anthropologists have contributed to such concepts as user evaluation, spatial concepts, cultural variation, human requirements, man-environment relations, environmental congruence, and social indicators
- designers of the future - members of the design professions who are promoting concepts and practices which are viable means for energy-efficient residential structures, as well as those addressing environmental and social change
- research - methodologies, theoretical concepts, and multidimensional perspective related to the problem, in this case, energy conservation.

Factors and concepts included in the preceeding Categories can be united by such themes as those specified in the Relationship Categories of the matrix: aesthetics; crowding/density; human needs in residential space; individuals, families and housing choice; interdependence of residential space on other systems; residential space experience; suburbanization; what we do not know; and what we have not accomplished.

Aesthetic response to residential attributes has only been dealt with to a minimal degree (Roske 1975) and is relevant to the acceptance of residential energy conservation innovation (Watson 1979). Crowding/density concepts are relevant to zoning for "sun rights" and exterior and interior space planning. In addition to crowding/density concepts, human needs--those viewed as basic space needs, needs for harmonious family life, the needs for physical and mental health, or the needs for fulfillment--are important and underlying concepts pervading all subject categories illustrated in the matrix. Individuals, families, and housing choise are involved in the selection of housing forms, house type and house components as well as man-environment relationships. The concept of residential space's interdependency on other systems provides a basis for examining the interconnectedness of the many variables which should be considered in human residential space theory and research. The concept of residential space experience[5] provides a focus by which to contribute further to the theory base. It

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[5]residential space experience - the impact of facilities on users, managers, etc., physically, socially, and economically.

has been a concern of interior designers, architects, environmental psychologists, and environmental design researchers (Roske, 1975). Suburbanization, on the other hand, is a relatively small but important category which will need to be addressed more extensively in light of rising energy costs and the time/distance relationship of house form to working women. What we do not know and what we have not accomplished are convenient categories by which to assess large questions, such as "How to meet national energy needs?"--questions that have caused concern to theorists and researchers, but that have by no means been completely answered. Many topics have been identified as goals to be accomplished and knowledge has been gained without attaining these goals. "Prefabrication, public housing, national housing goals, housing production, and energy conservation are a few examples" (Roske, 1975, p. 35).

Roske (1977) suggests that implementation and utilization of her Matrix of Human Residential Space Transaction Theory and Research has the advantage of allowing new theory and research to be added to the framework through expanding the subject sections as knowledge expands and becomes specialized. Research and theory can evolve "out of a very small cluster of concepts. . .any number of single starting points can be combined; any number of relationship categories can be used; and any number of subject sections can be included" (p. 38). Hence, the matrix was seen, by this author, to be an open system through which to gain direction for studying the environmental, technological, and social-psychological dimensions of residential energy conservation, a human space transaction.

Considering the literature with regard to Roske's matrix categories, one is able to identify five specific content areas as having relevance to developing an evaluative tool to measure consumer acceptance of residential energy conserving innovation. Research and theory content have been reviewed in the areas of (1) architectural perception, (2) architectural meaning, (3) architectural simulation, (4) semantic differential as an architectural scale, and (5) architectural innovation and energy conservation. Concepts from those areas which provided the foundation upon which to develop the evaluation instrument presented in Chapter IV are described in subsequent sections of this chapter.

Architectural Perception

Hesselgren (1971) stated that "How we experience, through our various senses, the man-made environment which we have created for ourselves is a problem of 'architectural perception'." His contributions to architectural perception include such thoughts as:

- It is necessary to understand that while external physical events can always be described in terms of the dimensions of length, mass and time, perceptual experiences can never be described using these dimensions.
- A perceptual experience is never evoked by a single physical event in itself,. . .but always by this event within the context of the total contextual field.

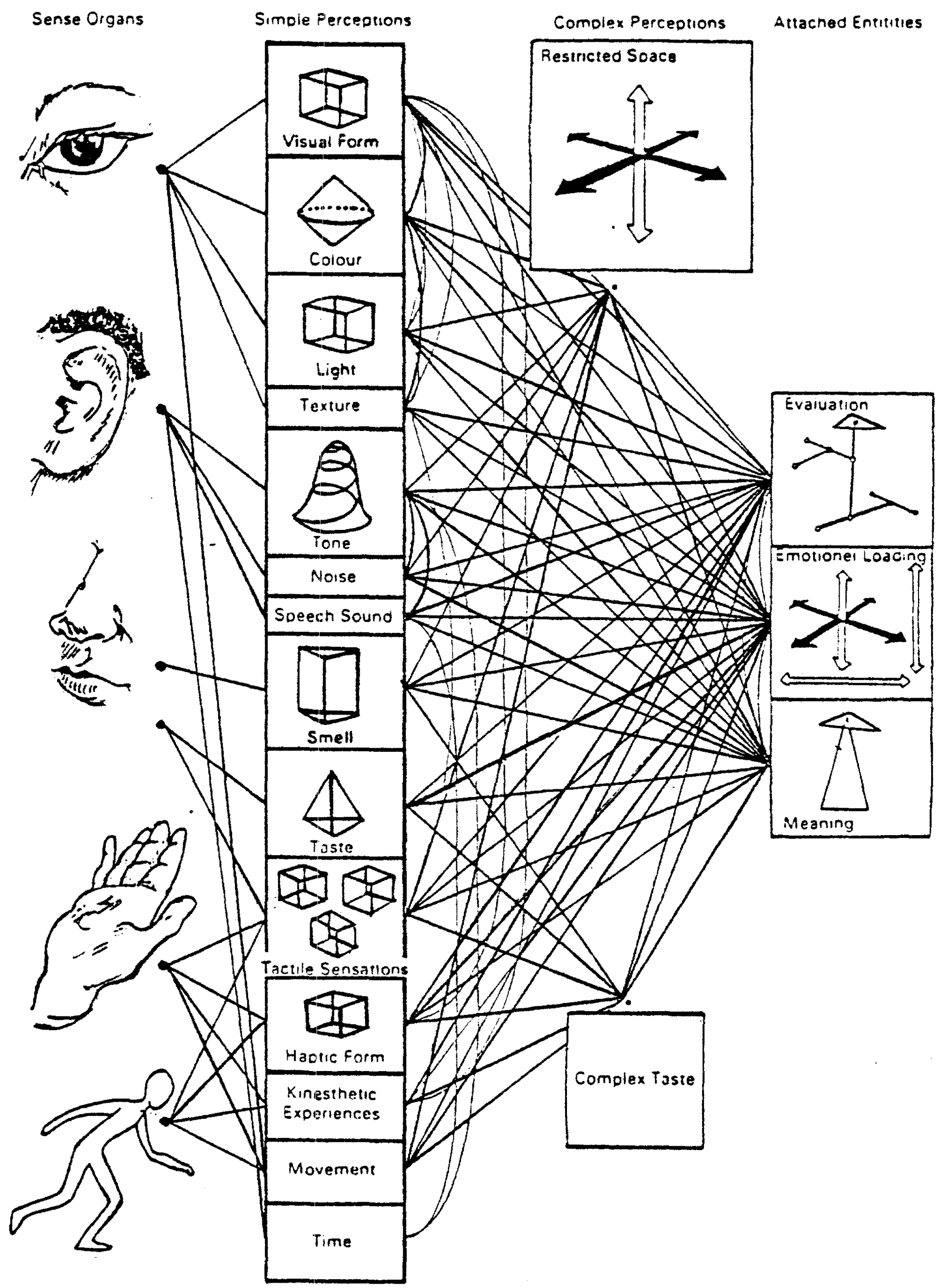
- It is therefore seldom, or never, possible to draw conclusions about the attributes of perceptions from the properties of single stimuli.
- A number of simple sensations associate with each other to form a more complex "basic concept" (light, form, color, sound, and other sensations, as well as memory and expectation play a large part) (Hesselgren, 1971, p. vii).

Hesselgren (1971) approaches architectural perception as applied perception psychology, and maintains that the two most important features of the perceptual process are (1) a clear distinction between the external physical stimulus and the mental perception and (2) that a distinct structure or pattern can be detected within the process. There are "inter-subjective phenomena and the perceptual process is structured accordingly" (p. 8). Figure II-10 illustrates, from Hesselgren's point of view, the inter-subjective phenomena in perceptual processes, as they relate to architectural theory.

Sensations do exist and are needed. The challenge is to create architectural structures that do not exceed the limits of optimal complexity or which are not over-monotonous. (If, in fact, what is "optimal" can be determined.)

Hesselgren (1971) suggests that these basic perceptions, without their contextual meanings being taken into account, "are usually evaluated aesthetically--either positively or negatively" (p. 12). The subject's reaction to a perception may be either silent evaluation and/or overt behavior. Figure II-10 provides a graphic representation of the evaluations which can be included in the silent processes of perception.

a. Basic Perceptions



b. Architectural Evaluations

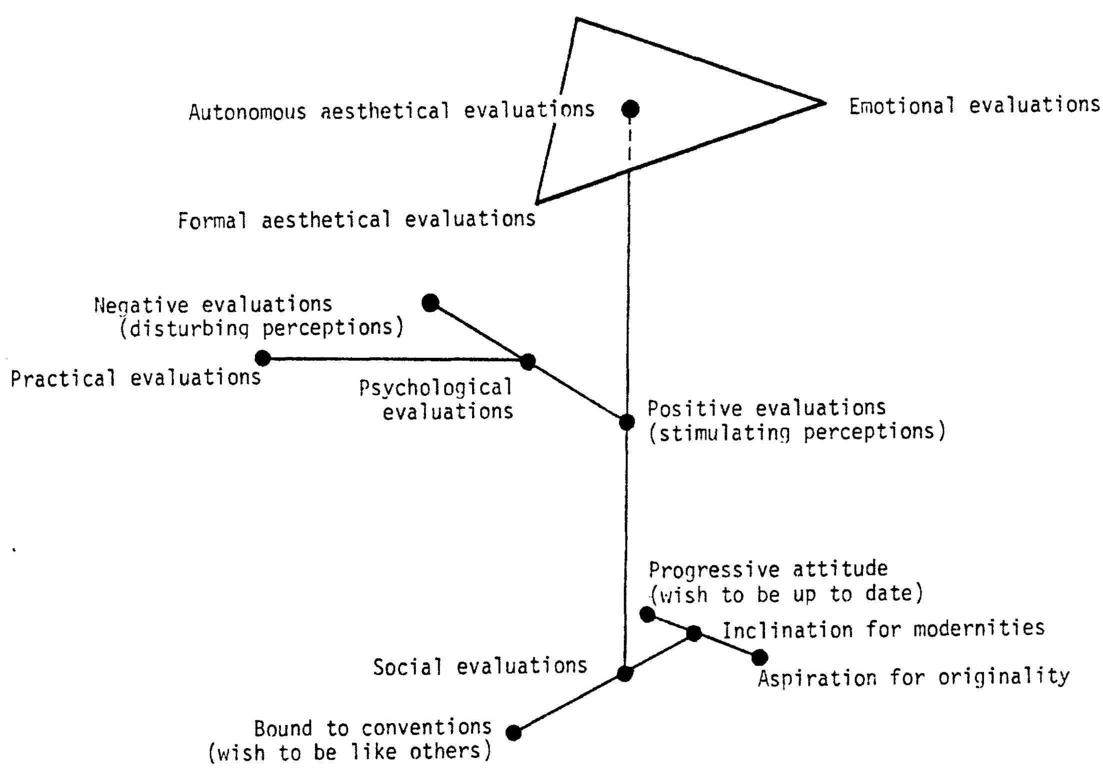


Figure II-10. Perceptual Processes and Architectural Evaluations Pertinent to Architectural Perception.

Source: Hesselgren, S. Man's Perception of Man-Made Environment. Stroodsburg, PA: Dowden, Hutchinson & Ross, Inc., 1975.

In addition to the information gained via perception, experience contributes to the <u>meaning</u> attached to the information perceived from any stimulus. Meaning and perception are therefore closely related (Hesselgren, 1971).

Architectural Meaning

Hesselgren (1975) suggests that architectural meaning is added to perception spontaneously but should be considered and evaluated for itself. If architecture is to be comprehensible, he contends that the user must perceive the same meaning in a form as the designer does. Accordingly, the role and nature of meaning needs to be considered. He has proceeded to do this under the heading architectural expression and presents the idea that "meaning" may be related to perception in three ways: (1) conventionally--implying conscious or unconscious agreement; (2) associatively--according to the laws of association; and (3) spontaneously--according to some natural relation.

Hershberger (1969) suggests that the meaning of the concept "meaning" has various meanings for architects. It may be a "mental" phenomenon; it may be an object's function; it may be a necessary product of a sign or symbol process. Its nature and characteristics when applied to architecture grow out of an interest in many fields of study. Many architects and philosophers have shared the notion "that meaning is a 'mental' event; that it deals primarily with 'images,' 'ideas,' 'concepts,' 'thoughts,' 'feelings,' etc." and this has provided the basis for <u>mentalistic theories</u> (p. 18). <u>Behavioral theories</u> have sought to promote meaning as an overt phenomenon which is observable and as a hypothetical construct or intervening variable "which while

existent is not central or crucial to the activities of behavioral scientists" (p. 19). Another notion which supports disposition theories is the one whereby the meaning of a stimulus: object, event, sign, as a "disposition to respond" is considered. The meaning is not observable but can be inferred from the response. Stimuli and responses are also studied in support of mediational theories. The model of meaning advanced by Osgood, Suci, and Tannenbaum is a well-recognized example within the mediational category. It is this model which provided the basis for the "semantic differential" technique incorporated into the evaluation instrument developed for the ENERSENSE substudy.

Osgood et al. (1967) in support of their two-stage model in which the semantic differential technique is grounded argued that:

> Whenever some stimulus other than the significate[6] is contiguous with the significate, it will acquire an increment of association with some portion of total behavior elicited by the significate as a representational mediation process. . . . process (a) being some fractional part of the total behavior elicited by the significate and (b) producing responses which would not occur without the previous contiguity of non-significate and significate pattern of stimulation (p. 5).

The following diagram, Figure II-11, and explanation illustrates that argument:

S' ———————— A ————————> Rt

S ————> rm <- - - - - - - - - sm ————> Rx

Figure II-11. Mediational Model

Source: Osgood, et al., The Measurement of Meaning, Chicago: University of Illinois Press, 1967.

[6] significate--any stimulus which, in a given situation, regularly and reliably produces a predictable pattern of behavior.

. . .this stimulus-producing process (rm-sm) is representational because it is part of the same behavior (Rt.) produced by the significant itself (S)--thus the buzzer becomes a sign ([S]) of shock (S') rather than a sign of any of a multitude of other things. It is mediational because the self-stimulation (Sm) produced by making this short circuited reaction can now become associated with a variety of instrumental acts (Rx) which "take account of" the significate--the anxiety state generated by the buzzer may serve as a cue for leaping, running, turning a rachet, or some other response sequence which eliminates the signified shock. (p. 6)

It was emphasized that meanings for primary "perceptual signs" would not vary across individuals in the same culture but that meanings of some signs would be effected by individual experiences. Hershberger (1969) combined the "mentallistic" and "mediational" theories and promoted the idea that for architectural purposes useful indices of meaning may be derived from asking persons to indicate what they feel or think about an object. His model of meaning does not assume that meaning is only dependent upon external sign phenomena. The basic model is presented as follows:

So----->(rm sm----->RmSm)---------->Rp

The symbols within the parentheses are intended to encompass "meaning" or the "representational mediation process." The stimulus (So) is responded to (rm) in the sense that it, or that to which it refers as a sign, is "represented" in the human organism. . . .We "see" the building, we "recognize" the sound of footsteps, we "feel" the wind in our hair. We have an "image" of one kind or another of some outside object or event. We do not internalize the object or event. We do not internalize the objects or events to which they refer as signs; we internalize only representations of them. Those representaations, whether sensation, percept, concept, or whatever, in turn serve as the mediated stimulus (Sm) for a mediated response (Rm). . .the mediated response (Rm) might consist of any number of changes in the human organism; either "mental" or "physical". . .the mediated response (Rm) is not to the object or event itself (So), but to our representations (RmSm) of the object or event. In its turn, the mediated response (Rm) may serve as a mediated stimulus (Sm) for a subsequent behavioral (observable) response (Rp). That is, our thoughts or feelings regarding our representation of an external object or event tend to condition or predict our behavioral response (Rp) to the object or event itself (So) (pp. 24-26).

A person's experience, characterized by memories, purposes, and values, influences responses to the environment causing him or her to see what he or she wants or needs to see and then to filter out the rest. "When this selective representation (rm) in its turn serves as an internalized stimulus (rmsm) for our thoughts and feelings (Rm) about a stimulus object or event, these thoughts and feelings are again dependent upon experience" (Hershberger, 1969, p. 30).

Our overt responses are also conditioned by past experience, either through internal responses as mediators or through conditioning. Although individuals have different experiences, most people's thoughts, feelings, and behavior toward objects are the result of perceiving common salient characteristics in these objects, with the result that they are very similar. Hence, "most people belonging to the same social or cultural group will not vary too widely in the alternative representations of behavior toward familiar objects and events" (Hershberger, 1969, p. 31).

The model of meaning advanced by Hershberger (1969) is felt to have two advantages over other formulations. First, the two-stage model "corresponds more closely than do other models to the actual relationships of meaning to external objects and events (including signs); hence, it has descriptive value" (p. 35) and "Second, and more importantly, it has exploratory value in that it indicates the functional dependence of the second state of meaning on the first" (p. 35). Thus, the model provides a means through which to study user reaction to designed forms. "Taken together the architect has a

reasonable estimate of how people will behave in his buildings--not to mention how they will feel" (p. 35).

Within the two broad categories of internalized stimulus and internalized response exist several sub-categories of meaning. Presentational and referential meaning make up the representational or objective phase of meaning created through internalized stimuli, while affective, evaluational and prescriptive meanings comprise the response or subjective phase (Hershberger, 1969).

Hershberger (1969) advanced these distinctions in meaning relative to architectural theory and outlines them as follows:

- presentational meaning - "with our representation we separate the object from its context (field); perceive its shape, texture, color, etc., realize its status relative to us and other objects; and categorize it according to known objects and events" (p. 38).
- referential meaning - some forms act as signs or symbols of other objects or events. (In architecture a form may be felt to <u>express</u> the personality or attitudes of the architect.)
- affective meaning - after our representation is formed, memories, purposes and values enter, and further internal responses are evoked. <u>Feelings</u> and <u>emotions</u> result. This affective meaning then "comes in response to a representation of a stimulus object rather than as a result of the stimulus object itself" (p. 39). It is also felt to be a learned response which is influenced by training and experience. It is not

strictly internalized and is regularly accompanied by observable physical or mental responses.

- evaluational meaning - following upon representations and possibly in response to affective meaning, evaluational meaning is related to our critical attitudes and ideas rather than to only immediate feelings and emotions toward one object. Our purposes and values are central to the process.
- prescriptive meaning - it is a "disposition to respond" and is the result of having been affected by representations and by evaluating the representations and their effect. Thus, in allowing one to decide what to do, this type of meaning becomes our purposes.

"Given our representation of a building, how it affects us, our evaluation of it, and our decision as to what should be done, we act." (Hershberger, 1969, p. 42). That act is our response to meaning. That act, however, according to Hall (1969), may be interpreted by others as "expressing" our meaning, personality, or character.

Within the framework of meaning which has been presented it is possible to illustrate specific levels of architectural meaning. Hershberger (1969) has provided a comprehensive overview of these possibilities which are briefly summarized below. Those levels of architectural meaning which may be identified include:

- recognition of form - the most basic level of architectural meaning which first categorizes forms relative to other forms and second categorizes forms by relating them to such aspects as their size, organization, texture, spaciousness, etc. Hence, forms are categorized at the descriptive and adjectival

level. Architectural forms are seen as rough or smooth, large or small, etc.; characteristics and qualities are attributed to them. Perception of such characteristics, or attributes, is affected by experience and this then provides the basis for communication between "form creators" and "form users."

- recognition of status - this is based upon the relationship of a form to the observer; it is dependent upon previous experience and is relative to the recognition of the form's use or convention.
- recognition of use - forms are signs or symbols of their use. "In order to operate, to move about, to function in a building, it is of primary importance that the greatest percentage of spaces, forms and objects which we perceive in the building are recognized in terms of use" (p. 47).
- recognition of human function - in a house, interior spaces are named according to function. In addition, the structure functions to provide privacy and thereby is able to provide for one of individuals' needs.
- recognition of building - possibly more basic than "human function" is the meaning indicated by building elements in terms of their structural tasks or the environmental conditions they maintain.
- recognition of purpose - a non-verbal type of symbolism recognition of a form's purpose indicates how it may be used to fulfill either a physiological or a psychological role, or to indicate a social role or status.

- recognition of value - "Values can be expressed both relative to the forms themselves, the use and purpose of the forms, and independently of either" (p. 53). Social purposes which are highly valued in a culture, as well as cultural values, are often symbolized through architectural forms.

> The fact that these types of symbolism change much more rapidly than functional symbolism does not make them any less valid, "unessential" or "superficial;" it only indicates that society and culture change far more rapidly than do man's physical and psychic characteristics (p. 57).

- responsive meaning - levels of meaning which are turned inward: (a) affective meaning which may come in response to a form itself, or the use of a form. It may come in response to presentational and or referential aspects of meaning; (b) evaluative meaning which involves a reflective response, as our representations are evaluated; and (c) prescriptive meaning which involves recognizing the form, its use and its value and "in light of all our representations, affects, and evaluations, we decide what we will do" (p. 59).
- connotative meaning - in respect to functional objects it is difficult to make the distinction between denotation and connotation. However, in the case of architectural theory, connotative meaning is attributed to the qualities of the architectural object that indicate its use for some activity of man. Connotative meaning would then also include affective and

evaluative meaning, as well as expressive meanings. Whereas prescriptive meaning would seem to be a blend of both denotative and connotative aspects, as it is a summation of all other types of meaning and an antecedent of behavior.

Hershberger (1969) emphasized that there is a great deal to be learned from the connotative categories of meaning. To accomplish this he suggested first, that we can study similarities in how groups of people represent architectural objects; secondly, that we can study the affects of buildings representations on observers; and thirdly, that values, perceived qualities and emotional effects of building representations may be determined through such study.

> Such knowledge would, of course, provide the architect with considerable insight as to what in architecture is important to the people studied. It might also provide a rather good indicator of potential behavior (Hershberger, 1969, p. 63).

Thus, "meaning" is regarded as a dimension of architectural theory which, if considered in detail, as Hesselgren (1971) suggested, is something which can contribute to meeting user needs through design and consequently the acceptance of designed form by its users.

Architectural Scales

Experience has shown that problems do occur because the user does not attribute the same meaning to an architectural form or space as the architect had intended. It is acknowledged that there is (1) both

representational and responsive meaning (affective, evaluative, or prescriptive), with the latter being dependent upon the first, and (2) that the potential to predict behavior is present if meaning is understood (Hershberger 1974), the question remains, "How can user 'representations' and 'responses' be measured?"

Sanoff (1974) reminded us that, with today's rapid development, the designers of man's environment require more than intuition to be involved in directing those changes. Several persons in the environmental-behavioral-design disciplines have sought to improve upon intuition by developing a technique that would permit the study of architectural meaning through establishing dimensions of meaning relative to characteristic attributes of architectural forms. Vielhauer (1965), Canter (1968), Hershberger (1969, 1970, 1974), Craik (1969), Collins (1970), Seaton and Collins (1971), Hesselgren (1971, 1975), Sanoff (1974) have used measurement scales built upon the semantic differential technique as advanced by Osgood et al. (1957). That is, they have employed bipolar adjective scales to establish the mediational link between the architectural display (the significate) and the sign used to represent it (the word descriptors). The scales are presented as either a five, or seven-point continuum and for evaluation purposes each scale is treated as an ordinal scale comprised of equal

intervals between a positive and negative pole. The format described is illustrated in Figure II-12.

(Concept to be ranked)

(+) cheap	(--)	(--)	(--)	(--)	(--)	(-) expensive

Figure II-12. Semantic Differential Scale Format

Osgood's technique makes it possible to obtain "a description of the 'dimensions' of the emotions, preferences, etc. And if all subjects have the same associations we might apparently begin to discuss some kind of consensus" (Hesselgren 1975, p. 133). It has been felt that, since the method could be used to explore abstract concepts, such as words, that it might well be used to explore perceptions of architectural forms and that their dimensions of meaning could be determined by "factor analysis." Canter (1969), however, in exploring the three dimensions of meaning presented by Osgood (1957)--evaluation, potency, and activity--found little evidence of their existence when applied to architectural phenomena. But he did hypothesize that differences among groups of people and modes of representation could occur in the presence of specific dimensions that would change, relative to the emphasis of the main dimensions. Dependent upon his research he supported the development of measurement instruments based upon the semantic differential technique.

Seaton and Collins (1971) cautioned that a semantic differential applied to a stimulus object (building, etc.) might not yield

information equivalent to that gained when a semantic differential is applied to a stimulus concept (word-itself a sign). Hesselgren (1975) considered the same possibility and reached the conclusion that "semantic differential judgements, in combination with factor analysis, can well be used to verify--or perhaps to deny or modify--the results of an analysis based on introspection and phenomenological analysis" (p. 134). He does not think, however, that they can be as varied and detailed as the analysis done by Osgood which provides "detail factors described as 'morally evaluative,' 'aesthetically evaluative,' 'socially evaluative,' and 'emotionally evaluative'" (p. 134). This difference exists because Osgood is not measuring the "meaning" of concepts, thus there is no sign of equality between the word and the concept. Rather there is an emotional loading, common to the word and the concept, which is the "something" being measured (Hesselgren 1975).

The semantic differential technique allows the intensity of meaning to be indicated. This has enhanced the method's popularity for the measurement of architectural meaning as well as for its use in marketing studies. (Two areas which have sought to measure representational and responsive meaning.) In addition, the technique allows "N" dimensions of a concept to be explored, as any number of scales can be used to describe the concept to be measured, and it permits the researcher to tailor the instrument to fit the research situation (Cox 1969, Kasmar 1970). Kasmar (1970) and Hershberger & Cass (1974), however, stress the importance of appropriate descriptors: first, "to identify those architectural dimensions which are 'central' and

'peripheral' determinants of the perception of architectural space" (p. 155) and the elements within those dimensions; second, to have relevant and meaningful descriptors which can be used by various groups of people.

Various scales have evolved for built environment studies. Vielhauer (1965) initiated the quest for a lexicon of environmental descriptors, then introduced the concept of an Environmental Descriptor Scale (EDS), and finally developed an initial list of appropriate adjective pairs. Craik (1968) produced an Environmental Display Adjective Checklist. Canter (1969), Hershberger (1969), and Collins (1970) continued to advance the options of adjective pairs. Sanoff (1974) advanced his DAS (Descriptive Attribute Scale), which also was conceptualized around the semantic differential technique.

Thus, it can be seen that during the past decade there have been several contributions toward the measurement of meaning in the built environment based upon the semantic differential technique and factor analysis. Further study, however, is required as there has been only a minimal degree of similarity among the studies.

Of the literature reviewed, the studies conducted by Hershberger since 1969, would appear to give direction to any future research. The examples set by Hershberger having been duly perceived the INOVAC instrument in the present study was conceived in an attempt to make a meaningful contribution toward improving preconstruction predictive ability and post design evaluation by (1) studying the environmental comprehension of a specific lay group, (2) attempting to develop a comprehensive set of semantic scales applicable to innovation in interior designed environments, (3) analyzing the validity of the set

of scales, and (4) considering problems relative to the selection of media to represent the architectural environment to be used in conjunction with an architectural scale.

Visual Simulation

Small-scale representations of architectural forms, visual simulation, are the very essence of architectural practice (Seaton and Collins, 1971). Graphic or physical simulation is used regularly to determine the degree of match between the architect's design concept and the client's perception of the design's attribute. Even though simulation has been used extensively, the issues of reliability and validity are complex and have not been thoroughly examined (Seaton and Collins, 1971; Foruzani, 1977).

Foruzani (1977) states that "a simulator needs to establish the reliability and validity of his simulation technique before he can infer the behavior of the real from the simulated" (p. 2). His study, "An Investigation of Slide Projected Image in Panoramic Visual Simulation of Architectural Space," presents an extensive overview of recent simulation studies, compares the judgements of various media, and indicates that as yet there is no consensus as to which media--slides, photographs, line drawings, models, etc.--provide a "best" simulation method.

In his discussion of environmental simulation, Foruzani (1977) highlights several concepts which should be considered in developing a simulation testing tool if a more reliable testing operation is to

occur. He commenced his discussion by saying, "A simulation represents, in addition to the structural characteristics, the functional and dynamic aspects of the system over time" (p. 71); and continued by quoting Roser (1969) who said:

> Simulators, therefore, must try not only to build a model of system structure, but also to incorporate system processes. In doing so, they abstract, simplify, and aggregate, in order to introduce into the model more clarity than exists in the referent system.

Thiel (1970) recommended that researchers ask five questions in attempting to identify the primary forces and components which constitute a simulation:

1. Who is involved in simulation? (i.e., designer, user, manager)
2. What is simulated? (i.e., environment, response)
3. Why is it simulated? (i.e., pretesting, pedagogy, prognosis)
4. When is it simulated? (temporal order of each step of operation)
5. How is it simulated? (mode, fidelity) (Foruzani, 1977, p. 72).

Those questions establish five categories which can be considered 1) Human Component, 2) Phenomenological Aspects (environmental descriptions), 3) Purpose, 4) Temporal Order, and 5) Mode and Fidelity. The human component category involves the various groups whose individual characteristics and participatory patterns influence the design outcome. The differences between designers, implementors, and users, need to be recognized and considered. While phenomenological aspects provide a comprehensive framework within which they operate,

the reality of the situation can only be simulated if temporal, spatial, experiential and sequential components are considered and/or incorporated into the simulation. The third component of simulation, its purpose or goal, is instrumental in determining the format which should be followed. Simulation can be used (1) as a teaching device; (2) as a means of studying perceptual response to single or combined stimulus dimensions; (3) as a method of prognosticating future change; and (4) as a technique to pretest the degree of match between intended and actual systems performance. Indeed recent modeling research by Delong supports the utility of all four of the above.

The four levels of problem solving included in each stage of design development[7] include: (1) generation, (2) evaluation, (3) selection, and (4) elaboration. The level of problem solving at each stage can be facilitated by the appropriate mode of simulation, i.e., at the two initial stages two dimensional graphic simulation may be adequate. Hence, attention should be given to the temporal order category of simulation. Finally, the mode and fidelity of simulation is contingent upon recognizing the temporal order of the design development. The problem has been described as one of selecting the most relevant variables, not all possible variables, to constitute an abstraction of reality. It may vary from being very abstract to

[7]design development - progresses in stages from highly schematic and conceptual alternatives through refinement and elaboration until a desirable, detailed solution is obtained.

looking like the real world, i.e., iconic simulation which "looks like" the subject of inquiry as in photographs; analogial simulation which transforms one set of properties for another as in structural plans; or symbolic simulation which represents characteristics and interrelationships through symbols as in mathematical formulas (Foruzani, 1977).

The components advanced by Foruzani (1977) have provided a basis upon which to develop the simulations of innovations included in the present study. Each component could, in itself, be an area for research, and, even though not researched individually, each has evoked an awareness of the complexities of simulation that have influenced the planning of the simulation operation and, consequently, should have resulted in its being a more reliable simulation of the real world. This in turn should enhance the potential of the study to make inferences about the real from the simulated.

Architectural Innovation and Energy Conservation

> The process of innovation is crucial to any proposal for energy conserving building design. Attempts to introduce new building products and construction processes may fail if they cannot be easily integrated into conventional practice. New concepts or methods of architecture and engineering may fail if design professionals do not take them up. Even the most agreeable innovations may fail to the extent that they do not take into account established consumer preferences, financing methods, or building codes and standards. . . .Energy-conserving building technology thus presents a classic problem for innovation planning (Watson, 1979, p. 278).

Innovations as summarized in Figure II-13 are required in the institutional parameters of the building industry.

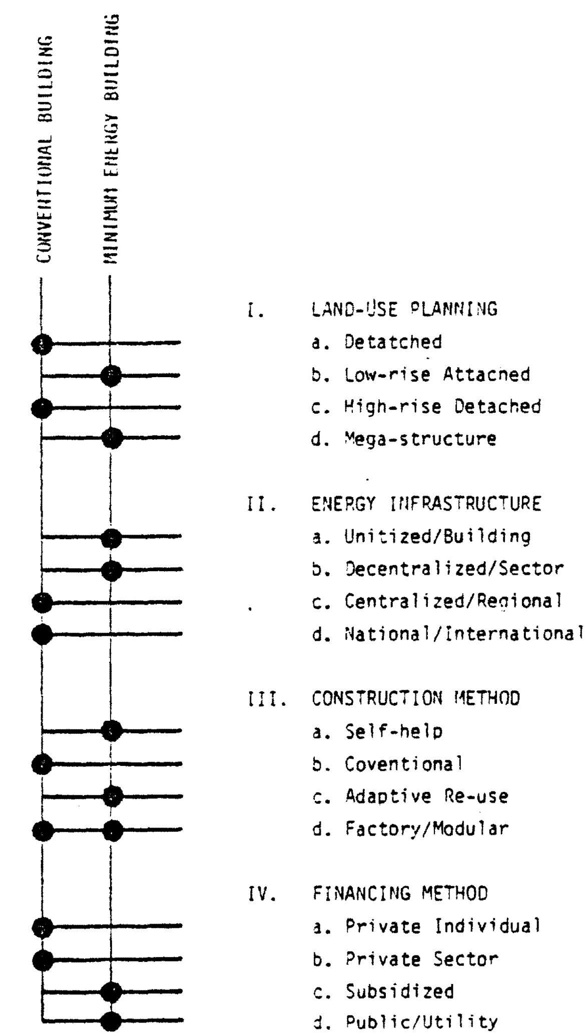


Figure II-13. Comparison of Conventional Buildings and Minimum Energy Building in Terms of Institutional Parameters

Source: Watson, D. Energy Conservation Through Building Design. New York: McGraw Hill Book Company, 1979.

Watson (1979) suggests that the ladder of innovation, Figure II-14, is already in place but will require that the designer play a more active coordinating role in selecting between planning, design, and construction alternatives already in the marketplace.

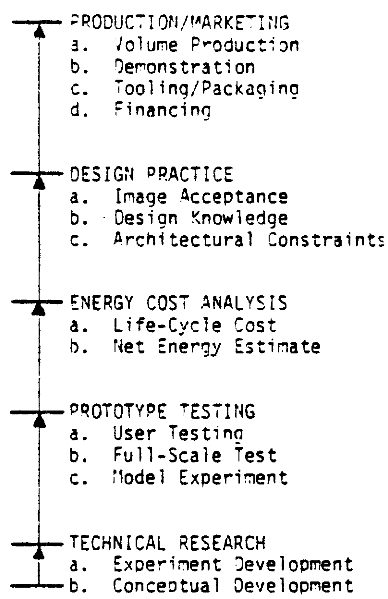


Figure II-14. The Ladder of Innovation

Source: Watson, D. Energy Conservation Through Building Design. New York: McGraw Hill Book Company, 1979.

In acknowledging that innovation is likely to encounter constraints in the area of design practice, "due to established architectural practices, or the unfamiliarity with the concept, or lack of consumer acceptance of the resulting building design" (p. 288), Watson

(1979) proposed several mechanisms to overcome Design Practice Barriers. These are summarized in Figure II-15.

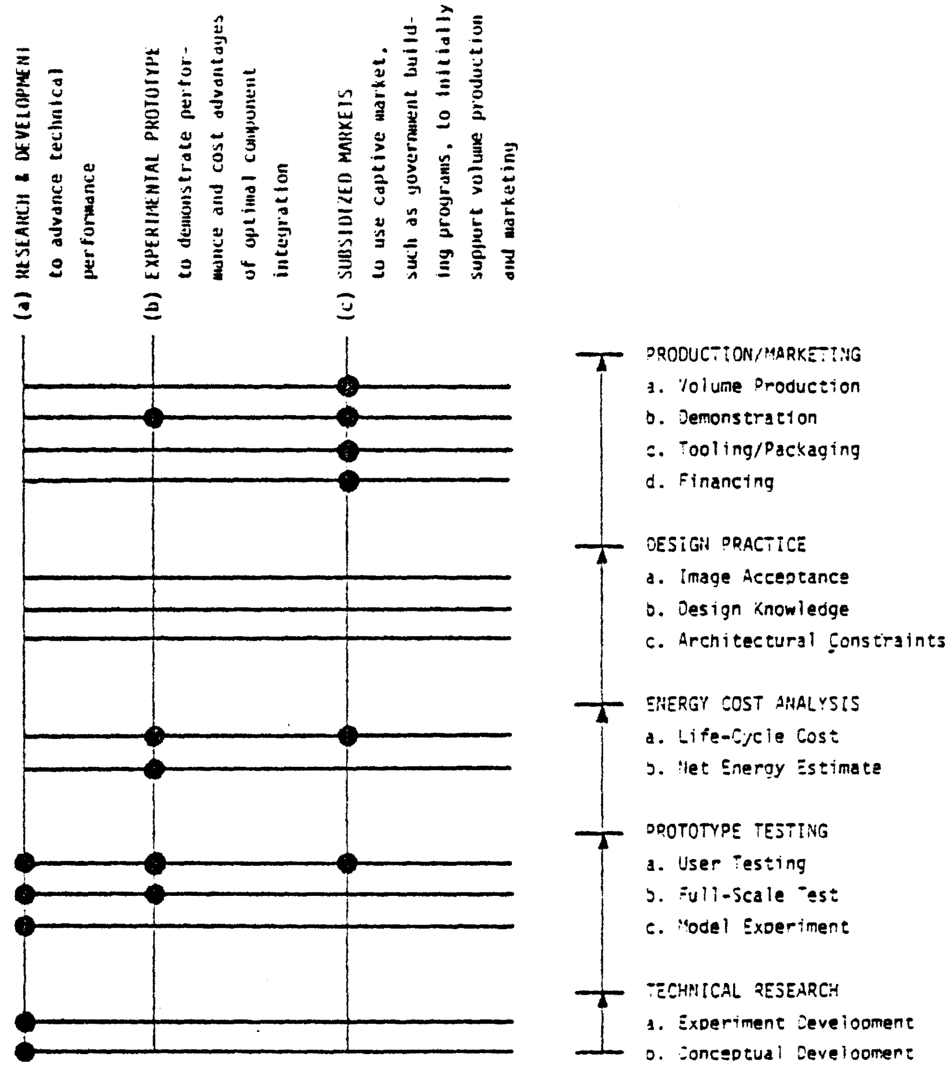


Figure II-15. Proposed Innovation Mechanisms to Improve Energy Conservation Design Practice

Source: Watson, D. Energy Conservation Through Building Design. New York: McGraw Hill Book Company, 1979.

Watson (1979) points out that new design concepts can be considered a liability as a resaleable product; or conversely, a concept promoted for energy conservation may have market acceptance disportionate to its real energy effectiveness. Consequently, he supports the idea that

market research and advocacy programs at the local marketing and financing institutions should be encouraged (Watson 1979).

But overcoming design practice barriers alone is not possible, nor is it sufficient. Watson (1979) echoes others in saying that "the innovation effort must address the land use and financing conventions, energy infrastructure, and construction methods that predetermine the design solution, particularly as to its net energy effectiveness" (p. 293).

Stein and Serber (1976), Marshall and Ruegg (1977), and Spielvagel (1979) illustrate financial and planning innovations. Their findings support the idea that life cycle costing is important, but illustrate that, given a "lowest first-cost" market mentality, mechanisms to encourage a future planning perspective for ultimate savings in capital are needed.(Watson 1979)

A better use of existing resources, including techniques of recycling, renovation, and design of long-life buildings and products is an example of how technical innovations can affect energy consumption. Eccli (1976) in advancing the concept of "appropriate technology," illustrated how technical innovation could improve environmental and social conditions through grass-roots efforts which combined job training with both sweat-equity efforts and modestly-scaled building technology.

It has been argued that social change is completely dependent upon advances in technology. Evidence against this argument has been presented earlier in the discussion on social change and its management.

Watson (1979) stresses "that the technology already exists, as do the required expertise, production capacity, and labor force, to put energy conservation into effect. What is needed are programatic social and economic incentives" (p. 297). He summarizes the relationship of innovation concepts and energy conservation in building design in Figure II-16. Several points are involved but Watson (1979) makes the point that the challenge can be met if "a number of small efforts are made simultaneously" (p. 298).

