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THE EFFECT OF PAST EXPERIENCE ON CURRENT ENERGY CONSUMPTION AND CONSERVATION PATTERNS: THE INTERACTION OF HISTORICAL TIME, SOCIAL TIME AND LIFE TIME

By

Susan Lee Hershey

Submitted to
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ABSTRACT

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This research was designed to examine the influence on current energy consumption and conservation behavior exhibited at the micro-level of past experiences with macro-level crises characterized by shortages or deprivation of natural resources. More specifically, the research was designed to determine if households headed by individuals exposed to varying levels of natural resource shortage or deprivation in the past were currently exhibiting differing patterns of energy consumption and, in response to the energy crisis, change in consumption behavior.

Two research questions guided the study. (1) Did exposure to shortages and deprivation of natural resources in the past influence current energy consumption patterns? (2) Did exposure to shortages and deprivation in the past influence change in energy consumption patterns over time

(i.e., conservation behavior), especially in response to the urgency placed on conservation since the Arab Oil Embargo in 1973-74.

Three macro-level events in twentieth century American history were identified as showing basic similarities to the current energy shortage crisis. Exposure to these three events by household heads, as determined through identification of the age of the household head, was used to answer the research questions. The effects of World Wars I and II were considered because during both periods rationing of basic foods and fuels was imposed by the Federal government in order to extend supplies for the armed forces fighting overseas. Americans thus faced shortages in both types of products. The impact of the Great Depression was considered because the general economic decline witnessed during this period forced drastic wage and working hour limitations on a large number of income earners. Thus, household purchasing power was reduced and ability to obtain goods was hampered.

Energy consumption data from utility and oil companies as well as sociodemographic and attitudinal measures reported by household members, along with age of the household head, were the basis of the analysis. Multiple regression procedures were employed to test the research questions.

Results of the first analysis indicated that, net of the effects of aging-related factors which could influence energy consumption patterns, level of past experience with shortages and deprivation was a statistically significant

predictor of current energy use behavior (Beta = .114, p = .02). Households headed by individuals with higher levels of deprivational experience currently appeared to be consuming larger amounts of energy than comparable households headed by individuals with less experience.

The second research question studied proportional change in consumption behavior between 1976-77 and 1978-79. This analysis revealed that, net of the influence of aging-related factors or change in the aging-related factors between 1978 and 1979, level of past experience with shortages and deprivation was a statistically significant predictor of percentage change in energy consumption behavior (Beta = -.114, p = .055). Households headed by primary income earners with higher levels of exposure to deprivation and shortages in the past appeared to be responding to the energy crisis by reducing proportional energy consumption to a greater degree than equivalent households with less exposure to hardship in the past.

The findings suggested that households headed by older individuals, those having faced hardship in the past, were responding to this experience by currently consuming more energy than households headed by individuals with less traumatic backgrounds. In addition, it appeared that households headed by younger individuals, those reared in the affluence of the 1950s and 1960s and lacking a backlog of experiential knowledge to draw upon to help them implement conservation practices, were not adapting as readily to the current

energy crisis. On the other hand, households headed by older individuals, those having faced deprivational experiences in the past, seemed to respond more readily to the need to adopt conservation practices.

For my Mother and Father,

and my aunts, Elaine

and Jean

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CHAPTER I

INTRODUCTION

Energy Shortages

Freezing to death in Ohio, or dying from heat prostration in Texas and Missouri; remaining in bed all day, or wearing overshoes inside your home in order to stay warm in New York; turning the oven on high and opening the door for heat in South Dakota and Michigan, or heating your dwelling from 60-68°F as opposed to 72-78° 10 years earlier; giving up hot food, using a flashlight for lighting, or having friends refuse to visit because your house is dark and cold, all in New York; waiting in line for gasoline in California, or paying $1.32 a gallon for gasoline that 10 years ago cost $.32, and thus foregoing a vacation in Iowa.

A mixture of horror stories combined with some minor inconveniences, perhaps; yet these represent the personal experiences some Americans have faced since the Arab Oil Embargo precipitated a national energy crisis in the winter of 1973-74. For that first initial encounter with deficits in petroleum supplies was followed, after a short respite, by nearly annual occurrences of energy shortages.

During the winter of 1976, for example, natural gas supplies were not available in levels sufficient to heat homes supplied with gas. A year later, in the winter of 1977, the second crisis was followed by a third characterized by still more intense shortages of natural gas. This time, however, the situation was exacerbated by shortages of coal. Finally, during the summer of 1979, Americans faced renewed deficits of petroleum and gasoline was in short supply. Thus the nation watched as nightly television reports showed Californians queuing in long lines to get their allotted ration of gasoline.

In a very general sense, then, the overall impression of the "energy crisis" conveyed to the American public via mass media or through personal experiences with closed gasoline stations or cold, dark homes has been one of shortages in the supply of commodities very much needed and demanded: shortages of natural resources that have come to be regarded as essential life-support systems and, perhaps most importantly, resources that have been inexpensive and readily available for well over a quarter of a century.

Past Experiences with Shortages and Deprivation

Viewed from this perspective, it was the argument of this research that the current "energy crisis" was, in fact, quite similar in character to other twentieth century crises marked by shortages of essential resources or personal deprivation and thus inability to obtain goods and materials.

During World War I, for example, as employment levels increased and incomes rose under the impact of an expanding wartime economy, Americans were asked to curtail consumption of needed resources in support of the war effort. Indeed, concern at the national level was so great regarding declining stocks of foodstuffs and fuels that rationing, limiting the use of sugar, wheat, meat, butter and other foods, was imposed, as were meatless and wheatless days. In addition, shortages in supplies of fuel, especially coal, were acute, and Americans were asked, first of all, to curtail unnecessary lighting and heating to extend supplies. In April 1918 more stringent regulations were implemented and general rationing to domestic users was introduced. Prior to this, fuel oil distribution had been controlled, and within months regulation was extended to natural gas and gasoline (Scheiber et al., 1976, pp. 317-328).

During World War II, with shortages in raw materials again acute and with World War I as an example, the federal government implemented rationing for a second time. Within a month after the war started distribution of tires was controlled due to shortages in rubber, while rationing of gasoline and fuel oil followed shortly thereafter. Food shortages were common within months, with sugar and coffee both in short supply due to interruptions in shipping from exporting nations in the Far East and South America. Rationing of each started early in the war, although coffee restrictions were lifted 8 months later. Then, towards the end of

1942, supplies of more basic foodstuffs began to dwindle as large quantities were shipped overseas to feed the armed forces. Canned, bottled, frozen and dried vegetables, fruits, juices and soups were thus rationed after March 1943. The list was expanded shortly to include meats and fats and then expanded still further to encompass nearly all food commodities. Scheiber et al. (1976) indicated, for example, that by mid-1943, 95% of the food supply was rationed which, they pointed out, ensured fairer distribution, but by no means solved the problem (see especially, pp. 407-411; see also Walton & Miller, 1978, pp. 139-145).

In many respects the character of still a third twentieth century event, the Depression of the 1930s, was similar to yet different from that of the two World Wars. During both wars, a sense of shared responsibility and commitment to doing without in support of a national cause appeared to have been strong motives in bringing about national consensus; the urgency of the war situation thus perhaps mitigating some of the psychological impact of the forced shortages (see, for example, Clark et al., 1977, pp. 316-317). In addition, severe hardship, in the real sense, was perhaps not realized during the war years because employment levels were high and the stability of having a job, thus, may have provided a sense of security about the future, somewhat softening the impact of shortages (see Clark et al., 1977, pp. 117-151, especially p. 143, for comments regarding the effect of World War I on American families).

The impact of the Depression, on the other hand, was different. Unemployment reached unprecedented levels with 4.34 million jobless in 1930, 8.02 million in 1931, 12.06 million in 1932 and nearly 13 million in 1933--approximately one-fourth of the civilian labor force[1] (Scheiber et al., 1976, p. 357). Concurrently, hours of work were cut for those still employed and wages fell. Allen (1969) commented that in 1932 the total amount of money paid in wages equaled 40% of the 1929 level (p. 130), while Scheiber et al. (1976) indicated that wage-rate cuts and hour reduction accounted for greater drops in payrolls than unemployment (p. 357). In desperation, numerous households turned to public assistance for the first time. Scheiber et al. estimated that by late 1934 at least 17 million families were receiving public help or welfare (p. 357).

Judgment concerning overall impact of the Depression was difficult. Elder (1974), in one study of the subject, pointed out that all families were not affected directly, nor with equal severity (pp. 43-53). Manchester (1979), in describing General MacArthur's order to shoot on the bonus marchers demonstrating in Washington in 1932 for back pay from service in World War I (pp. 3-18), or in detailing the actions of a group of desperate Iowa farmers who kidnapped and beat a local county judge to force a pledge that he

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[1]Walton and Miller (1978) indicated these estimates may be low, as precise figures on labor force participation were not available (p. 126).

would sign no more mortgage foreclosures (p. 59), was more impassioned, as was Steinbeck in his description of the Depression in The Grapes of Wrath. Perhaps Allen's (1969) analysis somewhat captured the character of the Depression:

> It marked millions of people--inwardly--for the rest of their lives. Not only because they or their friends lost jobs, saw their careers broken, had to change their whole way of living, were gnawed at by a constant lurking fear of worse things yet, and in all too many cases actually went hungry; but because what was happening to them seemed without rhyme or reason. Most of them had been brought up to feel that if you worked hard and well, and otherwise behaved yourself, you would be rewarded by good fortune. Here were failure and defeat and want visiting the energetic along with the feckless, the able along with the unable, the virtuous along with the irresponsible. They found their fortunes interlocked with those of great numbers of other people in a pattern complex beyond their understanding, and apparently developing without reason or justice. (p. 131)

Along with this suffering, surpluses in food, at least, abounded as farmers actually increased production by 3% between 1929 and 1932 in order to make up for a 70% decline in net income (Walton & Miller, 1978, pp. 126-127). Excesses consumers could not purchase piled up and led to the eventual destruction of surplus farm products in order to equalize supply and demand and thus raise price levels (Scheiber et al., 1976, pp. 357-358).

The Depression, then, was characterized by hardship and deprivation, just as World Wars I and II were characterized by shortages. Each event, in general, thus bore a basic resemblance to the present energy crisis situation. During each of the earlier periods, for example, resources were

denied to large numbers in the general population; during the war years, because supplies of basic consumer goods such as food and fuel were insufficient; during the Depression, because incomes were reduced and thus ability to obtain resources curtailed. In addition, each past event was of major national significance; few in the society could have missed the implications of each situation, although direct experience may not necessarily have resulted in lowered resource acquisition (see, for example, Elder, 1974, pp. 18-20, 43-53). Likewise, during the current situation, as it has developed since 1973, shortages and increased prices of energy have been evident, thus limiting access to supplies by some groups (Unseld et al., 1978). In addition, the problem has received national and local media attention. Few today remain ignorant of the general implications of the energy problem, whether they believe the situation is real or contrived.

Problem Statement

In light of the similarities between the current energy problem and the experiences with shortages and deprivation characterized by World Wars I and II and the Great Depression, it was the premise of this research that people exposed to these three past events would be influenced by attitudes, beliefs and perceptions gained from that set of experiences and further, that this influence would be manifest in current behavior exhibited toward the energy crisis. The

primary research problem, therefore, was to discern if past experience with deprivation and shortages influenced current patterns of energy consumption and conservation.

Research Objective and Research Questions

The specific research objective was to determine to what extent people exposed to varying levels of past experience with deprivation and shortages differed in their reactions to the current energy situation, with its implications for energy shortages and thus deprivation with respect to energy supplies. Two questions, in particular, guided the study: (1) Did exposure to shortages and deprivation in the past influence current energy consumption behavior? (2) Did exposure to shortages and deprivation in the past influence change in energy consumption behavior over time and, most particularly, reduced consumption (i.e., conservation) behavior, given the urgency placed upon conservation at the local and national levels? (Stobaugh & Yergin, 1979; Unseld et al., 1979)

Conceptual Framework

Inherent within this study was consideration of the concept of age, because of the direct positive relationship existing between age and level of past experience with shortages and deprivation. In order to have experienced the three historical events considered in this research, individuals necessarily must be in their sixties or older now

that impact from the current energy situation was being felt. On the other hand, individuals with no prior experience involving national crises marked by shortages or deprivation would presently be in their thirties or younger. Between these extremes, level of experience varies in a unidirectional manner, i.e., increasingly older individuals having had more experience, younger individuals less.