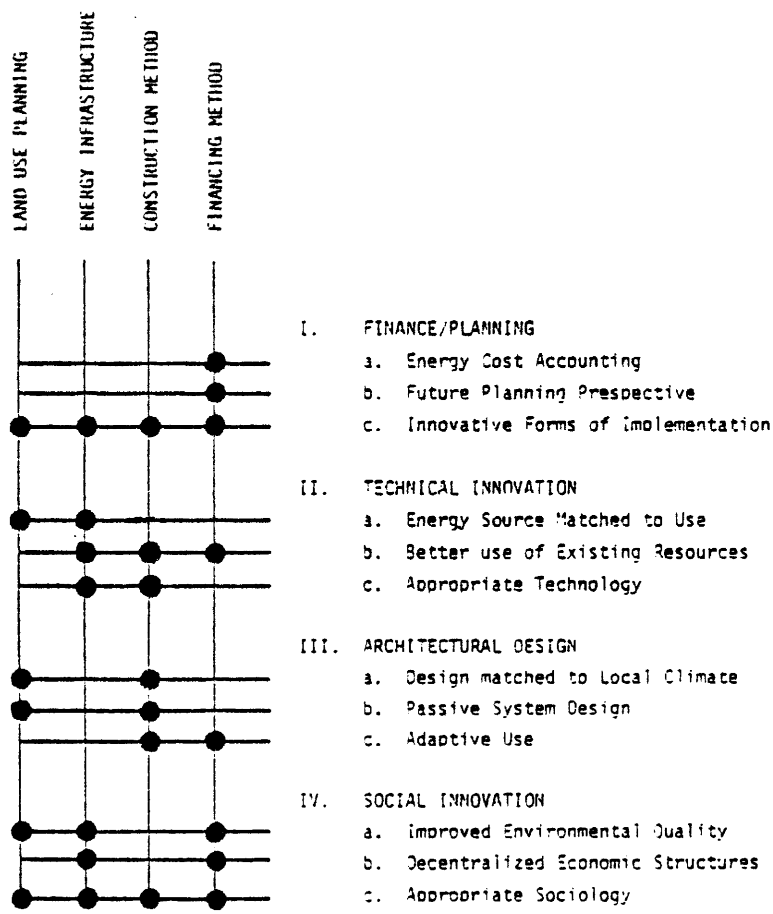


Figure II-16. Energy Conservation Through Building Design: Summary of Innovation Concepts

Source: Watson, D. Energy Conservation Through Building Design. New York: McGraw Hill Book Company, 1979.

Environmental Planning Perception Behavior and Assessment

In recent years a number of people have come to share the conviction that it is essential to know more about people's environmental perceptions and behavior in order to understand their environmental decision-making. An interdisciplinary field of study has evolved that "seeks to combine the insights of social and behavioral sciences with the skills of the design and planning disciplines" (Saarinen 1976, p. xi).

With the realization that energy is a finite resource has come the realization that it is necessary to make sensitive adjustments to avoid actions with severe adverse effects. "Whether considering the built environment, the natural environment, or the social environment, it seems clear that fundamental changes are likely to occur in people-environment interacts" (p. 2). As people strive to conserve energy it is essential that they examine the people-environment relationship. Contributions to that examination can be made by environmental psychology, environmental perception, man-environment relations, environmental design, to list only a few. Many approaches have been taken on a variety of topics in pursuit of understanding the people-environment relationship. Now, faced with the problem of conserving energy, the public should recognize that the potential for acquiring solution(s) lies in delving into this interdisciplinary field of study.

Saarinen (1976) offered some definitions which are basic to environmental planning:

- environment - conditions that affect and influence the growth and development of organisms
- social environment - composed of other people
- natural environment - weather, climate, and other physical processes of the earth
- behavioral environment - the portion of the environment that elicits a behavioral response or toward which behavior is directed
- social perception - the effects of social and cultural factors on our cognitive structuring of our physical and social environment. (Depends upon stimulus, capabilities of sense organs, past experiences, present attitude, and expectations; usually inferred from behavior or other indirect sources).
- environmental behavior - overt and subjective responses to environmental factors
- planning - the conscious organization of human activity to serve human needs. To be effective, planning must consider not only the physical environment but also the way people perceive and utilize each segment of the environment. . . .Whatever the scale, such planning requires great stress on the evaluation of results and on the use of objective measures of success or failure (pp. 6-8).

The field of environmental planning has four major characteristics (1) It has evolved during the past decade building upon older roots of ideas and concepts which supported the focus upon environmental perception and behavior. (2) The methodology has been developing around the tendency to abstract from total behavior in real-life situations, and it turns to the potential afforded by the controlled field-experiment or quasi-field experiments. (3) The search for planning applications related to current environmental problems, e.g., resource management, residential design and planning is also a characteristic. Throughout such studies there has been a strong emphasis on providing information beneficial to public policy decisions. (4) Lastly, the field is interdisciplinary in nature and through the free flow of methods, concepts, and measuring techniques across disciplinary lines, it may be possible that it will be a unifying factor for the social and behavioral sciences. Possibly it will also provide links between the planning and design professions, and the other sciences (Saarinen 1976).

It has been recognized that the communication process is fundamental to environmental planning. Downs (1976) offered a schema (Figure II-17) to aid in understanding the process whereby "people are viewed as decision makers. Their behavior being considered to be some function of their image of the real world, and they are regarded as complex information-processing systems" (Saarinen, 1976).

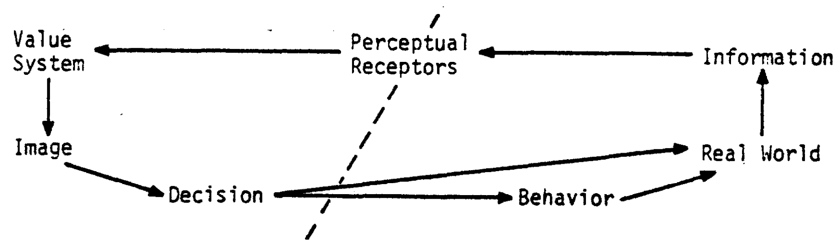


Figure II-17. Downs Conceptual Schema for Research Into Geographic Space

Source: Downs, Roger M. Environmental Planning Perception and Behavior by T. Saarinen, Boston: Houghton Mifflin Company, 1976, p. 10.

As illustrated in Figure II-17, the reason people see the same segment of the world differently is that the physiological "filters" of our sense receptors and such psychological "filters" as language, social class, personal values, need and culture screen incoming information (Downs 1970).

Delong (1972) stated that:

> It is through the communications process, internalized relatively early in life, then that the organism establishes a way of relating to both his physical and social environment. And the specific manner in which he does so irretrievably marks him as a member of a group, a group to whom his allegiances are conservatively drawn, emotionally reinforced, and neurologically guaranteed (p. 283).

Thus, it can be seen that the premises offered by Delong and Down reinforce the assumption that insight into the communication process is elementary to understanding why it can be said that the environment is not seen as it really is but rather as it is perceived to be. In

addition, Delong's theory assists in explaining why people may be resistant to change. It emphasizes that points of view will vary across groups. Consequently, points of view need to be recognized and dealt with to facilitate effective environmental planning and design and to avoid a visual-semantic communications gap (Saarinen 1976). Also essential to effective planning is the realization that the environment is comprised of interlocking units, which vary in scale from components in rooms to urban and even international settings. Each is a system operating within the larger system and influencing behavior accordingly.

An ecological approach provides an avenue by which to consider the various factors within these systems and their relationships. For example, at the people-machine level within the systems' hierarchy, consideration must be given to both physical and psychological dimensions because the level includes both human and nonhuman components. Residential innovations such as window treatments designed to conserve energy, as an example of this level, also affect other levels in the system's hierarchy. Thus, their physical and psycho/social impact, or lack of impact, should be considered in the environmental planning and design measures conceived to promote energy conservation.

Watson's (1977) endorsement of the principle of an ecosystem approach in housing, an another level, is evident in his concept of "ecodesign." Through ecodesign he suggests that houses can be <u>planned</u> which will require minimal mechanical intervention and as a result will

be more energy efficient. Through his building designs he illustrates how to optimize on natural environmental factors and develop a residence that is integrated into the total hierarchy of systems.

Saarinen (1976) suggested that plans and designs be considered experiments. An extension of that sentiment would be to suggest that planning be considered a cyclical entity in which one experiment provides predesign planning for the next experiment. Continuing on this theme, Studer (1970) called for evaluating planned environments to assess whether or not they were congruent with the needs or goals of the participants. Perin (1970) also called for the "congruent environmental response." Through evaluation of experiments we would be better able to work with the world and its complexities. Saarinen (1976) made the point that, "planning that fails to consider the activities of the main participants in a particular segment of the environment has been seen to create more problems than it solves" (p. 243). Partial planning has not been uncommon. The reason often suggested is that public and professional people involved in environmental decision-making are too "parochial" in their perspectives. Unfortunately, this parochialism appears to exist at all environmental scales.

Ostrander (1974) describes the problem as "the visual-semantic communication gap" (p. 47) and contends that "the designer-architect places considerable reliance upon visual modes of cognizing and communicating, while the behavioral scientist turns to the semantic mode" (p. 48). This theory of visual-semantic communication, based upon

brain hemisphere dominance information, may well be extended to include the user population and give direction to promotion and evaluation processes. That is, the idea that "a picture is worth a thousand words" should be taken seriously in conceptualizing environmental design planning and evaluation methodology. Lynch (1960), Appleyard (1969), Downs (1970), and Saa (1970) have made contributions toward this end relative to the greater urban context while Vielhauer (1965), Collins (1971), Hershberger (1974), and Hesselgren (1975) have advanced the concept in relationship to buildings and their near environments. The scales developed by these researchers in relationship to architectural forms have resulted in there being a limited number of guidelines for environmental planning and designing. Others are still needed.

However, a variety of other methodological and empirical studies, relative to environmental planning perception and behavior, has been undertaken in recent years. The body of knowledge is evolving. Now the "energy crisis" has provided a common cause around which to rally and this author suggests that the contribution that the general body of theories which have been evolving needs to be considered seriously. If the interdisciplinary solution(s) which the "energy problem" demands are to be found, the benefits of such interdisciplinary research, communication and cooperation are mandatory.

Summary

Seven major areas of literature have been reviewed. A close examination lends credence to the contention that energy conservation is an interdisciplinary topic, and that the content areas reviewed have all contributed to understanding the many environmental factors that should be considered and related to residential energy conservation.

Through the investigation of activities related to energy conservation the complexities of the energy problem have been identified. Energy conservation was related to the phenomenon of social change and the role of communications was considered in relationship to consumer behavior and attitude change. Consumer behavior and its relationship to residential space was considered through reviewing factors and concepts contained in the body of knowledge collected under the heading "human residential space transaction research and theory." Lastly, the scope of human behavior and perception which might impinge upon energy conservation in the total environment was investigated through an examination of concepts and theories presented in the area of study called environmental planning. Thus, an attempt was made to consider the topic of energy conservation within the interrelated factors of the total environment.

Many factors influence implementation of conservation practices. Therefore, such a basis as that provided by the review of literature was felt to be essential preparation for evaluating a residential energy conservation program which was part of a plan to encourage

social change. As a result many disciplines have either directly or indirectly contributed to the ENERSENSE research study.

This review has served to reinforce the author's view that quality of life is dependent upon the interdependence of the environment, design, and the use of energy. Moreover, the study of energy, while crossing boundaries, can also serve to connect previously untapped resources, and these can assist in meeting technical and social needs.

CHAPTER III

RESEARCH STUDY

Scope of the ENERSENSE Study

ENERSENSE consisted of two phases. Phase I, a field-testing exercise, involved the delivering of the multi-media program on energy conservation in the home to residential consumers in 30 Tennessee counties. This field-testing was accomplished through "in place" networks: (1) the Agricultural Extension Service Home Economics Agent system (AESHE), (2) the State's radio networks, and (3) the State's television networks. It used six media treatments which had been developed in 1977 for a "total communications effort". All six treatments were tested over a five-month period, along with an "agent only" effort (Treatment 1 and Treatment 2). A further description of Treatment 1 and Treatment 2 follows later in this chapter as does a description of the segment of the study completed for dissertaion research.

Phase II, an evaluation process, followed at the end of Phase I's communications effort in an attempt to evaluate: (1) the impact of the ENERGY CONSERVATION IN THE HOME multi-media program on the AESHE agents and their female clientele, and (2) the performance of the delivery systems, i.e., AESHE agents, radio, and television.

Target Population

The AESHE's female clientele served as the target population for the ENERSENSE project because precedents had been set by Home Economics

Extension Programs. The AESHE programs, in both Tennessee and other states in the nation, have provided information and/or presentations on topics of current concern to residential consumers. Home Demonstration Clubs, special interest meetings, home visits, the press, radio, and television have been used to expose those topics. Thus, the ENERSENSE multi-media program was developed with this target population in mind. However, consideration was given to the consumer population who might only be exposed to the program's energy conservation materials developed for radio and television. The need to determine the impact of the program and the effectiveness of the delivery systems was recognized. For that reason a controlled field experiment utilizing four evaluation strategies was designed to assess consumer, agent, and media delivery aspects of the program.

Controlled Field Experiment

To measure the impact of the multi-media communications effort under natural conditions, 30 of the 95 counties within the State of Tennessee were selected for the controlled field experiment (CFX). Selection was relative to the criteria outlined in the section, Selection of Counties for Experimentation. The 30 counties were randomly assigned to Comparison Groups A or B. Group A counties were designated to receive any one or all of the campaign's six media-treatments while Group B counties were formed into the control group. To establish the net difference between the control and treatment groups' responses to the treatment(s), four evaluation

strategies were used. They were as follows: (1) Strategy I: Post-test only mail survey using a questionnarie (Instrument I) sent to a sample of 3200 consumers in 14 counties (Group A:Group B in a 60:40 ratio); (2) Strategy II: A post-test interview (Instrument II) of 100 consumers who had completed the questionnarie (Instrument I) (Group A:Group B in a 50:50 ratio); (3) Strategy III: Pretest/Post-pretest/Post-test, a checklist (Instrument III) administered to AESHE agents in the 30 experimental counties; (4) Strategy IV: Media monitoring of the multi-media program delivery via mass communications and agent system as well as the delivery of other residential energy conservation information and/or materials delivered through other sponsors during the five month experimental period.

The relationship of the six media treatments and four evaluation strategies to the 30 experimental counties is presented in Table III-1.

Comparison Groups

Selection of Counties for Experimentation. Of the 95 counties within the State of Tennessee, fourteen were identified as experimental. These fourteen counties had the potential for receiving all of the six experimental treatments outlined in the section on Treatments, because they had these characteristics: (a) "clean" TV reception or (b) at least one radio station using the "Home and Garden Show" (a radio program organized by AES for presentation on a regular basis).

TABLE III-1

RESEARCH DESIGN OUTLINE BY COUNTY

Experimental Counties	Treatment Received	Evaluation Strategy
Group A_1	T1 T2 T3 T4 T5 T6	I, II, III and IV
Shelby		
Roane		
Loudon		
Knox		
Sevier		
Hawkins		
Washington		
Johnson		
Group B_1	All Treatment Withheld	I, II, III and IV
Chester		
Henderson		
Dickson		
Williamson		
Hamilton		
Bradley		
Group A_2	T1 T2	III and IV
Dyer		
Carol		
Lincoln		
Giles		
Franklin		
Cannon		
Cumberland		
Greene		
Group B_2	All Treatment Withheld	III and IV
Tipton		
Weakley		
Wilson		
Mergs		
Polk		
Fentress		
Trousdale		
Jefferson		

Using the convention that a "clean" TV reception county is one that is within a TV-market's Area of Dominant Influence (ADI) and has Class A reception from that market only (i.e., does not receive strong signals from other TV markets) as a selection characteristic facilitated the designation of experimental counties and limited the number of counties to fourteen. Limiting the experiment to "Home and Garden Show" counties had the additional advantages of permitting (a) concentration of effort to get broadcast stations to use the messages, and (b) concentration of subsequent evaluation/measurement efforts and resources into a smaller area, thus making the likelihood of measurable effects greater.

The 14 counties fulfilling those conditions are listed below:

Comparison Group "A":

Memphis area:	Shelby County
Knoxville area:	Roane, Loudon, Knox and Sevier Counties
Tri-Cities area:	Hawkins, Washington, and Johnson Counties

Comparison Group "B":

Jackson area:	Chester and Henderson Counties
Nashville area:	Dickson and Williamson Counties
Chattanooga area:	Hamilton and Bradley Counties

Figure III-1 indicates the geographic location of all Group A and B experimental counties.

Possible methods for assignment of counties to the two comparison groups. The fourteen experimental counties are sub-units within the

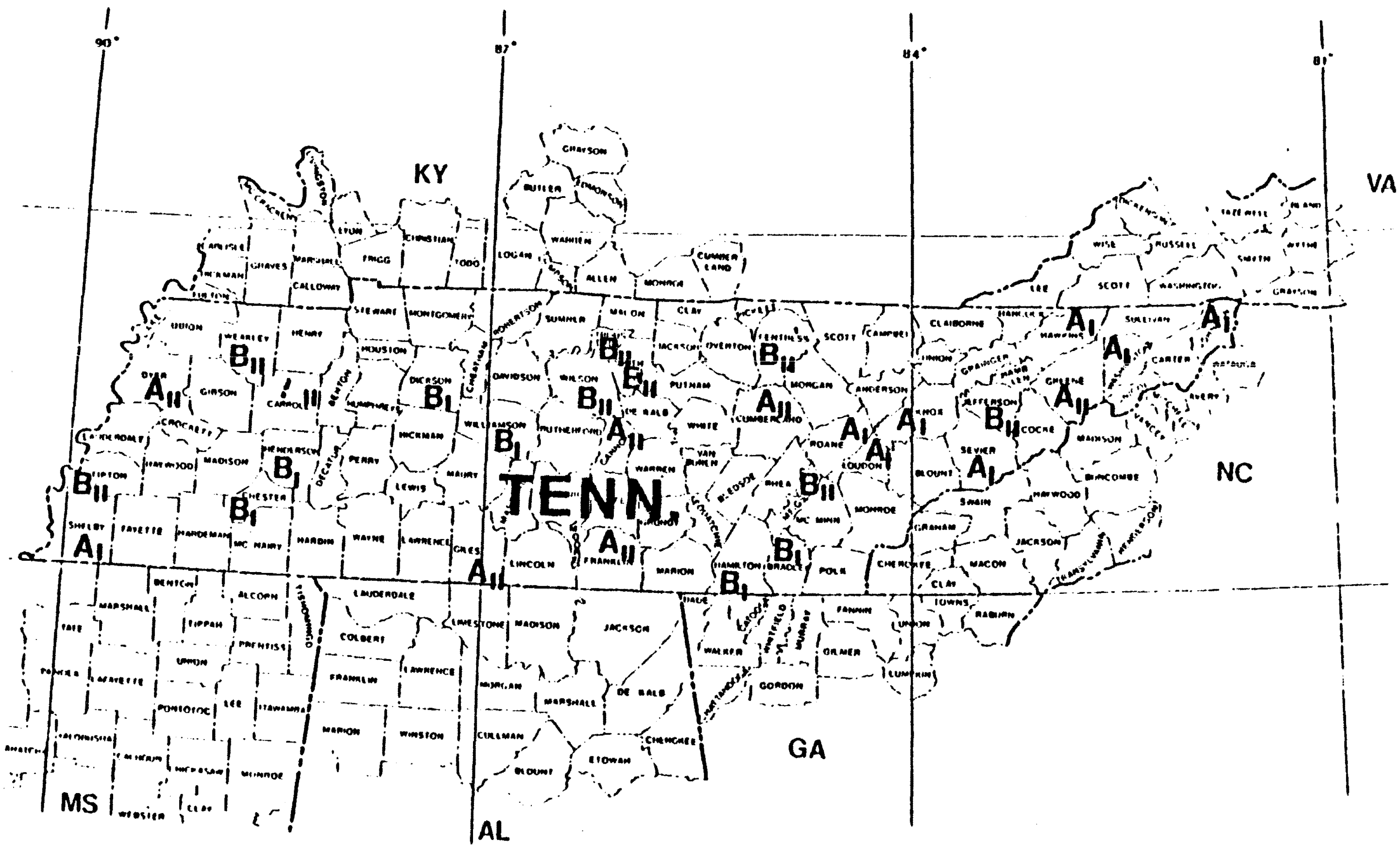


Figure III-1. Counties by Comparison Group

Key: A_1 Control Counties
A_{11}
B_1 Treatment Counties
B_{11}

State's six television markets. Thus the experimental counties comprise only six experimental units (areas). Several methods of assigning the counties contained in the six experimental areas to two comparison groups (A and B) are possible. The methods of assignment recommended for consideration by Haskins (1978) are identified and discussed below:

1. Subjective assignment to either Group A or Group B on the grounds of geography, availability of high "cooperation," population size, or any other grounds, is indefensible scientifically and would result in a biased pseudo-experiment with invalid data.

2. Matching of areas by common characteristics is also indefensible, because of subjective biases inherent in the process.

3. Simple random sampling or simple randomization is a pure procedure statistically, if the sampling frame is simple. However, with a total population having a limited number of experimental units, this pure probability method could accidently result in two widely disparate comparison groups that could yield data, confounding the communication effects.

4. Systematic randomization into two or more groups is equivalent to interval sampling from a list (i.e., assignment on an ABABAB basis with areas listed in some non-purposive sequence based on geographical location or size or alphabet-name, etc.). This method has the same drawback as simple random sampling--the possible chance separation into two disparate groups which would confound the effects.

5. Stratified systematic randomization is systematic randomization on strata, which, in order to avoid confounding effects, have been based on crucial characteristics in the two groups. To accomplish this particular form of randomization experimental units (counties) are ranked according to the crucial characteristic(s) assigned to each comparison group.

This last procedure may create problems for the statistician but, due to the identifiable characteristics of the limited number of experimental units available, it was chosen as the most workable and valid procedure for distinguishing treatment effects in the ENERSENSE experiment.

"Broadcast circulation volume" (BCV) was selected as the most crucial characteristic on which stratification could be determined. "Broadcast circulation volume" is a quantity representing the estimated maximum number of multi-media program broadcast minutes that a person could be exposed to during the campaign. For example, a person in Shelby County had the potential of receiving 464 broadcast minutes. While a person in Dickson County could only receive 222 minutes.

"Broadcast circulation volume" as the crucial stratification characteristic was employed with the following assumptions:

(1) The target audience is defined as AESHE clients.

(2) A client can attend only one broadcast station at a time, whether radio or television.

(3) A client's station attention is largy confined, though not limited to, stations located within her own county.

(4) The average broadcast attention time per client is approximately equal across counties.

(5) A client's probability of listening to any one station is the reciprocal of the total number of stations receivable (1/x).

(6) The total amount of broadcast attention by a client, or the probability that she will be attending to any station at any specific time, is not affected by the number of stations available.

(7) A broadcast message is omnipresent within a county; therefore, if the receiver is present and in working order, there is no physical limitaion on the number of clients who may attend a particular broadcast message (contrary to print media, which are somewhat limited by the physical numbers circulated).

The estimated "broadcast circulation volume" was computed individually for each experimental county, then the area BCV mean (over all counties) was computed. This resulted in the following ranking of areas by estimated BCV:

Rank	Area	Broadcast Circ. Vol.[a]	Counties
(A) 1	Memphis	464	Shelby
(B) 2	Jackson	403	Chester, Henderson
(A) 3	Chattanooga	370	Bradley, Hamilton
(B) 4	Knoxville	356	Knox, Loudon, Roane, Sevier
(A) 5	Tri-Cities	283	Hawkins, Johnson, Washington
(B) 6	Nashville	222	Dickson, Williamson

[a] Circulation = maximum estimated number of broadcast minutes per station (radio and television) for campaign messages; figure reported is mean per county.

Simple systematic randomization of the above rankings (ABABAB) would result in a systematic circulation bias in favor of Group A containing the off-numbered ranks.

Therefore, the AB-BA-AB randomization sequence determined by the flipping of a coin was followed resulting in the following group assignments:

Comparison Group A: Memphis, Knoxville, Tri-Cities areas (Treatment)

Comparison Group B: Jackson, Chattanooga, Nashville areas (Control)

Table III-2 shows characteristics of these two groups.

TABLE III-2

IDENTIFIABLE COUNTY CHARACTERISTICS FOR RANDOMIZATION TO COMPARISON GROUP A OR B

	Group A Memph-Knox-Tricities	Group B Jackson-Chatt-Nash
No. of Experimental Counties	8	6
County Broadcast Circulation (new)	23,665	332
Total Broadcast Circulation (Min.)	342	14,666
No. of TV stations	11	12
No. of H & G radio stations	12	7
No. of other radio stations	23	12
Total Broadcast stations	42	31
East West Geog. Placement Park	1-5-6	2-3-4
Population Rank (area)	1-3-5	2-4-6
No. of AESHE clients	5,469	4,267
No. of AESHE client contacts	58,519	45,655
No. of AESHE agents	7 1/2	6
No. of clients/co.	684	711
No. of client contacts/county	7,315	7,609
No. of client contacts/agent	7,802	7,609
Rural Pop	262,500	133,800
RP/clients	383	188
RP/Tot. Brd. Stat.	570	4,316
County Names	Shelby, Roane, Loudon, Knox, Sevier, Hawkins, Washington, Johnson	Chester, Dickson, Henderson, Williamson, Hamilton, Bradley

See Appendix A for characteristics data

The remaining sixteen counties in the experiment which did not have sufficient BCV characteristics were designated for the experiment by random selection from the State's five Agricultural Extension Districts. The AESHE agents in these counties were assigned either control or treatment status relative to whether or not they could or wished to use the Agent Kit (Treatment 1 and Treatment 2) during the experimental period or preferred to wait until after the experiment had been completed. The researcher having recognized that this method of designation does not have the scientific rigor that was present in the selection of experimental counties for Group A_1 and Group B_1 designated the following counties to be the second set of counties in comparison Groups A and B.

District	Comparison Group A_2 (Treatment)	Comparison Group B_2 (Control)
I	Dyer, Carrol Counties	Tipton, Weakley Counties
II	Lincoln, Giles Counties	Wilson County
III	Franklin County	Meigs, Polk Counties
IV	Cannon, Cumberland Counties	Fentress, Trousdale Counties
V	Greene County	Jefferson County

Figure III-1 introduced on page 158 indicates the geographic location of all A and B counties (A_1, A_2, B_1, B_2).

Treatments.

The ENERSENSE evaluation strategies were designed to determine the maximum possible effect to be obtained with an all-out communications campaign using "multi" media and three communication delivery systems.

The "total communication effect" possible for the ENERSENSE project was confined to the following multi-media treatments[1] under the control of the project directors:

Treatment I	Agent-(AES Home Economics Agent) delivered live audio-visual programs for audiences (five different audio-slide-cassette programs)
Treatment II	Booklets (five different, deliverable by a variety of means including agent delivery to home, agent delivery at Audio-Visual program, direct mail)
Treatment III	Radio public service announcements (PSA's) (20 different PSA's of 30 seconds each)
Treatment IV	Radio programs (12 different programs of 5 minutes each)
Treatment V	Television PSA's (22 different PSA's of 30 seconds each
Treatment VI	Television programs (two different programs of 30 minutes each)

All these treatments were independent of each other as far as assignment was concerned--that is, they could be distributed in any and all combinations or withheld on the same basis at the discretion of the project directors. The assignment of treatments in the agent kits T1 (audio-visual) and T2 (booklets), as treatments available to counties, was completely under the control of the investigators, and could be assigned on a purely random basis. Delivery of these two treatments (T1 and T2), however, was dependent upon the discretion of each AESHE

[1]The information on content and examples of all multi-media treatments included in the communications campaign are available through UTEERC.

agent relative to demand, appropriateness of the materials and opportunities perceived by her.

The four remaining treatments (T3, T4, T5, and T6)--all broadcast--were under more limited control. This was due to geographic station-availability and the choice, on the part of the TV or radio station, of whether or not to air the message.

Maximum station airing of broadcast messages was limited as follows:

(a) Radio PSA's: distributed to all radio stations in all markets, to be used as many times as possible by each station.

Complete Message: 11 minutes (22 messages @30 seconds each).

(b) Radio Programs: distributed only to those stations carrying the "Home and Garden Show" regularly, as a "one-shot" five-minute program insert.

Complete Message: 60 minutes (12 messages @5 minutes each).

(c) Television PSA's: distributed to all TV stations in all markets to be used as many times as possible by each station.

Complete Message: 11 minutes (22 message @30 seconds each).

(d) Television Programs: normally distributed to only one station per market, as a "one-shot" program.

Complete Message: 60 minutes (2 programs @30 minutes each).

Thus, a person who was exposed to all radio and TV PSA's and programs on one occasion only would be exposed to 142 minutes of ENERGY CONSERVATION IN THE HOME messages. The maximum exposure to TV programs and radio programs would normally be only once per person; however,

maximum exposure to TV and radio PSA's would be dependent on the number of stations using the materials and the frequency with which they were broadcast.

In summary, it should be noted that during the communication campaign, 30 counties were involved in the CFX. Consumers in eight counties had the potential of being exposed to up to six treatments, the "total communication effect," while consumers in another eight counties had the potential to be exposed to only T1 and T2. The remaining fourteen experimental counties were for control purposes and received none of the six treatments (See Table III-1, p. 156).

Study/Substudy Design

The ENERSENSE Study was designed around the controlled field experiment format and used three evaluation strategies to: (1) evaluate the impact the multi-media program had upon consumers and AESHE agents; (2) evaluate the "in place" delivery systems used for media dissemination; and (3) assess other sources of energy conservation media operative in the same time period as the ENERSENSE communications campaign but outside the CFX. A fourth strategy complemented the CFX but was separate from it.

Three of the evaluation strategies used post-test only measures, while Strategy III used a panel evaluation commencing with a pre-test. Strategy II was designed to be a substudy within the ENERSENSE Study. The Strategy II substudy was Phase II of the consumer evaluation and provided a sample of consumers who were given an opportuity to apply

knowledge possibly gained from the multi-media program in assessing an energy conserving innovation.

The research design outlined in Table III-3 illustrates the relationship of treatments, measures, groups sampled and the time sequence involved in the total study. In addition, it shows the association among strategies and the connection of each with the CFX.

Summary

The intent of this chapter was to present the scope of the ENERSENSE Study, the four strategies utilized for evaluation, and especially to identify the substudy conducted in Strategy II. Also the chapter described the six media treatments included in the communications campaign organized for the controlled field experiment, and introduced the comparison groups used in that experiment. Strategy methodologies and procedures are set forth in Chapter IV.

TABLE III-3

ENERSENSE STUDY RESEARCH PLAN

TREATMENTS		t1	t2	t3	t4	t5	t6	t7	t8	
STRATEGY I	P1Aa	--	--	--	T1-6 (ox)	M1	--	--	--	
	P1Ba	--	--	--	T0 (fn)	M1	--	--	--	Consumers
STRATEGY II (Substudy)	P1Ab	--	--	--	T1-6 (ox)	M1	S2 M2	--	--	
	P1Bb	--	--	--	T0 (fn)	M1	S2 M2	--	--	
STRATEGY III	P2	M3a	T1-2	M3ab1	--	--	--	--	--	
	P2A	--	--	--	T1-2 (ox)	--	--	M3ab 2	--	Agents
	P2B	--	--	--	T0 (fn)	--	--	M3ab 2	--	
STRATEGY IV		--	--	--	--	--	--	--	M4	Media

KEY:

P1 = AESHE Clientel
P1Aa = Treatment Sample of P1
P1Ba = Control Sample of P1
P1Ab = Subset of P1 Sample P1Aa
P1Bb = Subset of P1 Sample P1Ba
P2 = AESHE Agents
P2A = Treatment Sample of P2
P2B = Control Sample of P2
P3 = Other Media Sources Outside CFX
t = time
t1 = Pre Program Introduction
t2 = Program Introduction
t3 = Post Introduction
t4 = Jun 1 to Oct 31, '78
t5 = Nov '78 - Jan '79
t6 = Dec '78
t7 = Jan '79
t8 = Feb-Mar '79
T = Treatment, Multi-Media Program T1 T2 T3 T4 T5 T6
T(ox) = Opportunity for exposure to treatments
T(fn) = Forced non-exposure to treatments
M = Measurement
M1 = Survey questionnaire related to program
M2 = Interview using SISI
M3 = Questionnaire/checklist
M4 = Multi-method survey
S = Stimulus, innovation simulation

CHAPTER IV

EMPIRICAL RESEARCH: SUBSTUDY METHODOLOGY AND RESEARCH DESIGN

Introduction

The objective of this chapter is to discuss the methodology and research design for the substudy conducted as Evaluation Strategy II: Consumer Evaluation Phase II of the ENERSENSE Study. The thrust of the chapter is to present the second phase of the consumer evaluation by discussing the measuring instrument and its development, subject selection, field procedures, and techniques for data analysis.

The Measuring Instrument

As a means of collecting additional data from the consumer sample, the interview method of data collection was selected. The interview, according to Babbie (1973), has a history of providing the following advantages to a survey: (1) enjoys a higher response rate, (2) obtains a higher completion rate, (3) minimizes the number of "don't knows" and "no answers," (4) allows less confusion and thereby supplies more relevant responses, and (5) allows the interviewer to observe the respondent (pp. 171-172). The potential for using an interview having been recognized, several questions were raised in preparation for developing the research design for Instrument II: (1) What could be measured by an interview? (2) How could an interview assess a consumer's attitude and/or behavior towards energy conservation in a

new decision-making situation? (3) Should the interview be structured or unstructured? (4) To what extent should it be quantitative? To what extent qualitative?

In answer to the first question it was decided to focus on one specific aspect of residential energy conservation. Response to the second question involved developing an instrument that could assess a consumer's acceptance of a residential energy conserving innovation.[1] The results of such an interview survey could then be compared for Group A and Group B consumers to determine whether or not any differences existed which might be attributed to the cause and effect inferences facilitated by the ENERSENSE CFX.

The semantic differential was recommended by Nafziger (1963) as being especially applicable for communications research because it provides a multi-dimensional measurement. Its appropriateness was reinforced by its extensive use in marketing research (Mindak, 1956, 1961; Tillman, 1967; Cox, 1969; Boyd, et al., 1977) and to a limited extent during the past decade in environmental design (Vielhauer, 1965; Hershberger, 1969; Collins, 1970; Hesselgren, 1971, 1975). By selecting such a technique it was possible to design a measurement instrument that would quantify qualitative information and provide structure for the interview. Making those decisions thus provided answers for questions 3 and 4 raised earlier in this section.

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[1]An object or process which is perceived as a change.

The importance of developing a structured interview schedule became apparent as the interview survey plan was developed. The particulars of that plan and the features related to the interview instrument are discussed in depth later in this chapter.

Thus, the interview format was structured to use bipolar adjective pairs to determine consumer attitudes toward several attributes of a residential component that was innovative. It had been observed by the researcher that consumers in the past five years have been exposed to an ever increasing number of innovative energy conserving alternatives (Ellison, 1977-1978). Many of these alternatives are applicable for conserving energy in either new or old housing. Because window designs and concepts have been promoted as a means of conserving energy in residential environments, innovative window designs were selected as the residential component to be studied in relationship to consumer attitudes and behavior.

Would it be possible to develop an instrument to assess perceptions of window design concepts? Could differences between Group A1 and Group B1 consumers be measured and provide a basis for cause and effect inference? The environmental design literature, building from research in behavioral psychology, indicated that it was possible to measure the meaning of architectural stimuli through monochromatic perspective line-drawing simulations (Hershberger, 1969; Wedin, 1971; Hesselgren, 1971, 1975; Foruzani, 1977) and to evaluate attitudes for N dimensions (Canter, 1969 and Kasmar, 1970) related to attributes or characteristics of an architectural design concept. It was further

determined from the literature that the semantic differential was a reliable multi-dimensional scaled measurement for determining the meaning of architectural stimuli (Vielhauer, 1965; Hershberger, 1969; Collins, 1970; Hesselgren, 1971, 1975; Tepel, 1975). Such researchers during the past decade have advanced the concept as promoted by Osgood (1957).

Osgood, Suci, and Tannenbaum (1957), originators of the semantic differential concept, explain the psychological meaning of "meaning" as:

> that process or state in the behavior of a sign-using organism which is assumed to be a necessary consequence of the reception of sign-stimuli and a necessary antecedent for the production of sign-responses (p. 9).

Being built upon that definition, the format of the Strategy II interview was then designed around the model shown in Figure IV-1.

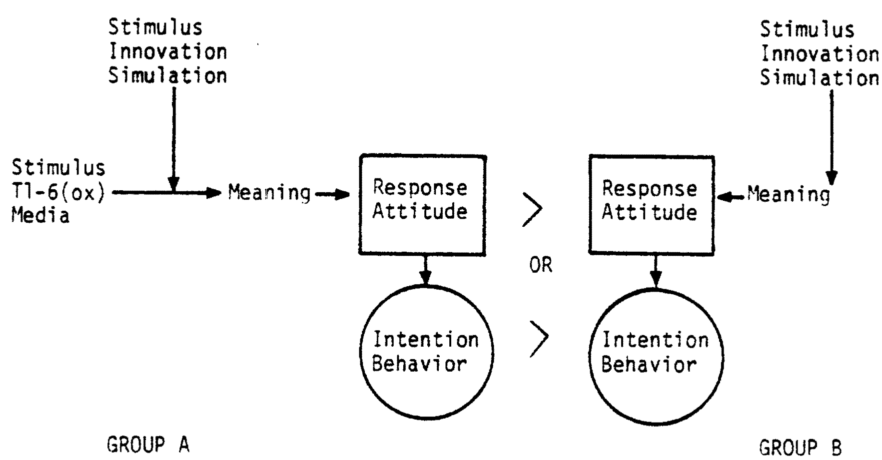

Figure IV-1. Strategy II Model

Research on the use of the semantic differential showed it to have these advantages: (1) it is easy to construct (time saving); (2) it is easy to code; (3) it has a discrete manner of statistical measurement and indexing (Tepel, 1975, p. 4). Those advantages, coupled with the potential for assessment promised by combining semantic differential scales with simulations of energy conserving innovations, reinforced the method's acceptability as a means of measurement for ENERSENSE Instrument II (See Appendix B).

Instrument II contained five sets of monochromatic line drawings depicting perspectives of five window concepts in both open and closed positions. Each of the five sets of pictures was combined with the semantic differential scales. Twenty-five scales were used and these were assigned to each set of pictures in a different randomized order. The selection of the window innovations that were simulated will be discussed in detail later in this chapter under Selection of Energy Conserving Innovations and Design Simulation/Media Presentation. The semantic differential scales that were used will be presentd in Selection of Semantic Scales.

To provide a cross-check on the responses facilitated through the semantic differential scale, two fact questions, items 27 and 28, were included for each set of pictures. Through those items, respondents were asked to indicate: (1) if they had seen the window design concept previously; (2) if they would use the window design concept to conserve energy.

Printed directions accompanied the instrument and verbal explanations were developed to be delivered at the time of each interview (See Appendix B). Both of these are discussed more extensively in the outline of the interview schedule presented in Experimental Research Design and Procedure.

The instrument developed for use in the Strategy II interview was the result of combining simulative and semantic concepts to assess consumer acceptance of innovations. Such an approach has a potential beyond the limitations of providing the design for Instrument II. For that reason this concept for an evaluative tool has been given the label INOVAC, i.e., Innovation Acceptance Evaluation Scale.

Subjects

Evaluation Strategy II was included in the study to provide a second opportunity to obtain feedback from a limited number of the AESHE clients who had responded to the Strategy I survey. The 100 subjects interviewed were female consumers randomly selected from the masterlist of respondents who had completed the self-administered questionnaire, ENERSENSE Instrument I.

When drawing the N = 100 from the original sample population (P1Ab & P1Bb), consideration was given to (1) having representation from all county postal codes in the 14 CFX counties, and (2) selecting a

proportionate number of respondents from each county.[2] Fifty respondents were interviewed from each comparison group; that is, Group A1b equalled Group B1b. A breakdown of county quotas for interviewing is presented in Table IV-1.

TABLE IV-1

INTERVIEW QUOTA SUMMARY

Comparison Group		Quota of Interviews
	1. Shelby	6
	2. Roane	6
A1b	3. Loudon	2
Counties	4. Knox	12
	5. Sevier	7
	6. Hawkins	6
	7. Washington	8
	8. Johnson	3
		N = 50
Comparison Group		
	1. Chester	7
	2. Henderson	4
B1b	3. Dickson	2
Counties	4. Williamson	2
	5. Hamilton	17
	6. Bradley	18
		N = 50
		Total N = 100

The number of subjects to be interviewed was limited to a sample of 100, equally divided between Group A1 and Group B1 due to the cost

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[2] $\frac{\text{N in StII County Sample}}{50} = \frac{\text{N in County List}}{\text{N in 2 N in County List for Comparison Group}}$

of interviewing, which would necessarily have been compounded by having subjects dispersed throughout the state, as well as the logistical limitations of organizing and supervising such an interview survey.

By using subjects who had also participated in the Strategy I phase of the consumer evaluation, two biases were introduced into the Strategy II evaluation. A person who had responded to the question-naire had (1) demonstrated an interest in the topic of energy conserva-tion and (2) gained familiarity with the topic of energy conservation. The existence of these biases having been recognized, the assumption was made that using respondents with them would not confound the evalu-ation strategy and possibly would act to improve respondent motivation to participate in Strategy II's interview.