Age has come to be viewed as a difficult analytical tool to utilize in research, however. As Baltes and Willis (1977) and Lerner and Ryff (1978) have pointed out, in and of itself, age measured nothing and was, in fact, a noncausal variable. It became useful in empirical studies, they indicated, only when it served as a marker along which experience occurred (Lerner & Ryff, 1978, p. 10). Within the context of this research, experience was multifaceted, however, encompassing not only past experience with shortages and deprivation, but experiences on dimensions of the aging process linked to biological, psychological and social aspects of aging.

What complicated the situation was the fact that energy consumption and conservation were also believed related to these three aspects of aging (i.e., biological, psychological and social aging, (Newman & Day, 1974, 1975; Morrison et al., 1978b, 1979; Farhar et al., 1979)). Higher income levels, for example, were related to higher energy consumption patterns, just as they were related to middle-aged as opposed to younger or older age levels. Size of household was also related to consumption of energy in a positive way. Its

relationship to aging was curvilinear, however, with younger and older households being smaller, and size of household expanding and then contracting throughout the middle years of adulthood.

In essence, then, a paradox existed. Aging defined past experience with shortages and deprivation and, in turn, was correlated with characteristics with known relationships to energy use. To the extent that these confounding linkages could have masked the relationship of interest, analysis was problematic. It was necessary, therefore, that each factor related to both aging and energy consumption and conservation be considered and controlled as past experience was studied.

The issue of systematically appraising age-energy relationships was most easily resolved by the development of a temporally oriented conceptual framework, capable of allowing separation of the interrelated aspects of aging, as well as specification of their characteristic linkages to energy use. Specifically, three dimensions of time were considered. Along with their aging-related components, the three temporal dimensions were: (1) life time or the measurement of aging as a psychological and biological process, (2) social time or social aspects of aging, which focused on consideration of stage in life and the process of accepting and relinquishing roles and responsibilities defining the various stages, and finally, (3) historical time or the locational juxtaposition of life time within the span of time surrounding it.

Summary

This introductory statement has focused on describing similarities between the current energy situation and three twentieth century historical events: World War I, the Great Depression and World War II. The parallels identified were: (1) shortages of basic life-supporting resources, or (2) inability to obtain basic resources, and (3) major national impact. It was pointed out that during each of these four periods, resources have been denied to households within the general population. While in each past instance, there may have been households not actually deprived, each historical event was of such major significance that few experiencing it could have remained ignorant of its implications. Likewise, dramatic increases in energy prices and shortages as well as extended media coverage have left few unaware of the present day energy situation, even though some households have not been forced to curtail consumption of energy as a result of shortages or price increases.

The research problem and research questions were then identified. The study was designed to determine whether living through these three historical events characterized by deprivation or shortages had influenced current energy consumption and conservation behavior and, if so, how and to what extent.

Problems particular to the study were specified as including: (1) the need to focus on the age variable as a means of determining level of experience with historical

events, (2) the analytical problems inherent when studying the age variable, and (3) the compounded problems of studying energy use behavior in relation to the age variable. A brief summary of the conceptual framework developed to help overcome these problems was specified last.

In the following chapters, the conceptual framework is explored in detail, as are the methods used to operationalize and measure the component elements of the framework. First, however, an analysis of the current state of knowledge concerning age-energy research is presented.

CHAPTER II

REVIEW OF THE LITERATURE

Dimensions of the Energy Problem as They Relate to Age

An exploratory review of the literature revealed that no information existed exploring the relationships between past experience with deprivation and shortages and current energy consumption and conservation behavior. An abundance of information was available, however, analyzing the relationships between age and a variety of energy-related issues. For a complete discussion the reader should consult Farhar et al. (1979), as this group has completed a comprehensive and timely analysis of 114 energy surveys conducted at the national, state and local levels since the Arab Oil Embargo in 1973-74.[1]

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[1] Farhar et al. (1979) analyzed the 114 surveys attempting to discern relationships between age and a broader range of questions than were applicable for discussion in this review. Specifically, they studied the surveys to identify relationships between aging and the following issues: (1) perceptions of the general situation, (2) expectations about the future, (3) perceived impact of the situation, (4) policy preferences, (5) energy and the environment, (6) knowledgeability and sources of information, (7) feelings about solar energy, (8) feelings about nuclear energy, and finally (9) energy conservation (Farhar et al., 1979, pp. B-20 to B-41).

In conducting their analysis Farhar et al. found that numerous studies included age level analysis of survey results to provide basic sociodemographic descriptions of their sample. Yet Farhar et al. also indicated that confusion existed concerning age level differences with respect to behavior and attitudes towards the energy situation. In effect, no clear and consistent age-related patterns were apparent. They hypothesized that problems in discerning differences were due to the varying number and variety of age categories employed in the surveys. They also indicated that the level of analytical method employed in the surveys may have masked differences. The majority of surveys relied on zero-order levels of analysis, and to the extent that factors with identified links to energy behavior and attitudes were interrelated with age level, they could have confounded the aging patterns (Farhar et al., 1979, pp. B-20 to B-21).

To help understand the analytical problems identified by Farhar et al., the literature review was separated into two broad categories: (1) findings exploring the zero-order relationship between age and various energy issues and (2) findings exploring the relationship by using more powerful analytical tools, which allowed separation of the impact of age from variables linked to both age and the particular issue under study.

For ease in interpreting the findings, the literature was further organized into sub-groupings. Three questions in particular were investigated because of their direct

association with this research effort. They included: (1) belief in the reality of the energy problem, (2) actual and reported energy consumption behavior, and (3) measured or self-reported energy conservation behavior.

Zero-Order Levels of Analysis

As Farhar et al. (1979) pointed out, the majority of information exploring relationships between age and energy use or attitudes had been analyzed by cross-tabulation procedures. The findings were somewhat contradictory. They were useful, however, because they indicated general patterns.

Belief in the reality of the energy problem

Morrison et al. (1979) studied the relationship between age and belief in the reality of the energy problem. Their findings indicated that over time older respondents, born before or during the earlier years of the Great Depression, appeared to have become less willing to acknowledge that an energy problem actually existed. In 1974, for example, when asked if they believed the energy problem was real, 50% (n = 169) of older respondents (40 and over or born during or before 1933) indicated yes, while 51% (n = 236) of younger respondents (less than 40 or born after 1933) indicated yes. By 1976, however, only 39% (n = 243) of older respondents (40 and over or born during or before 1935) indicated willingness to believe the energy problem was real, while 50% (n = 248) of younger respondents indicated belief in the reality of the problem (p. 15).

Morrison et al. (1979) found that high percentages in both age groups expected an energy problem to emerge in the near future, however. Fifty-eight percent of the older group in the 1976 survey expected an energy problem to exist by 1981, while 64% of the younger group concurred. Percentages were still higher for both groups concerning a belief that a problem would exist by 1985, 70% and 69% respectively (p. 15).

Thompson and MacTavish (n.d.) found similar results regarding belief in the reality of energy problems when they surveyed a group of Grand Rapids, Michigan residents. Their survey was conducted in February 1976, 2 months prior to the second phase of the Morrison et al. (1979) study. The Thompson and MacTavish study differed from the Morrison et al. study in two important ways, however. A broader range of age-belief questions were studied, and more age categories were employed to analyze sample responses. Thompson and MacTavish employed four age categories, for example, in comparison to Morrison et al., who used only two. The categories and the approximate years of birth of sample members in the Thompson and MacTavish study are shown in Table 1.

With respect to age patterns and belief in the energy crisis, Thompson and MacTavish found that, in general, older respondents were more reluctant to believe a problem existed, were more cynical about its causes and were more pessimistic about the future. Overall, for example, respondents believed an energy problem currently existed (63% - yes; 28% - no). Yet the 45 to 64 year age group was less willing to

Table 1.--Age, Year of Birth and Sample Weighting in Grand Rapids, Michigan Study, 1976[a]

Age	Year of Birth[a]	N = 515
19 thru 24	1951 to 1956	14%
25 thru 44	1931 to 1950	42%
45 thru 64	1911 to 1930	27%
65 and over	1910 or before	17%

Source: Phyllis T. Thompson and John MacTavish, "Energy Problems: Public Beliefs, Attitudes and Behaviors" (Allendale, Mi: Urban and Environmental Studies Institute, Grand Valley Colleges, 1976, mimeographed), p. iii.

[a]Years of birth are approximate, as they were established by the author for purposes of comparison. The base year used to determine year of birth was 1975, as the survey was conducted early in 1976.

acknowledge existence of the problem (55% - yes; 34% -no (p. 6)).

Concerning belief in future energy problems emerging, the Thompson and MacTavish findings differed from those of Morrison et al. (1979) because the percentage believing that there would be future problems decreased with age. A corresponding increase in the "don't know" category emerged as age increased (p. 10). Linked to belief in future energy problems, Thompson and MacTavish hypothesized, was the belief that oil and gas supplies in the United States would be exhausted and that shortages of these products would be prevalent in the future. Young people were more likely to expect oil and gas supply depletion in the future. This

expectation consistently decreased with age (pp. 19-20). Likewise, the expectation of future shortages, in general, decreased with advancing age, i.e., over 65 (p. 47).

Expectations regarding increases in energy price levels revealed similar relationships. Anticipation of major price elevations decreased with increases in age (pp. 31-32). Linked to this was the finding that the 25 to 44 age group was most likely to expect utility price increases in 10 years, while the elderly least expected utility costs to increase (p. 34). Thompson and MacTavish hypothesized that these cost findings were possibly a "sign of wishful thinking on the part of older respondents," as incomes were likely to be fixed for this age group and, thus, unable to keep up with price increases (pp. 31-32). The elderly, Thompson and MacTavish seemed to feel, were simply blocking reality due to their economic situation.

In citing reasons that utility bills might increase, the age groups differed as well. The under 25 group emphasized shortages and increased demand for energy, while they de-emphasized greed and production costs. The 25 to 44 age group emphasized increased demand and production costs; they de-emphasized greed. The 45 to 64 age group showed a slight tendency to emphasize greed, while de-emphasizing increased demand and shortages of supplies. The elderly, however, emphasized greed as a major cause of utility price increases; they de-emphasized increased demand (p. 34).

With respect to the possibility of solutions to the problem, fewer older individuals than expected felt answers would be found. This corresponded with the finding that older people, in general, were more pessimistic about the future. As age increased, expectations that solutions would be found decreased, while expectations that solutions would not be found increased (p. 13).[2]

One final interesting finding concerned the fact that all age groups indicated they did not believe a shortage "caused" the gasoline crisis of 1973-74 (i.e., they apparently felt it was a fraud). The elderly, in particular, were likely to indicate that shortages had not caused the crisis, however (p. 25).

In general, it appeared that as age level increased belief in the seriousness of energy supply problems decreased. This same pattern also seemed evident regarding the prospect of future shortages. Farhar et al. (1979), for example, when summarizing findings from a broader variety of surveys, indicated that younger age groups appeared more likely to report greater belief in the possibility of future shortages (see pp. B-21 to B-24, B-40).

Consumption of energy

Newman and Day (1974) indicated that analysis of actual energy use on a per household basis suggested that consumption

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[2]Thompson and MacTavish offered no explanation of the inconsistency between this finding and the finding indicating that older individuals did not know if energy shortages would be prevalent in the future.

increased if children were present, decreased if they were not. They concluded that younger and elderly households thus consumed less energy (p. 6).

Support for their findings came from an energy data bank tracing a 1 year period of energy consumption behavior for a national sample of households.[3] Surveying consumption of natural gas and electricity usage for the year ending May to July 1973, Newman and Day found that average annual consumption equaled 234.9 million British Thermal Units (Btu's). Households headed by persons under 45 (approximate birth date after 1927) used an average of 7% more than this overall mean amount; if they included children, they consumed 16% more than the national average. On the other hand, if no children were present, this same age group used 36% less than average. If the head was over 45 years of age (birth date prior to 1927), the household consumed 4% less than the national mean. Finally, elderly households, headed by people over 65 (birth date 1907 or before), used 18% less than the national average (Newman & Day, 1974, Table 1).