Selection of Residential Energy Conserving Innovations

Because the multi-media program being evaluated through the CFX campaign was directed at the home, and the house is all encompassing to the other topics included in the multi-media program, physical residen-tial component categories were selected to be considered for examples of energy conserving innovation. For the purposes of the study, inno-vations considered were those "new ideas," "methods," or "devices" that would depict, in the population being studied, a change for consumers.

Product proliferation in the name of energy conservation has increased over the past five years. The residential sector has provid-ed a major market target reinforced by the advent of energy credits for "insulation, storm windows or other energy-saving devices" (Lasser,

1978, p. 144). Upon scrutinizing options to be found in the popular press and technical literature, after reviewing residential energy alternatives presented by engineers, architects, owner-builders, and organizations and agencies such as the Department of Energy (DOE), National Socal Heating and Cooling Information Center (NSHI), National Bureau of Standards (NBS), American Institute of Architects (AIA), National Association of Home Builders (NHIB), Energy Research and Development Administration (ERDA), The University of Tennessee Energy, Environment, and Resources Center (UTEERC), and Energy Extension Services, and upon recognizing that the subjects being surveyed in ENERSENSE were female, the project designer selected windows to stand as the residential component category among the energy conserving innovations. The category, taken a step further, was limited to interior window design concepts. Consumer research shows that female residential decision-making is more often involved with interior aspects of the domestic environment (Maynes, 1976). That fact, added to observations made by the researcher in the course of providing residential interior design consultation, supported the assumption that window design concepts in their selection and operation, are a priority category to the female population.

Support for incorporating windows into the study was also reinforced by the "energy incentives." To date most consumers have looked to the "exterior treatments," such as storm windows and doors, as the means to save energy and realize tax credits. This study delved into the functional, novelty, economic, and aesthetic dimensions of

"interior window treatments." Five sesions with AESHE Home Demonstration Clubs in Tennessee and reports from AESHE agents throughout the State affirmed the researcher's belief that those female consumers were interested in interior window design alternatives for energy conservation in both new and old structures. Those women were especially interested in alternatives "they" could produce and/or install.

Several innovative alternatives and their energy conserving capacity were considered. The five window design concepts finally selected were chosen for the following reasons: (1) each contributed to having the group represent a continuum of concept features that ranged from being almost "traditional" to "new"; (2) each could be used both in new structures and for retrofitting existing housing;[3] (3) each would suit a variety of climates; (4) each contributed to having the group of concepts depict variety in price; (5) each had its own unique convenience, operation, and maintenance characteristics; (6) each had been promoted in a technical publication as being an interior window strategy for energy conservation; (7) each contributed to having the group of concepts range from "home-produced/owner-installed" to "commercial component/contractor-installed"; and (8) each was judged by the researcher not to be used commonly in Tennessee.[4]

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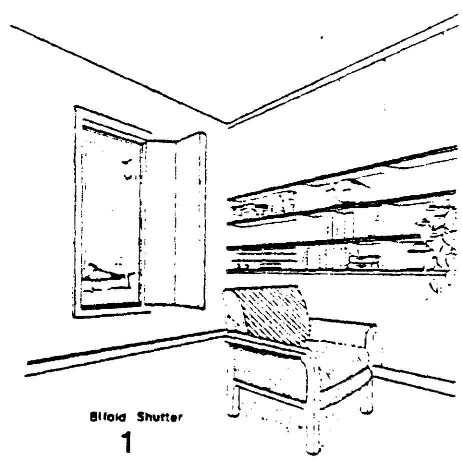
[3]The existing housing stock is very large relative to new stock added annually. Older stock needs to be weatherized (Marshall and Ruegg, 1977).

[4]Judgment supported by reactions recorded in instrument development and pre-testing.

Those criteria ultimately provided the basis for selecting innovative concepts with general multi-dimensional characteristics, the meaning of which were to be measured by the semantic differental scale/ innovation simulation instrument (INOVAC) used for the Strategy II interviews.

The five window concepts pictured in Figure IV-2 are arranged to illustrate the innovative progression in the set. This progression was

	Yes	No
Seen Before	6	43
Would Use	9	38



	Yes	No
Seen Before	15	34
Would Use	13	36

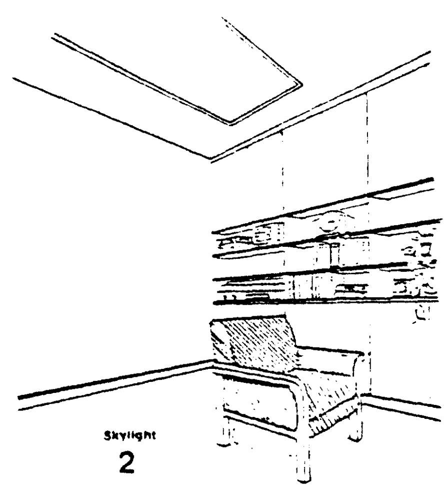
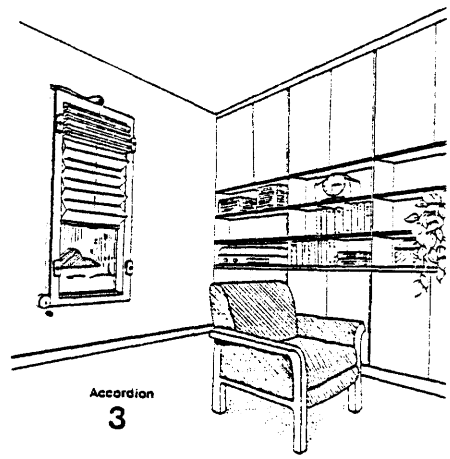
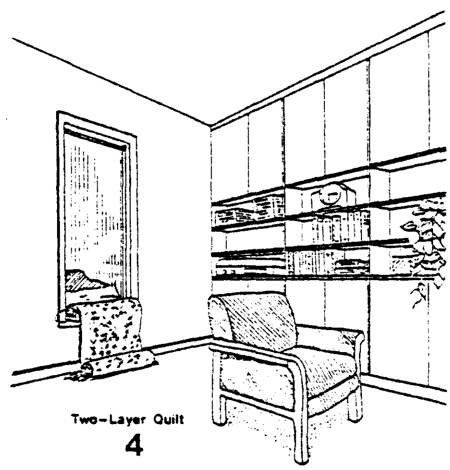


Figure IV-2. Window Concepts

	Yes	No
Seen Before	9	40
Would Use	15	33



	Yes	No
Seen Before	11	38
Would Use	18	30



	Yes	No
Seen Before	17	31
Would Use	16	33

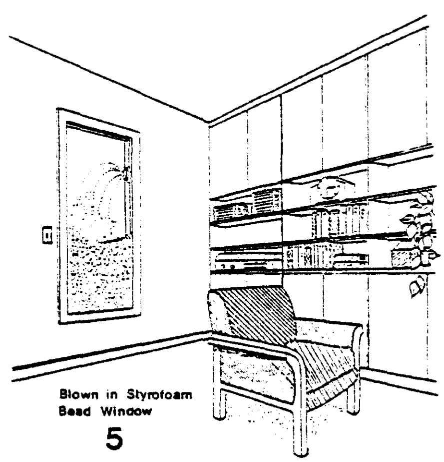


Figure IV-2. (Continued)

determined by the researchers in consultation with a panel of designers and it is related only to the visual innovativeness and not to the concept's potential to conserve energy (R-value)[5], the cost of the concept, or its operation.

Design Simulation and Media Presentation

Simulation[6] was used as a means to test the degree of similarity of meaning between the energy conserving innovative window concepts and the two groups of consumers. Those consumers who had the opportunity for exposure to the multi-media treatments were paired against those who had not.

The five sets of window concepts were simulated graphically via monochromatic perspective drawings. The five innovations simulated were drawn in ink on 8-1/2" x 11" sheets at the scale of 1/2" = 1'0", by one person. Multiple copies were then produced through photocopying (See Appendix B).

Each window concept was presented in the same environmental context so that in each set of pictures only the physical characteristics of the window concept changed. During the pre-testing the skylight concept was simulated in an interior/exterior set. On the advice of the review committee, comprised of interior design, housing, and planning faculty, the skylight was presented in an interior context for the interview.

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[5]R-value: Thermal resistance; computed by the conductivity divided into one. The measure of resistance to heat flow.

[6]For readers not familiar with the concept of simulation, it is presented in Chapter II.

Where necessary, a fuller explanation of each window concept was provided by drawing it in the opened and closed positions. The perspectives of both were displayed simultaneously for the subject's evaluation. Through the perspective drawings it was possible to use a minimum of detailing and to control the lightness and color. Floderus and Sorensen (1971) had shown that such a presentation "is sufficiently simulating to function as a medium" (Forugoni 1977, p. 49). The medium of presentation had also the advantages of economic reproducability, and clarity of detail, that would not overwhelm the consumer audience by its "slickness." Reports from AESHE agents had indicated that "homestyle" visuals were more positively received than commercially prepared "slick" visual aids. Finally, it offered convenience for display in home viewing settings.

The options of media for presentation, rather than real-life examples, were considered and after wise deliberation the method described was selected for the following reasons: (1) a range of existing examples, prototypes, and designs of window concept innovations could be presented to the subject; (2) the order of presentation could be varied; (3) it was possible to direct the subject's attention to the concept under consideration; (4) it was possible to control the length of exposure and between concept conversation; (5) it reduced the time and effort demanded of the subjects; hence, enhancing cooperation; and (6) it allowed a field survey to be economically feasible. There was, of course, the disadvantage of presenting the window concept on only one sensory channel. Advantages, however, appeared to outweigh

the disadvantages. Thus, the monochromatic perspective drawing was used and by integrating this element into the research plan, the CFX provided a means to probe further the relationship between simulation and meaning. The advantages to be realized, through inceased understanding of the role that simulation can play in innovation design concept development and acceptance, should provide the motivation for continued research.

Generation and Selection of the Semantic Scales

Using the work done by Kasmar as a model for the development of a lexicon of words, and Collin's and Sanoff's recommendations on the importance of using vernacular familiar to the population studied, a lexicon of words used by AESHE clientele was developed.

Women in five home demonstration clubs in two counties were asked to view the series of five sets of pictures simulating energy-saving window design concepts. Each window concept was illustrated in its open and shut position and the women, while viewing the pictures, were requested to listen to six questions (See Appendix C). After each question they were each asked to respond by listing as many words as came to mind. The questions asked were designed to solicit responses that were related to aesthetic, climatic, physical, and economic factors; or dimensions, associated with attributes perceived in the pictured window design concept. The "word bank" generated by the sessions was then tabulated. Adjective pairs were developed by using

words from the "word bank" and checking antonyms in Webster's Thesaurus before the bipolar adjective pairs were compared with the lexicon developed by Kasmar. Twenty-five pairs of adjectives common to both groups were selected for use in Instrument II. To complete the list of word pairs used in the instrument, two pairs were added--good-bad and thrifty-costly. Adjectives in both these pairs had been used frequently in the word generation sessions. Thus, the following twenty-five bipolar pairs were selected for the semantic differential scale in Instrument II.

```
            attractive-- -- -- -- --unattractive
           convenient-- -- -- -- --inconvenient
              private-- -- -- -- --public
              thrifty-- -- -- -- --costly
           functional-- -- -- -- --non-functional
           decorative-- -- -- -- --plain
            beautiful-- -- -- -- --ugly
               drafty-- -- -- -- --stuffy+
                 warm-- -- -- -- --cool
                clean-- -- -- -- --dirty
          comfortable-- -- -- -- --uncomfortable
            dangerous-- -- -- -- --safe+
               modern-- -- -- -- --old fashioned
comfortable temperature-- -- -- -- --uncomfortable temperature
              durable-- -- -- -- --non-durable
          interesting-- -- -- -- --boring
            expensive-- -- -- -- --cheap+
                 good-- -- -- -- --bad
              complex-- -- -- -- --simple+
                 neat-- -- -- -- --messy
      good ventilation-- -- -- -- --poor ventilation
         adequate size-- -- -- -- --inadequate size
              unusual-- -- -- -- --usual+
         good lighting-- -- -- -- --poor lighting
```

NOTE: +Positive pole reversed in bipolar adjective pair to prevent polar bias in ratings.

To avoid polar bias, five bipolar adjective pairs were reversed in positive negative orientation: (1) drafty-stuffy, (2) dangerous-safe, (3) expensive-cheap, (4) complex-simple, and (5) usual-unusual. Order bias among the adjective pairs was avoided by randomizing them for each window concept's set of semantic scales. Each set of scales was then printed on one of five colors of paper. Those sheets were matched to the window concepts by adding color tabs in order to color code each picture included in the set of window concepts which were used in the interview instrument.

Pretest

The interview instrument, comprised of five sets of monochromatic perspective line drawings of innovative energy conserving window concepts with the twenty-five semantic differential scales, was pretested by a senior class of housing/design students at The University of Tennessee, N = 30. The sets of window concepts, having been produced on acetate film, were displayed to the group via an overhead projector. Group instructions were given, and each student was asked to complete a set of semantic scales for each window concept while it was displayed on the screen. The completion time was noted for each student and the minimum and maximum length of time needed to complete each example was determined. As the shortest time recorded for completing a set of semantic scales was .75 minutes and the longest time was four minutes, the decision was made to retain five sets of pictures in the instrument. That provided the potential for a 12-15

minute interview which would allow most respondents to complete the scaling process before it was felt to be a burden.

In addition to determining the completion time, the pre-test identified (1) weaknesses in the instructions and (2) confusion caused by two of the adjective pairs. The instructions were reworded and the two adjective pairs were retained, but the idea of placing a question mark (?) beside any pair found confusing was formulated. Instruction to that effect was added to the instruction.

The final instrument was not pre-tested with AESHE clientele for many reasons. First, the window concepts had been viewed by over 100 persons in the home demonstration club sessions when the word bank was generated. Discussions at that time indicated that the simulated concepts were comprehended by those AESHE clients. Second, the AESHE clients had provided the vocabulary for the semantic scales. Third, the home demonstration club sessions had reinforced the researcher's assumptions that: (1) window design is a relevant topic for women and (2) the design concepts selected for the series included in the instruction were "innovations" in the experience of that sample of the AESHE client population. Consequently they probably would be appropriate for subjects in the CFX comparison groups.

The final instrument, however, was not completed until after it had been reviewed by a committee of design and housing professionals. Upon the recommendation of that committee the context, in which one concept was presented, was adapted. The details of that adjustment are oulined earlier in this chapter. Instrument II evolved from the

results of pre-testing several aspects to be included in Instrument II before it was used in Strategy II. Strategy II, itself, provided another phase of pre-testing in the development of the survey technique methodology peculiar to an instrument that combines design concept simulation with semantic differential scales.

Research Design and Procedures

Evaluation Strategy II: Consumer Evaluation Phase II was a supplement to the Strategy I evaluation segment of the ENERSENSE Study. The strategy was designed to survey a sample of consumers (N = 100) who had been surveyed by the Strategy I questionnaire. By developing this supplementary strategy to evaluate consumers in the CFX, the researcher planned to (1) strengthen the overall evaluation of the multi-media campaign; (2) curtail expenses while gaining more information by taking a "sample" within a sample; and (3) conduct a survey within a CFX that would afford opportunities to meet the objectives of the study while exanding upon established methodologies and techniques of survey and evaluative research. The research design for Evaluation Strategy II, and its relationship to the other evaluative strategies included within the study, is illustrated in Table IV-2.

TABLE IV-2

STRATEGY II IN THE CONTEXT OF THE
ENERSENSE STUDY RESEARCH PLAN

TREATMENTS		t1	t2	t3	t4	t5	t6	t6	t8	
STRATEGY I	P1Aa	--	--	--	T1-6 (ox)	M1	--	--	--	Phase I
	P1Ba	--	--	--	T0 (fn)	M1	--	--	--	Consumers
STRATEGY II	P1Ab N=50	--	--	--	T1-6 (ox)	M1	S M2	--	--	Phase II
	P1Bb N=50	--	--	--	T0 (fn)	M1	S2 M2	--	--	
	P2	M3a	T1-2	M3ab1	--	--	--	--	--	
STRATEGY III	P2A	--	--	--	T1-2 (ox)	--	--	M3ab 2	--	Agents
	P2B	--	--	--	T0 (fn)	--	--	M3ab 2	--	
STRATEGY IV		--	--	--	--	--	--	--	M4	Media

KEY:
t1 to t8 = different times during the study
T1-6(ox) = opportunity for exposure to treatments
T0(fn) = forced non-exposure to treatments
S = stimulus presented at M2
M1 = Questionnaire
M2 = interview with SISI
M3 = Questionnaire
M4 = Multi-method survey
P = Population
CFX = Controlled Field Experiment

P1Ab and P1Bb were equal-sized groups selected at random by the researcher from the portion of the population P1Aa and P1Ab, respectively, that had responded to M1 within three weeks.[7] P1Aa subjects had been given the opportunity for exposure to the six multi-media treatments in a real-life situation, i.e., T1 to T6(ox); P1Ba had the multi-media treatments withheld resulting in the control condition T0(fn). The M2 was administered simultaneously to both P1Ab and P1Bb ensuring that only those subjects received M1 and M2.

The methodological aspects for the strategy began with the plan to design an interview that would utilize an INOVAC[8] instrument. Innovative energy conserving window concepts were selected for simulation and a word bank to provide adjective pairs common in the vernacular of the test population was developed. Those two activities provided the components necessary to design and test aspects of the interview survey instrument.

The instrument development was accomplished during the summer and fall of 1978. The selection of 25 semantic differential scales and the simulation of five sets of innovative energy-conserving interior window concepts was organized, combined, and then presented for pre-testing. Two groups at The University of Tennessee were used in the testing process: (1) a senior class of interior design and housing students, N=30 and (2) a committee of interior design, housing, and planning

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[7]Names of persons selected initially for the sample were from those that had responded to M1 in two weeks. Alternates were selected from names of persons who had responded to M1 within up to three weeks.

[8]Innovation Acceptance Evaluation Scale.

faculty, N=8. Details of the pre-testing were presented earlier in this chapter. The instrument used for the interview is presented in Appendix B and the presentation of the media used in the interview is described fully earlier in this chapter.

In preparation for implementating the evaluation strategy the interview supervisor contacted AESHE county offices in A1 and B1 counties and requested suggestions for local persons to be contacted to serve as interviewers in those counties. Fifteen interviewers were interviewed and then engaged, three men and twelve women. Assignments were given based upon (1) the quotas established for the counties; (2) the idea that an interview case-load should range between four and twelve persons; (3) the geographic territory to be covered in the county, i.e., two sides of a river, urban setting, rural setting. A breakdown of the assignments is illustrated in Table IV-3. During the ten days prior to the interview survey, mandatory training sessions were conducted for the interviewers. Three half-day sessions were conducted with interviewers attending the one nearest their region. Centers used for training sessions are also outlined in Table IV-3.

TABLE IV-3

INTERVIEWER TRAINING AND INTERVIEWING SUMMARY

Training Session	Interviewers	Counties Group A1 or B1		Quotas for Interviews*
Knoxville	1	Roane	A1	6
	1	Sevier	A1	7
	1	Knox	A1	12
	1	Loudon	A1	2
	1	Hawkins	A1	6
	1	Washington	A1	8
	1	Johnson	A1	3
Jackson	1	Shelby	A1	6
	1	Henderson	B1	4
	1	Chester	B1	7
	1	Dickson	B1	2
		Williamson	B1	2
Chattanooga	2	Hamilton	B1	17
	2	Bradley	B1	18

*Quotas based upon percentage that AESHE client population per county is of total AESHE client population in the 14 experimental counties as determined through AESHE agents' directories/lists.

At each training session the interview supervisor introduced the interviewers to: the goals of the survey, the history of the research study, the survey plan, and the interviewing procedures to be followed. The interview instructions, the agreement, and report forms for interviewers are included in Appendix B. Each interviewer received an interviewing kit and the supervisor demonstrated the interviewing procedure through role playing and involved the interviewers in a practice situation.

The interview survey plan commencing December 5, 1978, was as follows:

- December 5th, interviewers phoned, given list of consumers to be contacted by phone to make appointments for interviews before December 15th.
- December 6th, original list of consumers to be contacted plus initial alternate names mailed to interviewers.
- December 6th - 15th, interviews conducted by appointment in consumers' homes.
- Consumers sign consent form to participate in survey after procedure is explained.
- Interviewers maintain log of activities and record (1) miles travelled and (2) phone calls made.
- Alternate names supplied upon request.
- December 10th, interviewers to check in with supervisor by phone--earlier and more frequently, if necessary.
- December 21st, interview forms and reports submitted to supervisor.
- December 22nd, supervisor scrutinizes interview reports.
- January 7th, supervisor spotchecks with sample of persons interviewed.
- Post-survey of interviewers.

The kit used for the interview included the five sets of pictures mounted in acetate protector sheets, and one practice picture. Each set of pictures was color coded to match a set of semantic differential

scales. Interviewers were asked to rotate the presentation of the pictures for each interview according to the order of color established by the set of semantic differential scales which was organized into a randomized sequence. Nine sequences were used in assembling the sheets of scales into pads which were stapled and then number coded for a specific interview in a specific county. The sequencing of scales was initiated to prevent sequential bias being introduced into the order in which pictures were presented at the time of the interview. The idea was explained to the interviewers and they were requested to arrange the order of pictures prior to entering a consumer's home for an interview. Consent forms were also included in the kits, and to meet the requirements for conducting research with human subjects, each subject was requested to complete one upon having received a satisfactory explanation of the interview's purpose and process (See Appendix B). Finally, each kit contained TVA energy conservation bumper stickers to be offered to subjects as a token of appreciation upon completion of the interview (See Appendix B).

Data Analysis

Data analysis was done primarily at The University of Tennessee Computer Center utilizing the Statistical Package for the Social Sciences (SPSS) subprograms. Supplementary analyses were completed via the University of Prince Edward Island Computer System in Charlottetown, Prince Edward Island, Canada.

Due to the fact that the substudy had methodological as well as substantive objectives, the use of both correlational and experimental approaches for the analysis of data was warranted--the correlational approach to establish differences among subjects and the relationships among measurements made on subjects; the experimental approach to discern the effects of the multi-media on the comparison group.

Hypothesis testing utilized both parametric and nonparametric statistical models with multiple significance levels considered to determine the probability of a Type I error. (Lee 1975, p. 42). When the purpose of the analysis was to determine whether or not the treatment condition had significant effects over the control condition, one- tailed tests of significance were used. (Huck et al., 1974, p. 45).

The major objectives of the substudy conducted as Strategy II of ENERSENSE were: 1) to develop an evaluation tool to assess consumer acceptance of innovative design concepts; 2) to test such an evaluation tool; 3) to evaluate if a multi-media residential energy conservation program had any significant effect on consumer acceptance of energy conserving design concepts; 4) to determine if there is a relationship between consumer attitude towards design concepts and personal characteristics determined by contextual variables. Hence, it was in pursuit of these objectives that the substudy data were analyzed via the methods and processes outlined below.

Measures of Central Tendency and Dispersion

The distributional and central tendency characteristics of variables for substudy respondents, (Group A, N=49, and Group B, N=49, the number of valid interviews) were examined via the SPSS FREQUENCIES and CONDESCRIPTIVE procedures. See Appendix E for Instrument I and Instrument II variables tables.

Creation and Addition of Variables and Factors

Variables in addition to the original variables from Instrument I and Instrument II were created via appropriate arithmetic expressions using SPSS COMPUTE transformations and the factor analysis of Instrument II semantic scales. Those variables, with values built upon the existing values of the original variables, were added to the data file and will be presented and described in subsequent sections of this chapter and in Chapter V. The relationship of Instrument II (INOVAC) variables is outlined in Figure IV-3.

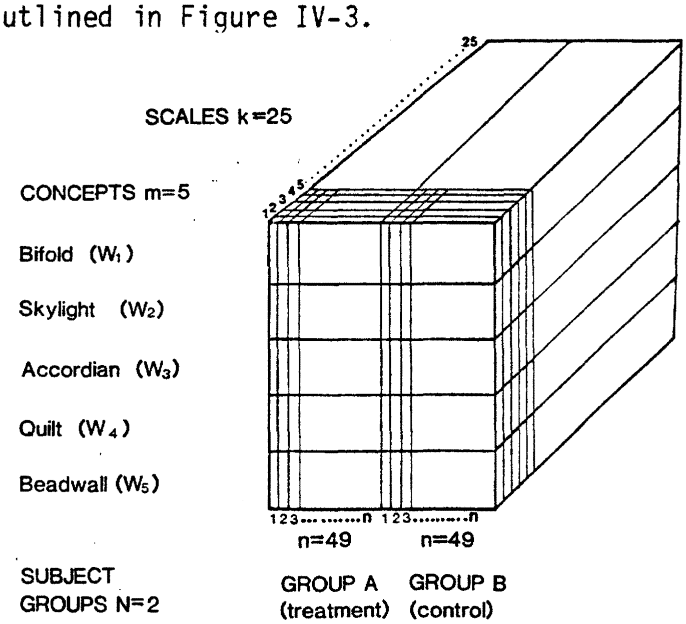

Figure IV-3. Instrument II Variables Matrix

Instrument Reliability and Validity

To determine the reliability of the INOVAC test instrument and thus identify any potential for external invalidity contributed to the substudy by Instrument II, two procedures were employed: (1) an item analysis to compare consistency across subjects and (2) a correlation of concept mean scale scores with an external criterion.

In the item analysis the two respondent groups were each divided in half (A_1, A_2, B_1, B_2). The mean scores, k=25, and items 26 and 27 (i) of subgroups on window concepts (m=5) were compared. The SPSS T-test GROUPS procedure was used for testing the null hypotheses:

(1.1) H_N: $M_{A1_{k=i}} = M_{A2_{k+i}}$ and H_N: $M_{B1_{k+i}} = M_{B2_{k+i}}$

To check the results in support of the behavioral validity of the INOVAC instrument the mean of scale scores (k=25), variable "Accept Wm" (a) was correlated with an external criterion[8], item 27, "Yousem" (i) for each concept (m-5). Spearman rank-order correlation technique was used with the SPSS NONPAR CORR program to establish those relationships for each group and to test the hypotheses

(1.2) H_N : $rho_{aim} = 0$

(3.4) and

H_A : $rho_{aim} > 0$

---

[8]Osgood et al. (1957) study using intention to vote as an external criterion was used as a model.

Interconcept Comparison Profiles

The profiles of means of judgements on the five-point bipolar semantic scales were plotted to make preliminary comparisons among the five window concepts, both within and between respondent groups. These profiles are presented in Chapter V, pp. 213-219 as an elementary visual demonstration of similarities and/or differences in concept judgements.

Interpoint Distance Calculations

As a means of expressing semantic similarity among window concepts, while taking into account both profile co-variation and the discrepancies between the means of profiles, the generalized distance formula of solid geometry was utilized. (Osgood et al. 1957).

The meaningfulness of the window concepts, between and within the two respondent groups, were indexed by employing the formula:

$$Dil = \sqrt{\underset{k}{dil^2}} \quad (k=25)$$

where Dil is the linear distance between concepts in the "semantic space"[9] of attributes of window concepts i and l on the same scale j. Summation was over k=25 scales (Hershberger 1969). The interpoint distance was programmed by the author. Distance (D) matrices may be found on pages 220 and 221.

[9] Semantic space--the space defined by the k coordinates orthogonal axex which fixes each of the m concepts as a point in space. (Osgood et al, 1957, pp. 90-91).

In addition to the interpoint distance calculations between concepts, the distance (D) between each concept and the origin (meaningfulness) was computed for each respondent group. These D's were then used in the construction of a three-dimensional "space model" (Osgood et al, 1957). Though not a means of illustrating statistical significance, such models allow the relativity of relationships between concepts and the origin of meaningfulness to be displayed more fully. This accomplishment was felt to be appropriate for presenting differentials in semantic space and for illustrating how information gleaned by the INOVAC instrument might be displayed to audiences interested in it as an evaluation tool. See space model illustration, page 222.

Factor Analysis

The data from Instrument II, the semantic scales judgements, were explored by factor analysis, a correlation method to reduce data. The raw data judgements on 25 variables (semantic scales) for five window concepts by the two respondent groups were analyzed by the SPSS subprogram FACTOR using the principal factoring with iteration method. That is, inferred factors were produced by using communality estimates in the correlational matrix which were improved through iteration until the new successive communality estimates were negligible. In addition to communalities, eigenvalues, and the proportion of total and common variance were computed. Factor loadings were rotated to simplify the factor structure to obtain more meaningful factors. In the first series of analyses the Orthogonal, Uncorrelated, Varimax Rotation method was used. In the second series of factor analyses the same

process was followed except the factors parameter was limited to three factors. The factoring and rotational method used was based on methods of factor analysis explained in Harmon's (1976) edition of Modern Factor Analysis, Nie et al. (1975) edition of Statistical Package for the Social Sciences, and Osgood et al. (1957) edition of The Measurement of Meaning.

Dimension Score Calculations

Factor scores from the second factor analysis series were used to compute dimension scores. Scales which loaded high (>.5) and exclusively on each factor were identified and used in the naming of dimensions. Five scales common to a factor across concepts and scales which loaded high on factors were selected to compose each dimension score. A concept score was developed by summing the three median dimension scores for each concept. (m=5). (See Table V-15)

Relationships Between Variables

Using data from Instrument II as well as selected contextual variables from Instrument I, the independence of relationships between dependent variables, window concept attributes, and/or independent variables, was investigated through the procedures outlined in Table IV-4.

TABLE IV-4

TESTS FOR SIGNIFICANCE OF RELATIONSHIP

Testing Strategy	Hypotheses	Program Used
Mann-Whitney	There is no difference in concept (m=5) meaning distances (D) between groups	BASLIB
	(2.1) H_N: DA = DB	
	H_N: DA > DB	
	There is no difference in meaningfulness (D) between two concepts (i+m) produced by Group A judgements and meaning distances (D) between Group B judgements of the same concepts over all possible pairs of concepts (m=5)	
	(2.2) H_N: $DA_{im} = DB_{im}$	
	H_A: $DA_{im} = DB_{im}$	
Wilcoxon Matched Pairs Signed-Ranks	There is no difference in meaningfulness (D) between concepts (m=5) as judged by the same group	Manually
	(2.3) H_N: DAio = DAmo	
	H_N: DBio = DBmo	
	H_A: DAio = DAmo	
	H_A: DBio = DBmo	
T-Test	There is no difference between groups in the characteristics of meaning (d=3 and k=15) attributed to specific concepts (m=5)	SPSS T-test + BASLIB MWUT

TABLE IV-4 (Continued)

Testing Strategy	Hypotheses	Program Used
	(2.4a) H_N: $A_k = B_k$	
	$k=15$	
	H_A: $A_k < B_k$	
	$k=15$	
	and	
	(2.4b) H_N: $A_d = B_d$	
	$d=3$	
	H_A: $A_d < B_d$	
	$d=3$	
Chi square χ^2	There is no difference between Group A and Group B in the proportion of members who indicate intention (i) to use specific window concepts (m=5)	SPSS CROSSTABS
	(3.1) H_N: Aim = Bim	
	H_A: Aim > Bim	
Chi square χ^2	There is no difference between Group A and Group B in the proportion of members who have previously seen (b) specific window concepts (m=5)	SPSS CROSSTABS
	(3.2) H_N: Abm = Bbm	
	H_A: Abm = Bbm	

TABLE IV-4 (Continued)

Testing Strategy	Hypotheses	Program Used
Spearman's rank order correlation rho	There is no relationship between acceptance of innovation (a) and exposure to a concept (b) over concepts (m=5) (3.3) H_N: $rho_{abm} = 0$ H_A: $rho_{abm} > 0$	SPSS NONPAR CORR
Spearman's rank order correlation rho	There is no relationship between intention to use an innovative concept (i) and acceptance of the concept (a) over concepts (m=5) (3.4) (1.2) H_N: $rho_{iam} = 0$ H_A: $rho_{iam} > 0$	SPSS NONPAR CORR
Analysis of Covariance	Experimental variable, group (g) and non-experimental variables, enersysh, (e), tincome (t), agegroup (a), windowal (w), and medinfo (me) contribute equally to consumer acceptance of innovation, INOVAT (acceptWm + youse m) (3.5a) H_N: g= e= t= a= me = 0 H_A: g= e= t= a= w= me = 0 Experimental variable, group (g) and non-experimental variables, Windowa (w) and medinfo (me) contribute equally to acceptance of an innovative window concept, acceptWm. (3.5b) H_N: g= w= me = 0 H_A: g= w= me = 0	SPSS ANOVA

The statistical testing strategies used were chosen based upon statistical theory and semantic differential methodology advanced by: Box et al., (1978) in Statistics for Experimenters; Hershberger (1969) in "A Study of Meaning and Architecture"; Vielhauer (1965) in "The Development of a Semantic Scale for the Description of the Physical Environment"; Osgood et al. (1957) in The Measurement of Meaning; Siegel (1956) in Nonparametric Statistics. To the best of this author's knowledge, these strategies are appropriate, but are acknowledged as not being the only methods of statistical analysis which could have been used.

Assumptions

1. A controlled field experiment is an appropriate experimental design by which to evaluate a multi-media program's impact.

2. A survey questionnaire and interview utilizing a structured evaluation instrument are an appropriate and complementary means for gathering both contextual and attitudinal measures to be examined in relationship to the acceptance of residential energy conserving innovation concepts in a controlled field experiment.

3. Simulation of innovative design concepts and semantic scales can be combined to form a structured evaluative instrument to be used in consumer interviews.

4. Attributes of simulated innovative concepts denoted by semantic scales constitute a code of underlying dimensions of meaning that will be used by consumers to determine acceptance of a concept.

5. Experience influences concept meaningfulness and therefore is a factor in consumer acceptance of a concept.

6. Although sample selection and size, and the measurement level, in Instrument II, merit the use of parametric statistics, the n-dimensions or n-variables which are to be compared present a multivariate problem. Historically, the distribution of D has not merited normal curve statistics (Osgood et al. 1957). Therefore, with the INOVAC data, nonparametric tests should be applied to the comparison of multivariate and nominal level data.

Limitations

The characteristics of the sampled community should be kept in mind when evaluating and generalizing the substudy results to other populations. The following characteristics should be considered: all respondents were female; all were AES program clientele; over 40% of each comparison group was 55 years of age or older. Moreover, only respondents from the Instrument I survey were considered for the Instrument II substudy sample.

A second area of limitation stemmed from the fact that the experiment only controlled the ENERSENSE media materials. Other agencies were simultaneously disseminating energy conservation information. Further, because media viewing is optional, exposure to ENERSENSE materials was not guaranteed. Data based upon consumer recall in answering media exposure items on Instrument I indicated that the two comparison groups had similar amounts of exposure to both radio

and television energy conservation programming. Although the research design, controlled field experiment, was selected because it theoretically could allow for such real world situations, the group media exposure similarity in this substudy has been acknowledged and recognized as a potential limitation to realizing differences between the control and treatment groups.

CHAPTER V

RESULTS OF THE EXPERIMENT

Introduction

Objectives of the Experiment

The purpose of the experiment was two-pronged and encompassed both methodological and experimental objectives. The methodological objectives were: first, to develop a method of assessing consumer acceptance of innovations via a specifically designed code in conjunction with simulated design concepts, and second, to test such an evaluation tool. The experimental objective was to determine if a multi-media residential energy conservation education program had any measureable impact on consumers' attitude toward (acceptance of) residential energy conserving innovations. An additional, but secondary objective, to those identified initially, was to determine if there was a relationship between consumer attitude and/or behavior, towards innovative energy conserving design concepts and consumer characteristics delineated by contextual variables[1]. These overall objectives provided the basis for the formulation of the research hypothesis tested in the analysis of data.

Findings and Discussion

The results of the data analysis are reported in relation to 12 hypotheses. The findings are presented and discussed under the

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[1]The contextual variables are described on page 245.

following headings: 1) the INOVAC[2] as an evaluation tool; 2) dimensionality of judgements; 3) judgements group comparisons and relationships with contextual variables; and 4) summary.

The INOVAC As An Evaluation Tool

To establish the merits of using the INOVAC test as an evaluation tool, its performance in this study was evaluated. Selected aspects of standard criteria for assessing measurement instruments were considered in conjunction with the data collected. Towards that goal the two methodological objectives for the study were translated into the following hypotheses:

H_N 1.1: There is no difference between subgroup scale score means of judgements on concept characteristics.

H_N 1.2: There is no relationship between overall acceptance of concept characteristics and the expressed intention to use a concept.

The alternative hypothesis to H_N 1.1 being that there would be a difference and in the case of H_N 1.2 that there would be a positive relationship.

Findings

The criteria considered in evaluating the INOVAC as an evaluation instrument included: objectivity, reliability, validity, sensitivity, comparibility, and utility. Objectivity, sensitivity, and utility of the semantic differential as an approach to measurement have been well established by other researchers. As a combination of controlled association and scaling procedures the INOVAC instrument was found to

[2]INOVAC - The semantic differential scale/innovation simulation instrument, Instrument II.

be no less effective than other instruments which have utilized the semantic differential format.

After those criteria which are present in the instrument due to its nature had been examined, the criteria related to specific characteristics of the INOVAC instrument were considered. The instrument's item reliability and validity, established through correlation with an external criterion, and its comparablity across concepts and subjects, were analyzed to determine the INOVAC's role as a method for evaluating or indexing acceptance of innovative design concepts.

Item reliability. The t-test was used to compare judgements of subgroups formed from halving Group A and Group B. The mean scale scores for the 25 characteristics attributed to each of the five window concepts plus items 26 and 27 were used in comparing group halves. The results indicate that the hypothesis tested over k+25 scales,

$$H_N\text{: } M_{A1_{k+i}} \text{ and } H_N\text{: } M_{B1_{k+i}} = M_{B2_{k+i}}$$

(characteristics) and question items i=2 cannot be rejected for 10 items over 10 trials for two groups with the five different concepts. Only three items, beautiful, heavy, and good ventilation, have a T value in two instances that merits rejecting the null hypothesis while the performance of 14 items supports the null hypothesis in 9 out of 10 trials or 90 percent of the time. These results are summarized in Table V-1 and support the decision that since all items were reliable 80 percent of the time or better, none of the items would be dropped from the test analysis. Those with 100 percent reliability were noted for examination in future performances of the INOVAC instrument.

TABLE V-1

ITEM ANALYSIS T-TEST SUMMARY FOR REJECTION OF H_N AT P. $\leq$ .05

Items	Group A1:A2					Group B1:B2				
	TW_1	TW_2	TW_3	TW_4	TW_5	TW_1	TW_2	TW_3	TW_4	TW_5
*Interesting							-2.06			
Decorative										
*Adequate Size									-2.89	
Clean										
*Attractive							-2.36			
Stuffy										
Convenient										
**Beautiful							-3.33		-2.18	
*Warm							-2.05			
Thrifty										
Simple										
*Modern					2.15					
*Good Lighting									-2.77	
**Heavy	-2.57				-2.05					
*Private										-2.17
*Comfortable					-3.03					
*Functional									-2.47	
Safe	-2.01									
*Good									-3.34	
Comfortable Temp.										
Usual										
Neat										
**Good Ventilation					-2.17					
*Durable					-2.29					
*Cheap					-2.33					
Window										
*Youse									-2.17	

$W_{1,2,3,4,5}$ Window concepts 1 to 5
**items with more than one instance of T with $\leq$ .05
*items with one instance of T with $\leq$ .05

Correlation with external criterion. The external criterion "youse" "Would you use it to save energy?", Item 27, when correlated with the group mean scale score for the 25 characteristics of each concept (m=5), established a rho which was significant in all instances at the .005 level. The correlation coefficients are presented in Table V-2 showing that seven of the ten rho's were significant at the .001 level. Such results support the behavioral validity of the INOVAC instrument. They also have interesting implications for using the INOVAC for planning for and predicting the acceptance of innovations.

TABLE V-2

SUMMARY OF SPEARMAN CORRELATION COEFFICIENTS BETWEEN VARIABLES ACCEPTW AND YOUSE

Variable Pair	Group A		Group B	
	rho	Significance Level	rho	Significance Level
Accept W_1 with Youse 1	.3867	.005*	.4067	.004*
Accept W_2 with Youse 2	.4857	.001	.5714	.001
Accept W_3 with Youse 3	.6652	.001	.5577	.001
Accept W_4 with Youse 4	.5948	.001	.6268	.001
Accept W_5 with Youse 5	.5666	.001	.4099	.003*

* > .001

Comparability across subjects and concepts. Because comparability is an extension of the notion of validity, its analysis across both groups and concepts is essential for determining the range of "situations" in which the INOVAC instrument can work. Previous research with the semantic differential has suggested that a high degree of comparability across subjects and groups exists while comparison across concepts has shown that the same factors keep appearing across categories of concepts. The findings related to INOVAC group and concept comparisons are discussed generally and for statistical significance in relation to H_N (2.1), through H_N (2.5) in the next section "Dimensionality of Judgements" p. 212. The findings illustrate that the INOVAC test is an evaluation instrument which determines common dimensions between groups and across concepts, while it also identifies differences in magnitude.

Thus, in this study, the INOVAC instrument has exhibited acceptable item reliability, positive behavioral validity, and provided a basis for comparison related to the meaningfulness and dimensionality of concepts for groups with varied experience. As it possesses these three qualities, plus utility and objectivity, which are standard criteria for the assessment of an evaluation instrument, one feels that the INOVAC instrument has begun to establish a favourable reputation for itself as an agent in the evaluation of innovation acceptance. Thus, the substudy achieved its first and second objectives.

Meaningfulness and Dimensionality of Judgements

The experimental objective for the substudy gave a rise to four hypotheses which compared the meaningfulness and dimensionality of the within- and between-group judgements of the five window concepts' attributes.

H_N 2.1: There is no difference in concept-meaning distance between groups.

H_N 2.2: There is no difference in meaning distances between two concepts produced by Group A judgements and meaning distances between Group B judgements of the same concepts over all possible pairs of concepts.

H_N 2.3: There is no difference in meaning distances between concepts as judged by the same group.

H_N 2.4a:
2.4b: There is no difference between groups in the characteristics of meaning attributed to specific concepts.

H_N 2.5: There is no difference in dimensionality within-groups in the characteristics of meaning attributed to specific concepts.

In these instances the alternative hypothesis for each null hypothesis specified that judgements of Group A would be more positive than those of Group B, or that the less innovative design concepts would have more positive meaning for both comparison groups. These hypotheses were summarized earlier in Table IV-4 pp. 200-202.

Findings

In addition to hypotheses testing, the meaningfulness of judgements on the five window concepts between and within the two comparison groups were compared through plotting profiles of mean scale scores (k=25) on the concepts (m=5). Figures V-1 to V-7 show these profiles with the 25 characteristics presented at the extremes of the chart.

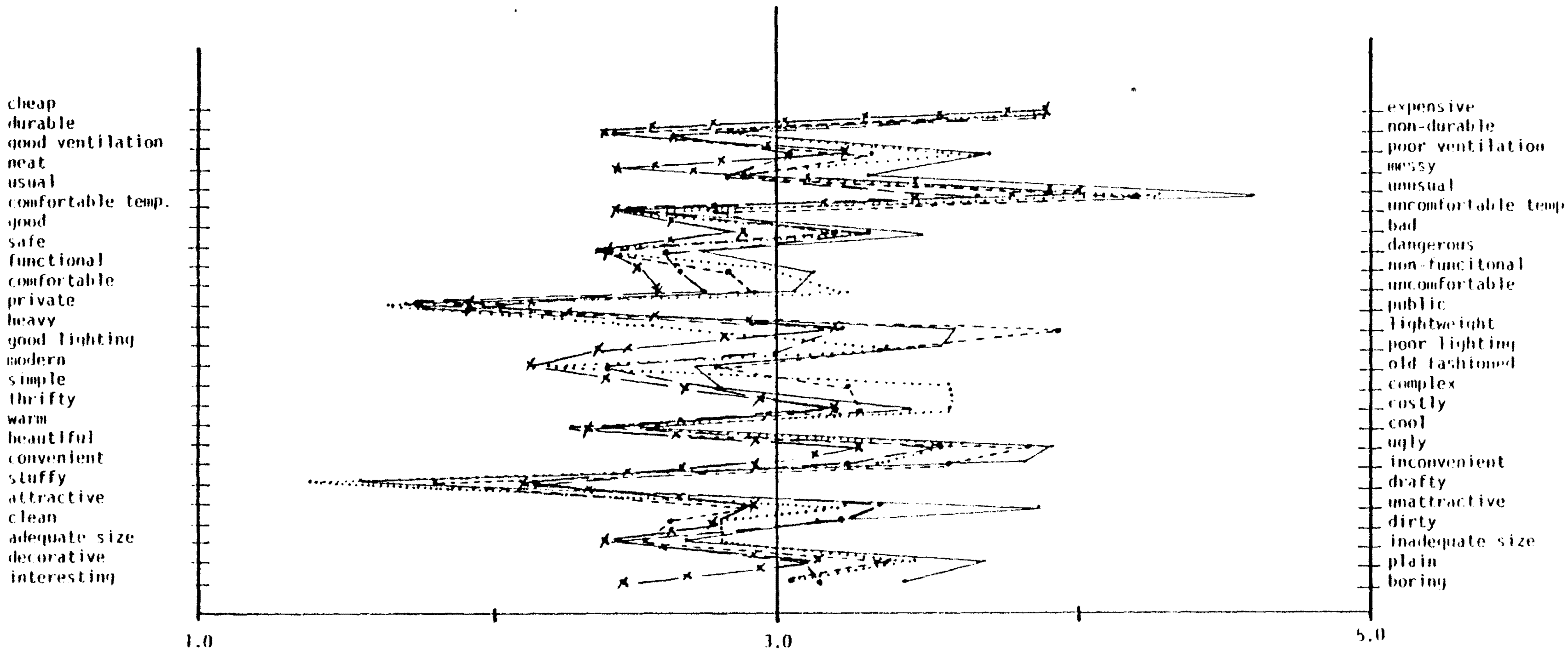

Figure V-1 Profiles of Means for Window Concept Characteristics Judged by Group A (N=49)

Key: Bifold Window 1 (W_1) ————
Skylight Window 2 (W_2) ....
Accordian Window 3 (W_3) --------
Quilt Window 4 (W_4) — — —
Beadwall Window 5 (W_5) --.--.--

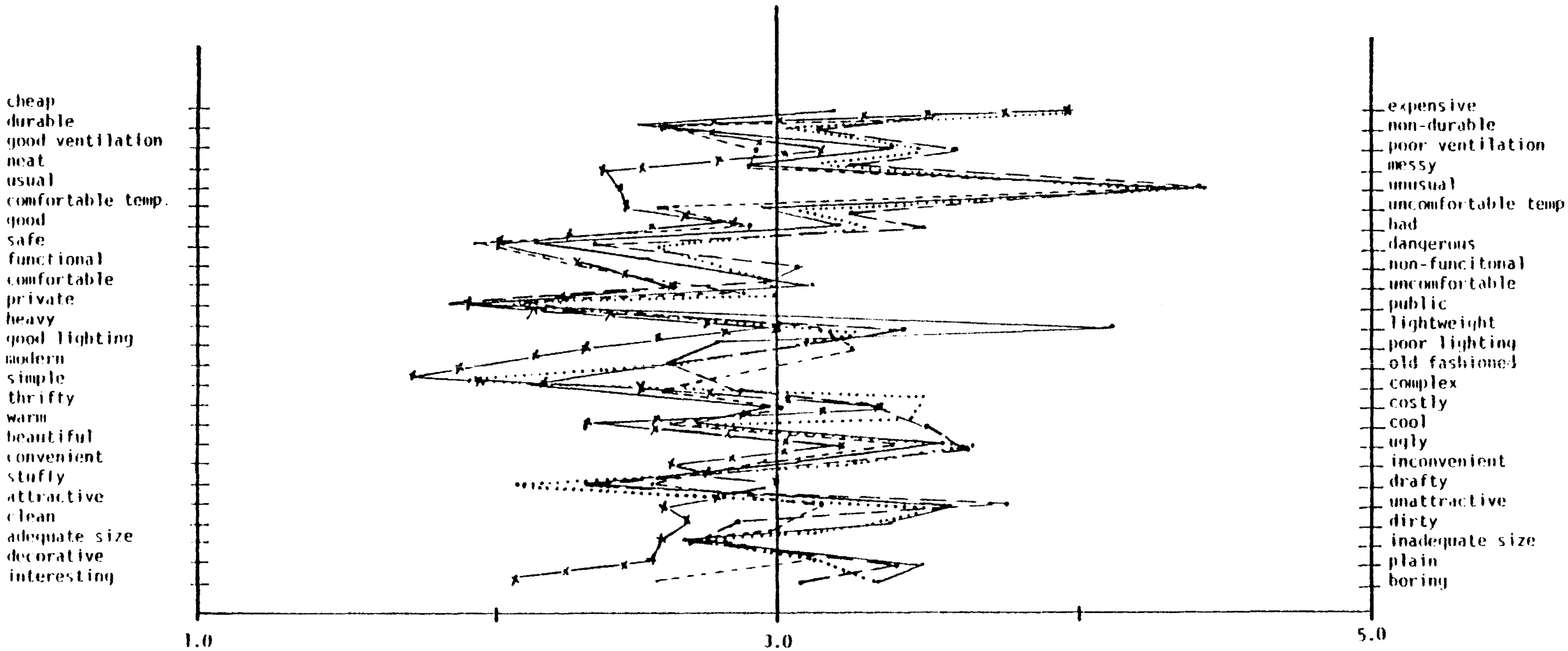

Figure V-2 Profiles of Means for Window Concept Characteristics Judged by Group B (N=49)

Key:
Bifold Window 1 (W_1) ————
Skylight Window 2 (W_2) ....
Accordian Window 3 (W_3) --------
Quilt Window 4 (W_4) — — —
Beadwall Window 5 (W_5) --.--.--

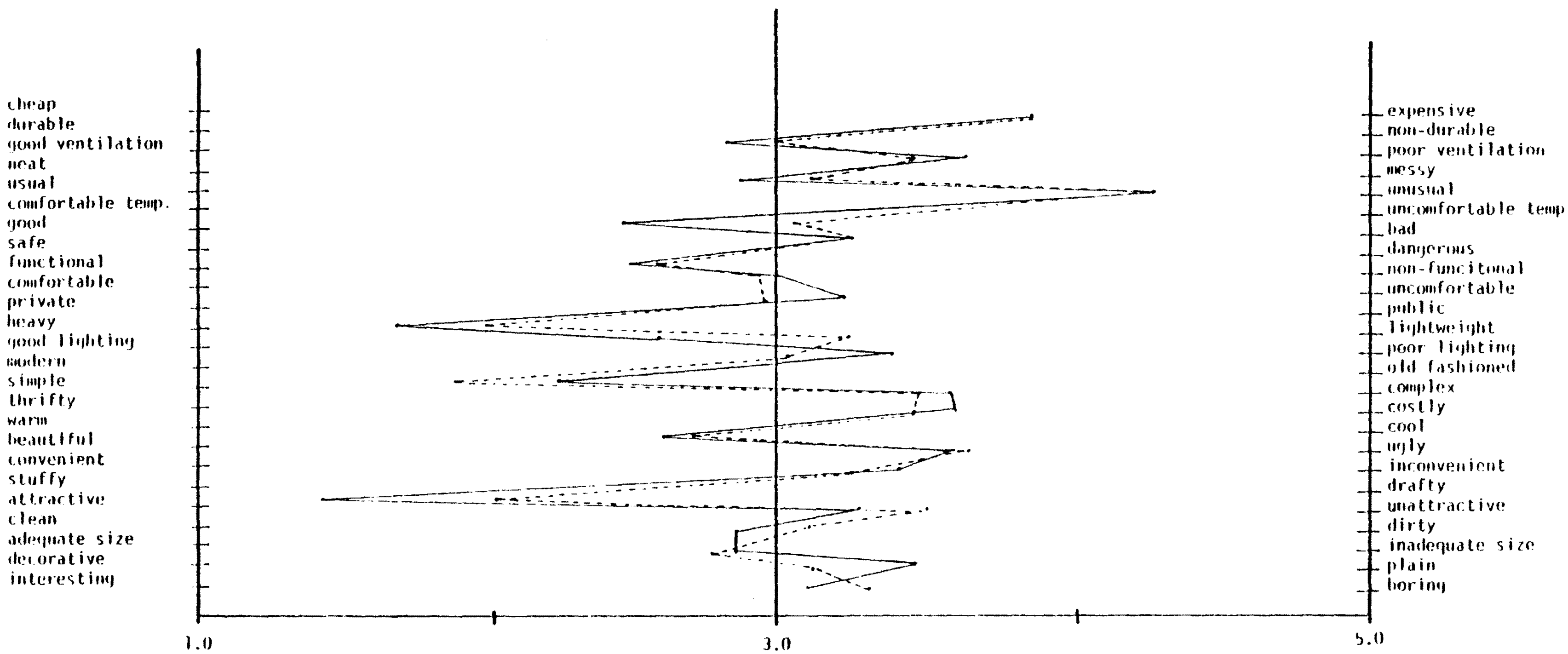

Figure V-3 Profiles of Window Concept I (Bifold) Means as Judged by Group A and Group B.

Key: A: ————
B: ....

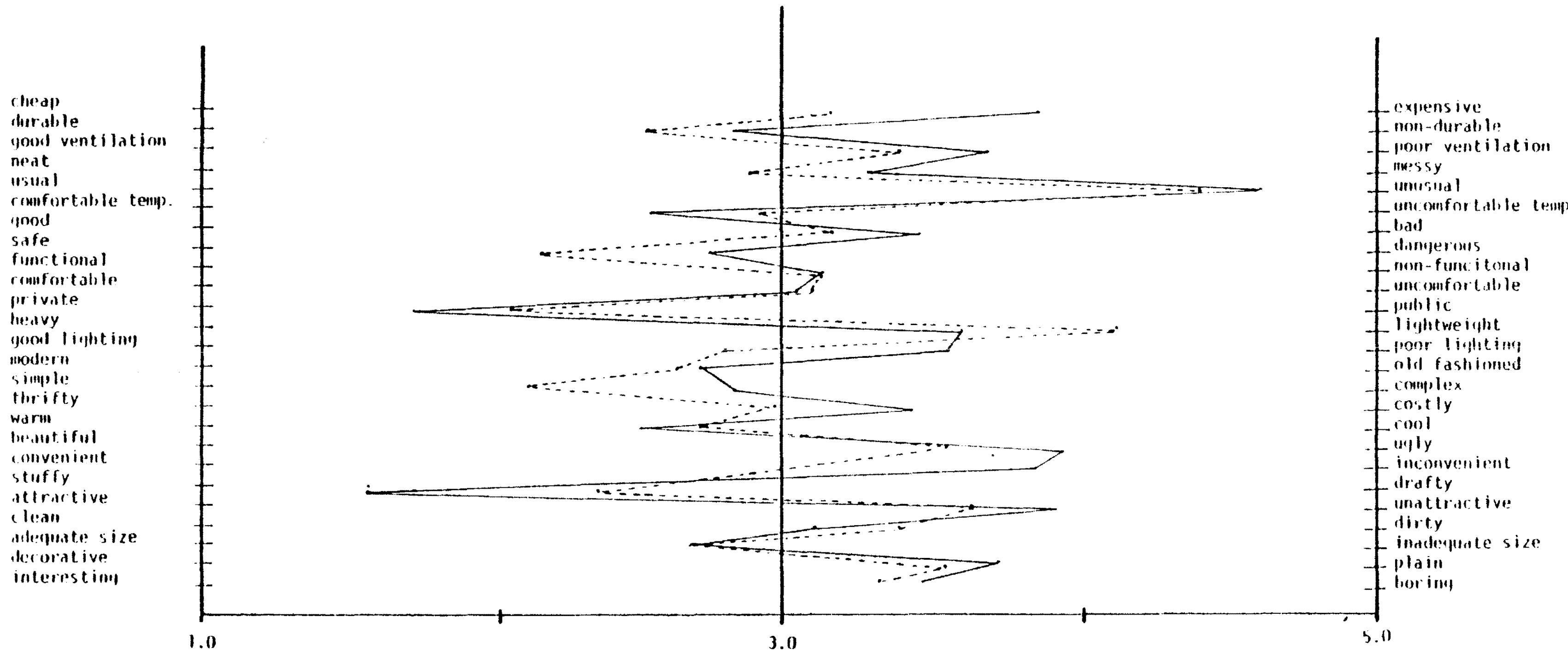

Figure V-4 Profiles Window Concept II (Skylight) Means as Judged by Group A and Group B.

Key: A: ————
B: ....

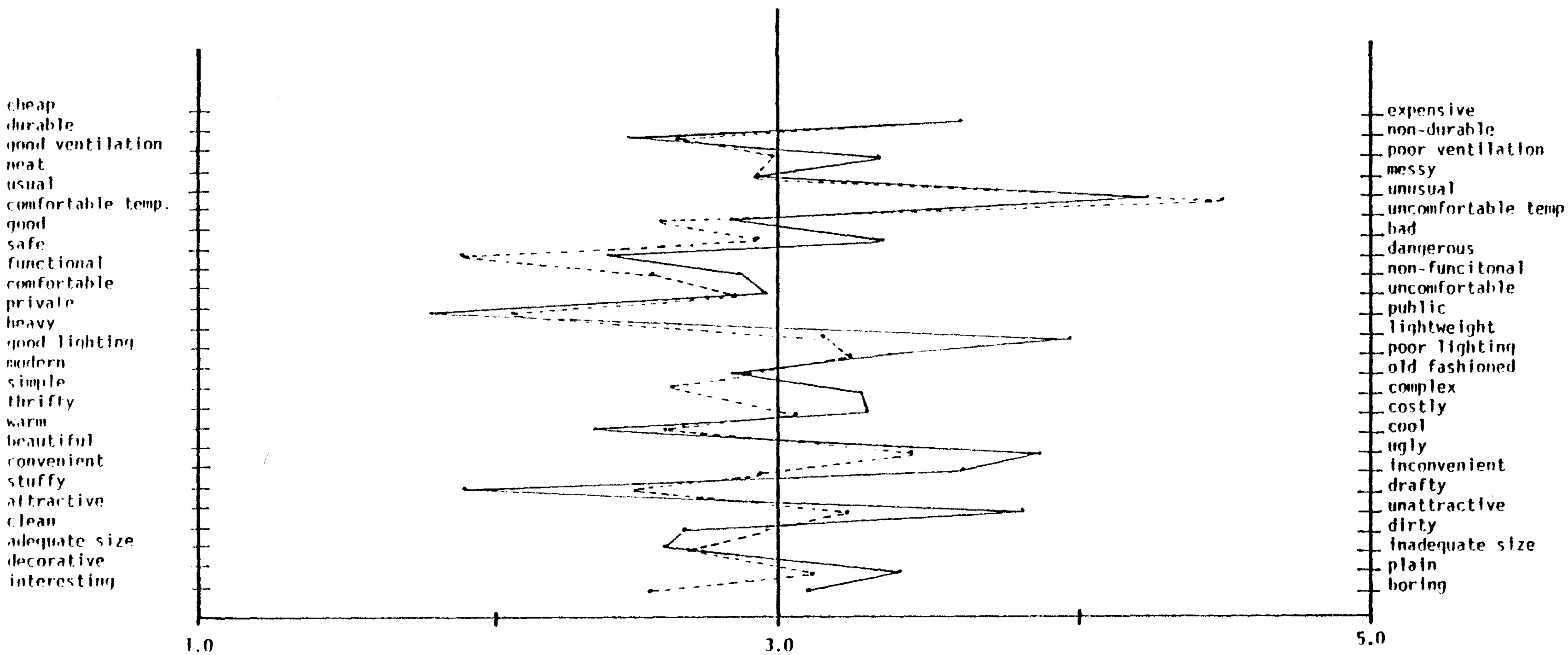

Figure V-5 Profiles Window Concept III (Accordion) Means as Judged by Group A and Group B.

Key: A: ————
B: ....

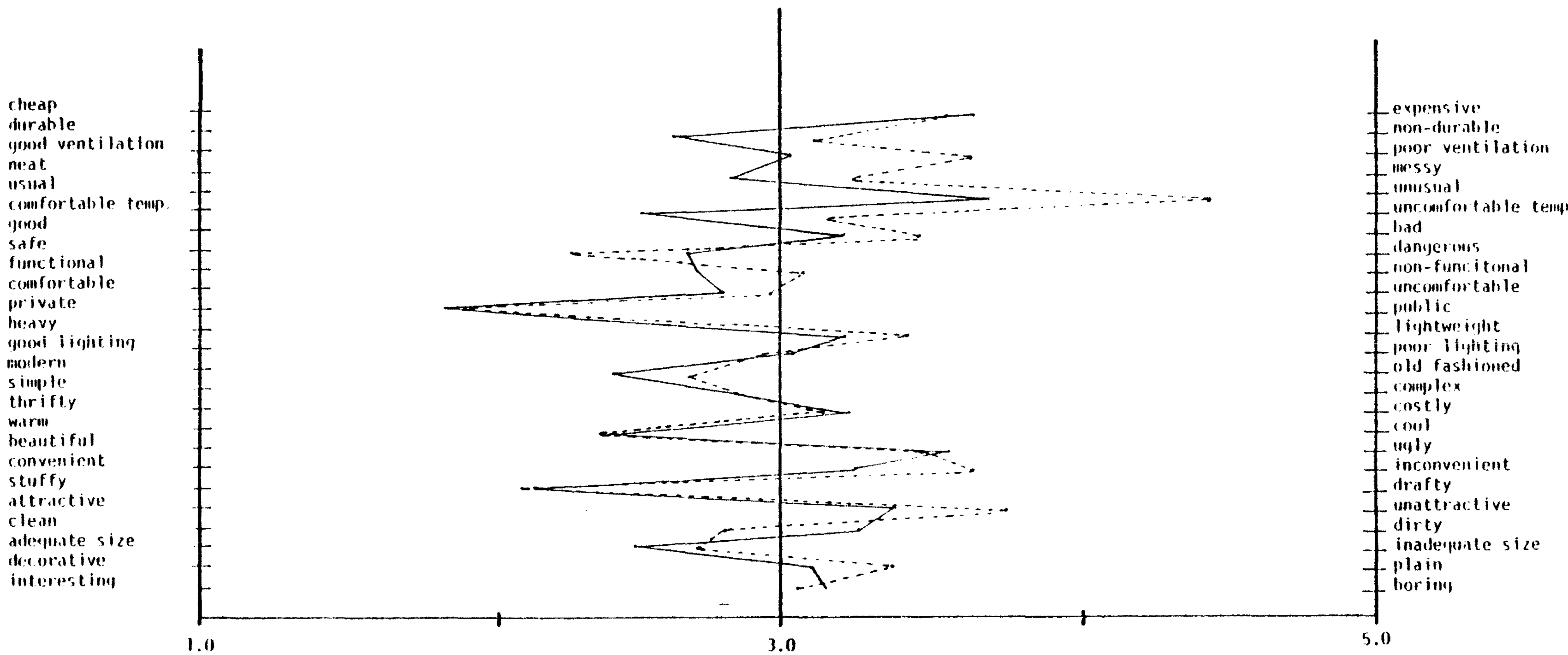

Figure V-6 Profiles Window Concept IV (Quilt) Means as Judged by Group A and Group B.

Key: A: ————
B: ....

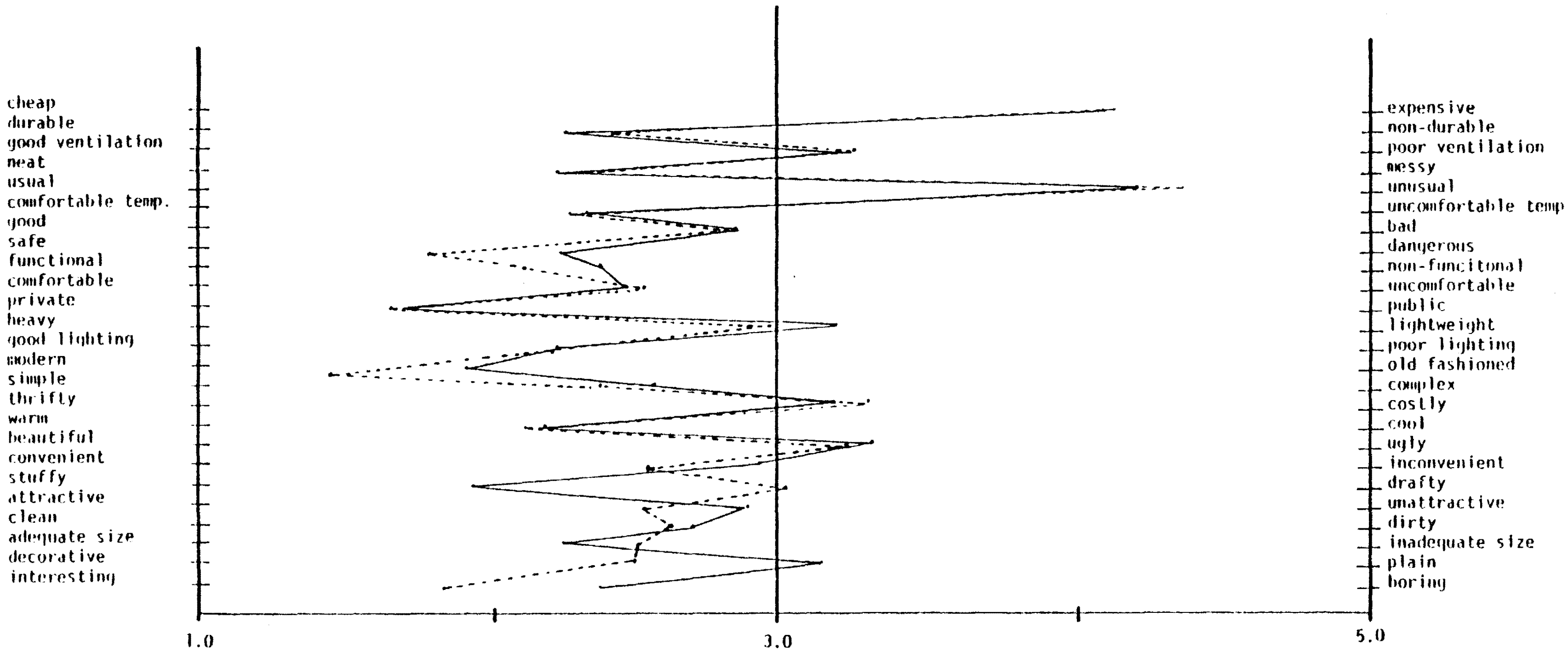

Figure V-7 Profiles Window Concept V (Beadwall) Means as Judged by Group A and Group B.

Key: A: ————

B: ....

When it is recognized that departure from the mid-point may be referred to as meaningfulness, these profiles provide a preliminary visual index of concept judgements, similarities, and differences.

To account for the profiles' covariation and the discrepancies between the means of profiles, as well as to allow for more complete analysis of the information in the data, the generalized distance function, D, computed as the multidimensional distance of each concept from the origin, O, or between concepts i and 1, provided distance measures presented in Tables V-3, V-4, and V-5.

TABLE V-3

DISTANCE MEASURES BETWEEN CONCEPTS BY GROUP

CONCEPTS		DISTANCE MEASURES (D)* GROUP A	GROUP B
Window 1	to Window 2	Dil = 1.696	Dil = 1.820
1	3	1.372	1.589
1	4	2.372	1.587
1	5	3.056	2.758
2	3	1.644	2.011
2	4	1.731	1.343
2	5	2.343	2.686
3	4	1.550	1.834
3	5	2.364	1.980
4	5	1.515	2.890

*The D's in this table are taken over k=25 scales.

TABLE V-4

CONCEPT DISTANCE MEASURES FROM ORIGIN BY GROUP

CONCEPTS	DISTANCE MEASURES (D_O)* GROUP A	GROUP B
Window 1 to Origin	Do_1 = 3.919	Do_1 = 2.420
2 to "	Do_2 = 2.840	Do_2 = 2.640
3 to "	Do_3 = 2.559	Do_3 = 2.570
4 to "	Do_4 = 2.170	Do_4 = 2.534
5 to "	Do_5 = 2.258	Do_5 = 2.919

*The D's in this table are taken over k=25 scales using a hypothetical concept which was checked at the midpoint of all scales.

TABLE V-5

BETWEEN-GROUP CONCEPT DISTANCE MEASURES

CONCEPTS		DISTANCE MEASURES ($D_{A^i B^i}$)*
Window A1 to Window	B1	DA_1B_1 = 2.036
A2	B2	DA_2B_2 = 1.339
A3	B3	DA_3B_3 = 1.822
A4	B4	DA_4B_4 = 1.600
A5	B5	DA_5B_5 = 1.058

*The D's in this table are taken over k=25 scales.

The values in the D matrices, Tables V-4 and V-5, were used to build three-dimensional space models, Figure V-8, which provided a more tangible means of representing the relationship of the concepts to the origin of the semantic space and between and within groups.

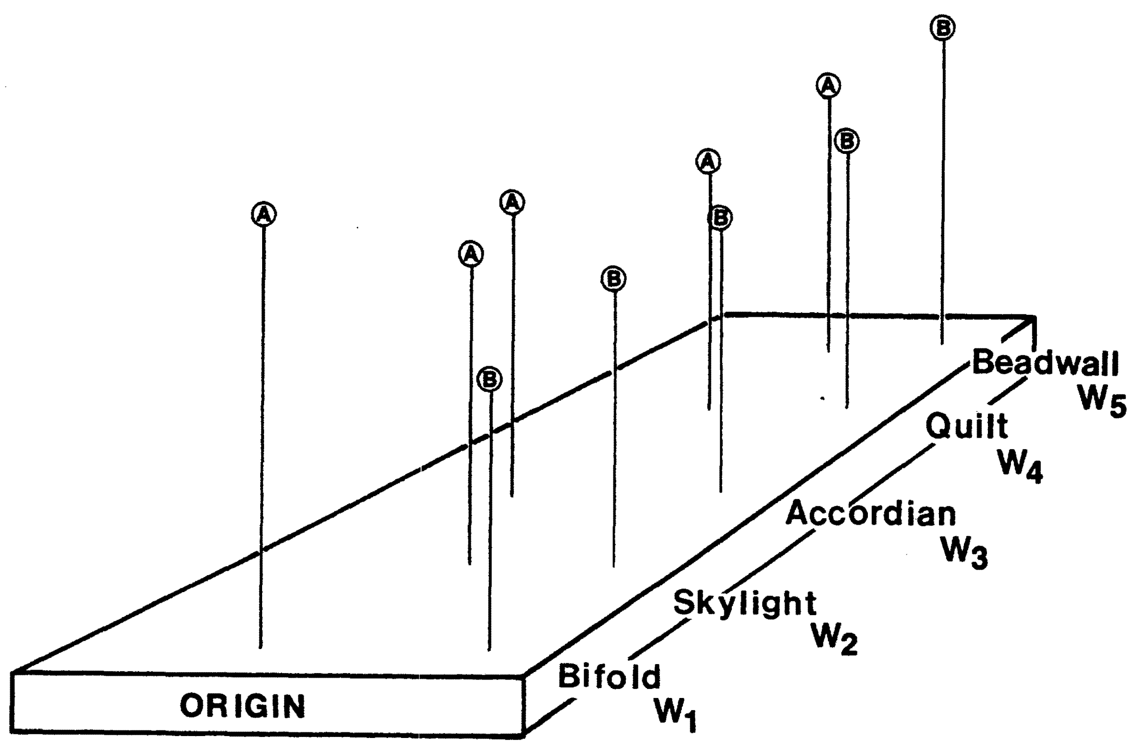

Figure V-8 Semantic Space Models of Group Relationships for Five Concepts Based Upon Distance Measures From the Origin and Between Groups A and B

Table V-6 presents the mean D (or distance) from the origin of the "semantic space" for the two comparison groups taken over the five window concepts, and the results of the Mann-Whitney U-test which was used to make the comparison. As the U=11 has a probability of .456, which is greater than $\alpha \leq .05$, the null hypothesis (2.1) $A_D = B_D$ cannot be rejected. The treatment group, Group A, did not find the concepts more meaningful. This fact was surprising as it was believed that the subjects having had the potential to receive energy conservation education would consider energy conserving innovations to be more meaningful than would those who had not.

TABLE V-6

BETWEEN GROUP MEANINGFULNESS OF JUDGEMENTS: MANN-WHITNEY U-TEST

GROUP A	Compared to	GROUP B
Mean D = 2.75		Mean D = 2.62
U = 11		p = .4562

In Table V-7, the mean D's of comparison group's judgements on all possible pairs (p = 10) of concepts (m=5) are presented with the results of the Mann-Whitney U-test used to compare them. Since the U = 43, has a probability level of .5, which is also greater than the selected acceptable level of significance $\leq .05$, hypothesis (2.2)

$$H_N: DA_{im} = DB_{im}$$

cannot be rejected.

TABLE V-7

BETWEEN GROUP MEANINGFULNESS OF CONCEPT PAIR JUDGEMENTS: MANN-WHITNEY U-TEST

GROUP A	Compared to	GROUP B
Mean D = 3.08		Mean D = 2.05
U = 43		p = .5000

D = the multidimensional distance of each window concept from the origin (0) of the semantic space; computed across all 25 scales.

U = statistic computed to test the difference in D values between the two groups.

P = probability for a one-tailed test obtaining a value as extreme as U.

It was expected that the distance between concepts would increase relative to the difference in innovativeness of the concepts paired for comparison, and that the two groups would not judge the pairs as equal. Such, in this instance, however, does not appear to be the case.

Wilcoxon's matched pairs signed-ranks test was used with concept pair distance measures within groups to test hypothesis (2.3). Table V-8 presents the results of those tests.

Group A judgements of concepts between pairs for the data in Table V-8 produced T values in Table V-9 ranging from 92 to 104.5. None of these T's has a probability which is less than the .025 level of significance. Therefore, the hypothesis cannot be rejected.

TABLE V-8

CONCEPT D SCORES (MEANINGFULNESS) RANKED BY JUDGES AND GROUP

CONCEPT	JUDGES RANKING Innovative-ness	JUDGES RANKING Meaningful-ness	GROUP A D	GROUP A Ranking	GROUP B D	GROUP B Ranking
Bifold (W_1)	1	5	3.92	5*	2.42	1
Skylight (W_2)	2	4	2.84	4**(*)	2.64	4**(*)
Accordian (W_3)	3	3	2.56	3**(*)	2.57	3**(*)
Quilt (W_4)	4	2	2.17	1	2.54	2*
Beadwall (W_5)	5	1	2.26	2	2.91	5

*Same rank as judged.
**Group agreement in rank.
- Judges high ranking most innovative
- High rank most meaningful

TABLE V-9

COMPARISON OF WITHIN GROUP MEANINGFULNESS OF JUDGEMENTS BETWEEN PAIRS RANKED BY GROUP: WILCOXON MATCHED PAIRS SIGNED-RANKS TEST

RANK	GROUP A	T
1:2	Quilt (W_4) compared to Beadwall (W_5)	92
2:3	Beadwall (W_5) compared to Accordion (W_3)	104.5
3:4	Accordion (W_3 compared to Skylight (W_2)	134.5
4:5	Skylight (W_2) compared to Bifold (W_1)	101.5
	GROUP B	
1:2	Bifold (W_1) compared to Quilt (W_4)	145
2:3	Quilt (W_4) compared to Accordion (W_3)	139.5
3:4	Accordion (W_3) compared to Skylight (W_2)	136
4:5	Skylight (W_2) compared to Beadwall (W_5)	70**

- The concept D scores employed in the Wilcoxon Test were calculated over all scales (k=25) for each of the concepts.
- T = statistical computed to test the difference in meaningfulness of within group judgements between pairs of concepts.
- Pairs compared were those formed between concept rankings of meaningfulness (TABLE 5-8).
- The higher rank is the most meaningful.

** $\alpha \leq .001$

Here again, groups have not judged the pairs of concepts to differ in meaning relative to varying degrees of innnovativeness. Therefore, although this was not what was expected, it can be concluded that the pairs of concepts considered were not judged to vary significantly in innovative qualities.

The final hypothesis (2.4) which was tested relative to meaningfulness and dimensionality of the concepts stated that there was no difference between groups in the characteristics of meaning attributed to specific concepts. Rather than looking at the overall meaning which concepts possessed, the meaning of n-attributes and n-dimensions were compared between the two comparison groups for each of the five window concepts. That is, scales with high factor loadings were selected, and factors identified through the two factor analyses dimensions were developed and compared between groups for general features, as well as for statistical significance. This process commenced with identifying the factors which each group judged each concept to possess. The results of the first factor analysis procedure may be found in Appendix G.

One important consideration in assessing innovative concepts is whether or not the same dimensions of meaning are identified in concepts. Another consideration is whether or not the dimensions of meaning that are identified are present for both comparison groups in all the concepts (m=5) considered.

Five concepts had been chosen for the substudy: (1) bifold shutters, (2) skylight, (3) accordion, (4) quilt, (5) beadwall. The

range of innovativeness had been determined by a panel of judges to range from the bifold shutter to the beadwall. The beadwall was felt to be at the most innovative end of the spectrum. This comparison was seen to be relevant for three reasons:

1) If different dimensions were perceived by different groups in each concept, it would be beneficial to know this for future concept development and promotion.
2) Knowledge of the differences would assist in evaluating the appropriateness of using such a set of scales for studying consumer acceptance of innovative concepts.
3) Through the rating of the attributes and dimensions a more objective index of user acceptance of concepts was provided which should allow a better understanding of those concepts.

The factor analysis procedure "grouped" scales which were used similarly by members of a comparison group into "factors" for each window concept. Through the orthogonal varimax rotation method the factoring process first identified all possible factors for each of the concepts judged by each group of respondents. It was found that the ten sets of factors produced by that process contained unequal numbers of factors. The titles, distribution and variance of the factors are presented in Appendix G and Tables V-10 and V-11.

TABLE V-10

INITIAL FACTOR ANALYSIS
SUMMARY OF FACTORS PER WINDOW CONCEPTS BY GROUP

GROUP	WINDOW CONCEPTS 1	2	3	4	5
A	9	8	8	7	7
B	8	7	6	8	7

TABLE V-11

PERCENT OF VARIANCE AND CUMULATIVE PERCENT
OF VARIANCE ACCOUNTED FOR BY THREE AND FOUR
FACTORS IN THE INITIAL FACTOR ANALYSIS BY
CONCEPT AND GROUP

	CONCEPT	F_1	F_2	F_3	CUM	F_4	CUM
	A	29.4	18.0	14.1	61.0	9.6	71.0
W_1	B	43.8	12.3	11.8	72.9	8.9	81.8
	A	47.8	11.9	10.2	69.9	7.0	76.9
W_2	B	40.4	19.5	13.0	72.9	8.9	81.8
	A	43.2	16.1	10.9	70.2	8.0	78.2
W_3	B	51.2	14.9	14.0	80.2	9.9	90.1
	A	52.7	16.7	8.7	78.0	7.1	85.2
W_4	B	40.2	15.1	10.5	65.8	10.0	75.8
	A	45.6	16.7	11.1	73.4	9.6	82.9
W_5	B	42.8	13.8	12.5	69.0	10.1	79.1

It was deemed necessary to establish a procedure by which comparisons among concepts and between the two comparison groups could be made,the data were refactored and the number of factors extracted for each concept limited. In this second factor analysis the number of factors to be extracted was determined by examining the variance accounted for by the factors identified in the first factor analysis. The total variance accounted for by two, three, and four factors, etc., (Table V-11) was considered and weighed against the criteria of selecting a sufficient number of factors to account for at least 50% of the total variance.

Four dimensions had been projected for concept judgements during the development of the INOVAC instrument. Consequently, it was reinforcing to the merit of earlier decisions to find that, in all but one of the factor sets, 75% of total variance was accounted for by four dimensions. Three dimensions accounted for 60% of the total variance in all factor sets. Since the fourth factor in the 10 sets of factors accounted for $\leq$ 10% of the variance it was decided to limit the number of factors to be extracted to n=3.

The factors extracted through the second analysis are presented in Appendix G. Factors were named after identifying scales with factor loadings $\leq$ .5. This made it possible to select factor names that characterized the predominant scales grouped together in each factor. The factors identified included: 1) aesthetic appeal, 2) performance evaluation, 3) economic dimensions, and 4) combinations of those three plus a novelty component.

Aesthetic appeal scales were predominant in Factor I appearing in sets W_1, WB_1, WA_3, as a pure factor[3] and in combination with performance evaluation scales in the other seven sets. The performance evaluatin scales were predominant in Factor II for seven of the sets. Sets WA_1, WB_1, WA_2, WB_3, WB_4, WB_5, had pure performance evaluation dimension for their second factor. In set WA_4 it was combined with aesthetic appeal. The remaining sets also had combination dimensions, WB_2 had an economic/novelty appeal dimension, while WA_5 had an economic/novelty/performance evaluation dimension for its Factor II.

Group A and B agreed on Factor I for four out of the five concepts and on Factor II for three out of the five concepts. There was little agreement between groups on the dimension represented by Factor III. Group A had seen performance evaluation dimensions along with a novelty dimension, while Group B identified an economic or economic/novelty dimension in four of the five concepts.

The dimensions identified were only partially consistent with the dimensions which had been anticipated. More multi-dimensional factors were identified and the novelty component was unanticipated. The fact that the novelty component appeared only in five of the ten sets of factors precipitates the necessity of asking the question, "If these are innovative concepts, why was the novelty component not identified in all the sets of factors?" This question should be pursued in future research.

---

[3] Pure factor: a factor comprised of scales characteristic of only one dimension.