The findings of Morrison et al. (1979), based upon a sample in a geographically distinct area as opposed to a national sample, confirmed Newman and Day's conclusions. Studying total, direct energy consumption patterns for the

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[3] A description of the procedures used to select the national income-stratified sample of 1,455 households and the consumption data subsample were discussed in Newman and Day, 1975 (see especially Appendix A-2, pp. 237-265).

1 year period from 1973-74, Morrison et al. found that a curvilinear relationship seemed to exist with age level of the household head.

The data represented a sample of households in the Lansing, Michigan Standard Metropolitan Statistical Area. Overall, average annual consumption was 207.83 million Btu's (p. 22). Households headed by persons less than 30 (n = 8, approximate birth date after 1943) consumed 150.83 million Btu's on the average. Households headed by people between 30 and 45 (n = 53, approximate birth date between 1928 and 1943) used 228.82 million Btu's, while households headed by persons over 45 (n = 69, approximate birth date prior to 1928) consumed 198.32 million Btu's.

In general, it seemed that a curvilinear relationship existed between age and energy consumption. It was apparent, however, that in both of these studies age acted as a surrogate for stage in the family life cycle (i.e., the temporal pattern of family life emerging as the size and composition of the unit changes, (Zimmerman, n.d.)). And to the extent that these patterns were captured, understanding of age and the characteristic it measures were masked.

Conservation of energy

The literature varied concerning the relationship between age and energy conservation. Some studies, for example, indicated no relationship existed between age and self-reported conservation behavior (Kilkeary & Thompson, 1975), while others indicated a relationship was evident. If a relationship was

identified, the direction of the association varied. Some studies, for example, found individuals over 65 conserving little if any energy (Smith, 1976), while others, based on actual consumption data, indicated major conservation was occurring in households headed by individuals over 65 (Morrison et al., 1979; Williams et al., 1979). In addition, some studies documented that middle-aged groups were conserving, while others indicated they were not. Finally, methods used to obtain results varied. Both methodology and results will be discussed in this section, therefore.

During the summer of 1974, Kilkeary and Thompson (1975) surveyed middle and working class households in two New York City communities to determine self-reported conservation behavior. The two communities were selected purposefully; one because it had experienced an extended power failure in the previous summer; while the second, because it had not and could therefore serve as a control sample. To assure comparability, the second community was chosen based upon similarity to the first in socioeconomic and ethnic character (pp. 4, 6). In addition, an attempt was made to assure that samples within communities were randomly selected by using U.S. Census Bureau Block Statistics to determine households to be interviewed by personal visit (p. 6). However, due to circumstances particular to the study (i.e., urban distrust and concern regarding allowing entry of strangers), much of the control was lost as interviewers

were forced to begin arbitrarily interviewing willing respondents from groups on the streets (p. 7).

The final sample consisted of 602 households, uniformly represented in each of six age strata (e.g., 18-25, n = 117; 26-35, n = 136; 36-45, n = 87; 46-55, n = 85; 56-65, n = 76; 66 or older, n = 90),[4] while age was one of the major independent variables hypothesized related to self-reported conservation behavior. Chi square analysis revealed, however, that no relationship existed between the two (p. 48).

This finding was interesting and somewhat problematic, as it contradicted results in other studies that indicated a relationship was evident between age and conservation behavior (see below). The Kilkeary and Thompson finding could, perhaps, simply have been a matter of sampling error. On the other hand, problems existed in their study which may have accounted for their inability to identify a relationship. Respondent selection, for example, did not allow for random sampling, as people "out-of-doors," (p. 7) willing to be interviewed, were interviewed and then winnowed if answers seemed to indicate a lack of interest in the interview (p. 4). Response on the conservation scale may have been uniformly high across age groups as a result and, thus, analysis incapable of detecting a relationship that, in fact, could have been identified in a more representative sample.

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[4]Eleven respondents refused to give their age.

A second problem identified in the Kilkeary and Thompson study concerned measurement reliability. The study used self-reported practices to index conservation behavior. Yet Milstein (1978) indicated that reported actions were a poor measure at best, as respondents, aware of the social desirability of conservation, tended to overestimate their activity. Thus Kilkeary and Thompson may have missed identifying a relationship because nonconserving age groups may have been reticent to report their behavior.

If this was the case, it was interesting to note that Smith (1976) found evidence of a curvilinear relationship between age and reported conservation practices. His data base seemed more representative as the 1,400 households studied were selected via a national probability sampling technique, and thus the findings would appear to have more validity. One additional difference between the Smith and Kilkeary and Thompson studies which may have influenced results concerned interviewing technique. Smith's interviews were apparently conducted by telephone rather than personally, and this more remote contact may have induced respondents to feel somewhat freer to admit nonconservation behavior.[5]

In any event, Smith reported a curvilinear relationship between self-reported conservation behavior and age. He

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[5]Milstein (1978), however, argued against self-reported behavior in general as a measure of conservation activity, making no allowance for interview technique.

indicated that 27% of the age group under 25 (approximate birth date during or after 1950) reported making no change in energy use behavior between 1974 and 1975, while 49% of the 65 and over age category (birth date during or prior to 1910) reported no change in behavior. Fewer in the middle age ranges indicated no change in energy consumption patterns: 17% in the 25 to 34 group (approximate birth date between 1941 and 1949), 21% in the 35 to 49 group (approximate birth date 1926 to 1940), and 22% in the 50 to 64 group (approximate birth date 1911 to 1925 (p. 5)).

Smith indicated one additional finding which had implications for this research. Respondents in the elderly age group who had not made adjustments in living patterns were questioned about the future. And Smith reported that "a significant number" indicated that a further 25% increase in energy prices would not influence them to conserve (p. 3).

The findings of Williams et al. (1979) concerning conservation somewhat contradicted Smith's findings. Like Smith, Williams et al. documented a relationship between age and conservation behavior. The discrepancy came in direction of the relationship. Williams et al. proposed that households headed by individuals 45 to 64 have conserved minimal amounts, while those headed by people 65 and over have shown major, rather than minor, changes in energy use patterns. No evidence was presented regarding conservation behavior of age groups under 45.

Findings in the Williams et al. study were based on energy consumption levels of a national sample of households in 1972-73, compared to consumption level in 1974-75.[6] Although change between the two periods was discussed, two independent sets of cross-sectional data, rather than longitudinal data, were used for comparison in the analysis. Thus, the same households were not studied over time. In addition, the sample was urban in character, while only consumption patterns of households utilizing natural gas and electricity were analyzed.

Williams et al. indicated that, overall, there was a reduction of 1.8% in total, annual Btu's consumed between 1972-73 and 1974-75, with conservation of natural gas being the major contributor. Natural gas consumption was reduced 3.9%, for example, while consumption of electricity actually increased by 1.2%. The findings related to age revealed divergent patterns. Those over 65 (approximate birth date 1909 or before) reduced overall consumption by an average of 7.1%, while those between 45 and 64 (approximate birth date between 1910 and 1929) increased consumption by 1.4%. Increased use of electricity accounted for most of the overall increase within the 45 to 64 age group. They increased electrical consumption by 3.0%, for example, while those over 65 reduced electrical consumption 7.4%. Use of natural

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[6]Base year data were the same as those analyzed by Newman and Day (1974, 1975), discussed earlier in the section on energy consumption patterns.

gas showed similar patterns; those 45 to 64 increased consumption by an average of .6%, while those over 65 decreased consumption by 6.9% (p. 45).

The final research studies to be discussed linking age to energy conservation were reported by Morrison et al. (1978b, 1979).[7] And the finding once again contradicted those presented above. Morrison et al. found a distinct linear relationship between age and conservation, ranging across three age levels from less than 30 to over 45. In addition, they found that the relationship was positive, suggesting that as age level increased, conservation increased; rather than increasing only in the older years as reported by Williams et al. (1979); or only in the middle years as Smith (1976) indicated.

Methodologically, the Morrison et al. (1979) study was similar to the Williams et al. (1979) study. The dependent variable, for example, was change in actual consumption behavior over a 3 year period. The time periods differed, however, as Morrison et al. studied conservation patterns between 1973-74 and 1975-76, while Williams et al. studied change between 1972-73 and 1974-75. In addition, geographical focus differed, as Morrison et al. concentrated on the more limited Lansing, Michigan Standard Metropolitan Statistical Area. Finally, methods of selection and design differed.

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[7]The Morrison et al. (1979) study was discussed earlier in the section on energy consumption.

Morrison et al. studied households using a wider range of fuel sources than Williams et al., and Morrison et al. utilized a modified panel design. The same households, therefore, were studied over the 3 year period (p. 12).

In general, Morrison et al. found a reduction of 6.3% in total, direct annual energy consumption between 1973-74 and 1975-76. More specifically with respect to age, they found that households headed by persons less than 30 (n = 8, approximate birth date after 1945) decreased consumption by 1.9% on the average, while households with heads between 30 and 45 (n = 53, approximate birth dates being 1930 to 1945) decreased consumption by 4.9% on the average. Finally, households over 45 (n = 69, approximate birth date prior to 1930) conserved an average of 6.35% (p. 22). Thus, their evidence indicated that conservation was occurring across all age levels, although it seemed more pronounced as age level increased.

Morrison et al. also attempted to determine household members' perceptions of the difficulty involved in future conservation efforts. The entire 1976 sample of male and female respondents was utilized to answer these questions. In general, the prospect of additional conservation was not alarming, as most sample members felt it could be accomplished with little disruption to lifestyles. With regard to age, however, individuals 40 or over (n = 243, approximate birth date during or prior to 1935) viewed anticipated conservation with somewhat more reluctance. Thirty-three

percent, for example, felt it would be very difficult to reduce miles currently driven, while 24% of those under 40 (n = 248, approximate birth date during or after 1936) felt reduced driving would cause hardships. In addition, 26% of those 40 or over felt it would be burdensome to reduce the amount of electricity they currently used. In comparison, 11% of those under 40 felt this would be a difficult change. The only prospect that concerned those under 40 more than those over 40 was reducing consumption of material goods. Twelve percent under 40 felt this would be a difficult alternative, while 6% over 40 were concerned about the impact of reduced consumption levels. Thus, it seemed that even though future conservation did not appear to concern sample members, older respondents, in general, were somewhat less likely to feel it could be accomplished easily.

In carrying analysis of the Lansing, Michigan data base still further, Morrison et al. (1978b) utilized a discriminant analysis technique to profile factors characterizing conserver as opposed to non-conserver households. In general, they found conservers had higher incomes ($15,000 annual gross income), while non-conservers were characterized by lower incomes ($12,600 gross annual income). In addition, they found that conservers had slightly more education (13.4 years), while non-conservers had slightly less (13 years).

With respect to age, they found that conservers were slightly younger than non-conservers. The measure used to compare households was the average age of the two spouses.

In aggregate, the conserver group of households averaged 48.6 years of age, while the non-conserver group averaged 53 years. Difference in age was not a statistically significant characteristic between the two groups, however.

Detailed discussion of these studies was included to illustrate the diversity of information available on the age-conservation question. Not only did findings differ, but measures of conservation and age differed, as did methods employed to gather information. Farhar et al. (1979), having surveyed and summarized a much wider selection of material, indicated that, in general, they found the same variation. They concluded, as a result, that there appeared to be no obvious age-related patterns in energy conservation behavior (pp. B-34 to B-38, B-41).

It was somewhat difficult to concur with Farhar et al., however, because they reached this conclusion by relying mainly on studies focusing on self-reported behavioral change to document conservation behavior, rather than studies using actual consumption data. When actual data were used, as they were in the Williams et al. (1979) and Morrison et al. (1979) studies, rather evident age-related differences existed. The older age groups in each study appeared to be conserving more energy. Patterns of differences in actual conservation behavior of middle and younger age groups were less apparent.

A basic problem existed in these two studies, however, as it did with others reviewed in this section which attempted to make generalizations regarding relationships

between age level and belief in the reality of the energy problem or energy consumption or conservation patterns. Analysis in each of the studies was conducted at the zero-order level, and to the extent that age was intercorrelated with other sociodemographic characteristics with identified relationships to various energy questions, its effect was confounded in each study. Morrison et al. (1978b), for example, indicated that higher income level and higher educational level were both significant predictors of energy conservation behavior. These two variables are related to age as well, and this multicollinearity makes the net contribution of each variable difficult to assess.

Higher-Order Levels of Analysis

Few studies were identified which explored the relationships between age and various energy issues by utilizing higher-order levels of analysis. When used, these procedures have enabled the impact of various independent variables to be analyzed simultaneously, along with allowing the net effect of each to be studied. Thus, they have permitted greater understanding of the separate contribution of each variable.

Belief in the reality of the energy problem

No studies were identified utilizing higher-order levels of analysis to measure the impact of age on belief in the reality of the energy problem.

Consumption of energy

Gladhart (1977a) studied a number of factors to estimate both annual demand for electricity and total residential energy consumption.[8] Included in the analysis were two age-related variables: (1) head of household 35 or under (born in 1940 or after) and (2) head of household 60 or over (born in 1915 or before). Both age factors were included as dummy variables, with the characteristic being given a value of 1 if it was present, a value of 0 if absent.

Gladhart found a negative relationship between head of household under 36 years and electrical energy consumption ($B = -11.14$, $p = .045$). A negative relationship was also identified between head of household over 59 and electrical energy consumption. At the .12 probability level, however, the finding was not statistically significant ($B = -9.93$ (Gladhart, 1977a, Table 1)).

The final question concerned demand for total residential energy. With respect to age, Gladhart found a negative relationship between head of household under 36 and total energy use. The relationship was not statistically significant, however ($B = -12.45$, $p = .124$). Head of household over 59 was not included in this analysis (Gladhart, 1977a, Table 3).

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[8]Gladhart's analysis was based on the Lansing, Michigan data utilized by Morrison et al. (1978b, 1979). To predict consumption levels, Gladhart analyzed sociodemographic characteristics and energy consumption patterns collected in the 1976 wave of interviews.

Any generalizations concerning a relationship between actual use of energy and age based upon one study would be tenuous. Yet Gladhart's findings seemed to suggest that younger households consumed less energy. He indicated that family life cycle factors may account for this finding, with younger households using less energy because children are younger and thus consuming less independently of parents (p. 10).

Conservation of energy

Hogan (1976), utilizing the same sample as Morrison et al. (1978b, 1979) and Gladhart (1977a),[9] analyzed a number of sociodemographic variables in order to determine their influence on reported energy conservation behavior. Included as predictor variables in the regression analysis were: (1) husband's age, (2) wife's age, (3) wife's education, (4) husband's education, (5) husband's occupation, (6) wife's employment status, (7) family income, (8) family size, and (9) urban or rural residence. Only wife's education was identified as having a statistically significant relationship with conservation behavior ($p = .03$). Wife's age and husband's age[10] did not appear to be related ($B = .02$, $p = .81$; $B = .03$, $p = .88$, respectively (Hogan, 1976, p. 75)).

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[9]Hogan utilized data collected in the first wave of interviews with the Lansing, Michigan sample. Thus, her analysis was based upon data collected in 1974.

[10]Hogan's sample included age levels ranging from 18 (birth date prior to or during 1955) to over 65 (birth date prior to or during 1908).

Bailey (1980), on the other hand, indicated that age was negatively related to reported conservation practices. She studied the effect of a more select set of sociodemographic factors, including size and income level of households as well as age and educational attainment of the household head. The age relationship accounted for 6.2% of the variance in the conservation practice scale, while the standardized regression coefficient equalled -.18 ($p = <.01$).

The larger sample size used in the Bailey analysis ($n = 1,875$), compared to the Hogan (1976) study ($n = 156$), may have accounted for this difference, as large sample sizes, in general, have a tendency to reveal significant patterns which are sometimes not apparent in smaller samples. In addition, use of fewer independent variables may have made some difference, although Bailey entered the age variable first, allowing it to account for the maximum amount of variance possible before entering the three additional variables. Hogan used stepwise procedures as well; however, age of husband and wife were entered last (Hogan, 1976, p. 75).

Finally, it should be noted that both Bailey and Hogan used self-reported activities to determine conservation behavior. As indicated previously, Milstein (1978) found that this was a somewhat unreliable measure, because individuals seemed to have a tendency to overestimate conservation activity when responding to formal inquiries about energy use behavior (p. 81). Thus, to the extent that this was occurring

with Bailey's respondents, generalizations about a relationship between age and energy conservation would be difficult.

As indicated at the beginning of this section, few studies have been conducted using higher-order levels of analysis to explore relationships between age and questions concerning belief in the reality of the energy problem or energy consumption and conservation behavior. And of those existing, some were based on unreliable measurement and analytical procedures.

Summary

The literature review revealed that three inherent weaknesses existed in research studies conducted thus far exploring the relationship of age to belief in the reality of the energy problem and energy consumption and conservation behavior. They included: (1) inappropriate analytical procedures (i.e., use of zero-order levels of analysis when higher-order levels would have been more appropriate), (2) unreliable measurement procedures (i.e., reliance on self-reported behavioral response rather than more precise energy consumption data measures), and finally (3) inadequate conceptualization of the meaning of age and thus its possible influence on attitudes about the energy situation or consumption of energy and change in consumption resulting from the energy crisis.

This research effort was designed to overcome the weaknesses of other studies, by first, providing a meaningful

rationale for use of age as an independent variable in energy research (i.e., as a measure of past experience with deprivation and shortages) and secondly, by exploring the relationship of past experiences to actual energy consumption and conservation behavior. Finally, higher order levels of analysis (i.e., multiple regression procedures), which allowed separation of the influence of past experience from other aging related sociodemographic and attitudinal measures, were employed to test the research questions and establish the net contribution of the age/experience variable towards explaining energy consumption and conservation patterns.

CHAPTER III

CONCEPTUAL FRAMEWORK

Temporal Dimensions of the Aging Process

Since the late 1960s, as emphasis has been placed on viewing phenomena from both a holistic and an ecological perspective, scholars focusing on similar problem areas have attempted to establish links or bonds between their various disciplines, the links serving as basic unifying themes and enabling discourse and the integration of knowledge. As integrative thinking has progressed, the concept of time has emerged as one such link for scholars of human development and family life. Historians of the family, for example, as well as sociologists and psychologists concerned with study of family and individual change have all acknowledged the importance of time as a causal agent, helping to explain growth, development and change in both individual and family behavior (Kantor & Lehr, 1977; Elder, 1978a, 1978b; Foner, 1978; Baltes & Willis, 1977, 1979; Lerner & Ryff, 1978).

In each of these disciplines, as advances in model building and theory or prototheoretical thinking have occurred over the past 10 years, the meanings of time have been clarified and expanded. Time has come to be viewed as

both an element and a process as a result, and its multi-dimensional character has been recognized. At the conceptual level, cognizance of time as an element and as a process has illuminated how time and movement through time, especially movement at different periods, have influenced human and family behavior (Riley et al., 1972; Riley, 1976a, 1976b; Foner, 1978). Concurrently, thinking regarding the multi-dimensional character of time has led to conceptualizing its component parts of life time, social time and historical time. The systematic and simultaneous interaction of these three dimensions, scholars have come to believe, has influenced behavioral change and developmental change (Elder, 1978a; Neugarten & Datan, 1973; Baltes & Willes, 1977, 1979).

Visualization of the impact of time and movement through time can be best illustrated by a concrete example, indicating not only the influence of time but the linkages between aging and time. The process of aging occurs on two temporal dimensions; first, it takes place over time, and secondly, within time (Elder, 1978a, p. S23). Thus for a particular individual or group of people born in one year, aging occurs over a specific span of time, such as 1900 to 1980. Numerous other age groups experience the same period, obviously; yet realization of the rather simple but important fact that the years from 1900 to 1980 are unique to the particular cohort born in 1900 is important. No other age group will experience those years in the exact same way (Riley, 1976a, pp. 193-194; Elder, 1978a, pp. S23-S24; Ryder, 1965).

Consider a second set of cohorts, for example, born in 1920 and living until 2000. Sixty years in the lives of the two groups coincide, covering the period from 1920 to 1980. During that shared time, however, the ages of the groups differ by 20 years, thus making the impact and perhaps the perceptions of events and occurrences within those years different for the two groups. Riley refers to this phenomenon as cohort-centrism (1976b, pp. 24-25) and indicates that successive cohorts have a distinct character because they age in different ways as a result of their interaction with historical events and the unique sequence of roles they fill in various historical periods (Riley, 1976a, pp. 191-192).

The impact of the Great Depression can be used as one example of the unique influence that time has on various cohorts. The 1900 to 1909 cohort, for example, would have reached adulthood by late 1929 when the stock market crashed, marking the beginning of the Great Depression. Thus they would have been employed or shortly seeking employment at a time when jobs were becoming increasingly scarce. The 1920 to 1929 cohort, on the other hand, experienced the Depression during childhood or adolescence, which was undoubtedly traumatic, but phenomenologically distinct from the experience of the other cohorts.

In essence, as viewed from the perspective of this research, life time, social time and historical time capture these differences by defining cohort-centrism, just as they, in turn, define: (a) the process of developing or aging

over time, (b) the influence of role sequencing through time and within time, and finally (c) the impact of aging through historical events or processes which occur within time. In the remainder of this chapter the nature of these three temporal dimensions is explored, as are their structure and process orientations and the systematic way in which they affect human development and behavior over time--which is the aging process.

Life Time

Life time is associated with chronological aging or the number of years lived since birth (Foner, 1978, p. S341), while aging is the process of accumulating years over time. The process is universal, inevitable and irreversible (Riley, 1976b, pp. 29-30; Riley, 1976a, p. 195). In addition, it is lifelong. Riley (1979b), for example, refers to aging as a process of growing up and growing old, commencing with birth (or conception) and ending with death (p. 4).

The process is not unidimensional, however, but rather, is defined by a set of processes. Change, growth and sometimes decline in psychological, social and biological functioning each play a role in carrying individuals through their life time, and the three are closely interrelated. Riley (1979b), for example, indicates the three are "systemically interactive." As they move people forward through their life time, each process influences the others, as change in one stimulates changes in the other two (p. 4; see

also Foner, 1978, p. S341). Consider the transition from childhood to adolescence, for example. The biological transition between these stages calls forth new psychological needs as well as a new set of social needs.

Among these three processes, the two linked most closely to life time are psychological and biological aging. They are discussed in this section. Social aspects of aging, on the other hand, are somewhat distinct conceptually from life time because of their relationship to cultural definitions of the aging process. They are best studied as a separate dimension, therefore, and are explored in a later section on social time.

Psychological aging

Emphasis by psychologists on time and historical time placement as causal agents affecting behavior and development is relatively new. They have only recently been explored, for example, after initial concern surfaced and died in the past 2 centuries (Baltes & Willis, 1979, p. 17). Temporal thinking is influencing perspectives, however, and helping shift focus from traditional age-developmental or bracketed specialities[1] towards a life-span developmental perspective which recognizes the impact of external,

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[1]Examples of age-bracketed specialities include fields such as infant development, child development or gerontology which emphasize: (1) normative, universal patterns of development influenced by genetic, maturational factors, rather than focusing on individual differences in development, and (2) intraorganismic sources of developmental change influenced by simple age functions, rather than considering external, contextual factors (Baltes & Willis, 1979, pp. 17, 18-21).

contextual forces on prospective developmental change (Baltes & Willis, 1979, pp. 17, 18-21).

In explaining this new focus, Baltes and Willis (1979) indicate that individuals continue to develop and change throughout their lives, and that aging, therefore, should be viewed as a continuous, lifelong process. They maintain, in fact, that aging can only be understood if experiences throughout the life time are considered (p. 15), along with factors relating to bio-cultural changes occurring around the aging individual. More specifically, they view life-span development as occurring within the context of both micro-level individual life events and macro-level ecological or social events. Thus, they feel that aging is not simply a process of inherent developmental change over time, but rather a dynamic process occurring within the context of societal level events and change (Baltes & Willis, 1979, p. 15).