These findings suggest that the INOVAC instrument has provided a method of evaluating the meaning of concepts within and between groups. In summary the aesthetic appeal dimension was a priority in concept judgements for both groups but not totally separate from the performance evaluation dimension. Group B was more prone to identify an economic dimension. Otherwise, there were many similarities within and between the two groups identified for the concepts.

This gives rise to the questions: 1) Are like concepts perceived to have equal meaning?; 2) If not, what attributes or dimensions hold more or less meaning?; Is the difference in meaning relative to the "innovativeness" of the concept? Table V-12 presents the mean scale score and standard deviations for selected attributes as well as the grand mean scale scores for those scales which were selected from the sets of factors. Five scales were selected from each dimension (n=3) based upon their factor loadings and their frequency of appearance across factor sets. Both Osgood et al. (1957) and Vielhauer (1965) stressed the importance of having equal numbers of scales in each dimension.

Three hypotheses were tested, H_N (2.4a), H_N (2.4b), and H_N (2.5), in pursuit of identifying differences in dimensionality (meaning). Table V-12 presents the results for the t-test used to test differences between the selected scales; Table V-13 presents the results for the Mann-Whitney U-test used to test concept differences, both being tests for between-groups. Within group differences H_N (2.5) were tested through the Wilcoxon Matched-pairs Signed Ranks Test, after concepts had been ranked on lowest to highest rating, Table V-14. Those results are shown in Table V-15.

TABLE V-12

COMPARISON OF SELECTED ATTRIBUTES
OVER FIVE CONCEPTS BY GROUP: T-TEST

		GROUP A N=49		GROUP B N=49		
	ATTRIBUTES	M	SD	M	SD	T
W_1D_1						
	interesting	3.47	1.65	3.37	1.73	.30
	decorative	3.75	1.56	3.55	1.53	.65
	attractive	3.98	1.36	3.67	1.49	1.06
	beautiful	4.00	1.14	3.60	1.31	1.65
	good	3.53	1.16	3.20	1.43	1.24
		MS = 3.75	MSD - 1.37	MS = 3.48	MSD = 1.50	
W_1D_2						
++	stuffy	2.06	1.23	2.63	1.54	-2.10*
+	convenient	3.90	1.54	3.08	1.67	2.51**
	neat	3.33	1.64	2.88	1.69	1.33
	durable	2.79	1.46	2.54	1.60	.86
++	comf. temp.	2.55	1.23	2.94	1.53	-1.10
		MS = 2.93	MSD = 1.49	MS = 2.81	MSD = 1.61	
W_1D_3						
	thrift	3.49	1.60	3.00	1.66	1.49
	simple	2.88	1.60	2.31	1.86	.06
	modern	2.73	1.63	2.65	1.69	.24
	usual	4.53	1.02	4.10	1.33	1.79
	cheap	3.59	1.34	3.27	1.58	1.10
		MS = 2.54	MSD = 1.42	MS = 3.07	MSD = 1.62	

Concept MS = 3.07 Concept DTS = 2.90
Concept MSD = 1.43 Concept MSD = 1.58

TABLE V-12 (Continued)

	ATTRIBUTES	GROUP A N=49 M	SD	GROUP B N=49 M	SD	T
W_2D_1						
	interesting	3.08	1.74	3.37	1.69	-0.82
	decorative	3.51	1.64	3.16	1.60	1.06
++	attractive	3.28	1.55	3.61	1.48	-1.06
	beautiful	3.67	1.35	3.71	1.24	- .16
	good	3.32	1.36	3.32	1.39	.0
		MS = 3.37	MSD - 1.53	MS = 3.43	MSD = 1.48	
W_2D_2						
++	stuffy	2.06	1.14	2.59	1.08	-2.36**
	convenient	3.39	1.73	3.31	1.67	.24
	neat	2.88	1.50	3.14	1.49	- .88
	durable	2.86	1.62	3.04	1.42	- .60
++	comf. temp.	2.47	1.32	3.06	1.31	-2.22*
		MS = 3.73	MSD = 1.53	MS = 3.03	MSD = 1.31	
W_2D_3						
	thrift	3.65	.146	3.47	1.60	.60
	simple	3.59	1.47	3.46	1.58	.60
	modern	2.24	1.59	1.92	1.38	1.02
	usual	4.04	1.24	4.06	1.50	-0.07
	cheap	3.67	1.51	3.80	1.40	- .42
		MS = 3.44	MSD = 1.45	MS = 3.34	MSD = 1.49	

Concept MS = 3.59 Concept DTS = 3.13
Concept MSD = 1.50 Concept MSD = 1.45

TABLE V-12 (Continued)

ATTRIBUTES		GROUP A N=49 M	SD	GROUP B N=49 M	SD	T
W_3D_1						
	interesting	3.10	1.61	2.57	1.58	1.65
	decorative	3.45	1.46	3.10	1.65	1.10
++	attractive	3.84	1.39	3.18	1.67	2.11*
++	beautiful	3.94	1.26	3.43	1.23	2.15*
	good	3.37	1.33	2.93	1.55	1.47
		MS = 3.54	MSD - 1.41	MS = 3.04	MSD = 1.54	
W_3D_2						
	stuffy	2.33	1.18	2.82	1.32	-1.94*
	convenient	3.65	1.64	2.98	1.60	2.06*
	neat	2.92	1.37	2.94	1.64	- .07
	durable	2.49	1.34	2.63	1.68	- .47
	comf. temp.	2.86	1.14	2.57	1.53	1.05
		MS = 2.39	MSD = 1.33	MS = 2.73	MSD = 1.55	
W_3D_3						
	thrift	3.31	1.66	3.02	1.66	.40
+	simple	3.31	1.54	2.73	1.40	1.92*
	modern	2.83	1.72	2.90	1.79	-0.17
	usual	4.08	1.29	4.12	1.13	-0.17
	cheap	3.51	1.40	3.55	1.55	- .14
		MS = 3.11	MSD = 1.52	MS = 3.26	MSD = 1.51	

Concept MS = 3.11 Concept DTS = 3.01
Concept MSD = 1.42 Concept MSD = 1.55

TABLE V-12 (Continued)

ATTRIBUTES	GROUP A N=49 M	SD	GROUP B N=49 M	SD	T
W_4D_1					
interesting	3.16	1.59	3.06	1.63	.31
decorative	3.10	1.66	3.41	1.53	-0.95
++ attractive	3.41	1.58	3.80	1.37	-1.30
beautiful	3.16	1.40	3.53	1.32	.30
good	3.22	1.40	3.53	1.29	-1.12
	MS = 3.30	MSD - 1.53	MS = 3.47	MSD = 1.43	
W_4D_2					
stuffy	2.61	1.32	2.73	1.24	-0.47
convenient	3.28	1.73	3.67	1.56	-1.16
neat	2.86	1.59	3.22	1.64	-1.13
durable	2.65	1.63	3.16	1.47	.14
comf. temp.	2.53	1.24	3.16	1.43	-2.33**
	MS = 2.79	MSD = 1.50	MS = 3.18	MSD = 1.47	
W_4D_3					
thrift	3.24	1.54	3.18	1.63	.19
simple	2.86	1.47	2.84	1.57	.07
modern	2.45	1.56	2.67	1.70	-0.68
usual	3.65	1.61	4.29	1.24	-2.17*
cheap	3.53	1.40	3.49	1.47	.66
	MS = 3.15	MSD = 1.52	MS = 3.29	MSD = 1.52	

Concept MS = 3.08 Concept DTS = 3.31
Concept MSD = 1.52 Concept MSD = 1.47

TABLE V-12 (Continued)

ATTRIBUTES	GROUP A N=49 M	SD	GROUP B N=49 M	SD	T
W_5D_1					
interesting	2.49	1.67	2.10	1.42	1.24
decorative	3.16	1.53	2.61	1.56	1.76
attractive	2.92	1.62	2.63	1.64	.87
beautiful	3.29	1.31	3.22	1.33	.23
good	2.90	1.37	2.90	1.32	.0
	MS = 2.95	MSD - 1.50	MS = 2.69	MSD = 1.45	
W_5D_2					
stuffy	2.78	1.16	3.02	1.27	-1.00
convenient	2.98	1.68	2.65	1.79	.93
neat	2.45	1.28	2.41	1.53	.14
durable	2.39	1.26	2.61	1.59	- .78
comf. temp.	2.49	1.16	2.47	1.41	.08
	MS = 2.61	MSD = 1.31	MS = 2.63	MSD = 1.52	
W_5D_3					
thrift	3.20	1.31	3.22	1.32	.23
simple	2.76	1.54	2.65	1.59	.32
modern	2.14	1.46	1.73	1.38	1.42
usual	3.81	1.38	3.91	1.44	-0.36
cheap	3.84	1.41	3.84	1.56	.0
	MS = 3.15	MSD = 1.42	MS = 3.07	MSD = 1.46	
	Concept MS = 2.90		Concept DTS = 2.80		
	Concept MSD = 1.41		Concept MSD = 1.48		

* $p \leq .05$
** $p \leq .02$
++ A more positive (Low score is most positive)
\+ B more positive
MS - mean score per dimension
MSD - mean standard deviation per dimension

TABLE V-13

COMPARISON OF CONCEPT MEDIAN RATINGS
BETWEEN GROUPS: MANN-WHITNEY U-TEST

GROUP A M=48.6	compared to	GROUP B M=46.3	U
Bifold (W_1)		Bifold (W_1)	89
Skylight (W_2)		Skylight (W_2)	109
Accordion (W_3)		Accordion (W_3)	79
Quilt (W_4)		Quilt (W_4)	133
Beadwall (W_5)		Beadwall (W_5)	101

- The concept ratings employed in the U-test were the median ratings on the selected attributes (k=15) for the three common dimensions compared across concepts (Appendix).
- U = statistic computed to test the difference in dimensionality of judgements between the two respondent groups over the five concepts.
- The higher sum of ranks designates more favourable rating.

* = .025 onetailed test
** = .01 onetailed test
> none were significant

TABLE V-14

CONCEPT MEDIAN RATINGS RANKED BY JUDGES FOR
INNOVATIVENESS AND BY GROUP FOR ACCEPTANCE

CONCEPT	JUDGES RANKING OF INNOVATIVENESS	GROUP A		GROUP B	
		CUMULATIVE MEDIAN	RANKING	CUMULATIVE MEDIAN	RANKING
Bifold (W_1)	1	53.40	5	47.50	3
Skylight (W_2)	2	48.90	3	49.15	4
Accordion (W_3)	3	50.87	4	44.80	2
Quilt (W_4)	4	47.20	2	50.68	5
Beadwall (W_5)	5	42.69	1**	41.55	1**

*Same rank as judged.
**Group agreement in rank
- Judges' high ranking most innovative
- High rating least acceptable
  Summary of median ratings used for cumulative median are to be found in Appendix E.

TABLE V-15

COMPARISON OF WITHIN GROUP CONCEPT MEDIAN RATINGS BETWEEN PAIRS RANKED FOR ACCEPTANCE BY GROUP: WILCOXON MATCHED PAIRS SIGNED-RANKS TEST

Rank		T
	GROUP A	
1:2	Beadwall (W_5) compared to Quilt (W_4)	19*
2:3	Quilt (W_4) compared to Skylight (W_2)	39.5
3:4	Skylight (W_2) compared to Accordion (W_3)	39
4:5	Accordion (W_3) compared to Bifold (W_1)	27.5
	GROUP B	
1:2	Beadwall (W_5) compred to Accordion (W_3)	17.5**
2:3	Accordion (W_3) compared to Bifold (W_1)	25*
3:4	Bifold (W_1) compared to Skylight (W_2)	23.5*
4:5	Skylight (W_2) compared to Quilt (W_4)	35

- The concept ratings employed in the Wilcoxon test were the median ratings on the selected attributes (k=15) for the three common dimensions compared across concepts.
- T = statistic computed to test the difference in dimensionality of within group judgements between pairs of concepts-
- Pairs compared were those formed between concept rankings acceptance (TABLE V-15).
- The lower sum of ranks designates less favourable rating.

* $\alpha \leq .025$
** $\alpha \leq .01$

When the data in Table V-12 had been examined, it was noted that seven of the fifteen attributes compared by the t-test had ratings on one or more concepts that were significantly different: attractive for concept W_3; stuffy for concepts W_1, W_2, W_3; convenient for concepts W_1, W_3, comfortable temperature for concepts W_2, W_4, simple for W_3; and usual for W_4. These are summarized in Table V-16. This further illustrates that significant between-group differences were found in: W_1 on stuffy and convenient; W_2 on stuffy and comfortable temperature; W_3 on attractive, beautiful, stuffy, convenient, and simple; and W_4 on comforable temperature and usual. There were no significant mean scale score differences for W_5, making it the concept with the least difference; while W_3, with five attributes' scores being significantly different, possessed the greatest difference in attributes between the two respondent groups. Hence, the null hypothesis (2.4b) H_N: $A_k = B_k$ can only be rejected for twelve of the t-tests, 75 tests (attributes k=15 concepts m=5) or one time in seven.

It is interesting to note in Tables V-12 and 16 that "stuffy," "convenient," and "comfortable temperature" were the attributes which differed significantly for two or more of the concepts. This is not inappropriate, perhaps, considering that the concepts were compared within the context of being energy conserving, and the attributes were in the performance evaluation dimension. In each instance, the stuffy-drafty bipolar scale was rated more positively by the treatment

TABLE V-16

SUMMARY OF ATTRIBUTES WITH SIGNIFICANT DIFFERENCE OVER FIVE CONCEPTS BETWEEN GROUPS

ATTRIBUTES	Total	CONCEPTS				
		W_1	W_2	W_3	W_4	W_5
D_1						
interesting						
decorative						
> attractive	1			(*)		
> beautiful	1			(*)		
good						
D_2						
<<< drafty	3	(*)	(**)	(*)		
>> convenient	2	(**)		(*)		
neat						
durable						
<< comfort temp.	2		(*)		(**)	
D_3						
thrift						
> simple	1			(*)		
modern						
< usual	1				(*)	
cheap						
Total	11	2	2	5	2	0

< A < B
> A > B
* $\alpha \leq .05$
** $\alpha \leq .02$

group than by the control group. Whereas, the convenient-inconvenient scale was treated more positively by the control group. On the comfortable temperature-uncomfortable temperature scale the more positive rating was given by the treatment group. In both instances where the attribute could be closely associated with energy conservation the treatment group's ratings were more positive and significantly different from the control group ratings.

In the aesthetic appeal dimension, both scales with a significant difference were rated positively by the control group. While in the economic/novelty dimension the treatment group rated usual-unusual positively and the control group rated simple-complex positively. Over all, the control group had five positive ratings and the treatment group had six positive ratings which differed significantly.

The comparison of individual attributes was followed by a comparison of the three common dimensions through using the Mann-Whitney U-test on the median ratings of the selected attributes. The U's found and presented in Table V-13 extended the trend established by comparing individual attributes. There was no significant difference in dimensionality between the group ratings over all five of the window concepts. Therefore, the null hypothesis (2.4b) H_N: Ad = Bd is accepted and it is concluded that the groups do not differ in their acceptance of innovative window design concepts.

Within group comparisons, through the Wilcoxon test, did exhibit significant differences in dimensionality between concepts. These

results presented in Table V-15 are based upon comparisons of concepts according to ranks established from comparing cumulative median scores which are found in Table V-14. In neither instance did the group ratings of concepts parallel the ranking assigned earlier by the judges or agree with each other.

In Group A only the W_5 differed significantly from the W_4. The remaining pairs did not differ significantly from each other. From knowing this, it would be possible to infer that W_5 also differed significantly from W_1, W_2, W_3, the other three ratings in the ranking. This, however, was not tested. In group B three of the pairs showed significant differences between their ratings. Only W_2 compared to W_4 did not. Therefore, it may be concluded that the null hypothesis (2.5) H_N: $A_i = A_m$ may be rejected for the alternative hypothesis H_A: $A_5 < A_4$ and H_N: $B_i = B_m$ may be rejected for the alternative hypothesis H_A: $B_5 < B_3$; H_A: $B_3 < B_1$; and H_A: $B_1 < B_2$. That is, illustrating that in this study the alternative hypothesis is acceptable 50 percent of the time; the control group, Group B, judged the concepts according to dimensional differences in four out of five occasions, while Group A judged only one pair of concepts to differ significantly on attribute and/or dimension ratings.

It may be concluded that the concepts are not perceived to have equal meaning. The differences, however, between concepts both within and between groups were not all significant.

To answer the question "What attributes or dimensions hold more or less meaning?" Table V-17 was prepared. Dimensions have been ranked

TABLE V-17

WITHIN GROUP CONCEPT MEDIAN RATINGS RANKED BY GROUP

DIMENSION	CONCEPT	MEDIAN RATING	RANK	MEDIAN RATING	RANK
Aesthetic Appeal	Bifold (W_1)	20.64	5	18.15	5
	Skylight (W_2)	17.52	3**	17.57	3
	Accordion (W_3)	18.25	4	14.72	2**
	Quilt (W_4)	16.86	2**	17.60	4* **
	Beadwall (W_5)	13.90	1**	12.39	1**
Performance Evaluation	Bifold (W_1)	15.51	5	13.82	3
	Skylight (W_2)	14.35	3**	15.31	4
	Accordion (W_3)	15.21	4	13.69	2**
	Quilt (W_4)	14.24	2**	16.50	5
	Beadwall (W_5)	12.81	1**	12.79	1**
Economic/ Novelty	Bifold (W_1)	17.25	4	15.53	1*
	Skylight (W_2)	17.03	3**	16.63	5
	Accordion (W_3)	17.41	5	16.39	3*
	Quilt (W_4)	16.10	2**	16.58	4* **
	Beadwall (W_5)	15.98	1**	16.37	2

*Same rank as judged concept ranking.
**Rank consistent on two or more dimensions
- Economic/Novelty cumulative rating is higher than Performance Evaluation's which was selected as the second dimension
- Aesthetic Appeal has the highest rating for W_1 to W_4 but not for W_5.

and related to the judges' earlier rankings. The differences between the concepts on each dimension have not been tested for significance because overall concept difference in this instance did not support doing this. Table V-17 is exhibited to show the trends present and to introduce an additional level of analysis which could be pursued within the data from the INOVAC test. By examining the Economic/Novelty dimension in comparison with the overall ranking of each concept, one might better understand its relationship with innovativeness. This phenomenon is beyond the scope of this study but is one that can be studied later.

Judgements, Group Comparisons and Relationships with Contextual Variables

The secondary, but important, objective which has been outlined earlier is concerned with concept acceptance, as expressed through the INOVAC instrument, and with contextual characteristics determined by INOVAC and Instrument I data. That objective was translated into the following five hypotheses:

H_N 3.1: There is no difference between Group A and Group B in the proportion of members who indicate intention to use specific concepts.

H_N 3.2: There is no difference between Group A and Group B in the proportion of members who have previously seen specific concepts.

H_N 3.3: There is no relationship between acceptance of innovation and exposure to a concept.

H_N 3.4: There is no relationship between indication of intention to use an innovative concept and acceptance of the concept.

H_N 3.5: Experimental variable, group, and non experimental variables:
1) enersysh, "Do you believe there is a shortage of energy in the U.S.?"
2) tincome, "In which category does your total household income fall?"
3) agegroup;
4) windowal, exposure to > or < 3, of the five window concepts;
5) medinfo, recalled media exposure to radio, telephone, television, AES presentations, AES publications or three of the five;

contribute equally to consumer acceptance of innovation, INOVAC.

The alternative hypothesis for H_N (3.1) was that Group A would have more members indicating an intention to use a specific concept, while the H_N (3.2) alternative was that there would be a difference between the groups. Hypotheses H_N (3.3) and H_N (3.4) alternatives specified that there would be a positive relationship; H_N (3.5) stated alternatively, specified that experimental and non-experimental variables did not contribute to acceptance of innovation.

Findings

In the comparison of group responses to the question "Would you use it to save energy?", variable $youse_m$, the chi-square analysis performed for each of the five window concepts identified only one instance of group difference significant at the .05 level of significance. The data compared are presented with X^2 in Table V-18.

TABLE V-18

2X2 CONTINGENCY TABLE FOR GROUP INTENTION TO USE INNOVATIVE WINDOW CONCEPT BY CONCEPT

Concept	Variable Youse	Group A	Group B	X^2
W_1	No response	2	2	
	Yes	9	15	
	No	38	32	
				2.01
W_2	No response	0	1	
	Yes	13	17	
	No	36	31	
				1.90
W_3	No response	1	1	
	Yes	15	22	
	No	33	26	
				2.15
W_4	No response	1	2	
	Yes	18	16	
	No	30	31	
				.48
W_5	No response	0	0	
	Yes	16	28	
	No	33	21	
				4.99*

*$\alpha \leq .025$
Youse = "Would you use it to save energy?"

Contrary to what had been projected, the treatment group, Group A, responded by <u>not</u> agreeing that they would use the concept, whereas the control Group, B, replied in the affirmative in almost a two to one ratio. Hence, the null hypothesis (3.1) H_N: $A_{im} = B_{im}$ can only be

rejected in one of the five comparisons. This lead to the conclusion that treatment and control groups are equal, in their intentions to use a concept 80% of the time.

A chi-square analysis was also performed to investigate the relationship between groups and their exposure to any of the design concepts used in the INOVAC test. As indicated in Table V-19, the chi-square statistic did not disclose a significant difference between groups. Therefore, the null hypothesis (3.2) H_N: $A_{bm} = A_{bm}$ was accepted and it was concluded that although up to one-third of each group had been exposed to W_5 and a minimum of 13% of each group had been exposed to the remaining four concepts, the groups were not significantly different overall in their exposure to the five concepts.

TABLE V-19

2X2 CONTINGENCY TABLE FOR GROUP EXPOSURE TO INNOVATIVE WINDOW CONCEPT BY CONCEPT

Concept	Variable Window	GROUP A	GROUP B	X^2
W_1	Yes	6	8	
	No	43	41	
				.08
W_2	Yes	15	10	
	No	34	39	
				.86
W_3	Yes	9	11	
	No	40	37	
				1.32
W_4	Yes	11	12	
	No	38	36	
				1.10
W_5	Yes	17	16	
	No	31	33	
				1.09

No statistically significant differences at $\alpha \leq .05$

Window = "Have you seen a window treatment like this before?"

Next the relationship of the exposure variable, $window_m$, to acceptance of innovation, $acceptW_m$, was explored. The Spearman rank order correlation (rho), used to test the null hypothesis (3.3) H_N: $rho_{akm} = 0$ when computed, showed that Group A correlation values were all significant at the .05 level or better and ranged from +.29 to +.54 for the five concepts. Group B rho's, however, were not significant for any concept, while the rho's for the two groups combined ranged from +.21 to +.28, and were significant at the .05 level or better for all the concepts, except W_1, the bifold shutter. Consequently, it may be concluded from the correlations presented in Table V-20 that there is a relationship between the acceptance of innovative and exposure to a concept in nine of the fifteen instances tested. Hence, the null hypothesis that the rho is greater than zero, H_A: $rho_{abm} > 0$.

Acceptance of each concept, $acceptW_m$, was also correlated with the variable $youse_m$, intention to use a concept, and was tested for significance through computing Spearman rank correlation coefficients for the variables over the five concepts. Table V-21 presents the results for the rho's for the two groups, individually and combined.

The correlation coefficients in Table V-21 were significant in all instances and exhibited positive relationships, +.40, for each of the five concepts when groups were considered individually and together. Therefore, the null hypothesis (3.4) H_N: $rho_{iam} = 0$ was rejected in favor of the alternative hypothesis H_A: $rho_{iam} > 0$ on all counts.

TABLE V-20

CORRELATION MATRIX OF THE VARIABLES ACCEPTW$_m$ AND WINDOW AS RATED OVER FIVE CONCEPTS BY GROUP SEPARATELY AND COMBINED

Variable	Group	Window1	Window2	Window3	Window4	Window5
AcceptW1	A	.32*				
	B	.07				
	Both	.11				
AcceptW2	A		.30*			
	B		.25			
	Both		.28**			
AcceptW3	A			.29*		
	B			.12		
	Both			.21*		
AcceptW4	A				.54***	
	B				.26	
	Both				.38***	
AcceptW5	A					.35**
	B					.25
	Both					.31**

* $<$ .05
** $\leq$ .025
*** $\leq$ .001
(a) AcceptW$_m$ = mean scale score over (k=25) attributes for each concept (m=5)
(b) Window$_m$ = item #26 for each concept (m=5) "Have you seen a window treatment like this before?"

TABLE V-21

CORRELATION MATRIX OF THE VARIABLES ACCEPTW$_m$
AND YOUSE AS RATED OVER FIVE CONCEPTS
BY GROUP SEPARATELY AND COMBINED

Variable	Group	Youse1	Youse1	Youse3	Youse4	Youse5
AcceptW1	A	.40**				
	B	.41**				
	Both	.42***				
AcceptW2	A		.48***			
	B		.57***			
	Both		.51***			
AcceptW3	A			.67***		
	B			.63***		
	Both			.61***		
AcceptW4	A				.59***	
	B				.41*	
	Both				.60***	
AcceptW5	A					.57**
	B					.41**
	Both					.50***

* $< .05$
** $\leq .025$
*** $\leq .001$

(a) AcceptW$_m$ = mean scale score over (k=25) attributes for each concept (m=5)
(b) Youse$_m$ = item #27 for each concept (m=5)
"Would you use it to save energy?"

Finally, an analysis of covariance was conducted and the null hypothesis (3.5) H_N: ${}_g = {}_e = {}_t = {}_a = {}_w = {}_m = 0$, was tested to determine if the experimental variable, group, and selected non-experimental contextual variables, contributed equally to consumer acceptance of innovation, (INOVAT index).

The variable INOVAT was developed as the index of innovation acceptance. The index was based upon the two variables acceptW_m and youse$_m$. Two points were assigned for each acceptW_m < 3, the mean score of the K=25 scales, and one point was assigned for each youse$_m$ = 1, for each of the five concepts. The sum was then divided by 15, the total possible score, a percentage score was the statistic. The descriptive statistics for the index, plus the T value resulting from a t-test between the respondent groups are presented in Table V-22.

TABLE V-22

DESCRIPTIVE STATISTICS FOR INOVAC INDEX BY GROUP AND T-TEST

Descriptive Statistic	Group A N=49	Group B N=49	F	T
Measure of central tendancy Mean				
Mean	40.41	46.80	1.14	-1.20
Measure of Dispersion				
Variance	648.90	741.65		
Standard Deviation	25.48	27.23		
Standard Error	3.64	3.89		
Kurtosis	-0.65	-0.97		
Skewness	.19	.08		

Not statistically significant at $\alpha \leq .05$

The statistics presented in Table V-22 show that although Group A's index statistic is 6% less than Group B's, the two are not significantly different.[4] Both exhibit an acceptance of innovation that is below 50% of the mean with a symmetric distribution. The non-experimental contextual variables included in the analysis of variance were: enersysh$^{(e)}$, agegroup$^{(a)}$, windowal$^{(w)}$, and medinfo$^{(m)}$. The distribution of these variables, plus the experimental variable group is presented in Table V-23.

The relationship between the contextual variables and acceptance of innovation was investigated using a hierarchial solution for the analysis of covariance with the factors and covariates being processed concurrently. The results of the analysis are presented in Table V-24. Only one of the variables, windowal, met the F-test of significance criterion. Therefore, these contextual variables were not meaningful in determining acceptance of innovation. Thus the null hypothesis (3.5a) was accepted.

Acceptance of innovation among the five window concepts was tested using analysis of covariance with three variables: group, windowal, and medinfo. No support was noted for differences among the variables for their contribution to the acceptance of the individual concepts (Table V-25). Consequently, the null hypothesis (3.5b) was accepted in these instances as well.

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[4]The effects of nonnormality in this sample of scores were viewed within the tolerable limits of parametric statistics. Thus the T-test was used to compare the group means.

TABLE V-23

DISTRIBUTION OF CONTEXTUAL VARIABLES

Variables	Group A Number	Group A Percent	Group B Number	Group B Percent
Nonexperimental				
ENERSYSH (item 1.14)				
Yes	28	57.1	16	32.1
No	12	25.5	8	16.3
Don't know	9	18.4	22	44.9
TINCOME (item 1.76)				
Less than 2,000	1	2.0		
2,000 to 5,999	4	8.2	9	18.4
6,000 to 9,999	10	20.4	4	8.2
10,000 to 14,999	12	24.5	6	12.2
15,000 & over	19	38.8	28	57.1
AGE GROUP (item 1.71)				
Under 20	2	4.1		
20 - 34	6	12.2	4	8.2
35 - 54	16	32.7	18	36.7
55 - 74	20	40.8	24	49.0
74 & over	5	10.2	3	8.1
MEDINFO How have you received information...? (item 1.79) Radio, Television, Agriculture slide, Agriculture Publication, Individual Instruction, Group Instruction				
$<$ 3 Yes	29	52.2	33	67.3
3 Yes	11	22.4	10	20.4
$>$ 3 Yes	9	18.4	6	12.2
WINDOWAL Have you seen a window treatment like this before? (item 2.26) for m-5 concepts				
$< 3_m$ Yes	45	91.8	43	87.8
3_m Yes	4	8.2	3	6.1
$> 3_m$ Yes	0	0	3	6.1
Experimental				
GROUP	49	100	49	100

TABLE V-24

ANALYSIS OF COVARIANCE OF INNOVATION ACCEPTANCE AND CONTEXTUAL VARIABLES

Source	df	MS	Hierarchial Solution F
Main Effects	6	1005.57	1.483
Group	1	1001.73	1.477
Enersysh (covar)	1	229.46	.442
Tincome (covar)	1	145.61	.215
Agegroup (covar)	1	922.60	1.360
Windowal (covar)	1	3605.94	5.317*
Medinfo (covar)	1	58.09	.086
Explained	6	1005.572	1.483
Residual	91	678.181	
Total	97	698.432	

* $\alpha \leq .01$

TABLE V-25

ANALYSIS OF COVARIANCE OF WINDOW CONCEPT ACCEPTANCE AND CONTEXTUAL VARIABLES

Source	df	MS	F
ACCEPTW1			
Main Effects	3	.917	2.187
Group	1	.827	1.971
Windowal (covar)	1	1.042	2.486
Medinfo (covar)		.882	2.104
Explained	3	.917	2.187
Residual	94	.419	
Total	97	.435	
ACCEPTW2			
Main Effects	3	.136	.294
Group	1	.099	.215
Windowal (covar)	1	.304	.657
Medinfo (covar)	1	.005	.011
Explained	3	.136	.294
Residual	94	.463	
Total	97	.453	
ACCEPTW3			
Main Effects	3	.341	.674
Group	1	.693	1.371
Windowal (covar)	1	.325	.640
Medinfo (covar)	1	.005	.011
Explained	3	.341	.674
Residual	94	.505	
Total	97	.500	
ACCEPTW4			
Main Effects	3	1.169	.077
Group	1	.727	.229
Windowal (covar)	1	2.744	.021
Medinfo (covar)	1	.036	.790
Explained	3	1.169	.077
Residual	94	.496	
Total	97	.517	
ACCEPTW5			
Main Effects	3	.070	.143
Group	1	.141	.291
Windowal (covar)	1	.067	.139
Medinfo (covar)	1	.000	.000
Explained	3	.070	.143
Residual	94	.485	
Total	97	.472	

No significance evident at $\alpha \leq .05$

Summary

The results of the analyses are summarized in Table V-26. The methodological and experimental objectives were realized, but between and within group differences were not significant for the majority of hypotheses on which tests were performed. And there was no meaningful relationship between acceptance of innovation, whether taken separately or indexed, and contextual variables.

TABLE V-26

SUMMARY OF FINDINGS BY HYPOTHESIS

Focus of Hypothesis[a]	H_N[b]	α[c]	Rejected	
Subgroup scale score means:			A1:A2	B1:B2
interesting	1.1	$\leq .05$		W_2
decorative				
adequate size		$\leq .05$		W_4
clean				
attractive		$\leq .05$	W_2	
stuffy				
convenient				
beautiful				
warm		$\leq .05$		W_2, W_4
thrifty				
simple				
modern		$\leq .05$	W_5	
good lighting		$\leq .05$		W_4
heavy		$\leq .05$	W_1, W_5	
private		$\leq .05$		W_5
comfortable		$\leq .05$		W_2
functional		$\leq .05$		W_4
safe		$\leq .05$	W_1	
good		$\leq .05$		W_4
comfortable temperature				
usual				
neat				
good ventilation		$\leq .05$		W_2
durable		$\leq .05$		W_2
cheap		$\leq .05$		W_2
window				
youse		$\leq .05$		W_4

TABLE V-26 (Continued)

Focus of Hypothesis[a]	H_N[a]	α[c] A	α[c] B	Rejected A	Rejected B
Correlation between overall concept acceptance and external criterion:	1.2				
$AcceptW_1$ with Yousel		.005	.004	x	x
$AcceptW_2$ with Youse2		.001	.001	x	x
$AcceptW_3$ with Youse3		.001	.001	x	x
$AcceptW_4$ with Youse4		.001	.001	x	x
$AcceptW_5$ with Youse5		.001	.003	x	x
Between-groups meaningfulness of judgements over all window concepts (m=5):	2.1				
Between-groups meaningfulness of concept pair judgements:	2.2				
Within-group meaningfulness of judgements between pairs:	2.4a				
Group A					
Quilt to Beadwall					
Beadwall to Accordion					
Accordion to Skylight					
Skylight to Bifold					
Group B					
Bifold to Quilt					
Quilt to Accordion					
Accordion to Skylight					
Skylight to Beadwall			< .001		x

TABLE V-26 (Continued)

Focus of Hypothesis[a]	H_N[b]	α[c]	Rejected
Comparison of attribute ratings (k=25) between groups:	2.4a		
D_1 interesting			
decorative			
attractive		$\leq .05$	W_3
beautiful		$\leq .05$	W_3
good			
D_2 stuffy		$\leq .05$	W_1 W_2 W_3
convenient		$\leq .02$	W_1 W_3
neat			
durable			
comfortable temperature		$\leq .02$	W_2 W_4
D_3 thrift			
simple		$\leq .05$	W_3
modern			
usual		$\leq .05$	W_4
cheap			
Comparison of the dimension ratings (d=3) between groups for all concepts (m=5):	2.4b		
			A:B
Bifold			
Skylight			
Accordion			
Quilt			
Beadwall			
Comparison of dimension ratings (d=3) within-group pairs:	2.5		
Group A			
Beadwall to Accordion		$\leq .025$	x
Quilt to Skylight			
Skylight to Accordion			
Accordion to Bifold			
Group B			
Beadwall to Accordion		$\leq .01$	x
Accordion to Bifold		$\leq .025$	x
Bifold to Skylight		$\leq .025$	x
Skylight to Quilt			

TABLE V-26 (Continued)

Focus of Hypothesis[a]	H_N[a]	α[c]			Rejected		
Difference between groups in intention to use concepts (m=5):	3.1						
Bifold							
Skylight							
Accordion							
Quilt							
Beadwall						x	
Difference between groups in previous exposure to concept (m=5):	3.2						
Bifold							
Skylight							
Accordion							
Quilt							
Beadwall							
Relationships between acceptance of the innovation and exposure to it:	3.3						
		A	B	A&B	A	B	A&B
Accept Bifold		≤.05			x		
Accept Skylight		≤.05		≤.025	x		x
Accept Accordion		≤.05		≤.05	x		x
Accept Quilt		≤.001		≤.001	x		x
Accept Beadwall		≤.025		≤.025	x		x
Relationships between acceptance of a concept and intention to use:	3.4						
		A	B	A&B	A	B	A&B
Accept Bifold		≤.025	≤.025	≤.001	x	x	x
Accept Skylight		≤.001	≤.025	≤.001	x	x	x
Accept Accordion		≤.001	≤.001	≤.001	x	x	x
Accept Quilt		≤.001	≤.05	≤.001	x	x	x
Accept Beadwall		≤.025	≤.025	≤.001	x	x	x

TABLE V-26 (Continued)

Focus of Hypothesis[a]	H_N[a]	α[c]	Rejected
Contribution of contextual variables to INOVAT index:	3.5a		
Group (Control or Treatment)			
Belief in Energy Shortage			
Total Income			
Agegroup			
Exposure to Window Concepts		$\leq .01$	x
Recall of Exposure to Media			
Contribution of contextual variables to acceptance of a concept (m=5):	3.5b		
Group (Control or Treatment)			
Exposure to Window Concept			
Recall of Exposure to Media			

a Hypothesis stated on pp. 200-202
b Hypothesis number
c significance level
A Treatment Group
B Control Group

W_1 Bifold
W_2 Skylight
W_3 Accordion
W_4 Quilt
W_5 Beadwall

CHAPTER VI

SUMMARY, CONCLUSIONS AND IMPLICATIONS

Summary of Methodological and Experimental Results

The results which evolved from the ENERSENSE substudy were considered in two ways: first, for their contribution to developing the INOVAC test as a method of evaluating consumer acceptance of energy conserving innovation(s); and second, for their value in determining if significant differences existed between and within experimental groups. A summary of the results from both types of analysis follows.

Methodological Results

This substudy explored the topics of environmental description and meaning as related to innovation and, more specifically, to energy conserving innovation. The INOVAC instrument was constructed and tested toward that end.

Its capacity to function effectively as an evaluation device was founded upon the degree to which the test possessed the standard criteria, by necessity, inherent in any effective measurement instrument. The six criteria considered were: objectivity, reliability, validity, comparability, sensitivity, and utility.

Ratings on the 27 items, i.e., 25 scales and two forced answer question items repeated for five simulated concepts, and judged by two groups, exhibited both item reliability and behavioral validity, as was discussed under H_N (1.1) and H_N (1.2), p. 207. Attribute ratings

considered individually, for overall concept meaningfulness, but grouped together in both factors and dimensions, provided a means of identifying characteristics unique to each concept. This allowed between-group and within-group judgements on concepts to be computed for meaningfullness and dimensionality. Judgements of concepts were then compared visually through plotting the mean ratings and constructing three-dimensional space models based upon D-scores. Differences were observed but were not consistent in direction or magnitude between and within the groups.

In addition to its potential for identifying descriptive features of a current and practical subject such as energy conserving innovation, the INOVAC test's utility extends to allowing judgements to be compared for statistical significance, a characteristic which adds to the value of the instrument as an objective means of evaluating a topic which has a definite subjective component. Lastly, the data collected through the INOVAC test provides the basis for developing an Innovation Acceptance Index (INOVAT) to be considered in relation to contextual variables and their contribution to acceptance of innovation(s). This additional feature of the test means that it links attitude measurement with other environmental variables and thus could serve to identify market segments with positive or negative indices of innovation acceptance.

Two hypotheses, (1.1) and (1.2), were tested specifically to establish the reliability and validity of the method, while the remaining hypotheses were the experimental outgrowth of the method and are presented in the next section.

Experimental Results

The two respondent groups used in the controlled field experiment provided results which were analyzed for between and within group relationships. Differences in concept meaningfulness and dimensionality were identified and/or tested for statistical significance along with relationships between contextual variables and variables depicting specific or general innovation acceptance.

Meaningfulness of Judgements

Concept profiles, plotted from attribute mean scale scores, indicated that concept judgements between groups and between concepts were not consistent in the direction or magnitude of ratings. Plots were so ambiguous that D-scores were computed over the 25 attribute scales as an indication of meaningfulness, (+) or (-) deviation from the origin. When the concepts' D-scores were compared between groups, Group A did not find the concepts any more meaningful than did Group B. Neither was there any significant difference between groups in their judgements of meaningfulness between pairs of concepts.

When D-scores were used to compare within group differences in concept ratings, the concepts were ranked first to fifth, least to most, meaningful. In both groups the ranking did not agree with that assigned by a panel of judges relative to the innovativeness of the concepts. Two concepts agreed in rank for both groups; Group A and

Group B each had one additional concept which was consistent with the rank assigned by the judges. Differences between pairs of concepts were identified; Group A had none which were significant, while Group B rated only W_2 and W_5 as being significantly different. The three hypotheses, (2.1), (2.2), and (2.3), which tested the meaningfulness of concepts between and within groups, generally identified no significant differences between concepts.

Dimensionality of Judgements

Factor analysis did not yield identical factors across concepts within or between groups. For that reason, in order to compare concepts, three dimensions, containing five scales each, were developed for all concepts and both groups, based upon scales which loaded > .5 in the second factor analysis. Attributes depicted by these selected scales were then used, individually and grouped, for the three dimensions to compare differences in concept meaning between and within groups. The dimensions were labelled Aesthetic Appeal, Economic/Novelty, and Performance Evaluation. The Aesthetic Appeal dimension was composed of such scales as decorative-plain and attractive-unattractive. The Economic/Novelty dimension was composed of thrifty-costly and usual-unusual; and Performance Evaluation was composed of such scales as stuffy-drafty and convenient-inconvenient.

Concept attributes did not all differ significantly between groups. Attributes which did show differences for at least two

concepts were stuffy, convenient, and comfortable temperature. While the attributes attractive, beautiful, simple, and usual indicated significant group differences for one concept, the only concept to have more than two attributes with significant differences was (W_3), the accordion design.