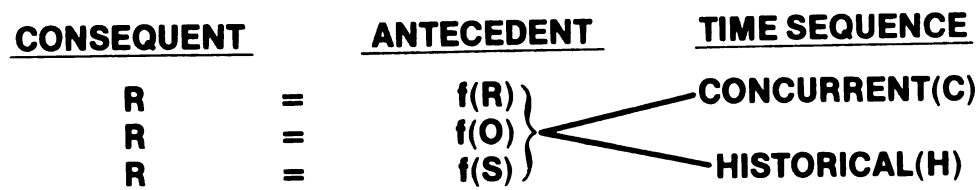
With regard to the field of behaviorism as it relates to aging processes, Baltes and Willis (1977) have a somewhat new perspective as well. They indicate, for example, that behaviorism traditionally focuses on three classes of antecedent or causal variables as determinants of behavioral response: (1) response or behavior variables (R), (2) stimulus or environmental variables (S), and (3) organismic or biological variables (O).

Baltes and Willis argue, however, that this perspective is simplistic because it neglects consideration of time as it

influences the set of three causal factors. They maintain that the relationships between the (R), (O) and (S) variables can themselves be either concurrent or historical (see Figure 1), with concurrent relationships focusing on determinants of behavior which are close or proximal in time to the response being explained. Historical determinants, on the other hand, focus on influences or chains of influences from the past and are thus more distant in time (Baltes & Willis, 1977, p. 140). They indicate, for example, that loss in intellectual functioning in advanced age may be the result of either concurrent or historical influences. Concurrent aging-specific conditions, such as a reduction in cerebral blood flow, could cause the decline, or the loss in mental ability could be the result of an historical life event, such as lack of aging-relevant education in childhood (Baltes & Willis, 1977, pp. 140-141).

In schematic form, temporal influences (i.e., concurrent or historical) on behavioral and/or developmental change can be viewed as a synthesis of three major sets of influence systems: (1) ontogenetic age-graded, (2) evolutionary history-graded, and (3) non-normative (see Figure 2). Again, however, it is the interaction of the three influence systems which induces developmental or behavioral change, just as it is the interaction of (R), (O), (S) factors which determines behavioral response (Baltes & Willis, 1979, p. 23).

Because the field of life-span analysis is new, Baltes and Willis indicate that definitions of the age-graded,



Legend: R Behavioral Response
(R) Response or Behavior Variables
(O) Organismic or Biological Variables
(S) Stimulus or Environmental Variables
(C) Concurrent Determinants of Relationship among (R), (O), (S) Variables
(H) Historical Determinants of Relationship among (R), (O), (S) Variables

Figure 1.--Illustration of the Influence of Time on Response-Behavior Variables, Organismic-Biological Variables or Stimulus-Environmental Variables as They Account for Behavior; Adapted from Baltes, 1973, p. 460

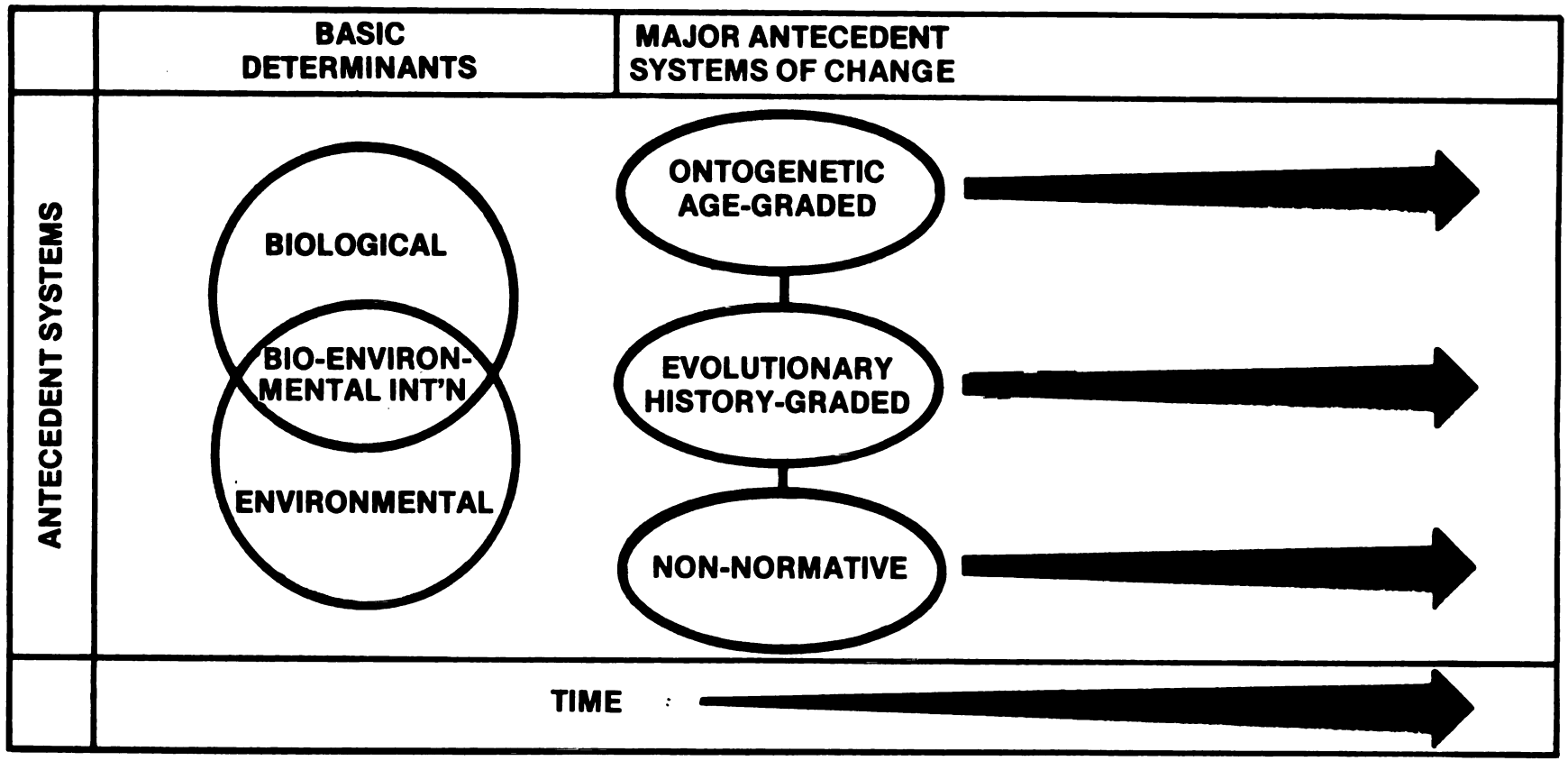


Figure 2.--Illustration of the Relationship between Life-Span Development and Three Major Influence Systems: Ontogenetic (Age-Graded), Evolutionary (History-Graded) and Non-Normative (Non-Developmental); Adapted from Baltes and Willis, 1979, p. 24[1]

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[1]Adapted by permission of Westview Press from Aging From Birth to Death: Interdisciplinary Perspectives, edited by Matilda White Riley. Copyright (c) 1979 by American Association for the Advancement of Science, Washington, D.C.

history-graded and non-normative influence systems are not precise. In addition, they are neither simple nor distinctly unrelated. The explanations are, therefore, presented in their entirety:

> Age-graded influences refer to biological and environmental determinants which exhibit a high degree of correlation with chronological age. They follow from the traditional focus on biological maturation and, as to socialization, from viewing the life-course as consisting of a series of normative age-graded . . . tasks and socialization influences.
>
> History-graded influences are those fairly normative-universal event patterns which occur in connection with biosocial change as evidenced, for example, in cohort effects. They exhibit a high correlation with historical time and apply to most individuals of a given cultural unit.
>
> Non-normative influences, finally, are those which are significant in their effect on development but are not normative in the sense that they do not occur for everyone or not necessarily in easily discernable and invariant sequences or patterns through the life-course of individuals. (Baltes & Willis, 1979, pp. 23-25).

Of particular concern to this research are the behavioral and developmental determining factors defined as non-normative influences. Baltes and Willis indicate, for example, that this particular set of antecedent influences focuses on historical events and patterns of change at the macro-level, such as economic depressions, wars or health epidemics.[2] In effect, non-normative factors deal with

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[2]A second set of non-normative influences deals with age-graded effects and involves critical or meaningful life events at the personal level, such as the death of significant others, illness, divorce or loss of employment.

events which are specific to particular historical moments or regions, or even clusters of people, rather than being universal event patterns which all people experience at equivalent age levels (Baltes & Willis, 1979, p. 25).

It is also important to note that among the three major antecedent systems, the combination and sequence of non-normative factors occurring within an individual's life time are assumed to account for a substantial portion of the influence operating to produce behavioral change (Baltes & Willis, 1979, p. 25). Thus, behavioral or developmental change across the life-span is not simply universal and normative. Rather, it is a consequence of individual life patterns directly influenced by external, contextual forces.

Viewing experiences with historical events as lifelong influences affecting behavioral response at the individual level leads to consideration of their impact upon successive cohorts developing through varying historical periods. During their life-span, for example, cohorts interact with differing combinations of macro-level historical events. And, from a life-span perspective, it follows that this difference in prior experience may elicit varying bahvioral responses from the successive cohorts as they are stimulated by later national-level events (Baltes & Willis, 1979, pp. 25-26). To be more explicit, it seems likely that older cohorts who have experienced deprivation and resource shortages in the past may react differently from younger cohorts to the current energy shortage situation.

Biological aging

Physiological aging is the second process linked to the more individualized aspects of aging defined as life time. And it is considered in this research because there may be a direct relationship between energy use and the deteriorative process which accompanies biological aging over the life-span.

There are a number of bodily systems and functions which appear to become gradually impaired as the body ages (Brocklehurst, 1978, pp. 150-152; Atchley, 1972, pp. 47-48, 51-55; Unseld, 1978, p. 39). And to the extent that the aging individual needs to substitute non-human energy in compensation for lowered physiological abilities, increasing consumption of fossil fuel energy is both a natural and necessary behavior.

Some gradually impaired functions with acknowledged links to energy consumption include: (1) vision, (2) hearing, (3) the central nervous system, (4) the circulatory system and closely related to the last two, (5) the thermo-regulatory system. Deterioration of the final system is by far the major consideration, however; because as the effectiveness of the thermo-regulatory system lessens, the body begins to rely on a steady state in external temperature to help maintain hemeostasis or an internal core temperature of 98.6^{o}F. Thus, as physical aging progresses, the body appears to become more dependent upon mechanical supports, such as heating and cooling systems, to help in the regulation of body temperature. If environmental support is not available,

one of two things can happen: (1) hypothermia, or low internal-core body temperature, which occurs when an excessive amount of body heat is lost due to protracted exposure to cold environments (Wicks, 1978, pp. 5-11), or (2) heat prostration, which occurs when an inordinate increase in body heat results from exposure to high environmental temperatures.

In either case, results can be devastating, as they were during the summer of 1980, when heat prostration claimed at least 1,200 lives (Adler et al., 1980, p. 28) throughout the south and midwestern regions of the United States when an extreme and prolonged heat wave covered much of the area (see also Mayer et al., 1980; Sheils et al., 1980). Although under rare and persistent conditions such as these, death can result in any age group, the elderly seemed especially susceptible, while an age-related, general weakening of the thermo-regulatory system may have been responsible (Unseld, 1978, p. 39).

The implication of this physiological factor for energy consumption and conservation patterns concerns the fact that older people, in general, may be forced to utilize heating and cooling systems to a greater degree than younger cohorts. Because the comfort systems within a dwelling unit are the two major energy consumers, consumption of energy, thus, may be proportionately higher and ability to reduce consumption substantially lowered for households composed of older members.

Summary

In essence, the development and change which an individual life time encompasses is the product of many factors. From the perspective of this research, they have been schematically divided and conceptualized as those forces occurring from within the individual--psychological and biological processes, and those occurring outside the individual--sociocultural and historical processes.

In this first section, emphasis has been placed on the internal aging processes. Yet, it has been emphasized throughout that both psychological and biological processes occur interactively with larger contextual variables, influencing and being influenced by them. Discussion of the psychological aspects of aging focused on the conceptual underpinnings of a life-span perspective, which emphasized interaction between the aging individual and the larger environment as a means of comprehending behavior and change over time. Biological aging, on the other hand, was viewed from a descriptive perspective, with emphasis placed on determining bodily functions and systems which appear to deteriorate with time and thus may necessitate greater reliance on consumption of energy in compensation.