Differences which were significantly different were concentrated in the Performance Evaluation dimension except for the accordion concept (W_3) which had attributes in all three dimensions, and the quilt concept (W_4), which had attributes in both the Economic/Novelty dimension as well as in the Performance Evaluation dimension.

Attributes with positive differences were distributed in both Group A and Group B. For the Bifold (W_1), Group A rated stuffy as significantly different and more positively than did Group B. Otherwise, Group B had the more positive ratings with only the "convenient" attribute being significantly different. On the Skylight (W_2), Group A rated stuffy and comfortable more positively. These were the only two attributes to be rated with a significant difference. Next on the Accordion (W_3), both groups favored attributes with significant differences: Group B rated attractive, beautiful, and simple more positively, while Group A assigned positive ratings to stuffy and convenient. In rating the Quilt (W_4), Group A assigned comfortable a positive rating and Group B rated usual positively. No attributes were found to be significantly different in the last concept, Beadwall (W_5).

Of the 75 T-tests performed on attributes, differences between groups occurred one time out of seven. The null hypothesis was rejected in those instances. Comparisons made over the 15 selected attributes grouped for cumulative median ratings, and therefore, over the three dimensions, did not identify any significant differences in overall meaning based upon dimensionality. The null hypothesis (2.4b) was accepted.

Additional understanding of concepts' meaning was gained through within group comparisons of concept median ratings. When ranking concepts according to cumulative median ratings, both groups ranked the Beadwall (W_5) most positively. This was the inverse order from that assigned by the panel of judges when they ranked the concepts on innovativeness. Possibly, experience can be assumed to be the underlying factor for this. Both groups had one third or more of the group who indicated having seen the concept previously and it was determined that other agencies were exhibiting the concept throughout the state. Otherwise, there was no agreement among the remainder of the other concept rankings.

The next most positive score for Group A was the Quilt (W_4), while Group B placed it in last place. Group B's second concept was the Accordion (W_3) followed by the Bifold (W_1). Group A placed the Bifold (W_1) last, but Skylight (W_2) third, and the Accordion (W_3) fourth, whereas Group B ranked the Skylight (W_2) fourth.

When pairs of concepts, based upon within group rankings, were compared, Group A indicated a significant difference in meaning only between the Beadwall (W_5) and the Quilt (W_4). Group B indicated significant differences in meaning between three pairs of concepts: 1) Beadwall (W_5) and Accordion (W_3); 2) Accordion (W_3) and Bifold (W_1); and 3) Bifold (W_1) and Skylight (W_2). Accordingly, the null hypothesis (2.5) was rejected for five of the eight tests.

Judgements, Comparisons, Contextual Variables

To achieve the secondary objective of the substudy, concept judgements were compared and considered in relation to contextual variables. The two groups had proportionately equal numbers of respondents who agreed or disagreed with using four of the window concepts when asked to indicate intention of willingness to use. Group B had more respondents willing to use the Beadwall (W_5) or conversely, Group A had more respondents indicating that they would not. Therefore, null hypothesis (3.1) was rejected once and accepted four times.

When the groups were compared on exposure to the concepts, although exposure ranged from 6 to 17 persons who had seen a concept previously, the between group difference was not significant. The null hypothesis (3.2) was accepted for all concepts.

There was a positive correlation between acceptance of each concept and exposure to it when group data were combined and for Group A by itself. The null hypothesis (3.3) was rejected in both instances.

A positive correlation was found between the overall acceptance of each concept and the question, "Would you use it to save energy?" for the two groups combined, and for each group independently. The null hypothesis (3.4) was rejected for the three occurrences.

No significant between group difference was found on the INOVAC INDEX. When the index was analyzed in relation to the four selected contextual variables only windowal, experience with the concepts, made a meaningful contribution to the index. The hypothesis of equality among variables (3.5a) was rejected in that instance. When acceptance of individual concepts was analyzed in relation to: 1) recalled exposure to media and 2) experience with the concepts, no meaningful contribution by either variable was identified. The null hypothesis (3.5b) was accepted.

Conclusions

Was the INOVAC test an appropriate method to use to evaluate consumer acceptance of energy conserving innovation? Were there differences between and within group judgements? What contribution was made by the contextual variables? How did the substudy contribute to energy conservation education evaluation? These four questions need to be raised to ascertain whether or not the substudy objectives were realized. Several conclusions can be drawn from the analyses.

General Support of the Method

The INOVAC instrument was developed upon the theory that architectural meaning is based upon meanings matching our "representations" of external signs, events, objects, etc., and upon meanings which match our internal reaction to "representations," i.e., how we react emotionally, how we evaluate what we represent; how we decide to respond to the representations, effects and evaluations. Also on the idea that past experience mediates what we represent and that part of those representations are aesthetic. These feelings, or emotions, about an object are not as influenced by attitudes, values, and standards.

The INOVAC test provided judgements or evaluations for five concepts through ratings on attributes (n=25) and a limited number of dimensions (d=3), (Aesthetic Appeal, Economic/Novelty, Performance Evaluation), which contained adjective scales (k=25) associated with affective and evaluative meanings. The behavioral validity present in the test provided evidence of subsequent consistency in relation to overt behavior when the mean of the scale ratings (k=25) were related to an external behavioral criterion. Therefore, the research results indicate that such a method can contribute to "representational" and internal responses to concept simulations generally, and differentiate between dimensions peculiar to concepts that are energy conserving and innovative.

Differences along adjective scales relating to energy usage, i.e., attributes, stuffy and comfortable temperature, supported the notion

what we "see" or "represent" of objects is based, to some extent, on purposes, values, and experience. The tendency for the treatment group, who had had the potential to be exposed to the ENERSENSE media program, to rate those attributes more positively along with rating Performance Evaluation attributes over Aesthetic Appeal is an example of this.

Inasmuch as the Aesthetic Appeal dimension was rated by the two groups least positively for all concepts, it is shown that this dimension has the least positive rating over the five concepts relative to the other dimensions. But the treatment group, having had the potential to receive media education, was not found to value energy conservation so highly that it made its Aesthetic Appeal dimension attribute ratings significantly different from those of the control group.

Further study into the difference between a concept's dimensions, as judged by the same group, would appear to be the next step in understanding consumer acceptance of innovative concepts. Such comparisons would provide an understanding of the importance of the concept dimensions, or features, and would provide direction in adapting a concept to improve acceptance. This could be done for both control and treatment groups and be followed by between group comparisons to explore whether or not different experiences contribute to the value placed upon concept dimensions; such as Aesthetic Appeal or Performance Evaluation.

The 15 scales selected for the three dimensions, and used to compare the concepts, need to be explored and the stability of the dimensions determined. Since a limited number of scales to be included were selected, some attributes were no doubt inadvertently omitted. Comparisons using other combinations of scales, with the number of scales limited to more or less than the five, should be made with the existing data and in additional studies on groups with varying experience. For example, a sample of designers and a sample of consumers should be compared.

The adjective scale generation method used for the INOVAC test involved both lay and design persons. This was done in an attempt to try to provide descriptors relevant to dimensions that might be perceived by both groups. The effectiveness of the scales should be tested and their versatility verified by using them to study: 1) the same concepts with other groups, and 2) different concepts within the energy conserving innovation category with other groups.

From the evidence gained in this research, it is felt that the physical attributes of energy conserving innovative concepts do form a code, as revealed by the types of factors and dimensions identified, through which consumer acceptance of concepts may be determined. Although additional areas of research relative to the INOVAC have been acknowledged and suggested, it is concluded that the ENERSENSE results support using the method as a means of evaluating acceptance of energy conserving innovative concepts.

Differences Between the Comparison Groups

The ENERSENSE study involved two comparison groups. Multi-media treatments were withheld from Group B, while Group A was composed of consumers who had the potential to be exposed to the media treatments. Each group's results on the INOVAC test were compared in three major ways: on meaningfulness of concepts; on dimensionality of concepts; and lastly, on an acceptance of innovation index (INOVAT). It was hypothesized that: 1) Group A would find the concepts more meaningful than Group B; 2) that Group A would rate the concept attributes and dimensions more positively than Group B; and 3) that Group A would have a higher INOVAT index.

The two groups did not differ significantly on their meaningfulness scores. When one realizes that meaningfulness is computed over both positive and negative deviation from the origin (0), it must be noted that the treament group did not demonstrate that their experience, which could have been enriched via the media program, affected their judgements of the concepts. It is concluded, therefore, that the media program did not have sufficient impact to influence consumers' perception of concept meaningfulness.

Evidence of energy conservation related differences were identified in the comparison of concept attribute ratings. Differences were found for stuffy, comfortable temperature, and unusual. In that Group A judged 52% of the significant differences more positively than did

Group B, and that those judgements were ratings on attributes related to energy conservation an innovation, the conclusion was reached that group A's experience influenced the judgements on individual attributes. Therefore, the media program had an effect on the treatment group, Group A, at the attribute level of perception.

Both groups appeared to rate the three dimensions used in the comparison of concepts between groups in the same order of magnitude. The Performance Evaluation had the lowest and most positive rating 80% of the time. This trend was evident across all but the Beadwall (W_5) concept and suggests that energy conservation and innovation were valued by both groups to the point that both performed in a similar manner. Impact from the ENERSENSE multi-media program was not evident.

In previous research involving pictured concepts, art work, etc., the aesthetic dimension has been a priority. (Osgood et al. 1957). Such was the case in this study when factors were identified. All concept judgements had an aesthetic component in the first factor. Other factors were not as consistent between groups. Therefore, additional combinations of selected scales used to develop dimensions might identify other and more significant differences between group concept judgements. From the dimensions that were compared, because no significant differences between group concept judgements were found, it is concluded that the impact of the ENERSENSE program did not influence consumers' perception of concept meaning through dimensionality.

Neither was support for the impact of ENERSENSE program forthcoming from the third means of group comparison. The groups' indices of innovation acceptance, INOVAT, were not significantly different. Because significant group differences were only identified on energy related attributes, it may be concluded that the ENERSENSE program had a minor impact. It did not influence consumers to value the potential for conserving energy to the point where it influenced performance in an applied decision-making situation.

Selection of Contextual Variables

Exposure to the window concepts windowal was found to be a meaningful variable and it supports the theory that experience plays a part in architectural meaning. The amount of exposure to media would also fall in the experience category. Medinfo, however, was not found to be meaningful. As it was on a recall basis, it may not have been an accurate indicator and should be reexamined in future tests before being discarded. Especially since research by Rogers and Shoemaker (1971) supported that the adoption of new practices could be encouraged by education. Total income has proved in other research to be related to adoption of energy conservation practices (Warren 1974, Kilkeary and Thompson, 1975). In those instances, however, it was related to gasoline consumption practices. As this substudy dealt with a hypothetical simulated situation and excluded gasoline, tincome might

not have been expected to have a positive relationship. However, as there was an economic component present in the factors identified, the variable should be related to the INOVAT in other studies. Lastly, the contextual variable agegroup was not meaningful. It, however, was seen as an important variable to be checked when over 50% of both comparison groups were 55 years of age or older. Its merit in other studies would rest upon the distribution of ages in the samples being studied.

Energy Conservation Education Evaluation

The promotion of energy conservation has been recognized as a topic which requires social marketing. The substudy suggests that the ENERSENSE multi-media program had limited success in assisting consumers to climb the ladder of social marketing presented by Kotler (1975). Group A, the treatment group, exhibited positive awareness to the program's central theme, energy conservation, or "cognitive change." As the awareness of energy conservation was tested in an applied situation, the cognitive change was at a higher level of cognition than mere recognition. There was similarity in values evident between the two comparison groups as shown through the identification of dimensions and ratings assigned to them. Therefore, the multi-media program did not contribute to "value change." Nor was there a significant difference between intention to use concepts, hence, the program could not be credited with encouraging "behavioral change." The INOVAC test did not

determine whether or not consumers actually did retrofit their homes with an innovative window design. Consequently, the "action change" possibly encouraged by the program was not assessed. Such an assessment would provide a focus for a post study and increase the number of indicators studied in evaluating the merits of the ENERSENSE energy conservation education program.

Different households will have different objective and subjective priorities in interpreting an education program's messages. Relating the actual act of retrofitting with INOVAT indices would contribute to understanding the segmentation among consumers. Phillips and Nelson's (1976) study indicated that, in the case of certain energy-saving devices, behavioral intention is a reliable predictor. Testing the reliability between intention and actual use of window designs could be verified in a post study.

Implications of the Experiment

Research Implications

In addition to utilizing the INOVAC test in similar situations it could be used to test differences: 1) between groups differing on other than the energy conservation education characteristic, i.e., experience, value, culture; 2) between different innovative concepts--energy conserving, interior or exterior; and 3) between non-energy conserving innovative concepts. Dimensions across concepts within and

between groups could be studied for significant differences between the dimensions. Multi-combinations of adjective scales depicting attributes combined in a dimension should be considered.

The INOVAC test could be extended to relate to a social marketing study and be used as the attitudinal test in a research model to check its relationship to persuasion motivation and actual installation of an innovative energy conserving product. The Phillips and Nelson (1976) model presented earlier, pp. 55-56, Model of Energy Saving and Installation Behavior in Private Households, would adapt easily to allow a research study which also employed the INOVAC instrument.

The whole continuum of innovativeness could be investigated so that it is more objectively appraised through the attribute and dimension ratings of meaningfulness. Such differences could then be related to contextual variables and provide insight into consumer market segmentation. Those differences could also be related to acceptance of specific concept characteristics. Thus the acceptance of innovation would advance beyond the knowing of who are the leaders as well as those who are the laggards in the adoption curve of concepts in general.

Investigation of the contextual variables' contribution to the acceptance of energy conserving innovation should be continued and expanded upon if the "who" and "why" of conserving behavior is to be understood. Through such an understanding would come more organized planning for the social change involved with conserving energy.

Further development of the INOVAT index, as a measure of attitude toward energy conserving innovation, would assist in that planning and should be developed in conjunction with contextual variables.

Energy Policy and Educational Implications

Kieth's (1977) study established that 77% of her sample was opposed to government enforced conservation. But will consumers conserve voluntarily? The ENERSENSE substudy data showed that the majority of both groups, when asked if they would use a concept to save energy, replied "no." The question then arises as to what is needed to have them reply "yes."

The study of concept characteristics has been explored through this substudy and additional areas of research have been suggested. Supplementary to activity in those areas are policy and educational implications which should be considered.

In the policy area, the acceptance of energy conserving innovations, or alternatives, is related to incentives. Whether they should be monetary, nonmonetary, or a combination of the two must be considered. Will a consumer use a window design to retrofit a house more readily because there is a financial subsidy, or because it will make the home more attractive, unique, and/or functional? Knowing who will use an energy conserving innovation and why--information such as this study initiated--could be used to provide a less subjective basis for electing to establish a "Super-saver" award for energy conserving

initiatives, or for providing a grant program which will give, or loan, a percentage of the price for installing energy conserving devices such as windows.

Closely aligned with marketing the concept of energy conservation, through education programs such as ENERSENSE, is the necessity of introducing consumers to technical and non-technical alternatives as well as incentives. Milstein (1976) suggested that households change what is easiest and requires a minimal effect on lifestyle. Therefore, education programs should emphasize what will bring positive response through conscious and unconscious behavior to reduce consumption. Other studies support the idea that information alone will not bring about the behavior change. (Goodman 1971). The understanding of what facilitates consumer change is essential for both the development of education programs and energy policies. Because consumer choices are tied to institutional decision making, this decision making, both for education programs and policies related to energy, needs to tie together the behavioral and physical factors involved.

The lower energy-intensive lifestyle enjoyed in Sweden has been attributed to cooperation among consumers, government and institutions. (Keith 1977). To get more people to conserve now is a challenge. It will take a combination of information, exhortation, incentives, along with legislative and institutional involvement. Feedback and evaluation are needed at all levels. Further study into the evaluation

of consumer acceptance of energy conserving innovation is needed along with evaluation of the effectiveness of information and education programs.

Design Evaluation Implications

Research implications of the INOVAC instrument have been discussed in general but it is not felt to be redundant to emphasize that the INOVAC instrument did establish a reputation for decoding innovative concept attributes. It is felt that the novelty, and other dimensions of concepts, through additional comparisons of concept dimensions, could be studied in relationship to one another.

The need to conserve energy has fostered inventions and innovations in the world of design. An index whereby they may be evaluated is needed. The INOVAT is offered as such a measure and it is suggested that its potential will only be completely realized through further study with new concepts and users.

Innovation Diffusion Implications

Katz et al. (1963) argued that "inner" changes precede "outer" changes and that ideas precede tangible manifestations of an idea. This study compared group acceptance of window designs in an attempt to establish if the idea of energy conservation manifested itself in the acceptance of a product which could be tangible. Relevant dimensions of the window designs were identified but across-design comparisons of

dimensions need to be conducted and analyzed. General acceptance of concepts between and within groups was not found to be significantly different. Why?

An earlier study by Menzel (1960) suggested features such as communicability, risk, and persuasiveness should be explored. And Katz (1963) classified diffusion of innovation in terms of: 1) adopting units, a wife is only one component of the household decision-making unit; 2) channels of diffusion, mass communications to interpersonal relations; 3) contextual variables, social, economic, and cultural factors, relative to the acceptance of innovation.

Experience did prove to be a predictor in the INOVAT index. Recall of exposure to media was not. Such elements are felt to be equally pertinent to the diffusion of energy conserving innovation. They support the need for an interdisciplinary approach to studying and understanding the diffusion of both technical and social innovation.

Other contextual variables could be selected to examine in relationship with the INOVAC data. A followup survey of other members of households would provide an additional means of determining acceptance of the window concepts. Probably it would be wise to interview two per household in future studies utilizing the INOVAC test.

Environmental Planning Implications

Saarinen (1976) described environmental planning as the interdisciplinary field which "seeks to combine the insights of the social and

behavioral sciences with the skills of the design and planning disciplines" (p. xi). Inasmuch as this substudy dealt with a people-environment relationship it has methodological and experimental implications for environmental planning.

The substudy investigated consumer perception of energy conserving innovation. Basically it identified that less than 50% of the consumers sampled had a positive acceptance of energy conserving innovation index. Barring the fact that it was just a reaction to the five concepts that happened to be presented, this negative performance on the INOVAT index could be interpreted as indicating that: 1) window designs are not a component which will be readily installed to conserve energy; 2) monochromatic line drawings simulating such concepts were too abstract; 3) consumers' perception of the need to conserve energy is not sufficient to motivate them to adapt their housing; 4) consumers are not aware that window design is an energy saving alternative. This raises the question: "If innovative window design is to be accepted as a component to be installed to make new and old structures more energy efficient, how can it be planned?" To be effective, the planning must consider the way people perceive and utilize window design concepts, as well as the physical environment. The substudy did identify that concepts are perceived differently.

People, according to Downs (1970), can be regarded as complex information processing systems. Further study into the meaning of concepts attributes and dimensions is necessary to avoid a visual-semantic communications gap. By using evaluation techniques such as

the INOVAC, it would be possible to gain understanding of many points of view. Such points of view as are influenced by the meaning of residential components and are necessary for effective planning for design and behavior on the component level as well as on the urban scale. The physical and phycho/social impact, or lack of impact, of window design innovations (or any other innovations) should be considered in the environmental planning and design measures conceived to promote energy conservation.

To establish whether or not window strategies, or fenestration, are congruent with the needs or goals of the consumer, one needs to evaluate planned environments. The INOVAC could be used as either a preplan, or post construction measure, in the cyclical evaluation process which should accompany any environmental plan. It was conceived as a means of transcending the parochial views of designers and planners and to function as a means of engaging the user in design planning and evaluation. It has a contribution to make in helping to identify the relationships that, if identified, would assist in the conscious organization of meeting human needs through energy conservation, a very specific and mandatory type of environmental planning.

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APPENDICES

APPENDIX A

Data for Determining Identifiable County Characteristics

TABLE A-1

BROADCAST CIRCULATION BY COUNTY AND BROADCASTING CITY

Broadcasting Categories	A	B	C	D	E	F	G	H	I
Cities and Counties	Est. TV Minutes	Est. Radio Minutes	Est. Total B'cast Minutes	No. of agent/ client contacts	C/K Best min per station	No. of TV Stans.	No. of Radio Stans. H&G	Oth	Total B'cast Stans.
Memphis[a]	675	1,500	2,175	3,000	464	4	3	10	
*Shelby[b]	675	7,220	7,895	3,000	464	4	3	10	17
Jackson	250	509	759	8,000	373	2	2	4	
Madison	250	1,320	1,570		314	2	0	3	5
*Chester	250	1,380	1,630		408	2	1	1	4
*Henderson	250	940	1,190		397	2	1	0	3
Nashville	292	500	792	8,700	172	5	2	3	
Dickson	292	940	1,232		205	5	1	0	6
*Cheatham	292	440	732		122	5	0	1	6
Robertson	292	440	732		122	5	0	1	6
*Williamson	292	1,380	1,672		239	5	1	1	7
Chattanooga	861	1,500	2,361	10,100	282	5	3	11	
Marion	861	440	1,301		217	5	0	1	6
Sequatchie	861	0	861		172	5	0	0	5
*Hamilton	861	5,840	6,701		419	5	2	9	16
*Bradley	861	1,380	2,241		320	5	1	1	7
Knoxville	210	2,947	3,157	25,000		3	6	16	
Campbell	210	880	1,090		218	3	0	2	5
Anderson	210	1,320	1,530		255	3	0	3	6
*Roane	210	940	1,150		288	3	1	0	4
*Loudon	210	1,880	2,090		418	3	2	0	5
*Knox	210	4,960	5,170		431	3	2	7	12
Union	210	0	310		70	3	0	0	3
Jefferson	210	440	650		130	3	0	2	5
*Sevier	210	940	1,150		288	3	1	0	4
Blount	210	880	1,090		218	3	0	2	5
Tri-Cities	250	1,965	2,215	12,000		4	3	11	
*Hawkins	250	1,380	1,630		272	4	1	1	6
Greene	250	880	1,130		188	4	0	2	6
*Washington	250	3,140	3,390		339	4	1	5	10
Unicoi	250	440	690		138	4	0	1	5
Carter	250	880	1,130		188	4	0	2	6
*Johnson	250	940	1,190		238	4	1	0	5

[a]Cities with stations to the counties immediately following are underlined.
[b]Counties with House & Garden Radio Program have been marked by (*).

FORMULA FOR RADIO AND TV MINUTES BY COUNTIES

Radio Programs

(a) Maximum minutes possible (12 x 5 = 60)
(b) Maximum frequency of usage (1)
(c) No. of H & G program stations( )
(d) A x B x C = Predicted program miniutes

Radio PSA's

(a) Maximum minutes possible (22 x 1/2 = 11)
(b) Maximum predicted frequency of usage (40 for H&G) (20 for others)
(c) No. of H & G stations x 1
(d) No. of other stations x 1/2 (or prob. of carrying)
(e) (AB)C + AB(D) = Predicted PSA minutes

Total Radio minutes = Predicted program minutes + Predicted PSA minutes

Max. usage of a single PSA by a highly cooperative station (a H&G station = 40 in 4 month period
Expected usage (max) by other stations = 20
TV

TABLE A-2

COMPUTATION OF RADIO MINUTES (CIRCULATION)

	A	B	C	Radio Program Min. D	A	B	C	ABC	D	ABD	Radio PSA Min. ABC + ABD	Total Radio Minutes
Shelby	60	1	3	180	22	40	3	2,640	5.0	4,400	7,040	7,220
Madison	60	1	0	0	22	40	0	0	1.5	1,320	1,320	1,320
Chester	60	1	1	60	22	40	1	880	.5	440	1,320	1,380
Henderson	60	1	1	60	22	40	1	880	0	0	880	940
Dickinson			1	60	22	40	1	880	0	0	880	940
Cheatham			0	0	22	40	0	0	.5	440	440	440
Robertson			0	0	22	40	0	0	.5	440	440	440
Williamson			1	60	22	40	1	880	.5	440	1,320	1,380
Marion			0	0	22	40	0	0	.5	440	440	440
Sequatchie			0	0	22	40	0	0	0	0	0	0
Hamilton			2	120	22	40	2	1,760	4.5	440	5,720	5,840
Bradley			1	60	22	40	1	880	.5	440	1,320	1,380
Campbell			0	0	22	40	0	0	1.0	880	880	880
Anderson			0	0	22	40	0	0	1.5	1,320	1,320	1,320
Roane			1	60	22	40	1	880	0	0	880	940
Loudon			2	120	22	40	2	1,760	0	0	1,760	1,880
Knox			2	120	22	40	2	1,760	3.5	3,080	4,840	4,960
Union			0	0	22	40	0	0	0	0	0	0
Jefferson			0	0	22	40	0	0	.5	440	440	440
Sevier			1	60	22	40	1	880	0	0	880	940
Blount			0	0	22	40	0	0	1.0	880	880	880
Hawkins			1	60	22	40	1	880	.5	440	1,320	1,380
Greene			0	0	22	40	0	0	1.0	880	880	880
Washington			1	60	22	40	1	880	2.5	2,200	3,080	3,140
Unicoi			0	0	22	40	0	0	.5	440	440	440
Carter			0	0	22	40	0	0	1.0	880	880	880
Johnson			1	60	22	40	1	880	0	0	880	940

APPENDIX B

Interview Forms

INTERVIEW EXPLANATION

You are being interviewed by ______________________________, who is assisting with a survey being conducted by THE UNIVERSITY OF TENNESSEE ENVIRONMENT CENTER.

The purpose of this interview is to see what you as a consumer would consider doing to save energy in your home. You have been selected randomly after you kindly answered the ENERGY CONSERVATION IN THE HOME QUESTIONNAIRE a few days ago.

In this interview you are to look at a series of 5 pictures that show window treatments which are <u>energy-saving</u> and, otherwise, work as regular windows to provide light and air.

<u>Steps to follow:</u>

1. Look at each set of pictures and think about the window treatment for a few minutes.

2. Indicate your reaction to the idea shown in the picture by checking ( ) <u>one</u> of the five brackets between each pair of words that are used to describe the energy-saving window treatment.

3. If you do not understand the pair of words place a (?) beside the pair.

EXAMPLES

(a) nice ( ) ( ) ( ) ( ) ( ) horrible

(b) useful ( ) ( ) ( ) ( ) ( ) useless?

(c) dark ( ) ( ) ( ) ( ) ( ) bright

PLEASE COMPLETE A FORM FOR EACH SET OF PICTURES AS THE SET IS SHOWN TO YOU.

CONSENT FORM

After having the interview's purpose and process explained to my satisfaction, I agree to participate in the activity. I realize that I may stop at any time and that I do not have to complete the interview.

Date_______________ Subject______________________________

Witness______________________________

INTERVIEW FORM

1. Look at the picture of this energy-saving window treatment.

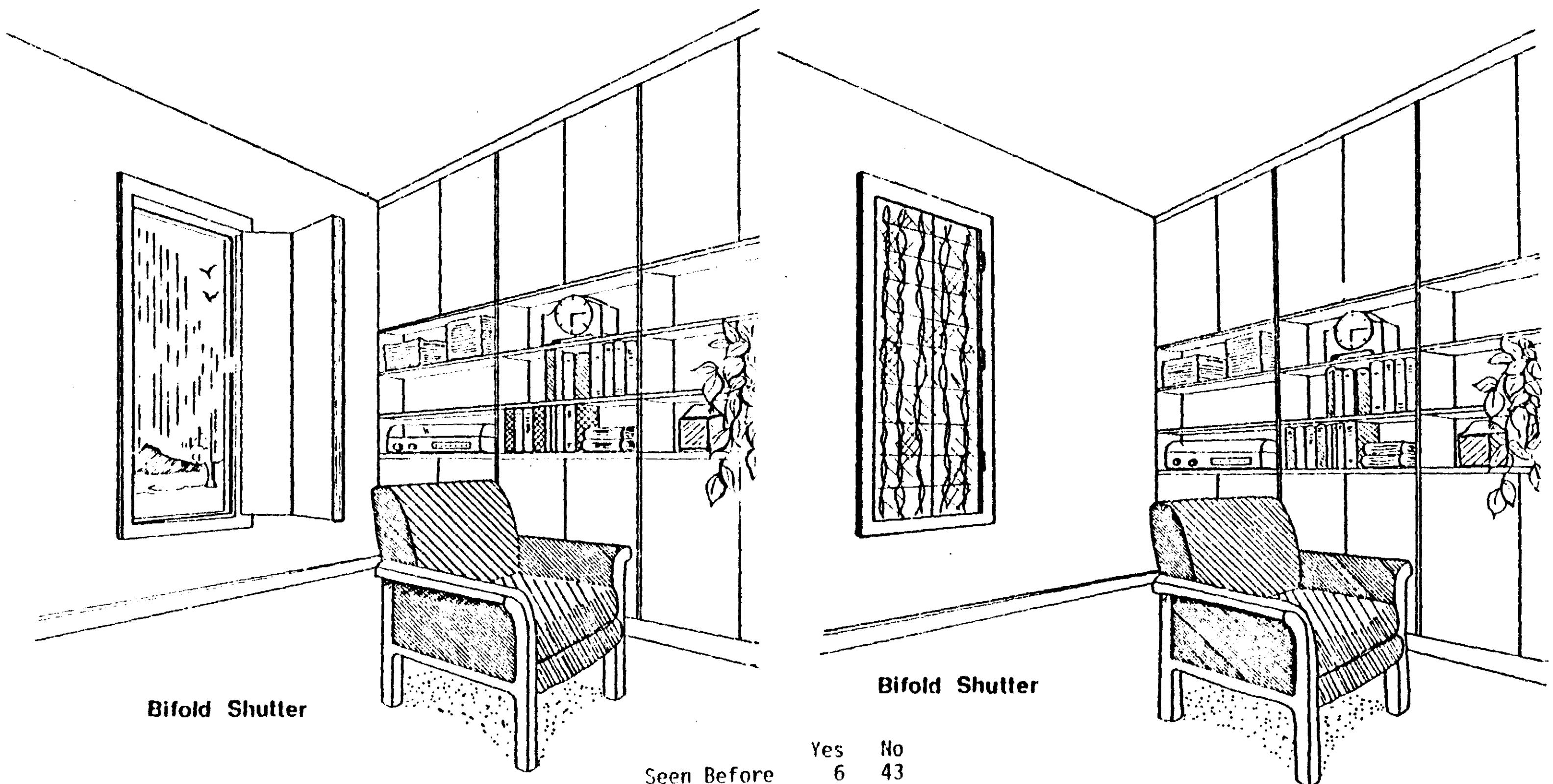
2. Show how you would describe the energy-saving treatment by checking each pair of words in the list below.

							Office Use Only
drafty	( )	( )	( )	( )	( )	stuffy	6___
convenient	( )	( )	( )	( )	( )	inconvenient	7___
decorative	( )	( )	( )	( )	( )	plain	2___
attractive	( )	( )	( )	( )	( )	unattractive	5___
comfortable	( )	( )	( )	( )	( )	uncomfortable	16___
interesting	( )	( )	( )	( )	( )	boring	1___
warm	( )	( )	( )	( )	( )	cool	9___
private	( )	( )	( )	( )	( )	public	15___
functional	( )	( )	( )	( )	( )	non-functional	17___
adequate size	( )	( )	( )	( )	( )	inadequate size	3___
good	( )	( )	( )	( )	( )	bad	19___
modern	( )	( )	( )	( )	( )	old fashioned	12___
thrifty	( )	( )	( )	( )	( )	costly	10___
beautiful	( )	( )	( )	( )	( )	ugly	8___
neat	( )	( )	( )	( )	( )	messy	22___
good ventilation	( )	( )	( )	( )	( )	poor ventilation	23___
complex	( )	( )	( )	( )	( )	simple	11___
dangerous	( )	( )	( )	( )	( )	safe	18___
heavy	( )	( )	( )	( )	( )	lightweight	14___
durable	( )	( )	( )	( )	( )	non-durable	24___
good lighting	( )	( )	( )	( )	( )	poor lighting	13___
expensive	( )	( )	( )	( )	( )	cheap	25___
unusual	( )	( )	( )	( )	( )	usual	21___
clean	( )	( )	( )	( )	( )	dirty	4___
comfortable temperature	( )	( )	( )	( )	( )	uncomfortable temperature	20___

3. Have you seen a window treatment like this before? Yes ( ) No ( ) 26___

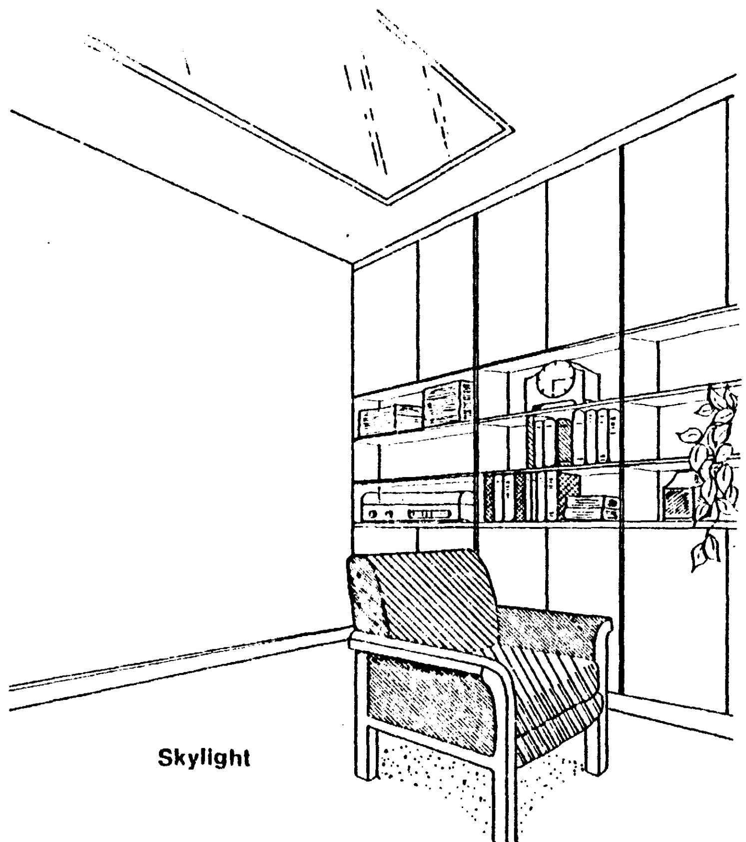
4. Would you use it to save energy? Yes ( ) No ( ) 27___

Note: Repeated for each window concept (m=5)



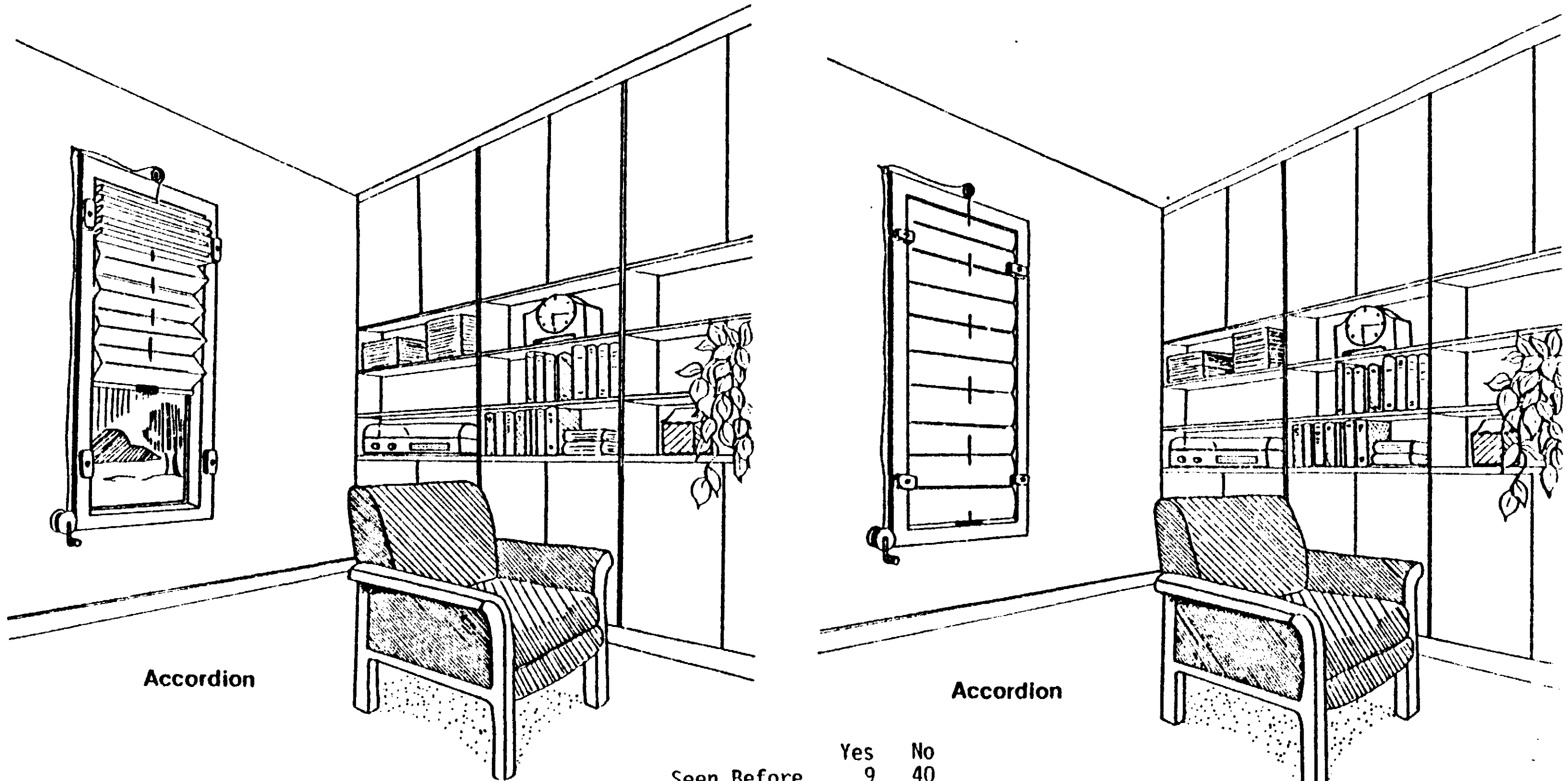
	Yes	No
Seen Before	6	43
Would Use	9	38

Figure B-1 Bifold Window Concept in Opened and Closed Position



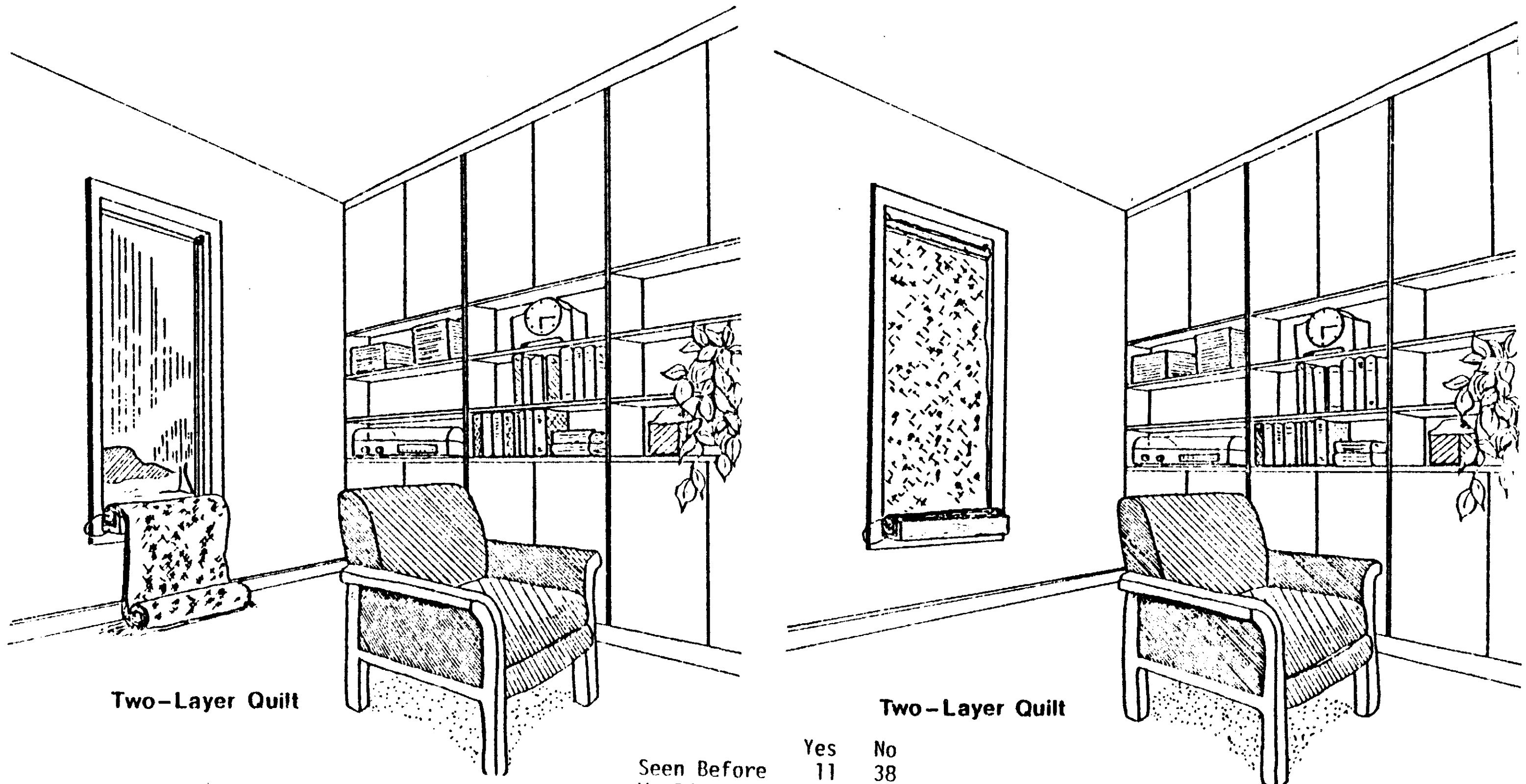
	Yes	No
Seen Before	15	34
Would Use	13	36

Figure B-2 Skylight Window Concept in Opened and Closed Position



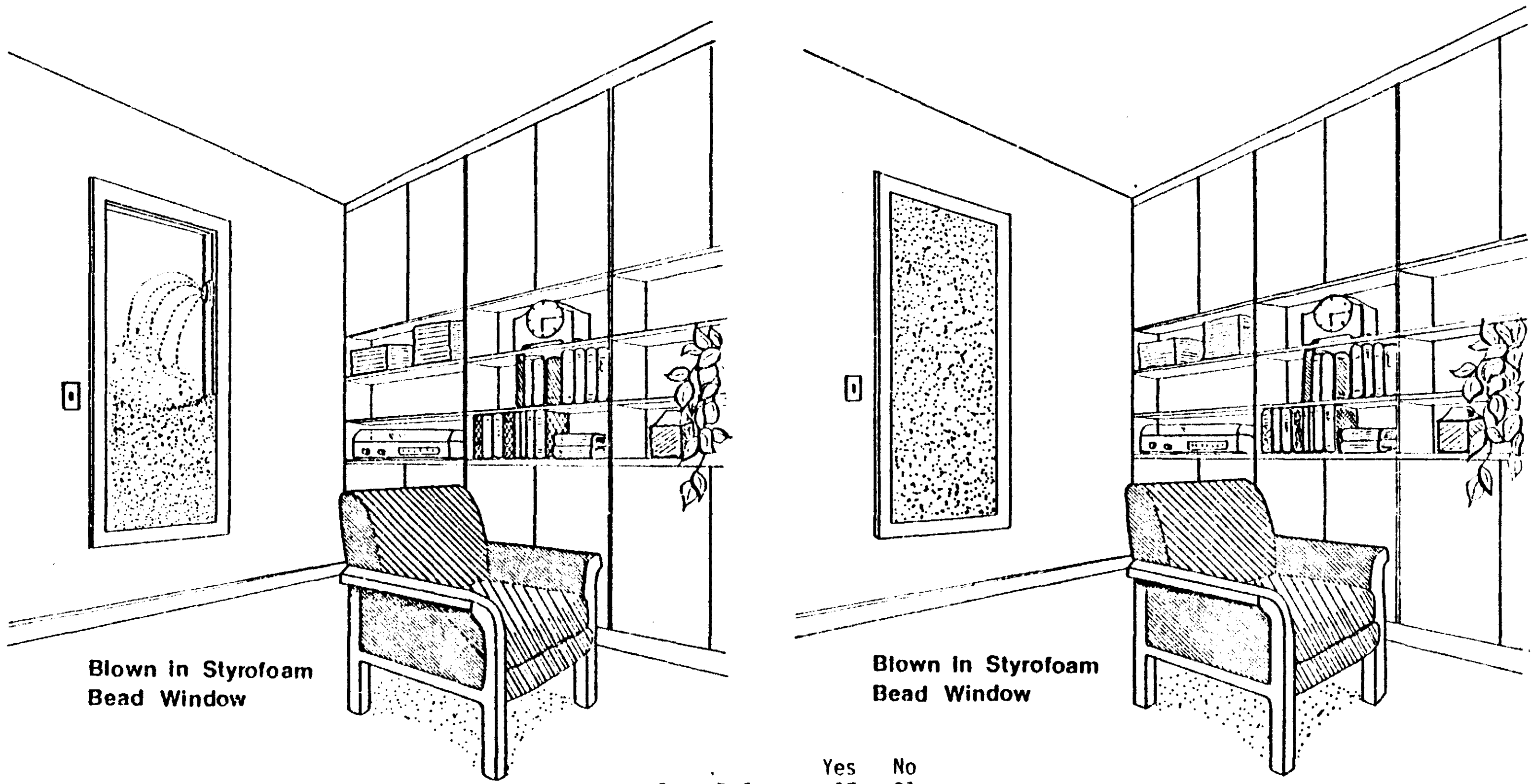
	Yes	No
Seen Before	9	40
Would Use	15	33

Figure B-3 Accordian Window Concept in Opened and Closed Position



	Yes	No
Seen Before	11	38
Would Use	18	30

Figure B-4 Quilt Window Concept in Opened and Closed Position



	Yes	No
Seen Before	17	31
Would Use	16	33

Figure B-5 Beadwall Window Concept in Opened and Closed Position

Figure B-6 Thank You Bumper Sticker

APPENDIX C

Questions for Word Bank Generation

Questions Asked Home Demonstration Club Members During Word Bank Generation

1. What words would you use to describe the picture?
2. What words describe how the window would work?
3. What words describe the "looks" of the window?
4. What words describe the cost of the windows?
5. What words describe how you would care for the windows?
6. What words describe how the window relates to your climate?