Social Time

Riley (1976a) indicates that as people age, they pass through a sequence of social roles over time, adapting new roles and relinquishing old ones as biological and psychological aging occur (p. 191). Elder (1978a) views this

process as social time, indicating that as individuals move through their life time, age takes on various meanings directly linked to social roles. Accordingly, events in the life course are synchronized and ordered, and social roles adopted and given up as the age-linked meanings change. Examples include schooling and role of student from the age of 5 to 18 or more, working and role of employee from the early twenties to approximately 65, and marriage and role of spouse, often beginning sometime in the twenties (Elder, 1978a, pp. S25-S26).

From a theoretical perspective, timing and role and event sequencing across the life-span are believed socially constructed, with each social system developing its own inherent reward and punishment system to force adherence to the relevant schedules. Foner and Kertzer (1979) indicate, for example, that social timetables structuring the timing and ordering of events are common in most societies, acting as normative influences and indicating to individuals options available to them and social expectations that they follow the sometimes narrowly prescribed schedules (see also Elder, 1978a, pp. S25-S26).

As individuals comply, life course patterns follow social expectations and social rewards accrue. Consider the experience of an adolescent in the United States who finishes high school, for example, as opposed to one who does not, or the employment opportunities available to an individual completing college in comparison to one finishing only high

school. On the other hand, if timing or sequencing schedules are disrupted, individuals are often penalized through informal sanctions. A visible form of sanctioning currently occurring in the United States involves the social outcry over the number of teenagers involved in premarital sexual activity (Gelman et al., 1980) and the resulting high levels of teenage pregnancy. In effect, these teenagers have become a "social problem" because they have broken two age-related norms. The first is their involvement in sexual activity at an age found unacceptable, while the second concerns the birth of children to these young unwed mothers. They have disrupted social timetables, in other words, and the stigma attached to their activities will quite possibly affect their life chances.

Conceptually, then, in one way, normatively defined social roles and the timing and event ordering necessary to achieve transitions from one set of roles to the next serve as social forces moving people forward across the life-span. Yet, for most societies, consideration of movement through social time or social role sequences as unidirectional is misleading. Rather, roles define life stages, with the various stages being hierarchically related to one another through an informal system of rewards. As people move through age-related roles, relinquishing old and adopting new ones, they make transitions between the life stages and thus move through a stratified social structure.

Riley (1976a, 1976b) and Foner (1975, 1978) have expanded thinking related to socially defined age structures and indicate that at the macro-level age-related social systems are similar conceptually to class stratification structures. Inequalities between age levels exist, for example, much the same as inequalities between class levels. The power of a child in comparison to adults or the status of an elderly individual when compared to a younger cohort illustrate these inequities and can be likened to the power and status of the poor as opposed to the wealthy. A second similarity exists in that mobility characterizes age systems, just as it does class stratification systems. People move upward accruing rewards and power until they reach a peak and downward movement commences as both are curtailed. Foner (1975) and Riley (1976b) indicate, in fact, that social mobility is perhaps more characteristic of age than class stratification. Movement through the age strata affects all members of a society as it is an inevitable and irreversible accompaniment of aging. Inevitable and irreversible mobility are not characteristic of class systems, however (see especially, Foner, 1975, pp. 144-148; Riley, 1976b, pp. 22-24, for similarities between age and class stratification).

In summary, recent developments in conceptual thinking related to social aspects of aging have illustrated the importance of socially structured age norms in influencing life-span development. As people age, they experience pressures to time and order events in relatively prescriptive

ways, thus somewhat compelling them to adopt new role complexes and make transitions from one life stage to the next. Neugarten and Datan (1973), especially, emphasize the universality of these processes, indicating that "all societies rationalize the passage of life time," by dividing it into "socially relevant units." Age norms structuring life stages thus "transform calendar time (or biological time) into social time" (p. 59).

Linked to the emerging realization that social expectations and pressures influence the aging individual at the micro-level is a new awareness of age as a macro-level factor in social analysis. At the societal level, people of a like age can be conceptually aggregated into an age stratum, with the various age levels coming together to form a social stratification system (Foner, 1978, p. S341). Movement through the age strata is marked by transitions or changes in social role complexes (Elder, 1978a, pp. S25-S26; Foner, 1978, pp. S341-S342). Thus micro-level life-span transitions between life stages denote motion and give a dynamic process orientation to the structured social system (Riley, 1976a, pp. 191-192, 194-196; Foner, 1978, pp. S342-S343).

Social aspects of aging in the United States

Foner and Kertzer (1979) point out that between societies, age systems vary in both process and structure. In some, age is a rather fluid, informal marker, merely serving as a guide for timing transition points between life stages. In still others, age acts as a formal determinant of role

allocation. Societies also differ in the number of life stages or age strata incorporated within the age system (pp. 122-123).

Neugarten and Datan (1973), having explored the issue of process or movement through the American age system, indicate that it is relatively informal. Some ascriptive turning points exist, such as age to enter school or age when voter eligibility is realized. Yet they indicate that, on the whole, consensual agreement concerning length of intra-strata stay and timing of transitions characterizes the system. No formal, compulsory requirements exist denoting age when school must be completed, for example, or age to leave home, accept a job, marry or bear children (Neugarten & Datan, 1973, p. 59). Rather, these transition points appear ordered by internally felt social pressures.

Elder (1978a) concurs that informal norms seem to regulate turning points in American society. He goes on to point out, however, that while theory assumes the importance of normative transition timing, little evidence exists documenting this influence (Elder, 1978a, p. S26; see also Elder, 1978b, pp. 27-29). Works by Neugarten (Neugarten & Datan, 1973) and Hill (1970) are among the exceptions.

Neugarten indicates, for example, that age seems a somewhat important consideration in life time planning, as people respond easily to empirical questions asking the "best age" for major life events to occur, such as the "best age for a man to marry" or the "best age to become a grandmother." Answers to such questions as the age "when a man should hold

his top job" or what age marks a "mature woman" elicit chronological age responses as well (reported in Neugarten & Datan, 1973, p. 60). In addition, Hill (1970) reported that families vary in their perception of accomplishments in relation to time. Some families felt they were ahead of schedule; others, behind schedule; while still others felt on schedule. With the exception of these studies, however, little empirical evidence seems available, as yet, exploring pressures influencing the timing of events or the age-related norms defining life-span turning points. Work, instead, seems to focus on identifying timing and sequencing schedules within the life course (Elder, 1978a, p. S26; 1978b, pp. 27-29; Winsborough, 1979; Uhlenburg, 1978).

In a like manner, relatively little is known concerning the structure of the age stratification system within the United States, as few studies have been conducted exploring perceptions of life course stages from an empirical perspective. The evidence that does exist, however, suggests that individuals sense their life as a series of plateaus.

Neugarten, for example, after exploring the issue with adults, indicates that middle-age people perceive adulthood as a series of four life stages: young adulthood, maturity, middle age and old age (Neugarten's work is reported in Neugarten & Datan, 1973, pp. 60-68). She also indicates that perceptions of the boundaries of the stages vary somewhat by sex, social class and chronological age (Neugarten & Datan, 1973, p. 60). Finally, she points out that three dimensions

of social aging and dimensions of biological and psychological aging appear to underlie perceptions of life stages:

> career line (e.g., major promotion, retirement), health and physical vigor, the family cycle (e.g., children entering school, children departing the family home), psychological attributes (e.g., "Middle age is when you become mellow."), or social responsibilities ("Old age is when you can take things easy and let others do the worrying."). (Neugarten & Datan, 1973, p. 60).

From a theoretical perspective, this type of evidence has led to generalizations regarding the American age structure. Neugarten and Datan (1973), for example, indicate that the system is highly differentiated, consisting of a comparatively large number of age strata in contrast to simpler societies (p. 59). Riley (1976a) concurs and posits the following breakdown: (1) infancy, (2) early childhood, (3) late childhood, (4) preadolescence, (5) early adolescence, (6) late adolescence, (7) early maturity, (8) maturity, (9) middle age, (10) early old age, and (11) advanced old age (p. 197).

This is merely a conceptual tool, however, and is certainly not supported with empirical evidence. In addition, it must be recognized that the age structure itself is in a constant state of tension and flux due to its interaction with historical forces and the biological and psychological aging of cohorts passing through it. The social and economic roles open to cohorts born during the 1930s compared to those available to the post-World War II cohort illustrates this strain and the pressures changing cohort configurations

place on social systems. The small 1930s cohort entered adulthood in the 1950s and early 1960s, for example, when the economy was growth-oriented and job demand outpaced supply. In contrast, the post-war generation was huge, and their life chances may reflect this difference. As the scarcity of jobs since the late 1960s indicates, competition to fill roles has been more difficult for the younger cohort, partly perhaps as a result of its large size as well as the changing economic conditions (see Waring, 1975, for a discussion of disordered cohort flow and the social problems resulting).

Influences upon the aging structure of such exogenous and endogenous forces as historical events and differing cohort sizes are important from a social change perspective. Knowledge of their impact can lead to an understanding of the reasons behind change, for example. It can also help in assessing the direction and the implications change may have for the future, especially with respect to social and economic problems such as the energy situation and the changes being forced by shortages and higher costs of energy.

Summary

Within this section, social time has been viewed from two perspectives. The first dealt with the relationship of individuals to their particular social surroundings over time, as defined by the changing role complexes accepted and relinquished while passing through the lifespan. Discussion then shifted to a macro-level perspective

which viewed the life-span as a series of life stages, the stages, in turn, forming a hierarchical social structure defined as an age stratification system. Explanations and linkages between these two levels were viewed from a universal perspective in the early portion of the discussion. Because societies vary in their age stratification systems, focus shifted towards the end of the section to a more concrete level and a discussion of the system within the United States.

In general, it appeared that movement through the American age structure was rather fluid and informal, as chronological age, per se, did not seem a major factor in marking passages between life stages. Rather, social pressures influencing event sequencing and timing within the life course appeared to demarcate turning points. With regard to the structure of the American age system, it was pointed out that relatively little seemed to be known concerning its dimensions. In addition, recent research has led to the realization that it has varied over time in relation to changing cohort configurations and the changing nature of historical events and processes occurring within American society. A more complete discussion of the past and its influence on change in the age structure is contained in the following section.

Historical Time

Neugartan and Datan (1973) indicate that the influence of historical time on aging systems and aging is bi-dimensional. One dimension concerns historical processes at

the macro-level as they influence long term social change, while the second involves the series of historical occurrences such as political, social, economic and military events which take place at specific points in time and thus influence the life course of individuals experiencing them (p. 8).

From the perspective of long term historical change, industrialization and urbanization appear to be the major forces molding the aging-related social structure (see, for example, Shorter, 1977; or Tilly & Scott, 1978). Recent research in social history, for example, indicates that these two processes have been instrumental in differentiating life course stages. More specifically, Ariès (1962) indicates that the concept and thus the life stage of childhood may be relatively new, having appeared as late as the seventeenth or eighteenth centuries as a function of the emergence of formalized educational institutions and the expansion of the middle class during industrialization's inception. Likewise, Demos (1977) feels that adolescence may be a newly developed concept. In studying family life in Plymouth Colony during the seventeenth century, he found no evidence indicating youth experienced a passage from childhood to adulthood accompanied by the trauma linked to adolescence today (pp. 145-146). Smelser and Halpern (1978) posit that adolescence may be a nineteenth century development, coupled closely with the emergence of public educational systems and the lengthening of time required for formal schooling. In turn, they link the emergence of public education with

industrialization, indicating that schools may have acted as shelters for youth displaced by mechanization (Smelser & Halpern, 1978, pp. S293-298, S309-S313).

Currently, conceptualization of a new life stage seems to be occurring. Recent medical advances and technological changes have extended the life-span. Yet for older individuals, the early years of retirement seem structually and phenomenologically distinct from later years when health is often poor and loneliness more prevalent. Thus from the earlier single stage, two life stages appear to be emerging (early old age and advanced old age), capturing these aging-related differences (Neugarten & Datan, 1973, pp. 64-68; Riley, 1976a, p. 197).

In one sense, then, at the macro-level, historical processes appear to shape the evolutionary formation of age norms; the norms, in turn, shaping the age stratification system by conventionalizing new stages of life course or social time. At the micro-level, historical impacts are more direct, as events occurring with the passage of time have a major and sometimes disruptive influence on the life course. Depressions, affluence, wars, health epidemics or periods of immigration all affect the life course as they intersect with the aging process. Elder's (1974) work, Children of the Great Depression, illustrates this influence by studying the impact of economic hardship on a group of Oakland, California cohorts passing through late childhood and adolescence during the 1930s.

Since concluding the study (1974), Elder (1978a, 1978b) has been a strong advocate of life course research, indicating that future studies attempting to clarify processes of human change and adaptation must necessarily consider the past. He feels individuals must be located in time and their life time/historical experience understood if insight into manifest behavior is to be gained (Elder, 1978a, pp. S18-S23), for as new experiences are encountered, perceptions of the situation will be filtered by ideas and attitudes formulated in the past; the past and memories of the past thus influencing current behavioral response.

Summary

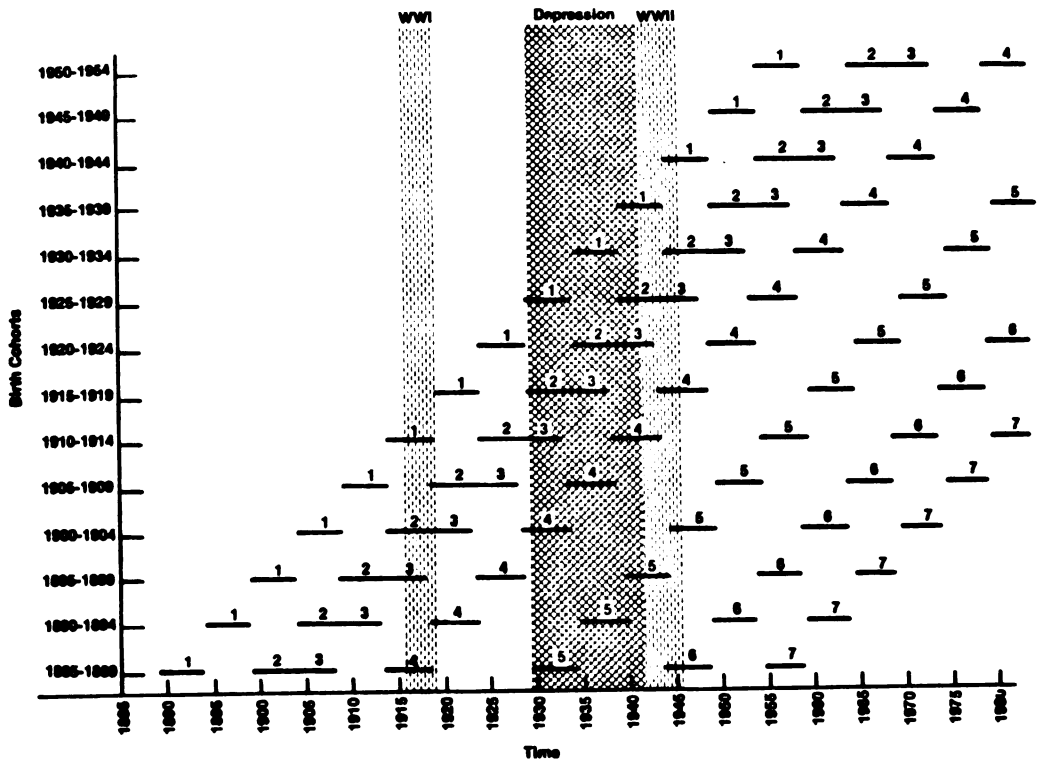
This section has focused on exploring recent developments in conceptual thinking concerning the impact of historical forces and events on life course direction. Macro- and micro-level historical factors were identified as separate components affecting individual growth and development in various periods. As work in the past 10 years by social historians and sociologists has illustrated, differences exist between current and past normative life time experience. How and why change has occurred are involved with historical change in a broad sense and historical events in a more restricted way.

Historical time and this research

In this study, the impact of specific historical events upon later behavioral response was the major research problem. To study this influence, three macro-level events in the relatively recent national history were considered

because they appeared to parallel a current problem facing Americans. Shortages of food and fuel in World Wars I and II and the general economic decline of the Great Depression each bore similarities to the current energy shortage problem being experienced by Americans. During each of the three past events, Americans were forced to modify behavior in order to adapt to living with fewer basic materials and resources. And to the extent that spot shortages and dramatically increased prices of energy were currently forcing similar behavioral adaptation, the four events were comparable. The three past events, therefore, became boundaries delimiting years of experience with deprivation and shortages, years of experience which were considered in this research as factors influencing current energy consumption and conservation behavior.

The influence of these three event boundaries is illustrated in Figure 3. In this representation, 5-year cohorts were shown aging or moving through the life course, as depicted by transitions through a hypothetical age stratification system. The figure also illustrated the cohorts moving through time and encountering the two World Wars and the Depression. The graphic presentation was particularly helpful in depicting differing levels of past experience with deprivation and shortages between the various age groups. It was this difference the research attempted to capture by determining its influence on current energy consumption and conservation behavior.



Legend: 1 Transition from Infancy and Early Childhood at Five
2 Transition from Childhood at Fourteen
3 Transition from Adolescence at Nineteen
4 Transition from Young Adulthood at Twenty-nine
5 Transition from Early Middle Age at Forty-five
6 Transition from Middle Age at Fifty-nine
7 Transition from Early Old Age at Seventy

Figure 1 —Five Year Birth Cohorts, by Stage in the Life Course, as They Experienced World War I, the Great Depression and World War II

Structured Research Models

From the conceptual framework advanced for this study, with its emphasis on dimensions of time as they influenced human behavior, two linearly structured models were developed to test the research questions. Each model suggested that for a given household, conservation and consumption of energy were functions of aging, while aging was further refined and viewed as a function of biological, psychological, social and historical processes. Of special importance was historical aging or temporal location with respect to shortages or limited access to resources, the thesis being that level of experience with these occurrences would influence current energy use behavior.

To the extent that psychological, social and biological aspects of the aging process were related to consumption and conservation of energy, they were also considered. In structuring the models, careful attention was directed toward controlling the influence of each of the three confounding processes in order to measure the effect of historical aging or past experience with deprivation and shortages on current energy consumption and conservation behavior.

Conceptual Research Models

The conceptual research models are stated below.

Model A

For any household, during a given period in time:

$$\text{Btu consumption} = f(\text{Age Level})$$

Or, more specifically,

Btu consumption = f(HISTAGE, BIOAGE, PSYAGE, SOCAGE) + e

where

Btu consumption	=	Level of consumption of total, direct annual Btu's per heating degree day
Age Level	=	The simultaneous influence of the various processes of aging
HISTAGE	=	Historical influences characterized by deprivation or shortages affecting the household
BIOAGE	=	Biological processes of aging inherent within the household
PSYAGE	=	Psychological processes of aging inherent within the household
SOCAGE	=	Socioeconomic processes of aging characterizing the household
e	=	Unexplained residual or variance, i.e., random error, in the consumption variable.

Model B

For any household, between two periods of time:

Btu conservation = f(Age Level)

Or, more specifically,

Btu conservation = f(HISTAGE, BIOAGE, PSYAGE, ΔPSYAGE, SOCAGE, ΔSOCAGE, BTUC1) + e

where

Btu conservation	=	Percentage change in level of consumption of total, direct annual Btu's per heating degree day between two periods in time
Age Level	=	The simultaneous influence of the various processes of aging and change in the processes between two points in time
HISTAGE	=	Historical influences characterized by deprivation or shortages affecting the household
BIOAGE	=	Biological processes of aging inherent within the household
PSYAGE	=	Psychological processes of aging inherent within the household
ΔPSYAGE	=	Change in psychological functioning between two points in time
SOCAGE	=	Socioeconomic processes of aging characterizing the household
ΔSOCAGE	=	Change in socioeconomic placement between two points in time
BTUC1	=	Level of Btu consumption before change occurred

e = Unexplained residual or variance, i.e., random error, in the conservation variable.

Specific Research Models

The various processes defining aging were operationalized and measured by specific variables. The actual research models, developed from the conceptual models stated above and used to test the research questions, are stated below.

Model A

$$\text{Btu consumption} = A + B_{1.1} X_{1.1} + B_{2.1} X_{2.1} + B_{3.1} X_{3.1} + B_{3.2} X_{3.2} + B_{3.3} X_{3.3} + B_{4.1} X_{4.1} + B_{4.2} X_{4.2} + B_{4.3} X_{4.3} + e$$

where

Btu consumption = Level of consumption of total, direct annual Btu's per heating degree day from July through June 1976 to 1977, including measurement of the total mix of energy sources utilized within the residence (e.g., natural gas, fuel oil, propane and electricity)

A = Constant value for all households

X_1 = Historical influences affecting aging

$X_{1.1}$ = Level of past experience with deprivation and shortages

X_2 = Biological processes of aging

$X_{2.1}$ = Winter heat setting over 68^{o}F due to health factors

X_3 = Psychological processes of aging

$X_{3.1}$ = Educational attainment

$X_{3.2}$ = Attitude regarding responsibility for helping to solve the energy crisis

$X_{3.3}$ = Belief that the energy situation is or will be a problem

X_4 = Social processes of aging

$X_{4.1}$ = Income level, 1977

$X_{4.2}$ = Number of rooms within the residence, 1978

$X_{4.3}$ = Number of occupants in the household, 1978

e = Unexplained residual or variance, i.e., random error, in the consumption variable.

Model B

$$\text{Btu conservation} = A + B_{1.1} X_{1.1} + B_{2.1} X_{2.1} + B_{3.1} X_{3.1} + B_{3.2} X_{3.2} + B_{3.3} X_{3.3} + B_{3.4} X_{3.4} + B_{3.5} + X_{3.5} + B_{4.1} X_{4.1} + B_{4.2} X_{4.2} + B_{4.3} X_{4.3} + B_{4.4} X_{4.4} + B_{4.5} X_{4.5} + B_{4.6} X_{4.6} + B_{5.1} X_{5.1} + B_{6.1} X_{6.1} + e$$

where

Btu conservation = Percentage change in level of consumption of total, direct annual Btu's per heating degree day between July through June 1976 to 1977 and July through June 1978 to 1979, including measurement of the total mix of energy sources utilized within the residence (e.g., natural gas, fuel oil, propane and electricity)

A = Constant value for all households

X_1 = Historical influences affecting aging

$X_{1.1}$ = Level of past experience with deprivation and shortages

X_2 = Biological processes of aging

$X_{2.1}$ = Winter heat setting over $68^{O}F$ due to health factors

X_3 = Psychological processes of aging

$X_{3.1}$ = Educational attainment

$X_{3.2}$ = Attitude regarding responsibility for helping to solve the energy crisis, 1978

$X_{3.3}$ = Change in attitude regarding responsibility for helping to solve the energy crisis, 1978 to 1979

$X_{3.4}$ = Belief that the energy situation is or will be a problem, 1978

$X_{3.5}$ = Change in judgment regarding belief in the energy situation being or becoming a problem, 1978 to 1979

X_4 = Social processes of aging

$X_{4.1}$ = Income level, 1978

$X_{4.2}$ = Change in income level, 1977 to 1978

$X_{4.3}$ = Number of rooms within the residence, 1978

$X_{4.4}$ = Change in number of rooms within the residence, 1978 to 1979

$X_{4.5}$ = Number of occupants in the household, 1978

$X_{4.6}$ = Change in the number of occupants within the household, 1978 to 1979

X_5 = Technical modifications

$X_{5.1}$ = Installation of a new furnace between 1978 and 1979

X_6 = Consumption behavior

$X_{6.1}$ = Level of energy consumption in 1976-77, measured in total, direct annual Btu's per heating degree day

e = Unexplained residual or variance, i.e., random error, in the conservation variable.

CHAPTER IV

METHODOLOGY

This study was designed to determine the influence of past experiences with macro-level crises characterized by shortages or deprivation of natural resources on current energy consumption and conservation behavior exhibited at the micro-level. More specifically, the research was designed to determine if households headed by individuals exposed to varying levels of natural resource shortage or deprivation in the past were currently exhibiting differing patterns of energy consumption and, in response to the energy crisis, change in consumption behavior.

Data collected in the evaluation phase of the Michigan Energy Administration pilot program, "Pilot Project Conserve," were used to answer the research questions. These data were collected in May 1978 and June 1979, with actual consumption data collected for the years 1976-77 through 1978-79. This study was designed following data collection and used a subsample from the larger study.