APPENDIX D

Interviewers Forms

ENERSENSE EVALUATION INTERVIEWER EXPENSE REPORT
(Complete by December 18, 1978)

Return to M. Ellison, University of Tennessee Environment Center, Knoxville.

Interviewer____________________ Soc. Sec. No.____________

Address____

____________________ County____________________

Telephone________________ Number of Interviews____________

****

(A) DISTANCE TRAVELED

	Interviewee	Address	Mileage	Date
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

Total Miles Traveled__________ @$.12/mile/20 mile average =
TOTAL $________

(B) LONG DISTANCE PHONE CALLS WITHIN COUNTY

	Date	Number Called	Name	Address	Time
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

Total Number of Calls_______ @ $.50/call = Total $_______

Date_______ Signature_______________ Total of (A) & (B) $_______

APPENDIX E

INOVAC Variables

TABLE E-1

ORIGINAL[a] AND COMPUTED[b] VARIABLES
FROM ENERSENSE STRATEGY II INOVAC INTERVIEW
AND STRATEGY I QUESTIONNAIRE

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
	Bifold Window (W_1)		1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.1	interesting 1	#	8	2	11	5	21	2	3.47	3.80	#	10	3	7	8	18	3	3.36	3.81
		%	16	4	22	10	43	4			%	20	6	14	16	37	6		
2.2	decorative 1	#	8	4	6	5	26	0	3.75	4.55	#	7	2	14	4	21	1	3.55	3.62
		%	16	8	12	10	53	0			%	14	4	29	8	43	2		
2.3	adequate size 1	#	16	4	11	3	9	6	2.69	2.63	#	10	7	16	3	7	6	2.67	2.71
		%	33	8	22	6	18	12			%	20	14	33	6	14	12		
2.4	clean 1	#	14	3	11	6	15	0	3.10	3.18	#	7	4	16	6	16	0	3.40	3.34
		%	29	6	22	12	31	0			%	14	8	33	12	33	0		
2.5	attractive 1	#	4	5	6	7	27	0	3.98	4.59	#	6	2	12	6	22	1	3.67	4.08
		%	8	10	12	14	55	0			%	12	4	25	12	45	2		
2.6	stuffy 1	#	22	7	17	1	2	0	2.06	1.86	#	15	2	18	6	4	4	2.63	2.80
		%	45	14	35	2	4	0			%	31	4	37	12	8	8		
2.7	convenient 1	#	6	7	3	3	30	0	3.89	4.68	#	14	5	11	1	18	0	3.08	3.00
		%	12	14	6	6	61	0			%	29	10	22	2	37	0		
2.8	beautiful 1	#	1	5	10	10	23	0	4.0	4.35	#	3	3	18	7	17	1	3.59	3.47
		%	2	10	20	20	47	0			%	6	6	37	14	35	2		

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
			1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.9	warm 1	#	17	10	11	4	5	2	2.51	2.25	#	13	7	18	4	5	2	2.73	2.75
		%	35	20	22	8	10	4			%	27	14	37	8	10	4		
2.10	thrifty 1	#	10	2	13	3	20	1	3.49	3.46	#	12	6	13	3	12	3	3.00	2.92
		%	20	4	27	6	41	2			%	25	12	27	6	25	6		
2.11	simple 1	#	16	4	12	4	13	0	2.87	2.87	#	19	8	13	1	7	1	2.30	2.06
		%	33	8	25	8	27	0			%	39	16	27	2	14	2		
2.12	modern 1	#	18	5	11	2	13	0	2.73	2.63	#	18	2	12	3	12	2	2.65	2.70
		%	37	10	22	4	27	0			%	37	4	25	6	25	4		
2.13	good lighting 1	#	9	3	10	5	21	1	3.59	4.00	#	14	5	15	2	11	1	2.81	2.80
		%	18	6	20	10	43	2			%	29	10	31	4	22	2		
2.14	heavy 1	#	9	2	15	4	19	0	3.45	3.40	#	2	2	21	4	15	1	3.75	3.42
		%	18	6	20	10	43	2			%	4	4	43	8	31	10		
2.15	private 1	#	36	3	2	3	5	0	1.73	1.18	#	26	5	9	4	3	2	2.04	1.40
		%	74	6	4	6	10	0			%	53	10	18	8	6	4		
2.16	comfort 1	#	9	7	14	5	12	2	3.08	3.03	#	9	5	12	4	15	4	3.10	3.12
		%	18	14	29	10	25	4			%	18	10	25	8	31	8		
2.17	functional 1	#	8	8	10	6	13	4	3.16	3.15	#	16	7	9	2	11	4	2.57	2.28
		%	16	16	20	12	27	8			%	33	14	18	4	22	8		
2.18	safe 1	#	14	5	15	5	10	0	2.83	2.86	#	16	5	18	3	5	2	2.63	2.69
		%	29	10	31	10	20	0			%	33	10	37	6	10	4		

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
			1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.19	good 1	#	3	3	22	7	14	1	3.53	3.34	#	7	4	19	6	11	2	3.20	3.15
		%	6	6	45	14	29	2			%	14	8	39	12	22	4		
2.20	comfortable temperature 1	#	12	6	23	3	4	1	2.55	2.73	#	10	5	21	3	5	1	2.93	2.90
		%	25	12	47	6	8	2			%	20	10	43	6	10	10		
2.21	usual 1	#	2	1	4	4	38	0	4.53	4.85	#	3	1	9	6	29	1	4.10	4.65
		%	4	2	8	8	78	0			%	6	2	18	12	59	2		
2.22	neat 1	#	10	4	10	5	19	1	3.32	3.45	#	16	4	9	5	14	1	2.87	2.88
		%	20	8	20	10	39	2			%	33	8	18	10	29	2		
2.23	good ventilation 1	#	3	4	15	7	20	0	3.75	3.85	#	7	2	19	3	15	2	3.40	3.26
		%	6	8	31	14	41	0			%	14	4	39	6	31	4		
2.24	durable 1	#	13	7	16	4	8	1	2.79	2.78	#	17	9	10	2	9	2	2.53	2.22
		%	27	14	33	8	16	2			%	35	18	10	4	18	4		
2.25	cheap 1	#	5	3	18	4	19	0	3.59	3.41	#	10	5	14	4	14	2	3.26	3.17
		%	10	6	36	8	39	0			%	20	10	29	8	29	4		
				Yes		No		NR					Yes		No		NR		
2.26	window 1 (seen before)	#		6		43		0			#		8		41		0		
		%		12		88		0			%		16		84		0		
2.27	Youse 1 (would use)	#		9		38		2			#		15		32		1		
		%		18		78		4			%		31		65		2		

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
Skylight Window (W_2)			1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.28	interesting 2	#	17	2	7	7	15	1	3.08	3.28	#	10	5	9	2	22	1	3.36	3.44
		%	35	4	14	14	31	2			%	20	10	18	4	45	2		
2.29	decorative 2	#	11	3	7	7	20	1	3.51	4.00	#	12	5	12	3	17	0	3.16	3.12
		%	22	6	14	14	41	2			%	25	10	25	6	35	0		
2.30	adequate size 2	#	13	7	16	3	7	3	2.85	2.78	#	10	4	25	2	6	2	2.79	2.88
		%	27	14	33	6	14	6			%	20	8	51	4	12	4		
2.31	clean 2	#	14	4	16	6	8	1	2.85	2.90	#	1	7	10	6	14	1	3.16	3.15
		%	29	8	33	12	16	2			%	22	14	20	12	29	2		
2.32	attractive 2	#	8	6	12	5	17	1	3.28	3.29	#	6	7	9	5	22	0	3.61	4.00
		%	16	12	25	10	35	2			%	12	14	18	10	45	0		
2.33	stuffy 2	#	20	3	22	1	1	2	2.06	2.33	#	11	6	27	2	3	0	2.59	2.77
		%	41	6	45	2	2	4			%	22	12	55	4	6	0		
2.34	convenient 2	#	13	4	6	3	23	0	3.38	4.00	#	12	6	6	5	20	0	3.30	3.60
		%	27	8	12	6	47	0			%	25	12	12	10	41	0		
2.35	beautiful 2	#	5	3	15	6	20	0	3.67	3.75	#	4	2	16	9	18	0	3.71	3.77
		%	10	6	31	12	41	0			%	8	4	33	18	37	0		
2.36	warm 2	#	13	5	21	4	5	1	2.59	2.76	#	14	3	19	5	6	2	2.71	2.84
		%	27	10	43	8	10	2			%	29	6	39	10	12	4		

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
	Skylight Window (W_2)		1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.38	simple 2	#	6	6	13	4	18	1	3.59	3.46	#	9	3	14	4	17	2	3.34	3.32
		%	12	12	27	8	37	2			%	18	6	29	8	35	4		
2.39	modern 2	#	27	3	8	5	4	2	2.22	1.40	#	31	3	8	2	5	0	1.91	1.29
		%	55	6	16	10	8	4			%	63	6	16	4	10	0		
2.40	good lighting size 2	#	11	4	7	7	20	0	3.42	3.85	#	10	5	16	4	11	3	3.08	3.03
		%	22	8	14	14	41	0			%	20	10	33	8	22	6		
2.41	heavy 2	#	11	9	16	3	8	2	2.87	2.78	#	10	2	17	6	12	2	3.28	3.23
		%	22	18	33	6	16	4			%	20	4	35	12	25	4		
2.42	private 2	#	33	5	7	2	2	0	1.67	1.24	#	27	5	11	1	5	0	2.02	1.40
		%	67	10	14	4	4	0			%	55	10	22	2	10	0		
2.43	comfortable 2	#	6	7	18	5	12	0	3.26	3.13	#	10	7	17	3	12	0	3.00	2.94
		%	12	14	37	10	25	0			%	20	14	35	6	25	0		
2.44	functional 2	#	12	5	16	4	11	1	3.00	2.96	#	13	7	13	2	12	0	2.98	2.84
		%	25	10	33	8	22	2			%	27	14	27	4	25	4		
2.45	safe 2	#	14	7	16	3	8	1	2.73	2.71	#	11	4	24	2	7	1	2.85	2.89
		%	29	14	33	6	16	2			%	22	8	49	4	14	2		
2.46	good 2	#	6	6	18	4	15	0	3.32	3.19	#	8	2	20	4	15	0	3.32	3.22
		%	12	12	37	8	31	0			%	16	4	41	8	31	0		

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
	Skylight Window (W_2)		1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.47	comfortable	#	15	10	16	3	4	0	2.46	2.45	#	3	7	26	1	9	3	3.06	2.98
	temperature 2	%	31	20	32	6	8	0			%	6	14	53	2	18	6		
2.48	usual 2	#	4	0	12	7	26	0	4.04	4.55	#	4	0	7	8	26	4	4.06	4.63
		%	8	0	25	14	53	0			%	8	0	14	16	53	8		
2.49	neat 2	#	13	7	14	3	12	0	2.87	2.82	#	9	7	16	3	13	1	3.14	3.03
		%	27	14	29	6	25	0			%	18	14	33	6	27	2		
2.50	good	#	6	1	16	4	21	1	3.73	3.87	#	5	5	18	4	15	2	3.51	3.30
	ventilation 2	%	12	2	33	8	43	2			%	10	10	37	8	31	4		
2.51	durable 2	#	15	7	10	6	9	2	2.85	2.75	#	8	9	18	3	9	2	3.04	2.91
		%	31	14	20	12	18	4			%	16	18	37	6	18	4		
2.52	cheap 2	#	6	1	15	5	19	3	3.67	3.8	#	4	4	14	6	18	3	3.79	3.03
		%	12	2	31	10	39	6			%	8	8	29	12	37	6		
				Yes		No		NR					Yes		No		NR		
2.53	Window 2	#		15		34		0			#		10		39		0		
	(seen before)	%		31		69		0			%		20		80		0		
2.54	Youse 2	#		13		36		0			#		17		31		1		
	(would use)	%		27		73		0			%		35		63		2		

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
Accordian Window(W_3)			1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.55	interesting 3	#	11	10	8	3	17	0	3.10	2.93	#	18	10	7	3	11	0	2.57	2.15
		%	22	20	16	6	35	0			%	37	20	14	6	22	0		
2.56	decorative 3	#	7	6	12	6	18	0	3.44	3.45	#	14	5	8	6	16	0	3.10	3.18
		%	14	12	25	12	37	0			%	29	10	16	12	33	0		
2.57	adequate size 3	#	17	8	14	1	5	4	2.61	2.43	#	17	4	16	5	4	3	2.67	2.71
		%	35	16	29	2	10	8			%	35	8	33	10	8	6		
2.58	clean 3	#	12	10	15	5	7	0	2.69	2.66	#	13	5	15	4	9	3	3.00	2.93
		%	24	20	31	10	14	0			%	27	10	31	8	18	6		
2.59	attractive 3	#	4	6	9	5	25	0	3.83	4.52	#	13	6	7	5	18	0	3.18	3.28
		%	8	12	18	10	51	0			%	27	12	14	10	37	0		
2.60	stuffy 3	#	17	7	20	2	3	0	2.32	2.52	#	13	1	23	7	4	1	2.81	2.95
		%	34	14	40	4	6	0			%	27	2	47	14	8	2		
2.61	convenient 3	#	8	8	4	2	27	0	3.65	4.59	#	12	11	7	4	15	0	2.98	2.71
		%	16	16	8	4	55	0			%	25	22	14	8	31	0		
2.62	beautiful 3	#	2	1	17	7	22	0	3.93	4.14	#	3	6	22	3	15	0	3.42	3.20
		%	4	2	35	14	45	0			%	6	12	45	6	31	0		
2.63	warm 3	#	15	11	18	3	2	0	2.30	2.36	#	14	9	16	1	5	2	2.59	2.53
		%	31	22	37	6	4	0			%	29	18	33	2	5	4		
2.64	thrifty 3	#	11	11	7	5	18	1	3.30	3.42	#	13	8	10	3	13	2	3.02	2.85
		%	22	22	14	10	37	2			%	27	16	20	6	27	4		

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
	Accordian Window(W_3)		1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.65	simple 3	#	8	7	15	2	15	2	3.30	3.13	#	15	3	18	6	7	0	2.73	2.86
		%	16	14	31	4	31	4			%	31	6	37	12	14	0		
2.66	modern 3	#	18	6	6	5	13	1	2.83	2.58	#	19	5	4	5	15	1	2.89	2.62
		%	37	12	12	10	27	2			%	39	10	8	10	31	2		
2.67	good lighting 3	#	7	5	15	7	14	1	3.38	3.33	#	10	5	16	3	12	3	3.22	3.09
		%	14	10	31	14	29	2			%	20	10	33	6	25	6		
2.68	heavy 3	#	3	5	14	5	21	1	3.79	4.00	#	10	2	18	4	11	4	3.32	3.19
		%	6	10	29	10	43	2			%	20	4	37	8	22	8		
2.69	private 3	#	29	8	7	1	2	2	1.75	1.31	#	21	11	13	1	3	0	2.06	1.81
		%	59	16	14	2	4	4			%	43	22	27	2	6	0		
2.70	comfortable 3	#	10	9	12	5	11	2	2.95	2.87	#	10	9	16	2	10	2	2.85	2.78
		%	20	18	24	10	22	4			%	20	18	33	4	20	4		
2.71	functional 3	#	14	8	9	7	10	1	2.87	2.77	#	20	8	7	6	5	3	2.53	2.06
		%	29	16	18	14	20	2			%	41	16	14	12	10	6		
2.72	safe 3	#	15	8	12	5	6	3	3.93	4.14	#	17	6	19	4	2	1	2.40	2.57
		%	31	16	24	10	12	6			%	35	12	39	8	4	2		
2.73	good 3	#	5	7	17	5	15	0	3.36	3.23	#	11	7	14	3	13	1	2.93	2.89
		%	10	14	35	10	31	0			%	22	14	29	6	27	2		
2.74	comfortable	#	7	8	24	6	3	1	2.85	2.89	#	14	4	22	0	4	5	2.57	2.70
	temperature 3	%	14	16	49	12	6	2			%	29	8	45	0	8	10		

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
	Accordian Window(W_3)		1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.74	comfortable temperature 3	# %	7 14	8 16	24 49	6 12	3 6	1 2	2.85	2.89	# %	14 29	4 8	22 45	0 0	4 8	5 10	2.57	2.70
2.75	usual 3	# %	5 10	0 0	8 16	9 18	27 55	0 0	4.08	4.59	# %	2 4	1 2	13 27	6 12	27 55	0 0	4.12	4.59
2.76	neat 3	# %	8 16	14 29	10 20	8 16	9 18	0 0	2.91	2.75	# %	15 31	5 10	12 25	3 6	13 27	1 2	2.93	2.87
2.77	good ventilation 3	# %	4 8	9 18	17 35	5 10	13 27	1 2	3.34	3.17	# %	11 22	4 8	21 43	2 4	10 20	1 2	2.98	2.95
2.78	durable 3	# %	16 33	9 18	13 27	6 12	5 10	0 0	2.49	2.44	# %	16 33	8 16	13 27	1 2	6 12	5 10	2.63	2.43
2.79	cheap 3	# %	6 12	6 12	11 22	9 18	17 35	0 0	3.51	3.66	# %	7 14	5 10	13 27	6 12	14 29	4 8	3.55	3.46
				Yes		No		NR					Yes		No		NR		
2.80	Window 3 (seen before)	# %		9 18		40 82		0 0			# %		11 22		37 76		1 2		
2.81	Youse 3 (would use)	# %		15 31		33 67		1 2			# %		22 45		26 53		1 2		

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
	Quilt Window (W_4)		1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.82	interesting 4	#	13	2	13	7	13	1	3.16	3.23	#	12	9	9	2	17	0	3.06	2.88
		%	27	4	27	14	27	2			%	25	18	18	4	35	0		
2.83	decorative 4	#	14	5	9	4	17	0	3.10	3.11	#	8	7	10	5	19	0	3.40	3.45
		%	29	10	18	8	35	0			%	16	14	20	10	39	0		
2.84	adequate size 4	#	17	6	18	1	2	5	2.46	2.52	#	12	7	19	5	6	0	2.71	2.78
		%	35	12	37	2	4	10			%	25	14	39	10	12	0		
2.85	clean 4	#	12	2	14	4	15	2	3.28	3.?5	#	14	6	14	4	10	1	2.85	2.82
		%	25	4	29	8	31	4			%	29	12	29	8	20	2		
2.86	attractive 4	#	11	2	11	6	19	0	3.40	3.58	#	4	5	12	4	24	0	3.79	4.3
		%	22	4	22	12	39	0			%	8	10	25	8	49	0		
2.87	stuffy 4	#	13	8	20	2	5	1	2.61	2.67	#	10	7	24	4	2	2	2.73	2.81
		%	27	16	41	4	10	2			%	20	14	49	8	4	4		
2.88	convenient 4	#	14	4	6	4	21	0	3.28	3.62	#	7	5	11	1	24	1	3.67	4.52
		%	29	8	12	8	43	0			%	14	10	22	2	49	2		
2.89	beautiful 4	#	6	4	11	11	16	1	3.61	3.81	#	5	5	14	9	16	0	3.53	3.55
		%	12	8	22	22	33	2			%	10	10	29	18	33	0		
2.90	warm 4	#	13	11	19	2	4	0	2.44	2.52	#	18	7	18	0	4	2	2.40	2.42
		%	27	22	39	4	8	0			%	37	14	37	0	8	4		
2.91	thrifty 4	#	11	3	14	6	14	1	3.24	3.25	#	12	5	12	3	16	1	3.18	3.12
		%	22	6	29	12	29	2			%	25	10	25	6	33	2		

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
	Quilt Window (W_4)		1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.92	simple 4	#	13	8	10	9	9	0	2.85	2.85	#	14	4	15	3	12	1	2.83	2.86
		%	27	16	20	18	18	0			%	29	8	31	6	25	2		
2.93	modern 4	#	23	2	11	5	8	0	2.44	2.25	#	21	3	9	4	22	1	2.67	2.55
		%	47	4	22	10	16	0			%	43	6	18	8	45	2		
2.94	good lighting 4	#	13	7	10	5	13	1	3.02	2.95	#	15	7	9	4	13	1	2.918	2.77
		%	27	14	20	10	27	2			%	31	14	19	8	27	2		
2.95	heavy 4	#	8	6	16	6	12	1	3.22	3.15	#	7	3	19	6	12	1	3.26	3.21
		%	16	12	33	12	25	2			%	14	6	39	12	25	2		
2.96	private 4	#	30	6	9	1	3	0	1.79	1.31	#	25	10	9	2	2	1	1.83	1.44
		%	61	12	18	2	6	0			%	51	20	18	4	4	2		
2.97	comfortable 4	#	14	8	11	8	8	0	2.75	2.72	#	12	6	16	2	12	1	2.98	2.90
		%	29	16	22	16	16	0			%	25	12	33	4	25	2		
2.98	functional 4	#	14	9	12	2	10	2	2.69	2.54	#	13	6	12	2	15	1	3.06	2.95
		%	29	18	25	4	20	4			%	27	12	25	4	31	2		
2.99	safe 4	#	12	4	20	6	6	1	2.85	2.92	#	16	3	20	2	6	2	2.69	2.77
		%	25	8	41	12	12	2			%	33	6	41	4	12	4		
2.100	good 4	#	7	7	17	5	12	1	3.22	3.11	#	4	4	20	5	15	1	3.53	3.32
		%	14	14	35	10	25	2			%	8	8	41	10	31	2		

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
	Quilt Window (W_4)		1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.101	comfortable temperature 4	#	1	10	11	22	4	1	2.53	2.61	#	6	8	22	3	5	5	3.16	2.97
		%	2	20	22	45	8	2			%	12	16	45	6	10	10		
2.102	usual 4	#	9	4	7	5	23	0	3.65	4.40	#	4	0	7	6	31	1	4.28	4.74
		%	18	8	14	10	47	0			%	8	0	14	12	63	2		
2.103	neat 4	#	15	6	12	4	11	1	2.85	2.79	#	12	4	13	1	19	0	3.228	3.15
		%	31	12	25	8	22	2			%	25	8	26	1	39	0		
2.104	good ventilation 4	#	9	5	16	3	14	2	3.04	3.03	#	5	4	16	6	14	4	3.65	3.46
		%	18	10	33	6	29	4			%	10	8	33	12	29	8		
2.105	durable 4	#	16	7	12	1	3	0	1.79	1.31	#	25	10	9	2	2	1	1.83	1.44
		%	61	12	18	2	6	0			%	51	20	18	4	4	2		
2.106	cheap 4	#	5	5	17	5	15	2	3.53	3.35	#	7	2	20	3	14	3	3.49	3.27
		%	10	10	35	10	31	4			%	14	4	41	6	29	6		
				Yes		No		NR					Yes		No		NR		
2.107	Window 4 (seen before)	#		11		38		0			#		12		36		1		
		%		22		78		0			%		25		74		2		
2.108	Youse 4 (would use)	#		18		30		1			#		16		31		2		
		%		37		61		2			%		33		63		4		

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
	Beadwall Window (W_5)		1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.109	interesting 5	#	22	8	4	3	12	0	2.49	1.81	#	21	9	10	1	6	2	2.10	1.66
		%	45	16	8	6	25	0			%	43	18	20	2	12	4		
2.110	decorative 5	#	9	11	7	7	15	0	3.16	3.14	#	16	8	10	4	10	1	2.61	2.43
		%	18	22	14	14	31	0			%	33	16	20	8	20	2		
2.111	adequate size 5	#	17	13	10	1	2	6	2.38	2.00	#	12	8	15	3	4	7	2.63	2.60
		%	35	27	20	2	4	12			%	25	16	31	6	8	7		
2.112	clean 5	#	14	7	13	6	8	1	2.79	2.76	#	12	7	17	3	9	1	2.73	2.76
		%	29	14	27	12	16	2			%	25	14	35	6	18	2		
2.113	attractive 5	#	15	6	10	4	14	0	2.91	2.85	#	16	10	8	1	13	1	2.63	2.25
		%	31	12	20	8	29	0			%	33	20	16	2	27	1		
2.114	stuffy 5	#	8	7	28	2	2	2	2.77	2.83	#	6	4	27	3	7	2	3.02	3.00
		%	16	14	57	4	4	4			%	12	8	55	6	14	4		
2.115	convenient 5	#	15	6	10	1	17	0	2.98	2.85	#	20	4	10	0	12	3	2.65	2.37
		%	31	12	20	2	35	0			%	41	8	20	0	25	6		
2.116	beautiful 5	#	5	8	17	6	13	0	3.28	3.17	#	5	5	21	5	12	1	3.22	3.14
		%	10	16	35	12	27	0			%	10	10	43	10	25	2		
2.117	warm 5	#	14	12	18	2	2	1	2.36	2.37	#	17	4	22	1	4	1	2.34	2.61
		%	29	25	37	4	4	2			%	35	8	45	2	8	2		
2.118	thrifty 5	#	10	6	13	4	16	0	3.20	3.15	#	13	3	9	1	19	3	3.32	3.33
		%	20	12	27	8	33	0			%	27	6	18	2	39	6		

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
	Beadwall Window (W_5)		1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.119	simple 5	#	17	4	12	6	10	0	2.75	2.79	#	15	4	15	4	8	3	2.65	2.73
		%	34	8	25	12	20	0			%	31	8	31	8	16	6		
2.120	modern 5	#	26	5	10	1	7	0	2.14	1.44	#	32	7	3	1	4	2	1.73	1.23
		%	53	10	20	2	14	0			%	65	14	6	2	8	4		
2.121	good lighting 5	#	22	7	7	5	7	1	2.40	1.85	#	21	7	9	3	6	3	2.36	1.85
		%	45	14	14	10	14	2			%	43	14	18	6	12	6		
2.122	heavy 5	#	8	6	15	8	10	2	3.24	3.20	#	8	2	25	3	8	3	3.08	3.04
		%	16	12	31	16	20	4			%	16	4	51	6	16	6		
2.123	private 5	#	26	8	8	4	3	0	1.98	1.44	#	28	4	11	0	5	1	1.91	1.33
		%	53	16	16	8	6	0			%	57	8	22	0	10	2		
2.124	comfortable 5	#	12	11	17	2	7	0	2.61	2.58	#	15	9	12	1	9	3	2.65	2.44
		%	25	22	35	4	14	0			%	31	18	25	2	18	6		
2.125	functional 5	#	18	5	16	3	7	0	2.51	2.59	#	23	5	10	1	7	3	2.32	1.60
		%	37	10	33	6	14	0			%	47	10	20	2	14	6		
2.126	safe 5	#	16	7	13	6	6	1	2.63	2.61	#	14	7	21	1	4	2	2.46	2.61
		%	33	14	27	12	12	2			%	29	14	43	2	8	4		
2.127	good 5	#	11	6	18	5	9	0	2.89	2.91	#	7	8	22	3	7	2	2.89	2.88
		%	22	12	37	10	18	0			%	14	16	45	6	14	4		
2.128	comfortable temperature 5	#	1	8	14	23	1	2	2.49	2.56	#	14	6	20	1	5	3	2.46	2.62
		%	2	16	29	47	2	4			%	29	12	41	2	10	6		

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
			1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.129	usual 5	#	5	3	12	5	24	0	3.81	4.40	#	5	1	9	7	26	1	3.91	4.55
		%	10	6	25	10	49	0			%	10	2	18	14	53	2		
2.130	neat 5	#	13	15	13	2	6	0	2.44	2.26	#	19	7	11	4	6	2	2.40	2.14
		%	27	31	27	4	12	0			%	39	14	22	8	12	4		
2.131	good ventilation 5	#	8	6	16	3	12	4	3.22	3.09	#	7	6	16	3	11	6	3.22	3.09
		%	16	12	33	6	25	8			%	14	12	33	6	22	12		
2.132	durable 5	#	15	12	14	5	2	1	2.38	2.29	#	16	5	18	6	3	1	2.61	2.63
		%	31	25	29	10	4	2			%	33	10	37	12	6	2		
2.133	cheap 5	#	5	3	11	8	20	2	3.83	4.18	#	4	4	13	2	21	5	3.83	4.52
		%	10	6	22	16	41	4			%	8	8	27	4	43	10		
				Yes		No		NR					Yes		No		NR		
2.134	Window 5 (seen before)	#		17		31		1					16		33		0		
		%		35		63		2					33		67		0		
2.135	Youse 5 (would use)	#		16		33		0					28		21		0		
		%		33		67		0					57		43		0		
2.136	ACCEPT W_1 M of bipolar scales k_1=25								3.22									3.03	

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			Semantic Scale									Semantic Scale							
			1	2	3	4	5	NR	Mean	Median		1	2	3	4	5	NR	Mean	Median
2.137	ACCEPT W_2 M of bipolar scales k_2=25								3.06									3.13	
2.138	ACCEPT W_3 M of bipolar scales k_3=25								3.09									2.95	
2.139	ACCEPT W_4 M of bipolar scales k_4=25								2.95									3.12	
2.140	ACCEPT W_5 M of bipolar scales k_5=25								2.79									2.71	
				<3m Yes		3m Yes		>3m Yes					<3m Yes		3m Yes		>3m Yes		
2.141	WINDOWAL Have you seen a window treatment like this before? for m=5 concepts	#		45		4		0			#		43		3		3		
		%		92		8		0			%		88		6		6		

TABLE E-1 (Continued)

Item	Variable		GROUP A									GROUP B							
Strategy II Interview			INOVAT INDEX PERCENTAGE									INOVAT INDEX PERCENTAGE							
			0%	7%	13%	20%	27%	33%	40%	47%		0%	7%	13%	20%	27%	33%	40%	47%
2.142	INOVAT	#	5	1	5	1	6	4	7	2	#	1	3	5	6	1	1	5	2
		%	10	2	10	2	12	8	14	4	%	2	6	10	12	2	2	10	4

$\frac{(\text{Accept } W_m<3)_n X2+(\text{Youse } m=1)_n}{15}=\%$

	GROUP A									GROUP B							
	INOVAT INDEX PERCENTAGE									INOVAT INDEX PERCENTAGE							
	53%	60%	67%	73%	80%	87%	93%	100%		53%	60%	67%	73%	80%	87%	93%	100%
#	4	4	3	3	2	1	0	1	#	6	4	6	1	4	1	1	2
%	8	8	6	6	4	2	0	2	%	12	8	12	2	8	2	2	4

TABLE E-1 (Continued)

Item	Variable		GROUP A							GROUP B					
Strategy I Questionnaire			Yes	No	Don't Know	NR				Yes	No	Don't Know	NR		
1.14	enersysh Do you believe there is a shortage of energy...?	# %	28 57	12 26	9 18	0 0			# %	16 33	8 16	22 45	3 6		
			Under 20	20-34	35-54	55-74	75 & over	NR		Under 20	20-34	35-54	55-74	75 & over	NR
1.71	age group What age group are you in?	# %	2 4	6 12	16 33	20 41	5 10	0 0	# %	0 0	4 8	18 37	24 49	3 6	0 0
			less than 2,000	2,000 5,999	6,000 5,999	10,000 14,999	15,000 & over	NR		less than 2,000	2,000 5,999	6,000 9,999	10,000 14,999	15,000 & over	NR
1.76	tincome In which category does your total household income fall?	# %	1 2	4 8	10 20	12 25	19 39	3 6	# %	0 0	9 18	4 8	6 12	28 57	0 0
			<3 Yes	3 Yes	>3 Yes					<3 Yes	3 Yes	>3 Yes			
1.84	MEDINFO How have you received information? 1.79 Radio, TV, Agricultural Ext., slide presentation, Agricultural Ext. publication, Individual Instruction, Group Instruction.	# %	29 59	11 22	9 18				# %	33 67	10 20	6 12			

*Note: a. Original variables printed in lower case letters.
b. Computed variables printed in upper case letters.
c. N.R. - no response.

APPENDIX F

Initial Factor Analysis Varimax Rotation Factor Loadings

TABLE F-1

INITIAL FACTOR ANALYSIS
VARIMAX ROTATED FACTOR MATRIX
GROUP A

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9
Interst 1	0.70954	0.08964	0.04556	0.17238	-0.08959	-0.03394	0.12231	0.10883	-0.01506
Decor 1	0.57320	0.16830	0.03573	-0.10846	0.07271	0.09919	0.01253	0.00329	-0.02248
Adeqsze 1	-0.08425	0.59161	0.16387	-0.05085	0.15032	0.05387	-0.07091	0.04988	-0.08879
Clean 1	0.18011	0.02201	0.59532	0.20734	0.23519	-0.04033	0.15166	0.23171	0.15802
Attract 1	0.84761	-0.04613	0.08551	0.13166	0.10762	0.03433	0.06956	0.23223	-0.03269
Drafty 1	-0.17435	0.11055	-0.16858	-0.00731	-0.71811	-0.06721	-0.23676	-0.09026	-0.12773
Convnt 1	0.18508	0.08241	0.52795	0.11924	0.18404	0.05998	0.07327	0.29411	0.14882
Beautif 1	0.85487	0.06456	0.10588	-0.11839	0.28031	0.12048	0.09791	0.06552	-0.13707
Warm 1	0.20658	0.56325	-0.05490	0.03726	-0.06622	0.10735	-0.13141	-0.03022	-0.05970
Thrift 1	0.03474	0.07142	0.84595	-0.03672	-0.09686	-0.05691	-0.07521	0.05481	-0.01332
Simple 1	-0.11461	-0.06499	0.05622	-0.00411	0.00353	0.04313	0.02832	0.01964	0.44495
Modern 1	0.10993	-0.02329	-0.01049	0.42881	0.51566	0.22719	-0.02758	-0.12974	-0.22008
Goodlit 1	0.17310	-0.03827	0.07029	0.04719	0.10631	0.54643	0.04828	0.02166	0.08002
Heavy 1	0.05723	-0.08994	0.04719	0.83616	0.18614	-0.09183	0.08658	0.10915	-0.00500
Private 1	0.24270	0.50218	0.06801	-0.20343	-0.15911	-0.42881	0.09065	0.07500	-0.26863
Comfort 1	0.42412	0.60351	0.00392	0.07565	0.04065	0.10091	0.06414	-0.07629	0.49983
Funct 1	0.15651	-0.00511	0.19435	0.02566	-0.03904	0.07429	-0.03298	0.70317	0.03975
Safe 1	-0.04187	0.02469	0.26952	0.59128	-0.26855	0.33426	0.09812	-0.05544	0.11434
Good 1	0.23404	0.21420	0.12634	0.02142	0.25044	-0.09593	0.03030	0.36536	-0.04217
Cmftemp 1	0.04784	0.68259	0.13305	-0.03134	-0.12604	-0.18012	-0.01547	0.08338	0.04511
Usual 1	0.17677	-0.27773	-0.09346	0.10621	-0.00199	-0.17404	0.68079	-0.01715	0.05908
Neat 1	0.10761	0.12717	0.37840	-0.00695	0.23162	0.16090	0.33272	0.02014	0.02362
Goodvnt 1	0.09331	-0.01708	0.30782	0.06661	0.24323	0.24284	0.60441	-0.00821	0.01474
Durable 1	-0.25941	0.25155	0.49050	0.28059	0.02466	0.19935	0.29367	-0.06524	-0.27585
Cheap 1	-0.03014	-0.48780	0.27242	0.09171	0.10181	-0.56578	0.05757	-0.42325	0.28540

TABLE F-1 (Continued)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Interst 2	0.79305	0.09451	0.09438	0.17907	-0.11172	0.09784	0.11308	0.07806
Decor 2	0.57333	0.15615	0.00874	-0.01125	-0.06500	-0.05256	-0.01324	0.05056
Adeqsze 2	0.23303	0.28416	0.05259	0.06170	0.20290	0.19038	0.76111	-0.00900
Clean 2	0.37471	0.09081	0.72582	0.15402	0.20491	0.13953	0.15682	0.12157
Attract 2	0.87030	0.11522	-0.15187	-0.02649	0.12120	0.18160	0.09463	0.01231
Drafty 2	-0.37098	-0.55296	-0.08801	0.14185	0.33680	-0.02023	-0.09576	-0.17430
Convnt 2	0.65549	0.21313	0.47854	0.05939	0.12934	0.00051	-0.04405	-0.05908
Beautif 2	0.77229	0.09762	0.17340	0.01465	0.15340	-0.03319	-0.00824	0.10611
Warm 2	0.19271	0.03286	0.09123	0.08572	0.84653	0.18245	0.09695	0.05154
Thrift 2	0.06467	0.23761	0.06533	-0.02135	0.02067	-0.01311	0.05206	0.89252
Simple 2	0.08071	0.24399	0.49754	-0.34950	-0.19137	0.04434	0.04913	0.08791
Modern 2	0.31693	0.15283	0.22384	0.72940	-0.16093	0.37102	0.15767	0.00731
Goodlit 2	0.73251	0.31451	0.21145	-0.06959	0.11506	0.05581	-0.00197	-0.21195
Heavy 2	-0.26310	0.04049	0.42189	0.31510	0.00866	-0.21847	0.39614	-0.04146
Private 2	0.00039	-0.00695	0.00466	0.01416	0.06502	0.75178	-0.05879	0.01994
Comfort 2	0.58477	0.28995	0.31246	-0.11746	0.29926	0.04211	-0.03083	0.02250
Funct 2	0.33474	0.65815	0.30688	0.05396	0.02345	0.15472	-0.08574	0.03356
Safe 2	0.13036	0.30964	0.33683	-0.03785	0.17928	0.53875	0.25916	-0.09758
Good 2	0.70552	0.45382	0.25637	-0.12963	0.22591	0.04828	-0.02751	0.00265
Cmftemp 2	0.29778	0.42652	0.39107	0.29715	0.44210	-0.12481	-0.06978	-0.13344
Usual 2	0.10590	0.17572	0.02699	-0.68282	-0.15809	0.10673	0.08192	-0.00115
Neat 2	0.52824	0.16386	0.52835	0.09078	0.17623	0.19935	-0.03666	-0.00047
Goodvnt 2	0.20447	0.63779	0.08030	-0.16814	0.01068	-0.04562	0.12164	0.01726
Durable 2	0.11816	0.53322	0.02701	0.04972	0.10734	0.08647	0.03908	0.17531
Cheap 2	-0.17330	-0.24035	0.06812	-0.33257	-0.22075	-0.26802	0.58450	0.23077

TABLE F-1 (Continued)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Interst 3	0.55016	0.05015	-0.09642	0.05218	0.09521	0.44102	-0.00270	-0.14620
Decor 3	0.77555	-0.05092	-0.00336	0.14761	-0.03045	0.14345	0.12019	0.01992
Adeqsze 3	0.13901	0.16263	0.15292	0.14516	0.19671	0.46829	0.15178	-0.01046
Clean 3	0.23910	0.12395	0.11250	0.64775	-0.21561	0.33611	0.13594	0.16526
Attract 3	0.85315	0.22883	0.03601	0.06671	-0.02778	0.09345	0.11753	0.07140
Drafty 3	-0.10927	-0.13815	-0.04298	0.02819	-0.81502	-0.15756	0.02536	-0.04524
Convnt 3	0.64655	0.26953	0.06899	0.24386	0.30021	-0.13877	0.11234	0.17736
Beautif 3	0.83104	0.16383	0.06886	0.01000	-0.01867	0.06485	-0.02220	-0.13226
Warm 3	0.10533	0.62468	0.02917	-0.04527	-0.01695	0.00074	0.10081	-0.51375
Thrift 3	0.13171	0.29029	0.60630	0.21960	0.23199	0.08935	0.18589	-0.12028
Simple 3	0.16435	0.05956	0.68494	-0.05917	0.15356	-0.03399	0.06269	0.15274
Modern 3	0.23329	0.09184	-0.35721	-0.03577	-0.02035	0.43984	-0.01543	-0.13881
Goodlit 3	0.27828	0.48528	0.07571	0.17410	0.46926	0.01359	0.25100	0.20546
Heavy 3	0.10853	-0.04458	0.42554	-0.01138	-0.33236	-0.01670	-0.18074	0.15237
Private 3	0.08117	0.18314	-0.20138	0.81279	0.24628	-0.03466	-0.12276	-0.24975
Comfort 3	0.44381	0.36890	0.04654	0.14985	0.18681	0.27493	0.22941	0.20130
Funct 3	0.42707	0.68178	0.12227	0.09832	0.25128	-0.07127	0.15132	-0.01938
Safe 3	0.12195	-0.06794	0.40707	0.40587	-0.07114	0.05188	0.17055	0.03631
Good 3	0.67825	0.09646	0.07548	-0.00789	0.22276	0.22252	0.33050	-0.01072
Cmftemp 3	0.07400	0.73979	-0.01531	0.04430	0.07484	0.18496	-0.04845	0.02958
Usual 3	0.00849	0.05727	0.26228	-0.06643	0.04558	-0.06443	0.02005	0.73359
Neat 3	0.45261	0.49242	0.14024	0.23456	0.17354	0.42100	0.01058	0.12399
Goodvnt 3	0.28302	0.10088	0.05760	0.02481	0.07383	0.08224	0.78733	-0.01776
Durable 3	0.08820	0.48578	-0.33789	0.23413	0.04991	0.34374	0.33577	0.15725
Cheap 3	-0.16298	-0.04009	0.86720	-0.07046	-0.08207	0.00101	-0.06663	0.11245

TABLE F-1 (Continued)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Interst 4	0.41908	0.63182	-0.08616	0.00533	0.18500	0.20136	0.17417
Decor 4	0.06487	0.61356	-0.00623	-0.06739	0.11410	0.44241	0.04094
Adeqsze 4	0.16036	0.04000	0.06420	0.48489	-0.10562	-0.08547	0.16140
Clean 4	0.69478	0.20281	0.03018	0.23412	-0.08091	0.23423	0.29255
Attract 4	0.51787	0.76361	0.14039	-0.04821	0.06954	-0.02776	0.04239
Drafty 4	-0.05886	-0.49972	0.08806	-0.33280	-0.41835	0.17033	0.00194
Convnt 4	0.66675	0.40358	0.32835	0.14785	0.06353	0.11331	-0.14367
Beautif 4	0.41649	0.75239	0.04084	0.08746	0.02746	0.09983	0.19740
Warm 4	0.29088	0.02131	0.05735	0.05076	0.04614	0.77474	-0.10026
Thrift 4	-0.07043	0.06110	0.11861	0.85668	0.11687	0.12871	-0.11537
Simple 4	0.13520	0.12616	0.78870	-0.03232	-0.01109	0.06734	0.02733
Modern 4	0.66576	0.19359	-0.24106	-0.07995	0.00359	0.11158	0.12020
Goodlit 4	0.28111	0.58811	0.04632	0.01489	0.11748	-0.20911	-0.20171
Heavy 4	0.01732	0.04837	0.48049	0.08403	0.01825	-0.23959	0.59154
Private 4	0.27758	0.05403	0.08731	0.01410	0.15360	0.02136	0.22213
Comfort 4	0.56309	0.38842	0.27725	-0.03375	0.21588	-0.00724	-0.29643
Funct 4	0.58501	0.30886	0.17500	0.08690	0.21315	0.05311	-0.24281
Safe 4	0.39464	0.06236	0.61076	0.03619	-0.14816	0.13471	0.29877
Good 4	0.69610	0.29376	0.16577	-0.06182	0.18255	0.01876	0.16072
Cmftemp 4	0.59275	0.34465	-0.05981	-0.19818	0.30029	0.27784	-0.01729
Usual 4	-0.04168	-0.06572	0.75453	0.25914	0.04655	-0.05302	0.01984
Neat 4	0.74447	0.43624	0.20054	0.05486	0.10279	0.07425	-0.01968
Goodvnt 4	0.39563	0.31996	-0.05414	-0.10762	0.83575	0.15804	0.03445
Durable 4	0.76564	0.10563	0.04894	0.00266	0.07109	0.05014	-0.02606
Cheap 4	-0.37307	-0.34264	0.41311	0.48040	-0.20394	0.04944	0.00883

TABLE F-1 (Continued)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Interst 5	0.40552	0.58730	0.23909	0.08045	0.07478	-0.15467	0.15098
Decor 5	0.13190	0.81990	0.17270	0.14931	-0.03518	-0.03525	-0.02678
Adeqsze 5	-0.11323	0.02765	-0.05878	0.80057	0.21945	-0.30933	0.26335
Clean 5	0.18010	0.11473	-0.02935	0.66218	0.06399	-0.04513	0.03473
Attract 5	0.40807	0.77852	0.05612	-0.02678	0.11267	-0.10713	0.09624
Drafty 5	-0.52574	-0.23916	-0.04868	0.09092	-0.29620	0.30870	-0.06705
Convnt 5	0.76958	0.29299	-0.04707	0.13060	0.00276	0.04546	0.09431
Beautif 5	0.18702	0.76823	-0.01546	0.24954	0.06900	-0.09788	-0.06899
Warm 5	0.01750	0.03880	0.26152	0.42314	0.11380	0.18191	0.00484
Thrift 5	0.74321	0.12489	-0.13144	0.07623	-0.23907	-0.07199	0.17637
Simple 5	0.02993	-0.01625	-0.18274	-0.19070	0.00641	0.60267	-0.01665
Modern 5	0.06439	0.15612	0.80739	0.05765	0.01880	-0.04311	0.18445
Goodlit 5	0.55393	0.23905	-0.07443	-0.04590	0.18591	-0.44947	0.07929
Heavy 5	0.16614	-0.19473	0.03294	-0.09463	-0.06846	0.36220	0.69275
Private 5	0.07180	0.08550	0.52590	0.08527	0.66630	-0.03287	-0.04336
Comfort 5	0.57039	0.38104	-0.12122	0.16403	0.26082	0.08344	-0.05893
Funct 5	0.59178	0.17389	0.14526	0.16512	0.18966	0.15896	0.09351
Safe 5	-0.03889	-0.07640	0.00524	0.00397	-0.06854	0.51932	0.16608
Good 5	0.50410	0.66808	0.04675	0.02478	0.18969	-0.01294	0.00994
Cmftemp 5	0.23545	0.26494	0.09107	0.55297	-0.05170	-0.12016	-0.17855
Usual 5	0.08025	0.07750	-0.76261	-0.02915	0.08784	0.01760	0.22785
Neat 5	0.53440	0.43457	0.09858	0.19457	0.23999	-0.01944	0.22592
Goodvnt 5	0.25902	0.24055	-0.04057	0.18871	-0.00868	-0.03292	0.56495
Durable 5	0.21002	0.11220	-0.02587	0.28659	0.59667	-0.13336	-0.04102
Cheap 5	0.06460	-0.23281	-0.67157	-0.01329	-0.29434	0.16468	-0.04586

TABLE F-2

INITIAL FACTOR ANALYSIS
VARIMAX ROTATED FACTOR MATRIX
GROUP B

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Interst 1	0.27086	0.42165	0.34918	-0.04322	-0.11247	-0.02460	0.05999	-0.13056
Decor 1	0.71274	0.22244	0.15456	-9.00268	0.10439	0.11250	0.08385	0.11600
Adeqsze 1	0.49029	0.14693	0.46407	0.11573	0.23382	0.06063	-0.13623	-0.17828
Clean 1	-0.01626	0.21900	0.64664	-0.10820	-0.26237	0.30904	0.09781	-0.04856
Attract 1	0.66565	0.42414	0.02271	-0.01860	-0.09956	0.14250	0.23246	0.11901
Drafty 1	-0.03526	0.06508	0.11784	-0.04703	0.76650	0.07388	0.04404	-0.03148
Convnt 1	0.23788	0.41863	0.21281	-0.12350	-0.46987	0.24454	-0.01068	0.02838
Beautif 1	0.52405	0.41370	0.14114	-0.09133	0.12951	0.28299	0.46285	0.10202
Warm 1	0.15739	0.52722	0.39841	-0.10793	0.49767	0.12064	0.03008	-0.18127
Thrift 1	0.28935	0.24961	0.20541	0.50610	0.15663	0.07374	0.28916	0.12143
Simple 1	0.02184	-0.02337	0.05254	0.17666	0.07010	0.66797	0.02120	0.08470
Modern 1	0.24297	0.25769	-0.04492	-0.49097	0.16536	-0.07415	0.05071	-0.19307
Goodlit 1	0.59210	-0.04901	0.11867	-0.10164	-0.09855	0.17200	-0.12110	-0.08270
Heavy 1	-0.01717	-0.05906	0.02807	0.14444	0.03410	-0.01175	0.77717	0.10254
Private 1	0.15039	0.15230	0.46240	-0.08849	0.32903	0.01586	-0.29945	0.34082
Comfort 1	0.34845	0.49065	0.26027	-0.08478	0.07072	0.15563	0.02512	0.14638
Funct 1	0.29775	0.37669	-0.02629	0.03997	0.14907	0.34214	-0.28752	0.14566
Safe 1	-0.02313	0.78040	0.30443	0.14618	0.04923	-0.00169	-0.11549	-0.01371
Good 1	0.72008	0.43440	0.27392	0.00451	0.02248	-0.06497	0.12855	0.16046
Cmftemp 1	0.20303	0.27407	0.45164	0.00373	0.13635	-0.04763	0.04884	0.06141
Usual 1	0.21486	0.00410	0.01806	0.07254	-0.08993	0.22756	0.16479	0.72415
Neat 1	0.21391	0.27125	0.30822	-0.38280	-0.12022	0.66197	0.01003	0.22101
Goodvnt 1	0.74221	-0.07602	0.12235	-0.12363	-0.07807	-0.12310	-0.11709	0.19004
Durable 1	0.25804	0.14795	0.79143	0.00632	0.14941	0.09990	0.05240	0.07830
Cheap 1	-0.11683	0.08823	-0.16338	0.95332	-0.02044	0.02335	0.12330	-0.08771

TABLE F-1 (Continued)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Interst 2	0.66175	0.12455	-0.25792	0.07207	-0.07547	0.21210	0.23825
Decor 2	0.46767	0.35597	-0.04010	-0.17634	-0.05067	0.07100	-0.23805
Adeqsze 2	0.18718	0.09851	-0.11901	0.12354	0.67389	0.17929	-0.07890
Clean 2	0.05026	0.74384	-0.01210	0.03601	0.08413	0.05681	-0.12551
Attract 2	0.73055	0.15658	0.22608	0.23727	0.22378	0.16276	0.18743
Drafty 2	-0.25966	0.11778	-0.01688	-0.28422	-0.09292	-0.04688	-0.60341
Convnt 2	0.38208	0.37178	0.29007	0.27622	0.21307	0.07381	-0.17309
Beautif 2	0.80557	0.14009	0.06320	0.08508	0.15005	0.21626	0.11562
Warm 2	0.29155	0.48219	0.29864	-0.16688	-0.09095	-0.27676	0.42968
Thrift 2	0.12183	0.12292	0.63523	-0.02851	0.20323	0.06771	0.16660
Simple 2	0.09148	0.05924	0.63580	0.14094	-0.04493	0.06176	-0.11736
Modern 2	0.18820	0.11802	-0.61231	0.25631	0.27725	0.01235	-0.22667
Goodlit 2	0.21014	-0.31774	-0.01750	0.68915	0.17063	0.05130	0.09612
Heavy 2	-0.07201	0.10143	-0.09017	0.56078	-0.10392	-0.08574	0.09531
Private 2	0.07598	0.10238	-0.09269	-0.23948	0.47903	0.18309	0.36936
Comfort 2	0.33345	0.62277	0.13888	0.36615	0.12991	0.26051	0.11845
Funct 2	0.22041	0.31720	0.28136	0.14700	0.26356	0.49177	0.18586
Safe 2	0.23266	0.49303	0.23135	-0.24410	0.04378	0.25222	-0.00477
Good 2	0.50921	0.28905	0.19805	-0.04784	0.19759	0.57684	0.12371
Cmftemp 2	-0.09967	0.37221	0.05494	0.04427	0.51914	-0.14570	0.14974
Usual 2	0.12737	0.02629	0.50418	0.33809	-0.51933	-0.06324	0.04520
Neat 2	0.24332	0.26629	0.16128	0.56092	0.01190	0.26241	-0.09890
Goodvnt 2	0.22386	0.07228	-0.14109	0.00199	0.02914	0.60032	-0.04542
Durable 2	0.28818	0.58059	0.01829	0.06805	0.26950	0.16517	0.08841
Cheap 2	-0.04328	0.16130	0.69739	-0.15487	-0.35728	-0.27142	-0.17066

TABLE F-2 (Continued)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Interst 3	0.84161	0.05832	0.13002	0.13011	0.05768	-0.20378
Decor 3	0.88038	-0.07674	0.01611	0.07900	-0.00954	0.01352
Adeqsze 3	0.38751	0.56713	0.41582	-0.17605	0.20805	-0.10116
Clean 3	0.31928	0.63185	-0.06628	0.02349	-0.14791	-0.37817
Attract 3	0.84814	0.15932	0.04405	-0.06498	0.04561	0.13356
Drafty 3	-0.27731	-0.11144	0.17989	-0.43238	0.07444	-0.04870
Convnt 3	0.66899	0.29626	0.28213	-0.16619	0.06351	0.08584
Beautif 3	0.22806	0.12165	0.06436	0.09146	0.11931	-0.04980
Warm 3	0.19242	0.46417	0.46983	0.12576	0.04368	0.06687
Thrift 3	0.02061	0.01297	0.36993	0.55616	-0.29337	0.38447
Simple 3	-0.02050	0.16430	-0.14818	0.16816	-0.03885	0.59715
Modern 3	0.06511	0.07437	0.13545	-0.37436	0.63571	-0.13093
Goodlit 3	0.65011	0.46292	0.07036	0.00770	-0.07499	-0.08456
Heavy 3	-0.09398	0.10492	-0.40881	0.18682	0.03544	0.04308
Private 3	0.00679	0.05483	0.73210	0.14081	0.08102	-0.11379
Comfort 3	0.42362	0.33711	0.33850	0.07035	0.33647	0.00248
Funct 3	0.61783	0.42085	0.26902	-0.14409	0.04692	0.12165
Safe 3	0.03575	0.53295	-0.14641	0.11806	0.53216	0.10426
Good 3	0.56040	0.24202	0.49847	0.01831	0.03627	0.03955
Cmftemp 3	-0.03035	0.77866	0.02529	0.01999	0.12700	0.00583
Usual 3	0.48797	0.06268	-0.08781	0.04950	-0.30969	-0.05301
Neat 3	0.49386	0.42499	0.33822	-0.15264	0.13799	0.03285
Goodvnt 3	0.28310	0.50431	0.08815	-0.04952	0.11221	0.22409
Durable 3	0.14733	0.69639	-0.02906	0.08546	-0.03754	0.22921
Cheap 3	-0.07885	-0.03711	0.05631	0.94499	-0.02819	0.06422

TABLE F-2 (Continued)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Interst 4	0.64865	0.23684	0.24610	-0.08444	0.27994	0.10560	-0.11294	0.10647
Decor 4	0.56252	0.09693	0.09622	0.06784	0.16725	-0.20418	-0.11448	0.10456
Adeqsze 4	0.00742	0.55506	0.02486	0.19534	0.53488	-0.17929	0.28100	0.21890
Clean 4	0.38467	0.16115	0.67768	0.08774	0.25198	0.14622	0.09056	-0.29880
Attract 4	0.75567	0.13631	0.14771	-0.00198	0.04913	-0.09095	0.13953	0.16570
Drafty 4	-0.18873	0.02588	-0.03597	-0.01427	-0.15052	0.76542	0.02551	-0.14623
Convnt 4	0.64151	0.08258	0.14460	-0.02526	-0.19325	0.20143	0.29737	-0.00877
Beautif 4	0.78108	0.22408	0.25101	-0.14023	-0.04103	0.07999	-0.05908	0.11370
Warm 4	0.24482	0.24695	0.24821	0.07937	0.16278	0.72022	0.15981	0.14039
Thrift 4	0.07777	0.21118	0.11591	0.79263	0.13098	0.03776	0.00953	0.10719
Simple 4	-0.25041	-0.07731	0.10713	0.33147	-0.24213	-0.00198	-0.09133	-0.25719
Modern 4	0.35902	-0.07102	0.72431	-0.12790	0.04392	-0.02762	-0.17542	0.24356
Goodlit 4	0.43459	-0.07770	0.39978	0.06603	0.10064	-0.22751	-0.05471	0.51700
Heavy 4	-0.11345	-0.19757	0.27315	0.11422	0.01915	0.00245	-0.75135	-0.03933
Private 4	-0.08842	0.12024	0.37605	-0.05850	0.23024	0.28299	0.70556	0.04142
Comfort 4	0.10133	0.20672	0.69009	0.12352	-0.01087	0.09286	0.06585	0.09055
Funct 4	0.18750	0.69551	0.20963	0.13970	0.21678	0.16310	0.15872	0.05769
Safe 4	0.17988	0.59042	-0.06589	0.05938	-0.41561	0.30035	0.17282	-0.14019
Good 4	0.51331	0.54542	0.08245	0.07724	0.13297	0.03248	0.32044	0.19993
Cmftemp 4	0.19476	0.55389	0.05990	-0.10329	0.08536	0.29779	0.13609	0.35587
Usual 4	-0.11865	0.00663	-0.05585	0.10016	-0.82185	-0.00274	-0.05831	0.08464
Neat 4	0.33068	0.40472	0.55983	-0.22187	-0.11935	-0.03388	-0.07023	0.04889
Goodvnt 4	0.44409	0.27925	0.11871	0.04104	-0.15428	-0.02990	0.11627	0.63375
Durable 4	0.15666	0.85429	0.16781	0.03806	-0.07369	-0.02958	-0.00775	-0.01057
Cheap 4	-0.08320	-0.02856	-0.14018	0.86714	-0.17031	-0.01192	-0.10853	-0.04529

TABLE F-2 (Continued)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Interst 5	0.13341	0.38332	0.29999	-0.17188	0.17893	0.06773	0.67173
Decor 5	0.73911	-0.02845	0.23022	0.10494	0.13893	-0.00655	0.19053
Adeqsze 5	0.40710	-0.00175	0.03063	-0.09650	0.33929	0.56849	0.15023
Clean 5	0.21315	0.17985	0.38659	-0.07423	0.50885	-0.14630	-0.17857
Attract 5	0.76354	0.20202	0.35380	-0.00889	0.00363	0.08284	0.23138
Drafty 5	0.04313	-0.08250	0.02764	0.24978	0.24948	0.52135	-0.19072
Convnt 5	0.10732	0.62945	-0.43940	0.17866	0.04177	-0.11667	0.19476
Beautif 5	0.65228	0.30133	0.46181	-0.09816	0.07842	0.18011	0.13232
Warm 5	0.19084	0.00480	0.10914	0.10438	0.73280	-0.01124	0.28582
Thrift 5	0.21003	0.05691	-0.08230	0.80336	0.15196	-0.04429	0.04779
Simple 5	0.10768	0.01991	0.24236	0.56359	-0.05405	0.43423	0.15660
Modern 5	0.31695	-0.30238	0.25725	0.05589	0.22349	-0.08031	0.42630
Goodlit 5	0.27484	0.40099	0.11586	-0.22474	-0.00283	0.08041	0.31880
Heavy 5	0.13369	-0.07106	0.00990	0.12210	-0.10504	0.02715	0.60446
Private 5	0.07648	0.10639	0.08439	-0.08582	0.58734	0.27117	-0.33223
Comfort 5	0.71126	0.49806	0.08633	0.09866	0.19469	-0.00711	0.02128
Funct 5	0.46241	0.37743	0.04955	0.23173	0.29454	-0.03657	0.17119
Safe 5	0.62659	0.34857	0.04461	0.25178	0.20100	0.08422	-0.03518
Good 5	0.26374	0.09028	0.67160	0.07344	0.08027	0.29106	0.02247
Cmftemp 5	0.51225	0.23203	-0.37288	-0.02604	0.46929	0.49123	0.06923
Usual 5	-0.09708	0.18299	0.19454	0.10062	-0.16892	0.71279	0.08520
Neat 5	0.20531	0.10338	0.81363	0.01979	-0.05003	0.01850	0.18201
Goodvnt 5	0.26026	0.61320	-0.10936	0.10980	0.09286	0.14088	0.02010
Durable 5	0.17124	0.68912	0.23662	0.10327	0.03575	0.07258	-0.27853
Cheap 5	-0.04296	0.16604	-0.10006	0.78347	-0.14355	0.15137	-0.04097

APPENDIX G

Second Factor Analysis: Factor N=3 Varimax Rotation Factor Loadings

TABLE G-1

SECOND FACTOR ANALYSIS: FACTOF N=3 VARIMAX ROTATION FACTOR LOADINGS FOR GROUP A AND GROUP B

	Group A				Group B		
	Factor 1	Factor 2	Factor 3		Factor 1	Factor 2	Factor 3
Interst 1	0.65930	0.08045	0.08904	Interst 1	0.33152	0.42195	0.00552
Decor 1	0.57831	-0.00836	0.18020	Decor 1	0.67358	0.30029	0.11004
Adeqsze 1	-0.02611	0.20744	0.56459	Adeqsze 1	0.30323	0.54232	0.02325
Clean 1	0.23888	0.68625	-0.01302	Clean 1	0.24134	0.40514	-0.06295
Attract 1	0.86788	0.13028	-0.03728	Attract 1	0.77060	0.21088	0.19572
Stuffy 1	-0.34384	-0.38468	0.27054	Stuffy 1	-0.18258	0.42856	0.00283
Convnt 1	0.24613	0.59074	0.09419	Convnt 1	0.49290	0.18029	-0.06191
Beautif 1	0.89789	0.09181	0.05667	Beautif 1	0.64072	0.38447	0.22076
Warm 1	0.18707	-0.03212	0.55111	Warm 1	0.07322	0.86210	-0.04248
Thrift 1	-0.01920	0.51309	0.20925	Thrift 1	0.23985	0.34623	0.67505
Simple 1	-0.09772	0.09446	-0.10013	Simple 1	0.13041	0.11139	0.17674
Modern 1	0.17683	0.26985	-0.19630	Modern 1	0.21133	0.21544	-0.34781
Goodlit 1	0.20150	0.20665	-0.07853	Goodlit 1	0.52267	0.07138	-0.13785
Heavy 1	0.09326	0.37717	-0.24731	Heavy 1	0.06669	-0.05640	0.39996
Private 1	0.20540	-0.09258	0.52818	Private 1	0.15905	0.50148	-0.15398
Comfort 1	0.38773	0.14023	0.39265	Comfort 1	0.46737	0.49434	0.03157
Funct 1	0.23581	0.21754	0.12181	Funct 1	0.32023	0.31556	0.00727
Safe 1	-0.09108	0.42133	-0.04390	Safe 1	0.10239	0.61153	0.13271
Good 1	0.34390	0.21148	0.20361	Good 1	0.72565	0.42851	0.14554
Cmftemp 1	0.03799	0.10614	0.70256	Cmftemp 1	0.20430	0.52105	0.03526
Usual 1	0.20691	0.10674	-0.38153	Usual 1	0.42293	-0.06074	0.20833
Neat 1	0.18907	0.50084	0.04101	Neat 1	0.53550	0.32710	-0.20310
Goodvnt 1	0.20619	0.53355	-0.17932	Goodvnt 1	0.62400	0.02770	-0.12415
Durable 1	-0.21268	0.61895	0.15798	Durable 1	0.29385	0.64797	0.00995
Cheap 1	-0.12548	0.06936	-0.42973	Cheap 1	-0.25341	-0.06749	0.82241

TABLE G-1 (Continued)

	Group A				Group B		
	Factor 1	Factor 2	Factor 3		Factor 1	Factor 2	Factor 3
Interst 2	0.64794	0.28971	0.17594	Interst 2	0.41879	-0.26311	0.31019
Decor 2	0.54704	0.06272	0.18351	Decor 2	0.46626	-0.04208	-0.08063
Adeqsze 2	0.07935	0.37678	0.34925	Adeqsze 2	0.36247	-0.42900	0.16533
Clean 2	0.17762	0.71222	0.32921	Clean 2	0.51989	0.02113	-0.11248
Attract 2	0.81925	0.17989	0.11425	Attract 2	0.64648	-0.00333	0.49790
Stuffy 2	-0.33404	0.02697	-0.64003	Stuffy 2	-0.13217	0.06970	-0.42388
Convnt 2	0.55240	0.50681	0.28598	Convnt 2	0.55012	0.14375	0.28712
Beautif 2	0.69422	0.29846	0.18193	Beautif 2	0.63711	-0.13026	0.37703
Warm 2	0.18743	0.51204	-0.07857	Warm 2	0.46054	0.31610	-0.08375
Thrift 2	0.03278	0.03067	0.34698	Thrift 2	0.38828	0.39921	0.06834
Simple 2	0.01798	0.06074	0.58273	Simple 2	0.21569	0.54346	0.16323
Modern 2	0.16981	0.58041	0.00079	Modern 2	0.06826	-0.59932	0.18211
Goodlit 2	0.70220	0.33632	0.28748	Goodlit 2	-0.13012	-0.12262	0.80159
Heavy 2	-0.43526	0.38120	0.13579	Heavy 2	-0.10388	0.04551	0.40029
Private 2	0.05658	0.18608	-0.03852	Private 2	0.34136	-0.33718	-0.09770
Comfort 2	0.55190	0.39661	0.32883	Comfort 2	0.70545	0.05852	0.35753
Funct 2	0.33872	0.39691	0.50142	Funct 2	0.62160	0.03150	0.25823
Safe 2	0.08102	0.48473	0.34786	Safe 2	0.64440	0.13982	-0.19886
Good 2	0.69199	0.36993	0.44696	Good 2	0.75753	-0.07435	0.20612
Cmftemp 2	0.26845	0.65840	0.14458	Cmftemp 2	0.30543	-0.10165	-0.05488
Usual 2	0.14967	-0.35210	0.49325	Usual 2	-0.14861	0.72586	0.26468
Neat 2	0.42468	0.59749	0.25031	Neat 2	0.34945	0.11490	0.52980
Goodvnt 2	0.21850	0.10193	0.56229	Goodvnt 2	0.31865	-0.25444	0.14634
Durable 2	0.14171	0.21204	0.35894	Durable 2	0.68138	-0.11051	0.07087
Cheap 2	-0.32230	-0.27783	0.26373	Cheap 2	0.06575	0.84114	-0.23494

TABLE G-1 (Continued)

		Group A				Group B	
	Factor 1	Factor 2	Factor 3		Factor 1	Factor 2	Factor 3
Interst 3	0.59386	0.19148	-0.17426	Interst 3	0.84720	0.13491	-0.00725
Decor 3	0.82831	0.02722	0.00317	Decor 3	0.87164	-0.00697	0.04857
Adeqsze 3	0.23768	0.38029	0.08790	Adeqsze 3	0.37593	0.70342	-0.26535
Clean 3	0.36160	0.26686	0.10111	Clean 3	0.29158	0.45983	-0.00060
Attract 3	0.85112	0.22467	0.05969	Attract 3	0.79704	0.24878	-0.04066
Stuffy 3	-0.07213	-0.45639	-0.04882	Stuffy 3	-0.25459	-0.05938	-0.44871
Convnt 3	0.56370	0.42440	0.15057	Convnt 3	0.65447	0.42125	-0.15922
Beautif 3	0.77602	0.13942	0.02478	Beautif 3	0.80183	0.21159	0.00391
Warm 3	0.09781	0.41858	-0.11260	Warm 3	0.22350	0.57131	0.10922
Thrift 3	0.15305	0.45855	0.52153	Thrift 3	0.09875	0.07361	0.62692
Simple 3	0.13919	0.11782	0.72457	Simple 3	-0.07846	0.16169	0.35861
Modern 3	0.29964	0.12847	-0.41996	Modern 3	0.01371	0.25762	-0.59017
Goodlit 3	0.64640	0.69283	0.15023	Goodlit 3	0.61709	0.45798	0.02723
Heavy 3	0.11193	-0.23465	0.42303	Heavy 3	-0.16001	-0.00372	0.20401
Private 3	0.11129	0.38515	-0.20959	Private 3	0.12603	0.22339	-0.01214
Comfort 3	0.48357	0.53737	0.08763	Comfort 3	0.40696	0.51432	-0.07164
Funct 3	0.35955	0.64579	0.12725	Funct 3	0.59195	0.52913	-0.10293
Safe 3	0.19684	0.07911	0.37795	Safe 3	-0.06060	0.56481	0.00829
Good 3	0.70498	0.29654	0.07230	Good 3	0.59366	0.40242	-0.02514
Cmftemp 3	0.07066	0.62005	-0.03765	Cmftemp 3	-0.09916	0.75293	0.05132
Usual 3	0.00057	0.04003	0.41823	Usual 3	0.48549	-0.01870	0.14204
Neat 3	0.49050	0.62634	0.11881	Neat 3	0.47967	0.55607	-0.18830
Goodvnt 3	0.36225	0.27318	0.07449	Goodvnt 3	0.21974	0.56660	0.03464
Durable 3	0.19631	0.58195	-0.28616	Durable 3	0.07662	0.65370	0.24084
Cheap 3	-0.14650	-0.10029	0.84481	Cheap 3	-0.02681	-0.03102	0.73990

TABLE G-1 (Continued)

	Group A				Group B		
	Factor 1	Factor 2	Factor 3		Factor 1	Factor 2	Factor 3
Interst 4	0.59603	0.50065	-0.08814	Interst 4	0.68564	0.27315	-0.13281
Decor 4	0.35776	0.38132	-0.08147	Decor 4	0.58898	0.01844	0.03650
Adeqsze 4	0.03442	0.14728	0.32812	Adeqsze 4	0.19370	0.47279	0.13018
Clean 4	0.67197	0.11597	0.17991	Clean 4	0.51849	0.30356	0.00770
Attract 4	0.68443	0.54283	0.07863	Attract 4	0.67630	0.24438	-0.09804
Stuffy 4	-0.05048	-0.76622	-0.04518	Stuffy 4	-0.34492	0.28251	-0.05322
Convnt 4	0.71961	0.32097	0.31176	Convnt 4	0.40340	0.36237	-0.15180
Beautif 4	0.59331	0.53834	0.08068	Beautif 4	0.72563	0.27702	-0.18260
Warm 4	0.39441	-0.01253	0.01494	Warm 4	0.21310	0.59322	-0.04772
Thrift 4	-0.15506	0.32816	0.41590	Thrift 4	0.18644	0.26840	0.75612
Simple 4	0.28782	-0.04091	0.61540	Simple 4	-0.21792	-0.12596	0.36485
Modern 4	0.66353	0.07230	-0.23120	Modern 4	0.73537	-0.06698	-0.10293
Goodlit 4	0.34362	0.52168	-0.00034	Goodlit 4	0.74855	-0.09066	0.03670
Heavy 4	0.07979	-0.03592	0.48348	Heavy 4	0.14852	-0.45663	0.22635
Private 4	0.30744	0.04182	0.09298	Private 4	0.02798	0.49948	-0.18489
Comfort 4	0.61166	0.35600	0.13873	Comfort 4	0.43471	0.27072	0.11612
Funct 4	0.59650	0.32874	0.11966	Funct 4	0.27769	0.73620	0.13213
Safe 4	0.50370	-0.17194	0.60268	Safe 4	-0.04841	0.61955	0.06420
Good 4	0.76175	0.18884	0.10666	Good 4	0.46465	0.67123	-0.00819
Cmftemp 4	0.73457	0.25297	-0.21165	Cmftemp 4	0.23346	0.64628	-0.11963
Usual 4	-0.01946	-0.01545	0.77199	Usual 4	-0.18531	-0.06968	0.15053
Neat 4	0.80985	0.32677	0.17620	Neat 4	0.56425	0.29309	-0.12906
Goodvnt 4	0.52468	0.45649	-0.17902	Goodvnt 4	0.53287	0.32145	0.00455
Durable 4	0.71224	0.06711	0.03904	Durable 4	0.25433	0.61574	0.13269
Cheap 4	-0.47712	-0.19053	0.62513	Cheap 4	-0.14179	-0.03508	0.85005

TABLE G-1 (Continued)

	Group A				Group B		
	Factor 1	Factor 2	Factor 3		Factor 1	Factor 2	Factor 3
Interst 5	0.71120	0.28509	0.12745	Interst 5	0.61769	0.15286	-0.05198
Decor 5	0.58477	0.27436	0.16314	Decor 5	0.55686	0.36299	0.10530
Adeqsze 5	0.02766	-0.08469	0.86511	Adeqsze 5	0.22485	0.58764	0.07635
Clean 5	0.22966	-0.10730	0.61398	Clean 5	0.36291	0.28639	-0.05490
Attract 5	0.82241	0.18265	0.03665	Attract 5	0.76380	0.32497	0.12453
Stuffy 5	-0.58665	-0.10750	-0.06402	Stuffy 5	-0.17817	0.34331	0.33670
Convnt 5	0.77425	-0.13703	0.03431	Convnt 5	0.60398	-0.01045	0.29670
Beautif 5	0.61508	0.12276	0.27707	Beautif 5	0.78805	0.34001	0.10951
Warm 5	0.04277	0.19281	0.34122	Warm 5	0.11075	0.54076	-0.02816
Thrift 5	0.62393	-0.27772	-0.04199	Thrift 5	0.10384	0.12291	0.63550
Simple 5	-0.01383	-0.18879	-0.34205	Simple 5	0.16984	0.04676	0.64172
Modern 5	0.15556	0.69902	0.07923	Modern 5	0.36486	0.11400	-0.06330
Goodlit 5	0.59880	-0.02160	0.11419	Goodlit 5	0.48082	0.19394	-0.05837
Heavy 5	0.06748	-0.13369	-0.20337	Heavy 5	0.24136	-0.03109	0.05763
Private 5	0.16603	0.58174	0.25707	Private 5	0.02323	0.49227	0.00355
Comfort 5	0.68741	-0.07891	0.14536	Comfort 5	0.56061	0.53729	0.22970
Funct 5	0.57075	0.06742	0.09507	Funct 5	0.41794	0.44637	0.25983
Safe 5	-0.07791	-0.08443	-0.17914	Safe 5	0.39414	0.52095	0.34844
Good 5	0.82745	0.14867	0.05228	Good 5	0.57302	0.06511	0.24911
Cmftemp 5	0.31639	0.05205	0.49232	Cmftemp 5	0.02935	0.93988	0.11271
Usual 5	0.17121	-0.66071	-0.02326	Usual 5	0.09740	0.04198	0.34751
Neat 5	0.74633	0.09959	0.20760	Neat 5	0.75276	-0.19690	0.13670
Goodvnt 5	0.42574	-0.10530	0.14635	Goodvnt 5	0.23181	0.36832	0.28504
Durable 5	0.42742	0.08492	0.41615	Durable 5	0.33269	0.18197	0.31971
Cheap 5	-0.12257	-0.78343	-0.17208	Cheap 5	-0.17500	-0.06171	0.84114

VITA

Margaret (Bateman) Ellison was born in the Canadian province of New Brunswick, February 28, 1943, the only child of Louise R. Wooster and Stanley E. Bateman. She attended public school in Black's Harbour, N.B., and in 1963 completed teacher training. In 1965, she earned a Bachelor of Science in Home Economics from Mount Allison University, and in 1969, after also having attended the Ontario College of Education, she received a Bachelor of Education degree from the University of New Brunswick.

Since 1965, she has taught in secondary schools in Ontario and Prince Edward Island, served for two years as Dean of Women at the University of Prince Edward Island, worked as a free lance Home Economist, as an interior design consultant, and as Prince Edward Island's provincial co-ordinator for International Women's Year.

In 1965, she married Robert A. Ellison of Trail, B.C. and they have two sons, R. A. Scott, born 1970, and Richard L., born in 1973. Accompanied by her family in 1976, she began a three-year leave of absence from her position as an interior design consultant with M. E. Associates, Ltd., in Charlottetown, Prince Edward Island, and joined her husband in commencing graduate study at the University of Tennessee.

In 1977, she completed a program in interior design and housing and qualified for her Master of Science in Home Economics. She continued her work at that university in the environmental factors

option of the inter-disciplinary Home Economics doctoral program and served as a graduate teaching assistant in the housing program and as a research assistant at the University of Tennessee Energy, Environment, and Resources Center. She will be awarded the Doctor of Philosophy degree in August 1980.