In this chapter, the following aspects of the research process are discussed: (1) sampling and data collection procedures, (2) selection of the research subsample,

(3) measurement procedures, including definitional and distributional characteristics of the major measures, (4) a statement of the research hypotheses, (5) identification of the major assumptions underlying the study, and (6) analysis procedures used to answer the research questions.

Sampling and Data Collection Procedures

The data analyzed for this research were collected as part of the evaluation phase of a study entitled "Pilot Project Conserve," designed to field test a computerized residential audit/energy conservation program. The purpose of the project was to provide information to households concerning technical and behavioral steps to accomplish conservation of thermal energy within the residence. Members of an interdisciplinary research team at the Institute of Family and Child Study at Michigan State University conducted the program, with funds provided by the Michigan Energy Administration and the Michigan Agricultural Experiment Station.

The initial phase of the project, including information dissemination, computer evaluation and feedback, was carried out within 15 counties in the lower mid-Michigan area during winter 1977 (see Figure 4). In May 1978, a telephone evaluation survey was conducted by Market Opinion Research Corporation, under subcontract to the research team at Michigan State. This interview was followed 14 months later, in June 1979, with a second telephone interview carried out

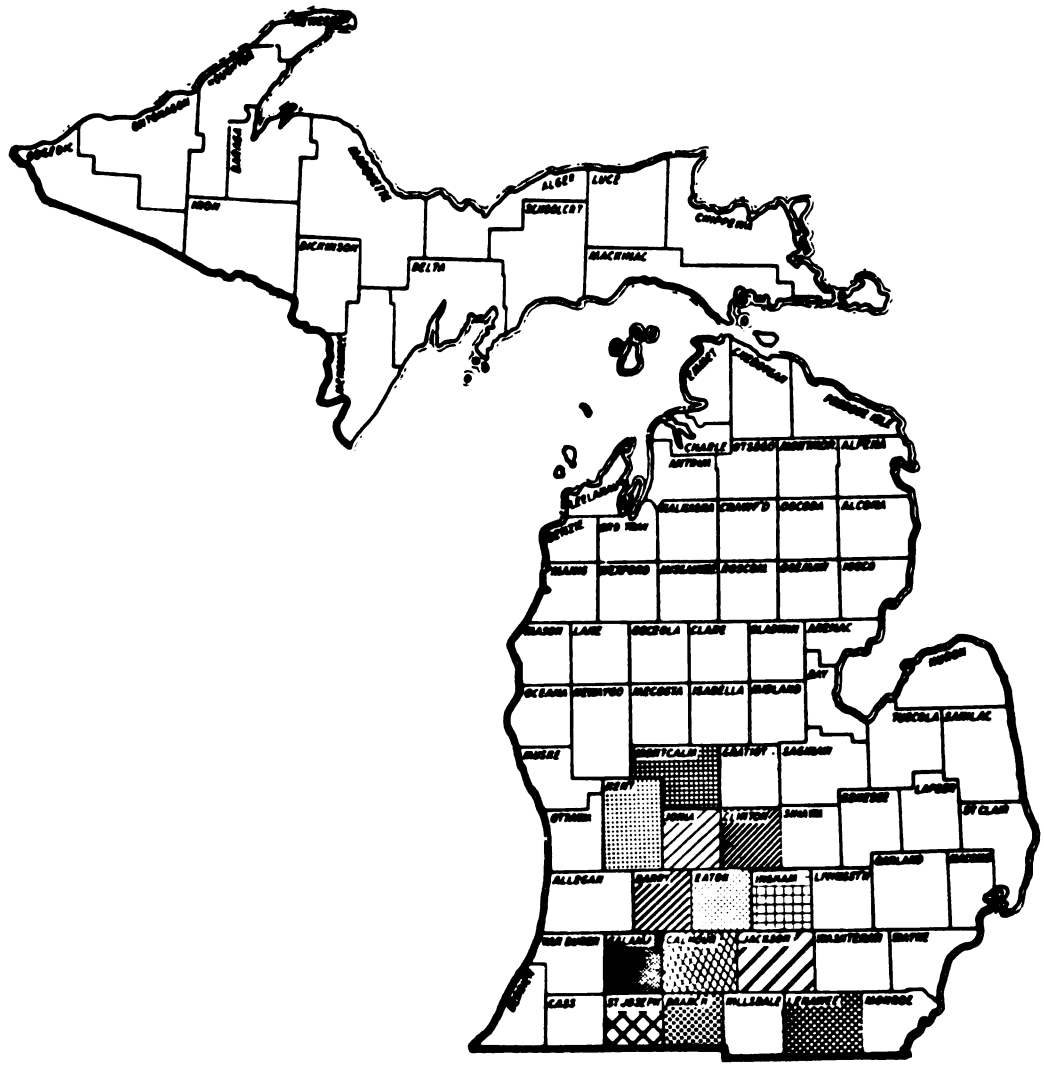


Figure 4 .—Identification of 15 Counties in the Mid-Michigan Area Targeted for the Computerized Residential Energy Audit Program, "Pilot Project Conserve," Winter 1977-78

under subcontract by Neal and Associates of Ann Arbor, Michigan. The purpose of the two telephone surveys was to determine structural and behavioral modifications affecting energy use between the two periods, as well as changes in knowledge and attitudes about energy in general and, more particularly, energy conservation. Information concerning changes in a selected set of sociodemographic characteristics was also collected.

For the first evaluation, in order to assure random selection of participating households, a stratified sample of the original 12,662 respondents to the pilot project was drawn. Households were first stratified according to initial contact method, which resulted in the following three groups: (1) a group contacted by direct mail, (2) a group contacted by direct and indirect voluntary distribution channels, and (3) a group contacted by the Michigan State University Cooperative Extension Service (CES). Within each of these three groups, cases were then drawn at random.

Three additional non-participating groups were also randomly drawn: two within the 15 county "Pilot Project Conserve" target area, and one outside the target area. The two groups from within the target area were drawn specifically for purposes of comparison with the three participating groups. The first group was selected because they had not responded after being directly contacted by mail with information concerning the availability of free household audits which had the potential to help them conserve thermal energy. The

second group was included because they had not been directly contacted by mail, yet were within the target area, and thus within mass media and voluntary distribution range. Finally, for control purposes, a third group from outside the target area was selected.

The sample of evaluation respondents, including both participating and non-participating groups, totaled 1,100. Two hundred households represented five of the six groups, while households contacted by CES were represented by 100 respondents. Because the number of participants was more limited within this last subgroup, fewer respondents were included in the evaluation surveys.

After the first interview, all survey respondents were asked to sign release forms permitting collection of energy consumption data from utility companies (natural gas and electrical) and fuel oil and propane dealers servicing the household. Approximately 60% agreed, and data, including the total mix of sources to each household, were collected for a 3 year period. They covered the heating years, July to June, from 1976-77 through 1978-79.[1]

The Research Subsample

The specific purpose of this research was to determine the influence of past experiences defined by shortages and

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[1]See Zuiches et al. (1978) and Harris et al. (1980a), for a more complete discussion of "Pilot Project Conserve," including dissemination methods used and sample selection, survey and energy data collection methods utilized to evaluate the impact of the program.

deprivation on current energy consumption and conservation patterns. This objective guided selection of the research subsample from the larger "Pilot Project Conserve" sample.

The first decision concerned selection of cases from each of the six groups used to evaluate the effectiveness of the project. Because age was not a factor in selecting evaluation respondents in the original research design, it seemed reasonable to assume: (1) that age level of households was distributed randomly across each of the six groups and (2) that this random distribution erased any bias in consumption or conservation patterns resulting from participation in the project. In other words, age level of household was assumed independent of treatment (i.e., program participation) and, consequently, capable of being analyzed across each of the groups in order to determine general age-level behavioral trends.

In addition, it should be pointed out that analysis of the general behavior of each of the six groups was conducted. These results indicated that behavior across the groups was unidirectional (i.e., each group was behaving in a similar manner during the time period studied). Differences between groups were apparent only with respect to magnitude of behavioral change (findings for five of the groups, sans the CES group, are reported in Harris et al., 1980a, 1980b, 1980c). This finding gave additional support to the assumption that analysis of the groups in toto would better capture age-graded behavioral trends.

Three major criteria also guided decision making regarding selection of cases from the larger sample. The first criterion concerned the availability of data on the total mix of energy sources utilized within the household (i.e., electrical alone or in combination with natural gas, fuel oil or propane). Because the analysis focused on energy consumption and change in consumption over time as the dependent variables of interest, it was necessary that valid, precise data on actual consumption patterns be studied for the 1976-77 and 1978-79 heating years.

As indicated previously, approximately 40% of the total sample refused to sign the consent form allowing release of their energy consumption data. Information thus was not available on these cases and they were eliminated. For cases with consumption data, it was available for the full 3 year period, from 1976-77 through 1978-79, in most instances. There were two exceptions, however. Measures were missing intermittently in some cases, and it was necessary to interpolate consumption for these periods, based upon conservative estimation procedures (see Harris et al., 1980a, pp. 3-1 to 3-4, for a fuller explanation of the consumption data collection, coding and estimation procedures used). These cases, along with cases having complete energy consumption data, were considered for analysis.

The second exception concerned missing electrical consumption data. If data were not available, cases were analyzed individually to determine the fuel source servicing

high usage systems within the home, such as heating, cooling and major appliances (stove, oven, water heater or clothes dryer). If electricity was the source, the case was eliminated, as missing information on energy supplying these systems would have biased results. On the other hand, if electricity serviced only small use systems within the household, such as lighting, and data were available on the fuel source supplying the comfort systems and major appliances (e.g., natural gas, fuel oil or propane), the case was included in the analysis.

The second criterion concerned ability to determine the level of household exposure to past events characterized by deprivation and shortages. Because precise information was not available regarding energy-use decision making within households, the assumption was made that the principal or oldest income earner would exert major control due to power influences or experiential level. Thus, this person was identified and his or her age was used to stratify the household into a grade measuring past experience with deprivation and shortages.

In some cases, however, the survey respondent indicated ignorance of the identity and age of the household's oldest or primary income earner. In these instances, household composition and age levels of household members were examined. The following rules guided the selection process: (1) if there were married adults living within the household, but no other adults over the age of 18, or (2) if no married

adults and no other adults over the age of 18 were present within the household, the age of the respondent was identified and used to stratify the household. Thus cases were eliminated if adults over 18, other than married adults, were present within the household. The presence of these additional individuals capable of supplying income, involved too many adults for adequate judgment concerning the identity of the primary or oldest earner. Finally, a few respondents simply refused to supply information regarding age. In these instances, the case was simply eliminated.

The final criterion considered was completeness of data on the various measures defining psychological, biological and social aging processes. These measures acted as independent variables in the analysis and were considered in order to control their effect so the influence of past experience on present day energy use could be analyzed. Valid and complete information was therefore necessary on each measure. Attrition between interviews accounted for the loss of 93 cases. In other instances, cases had incomplete data on one or both comparison interviews due to "don't know" or "refusal" responses. If either situation was encountered, cases were eliminated.

With each of the criteria considered, sample size was reduced to 435 cases from a possible 1100 cases. The majority of cases were eliminated because consumption data were not available. From the total sample, 45.2% were excluded because measures on total consumption data were missing.

Elimination due to incomplete data on the age and control variables reduced sample size by an additional 28%.

To determine if this attrition rate resulted in sample bias, distributions and means on consumption data and demographic and dwelling unit characteristics were compared between the total sample and the two subsamples (i.e., the consumption subsample and the further reduced research subsample). In no instances did differences exceed 10%. It was, therefore, concluded that the research subsample adequately represented both the consumption subsample and the total sample (for comparisons, see Appendix A, Tables A-1 through A-12).

Comparisons were then made between selected characteristics describing the research sample and the general Michigan population in order to determine representativeness of the sample. This step was somewhat superfluous as this research was an exploratory effort, not designed for purposes of extrapolating the findings to the general population. The comparisons revealed interesting results, however, as reported in Tables 2 through 6.

Sixty-five percent of the sample households had incomes in the range over $15,000, while in the Michigan population, 44% had equivalent incomes. On the other hand, 56% of the general populations' incomes were below $15,000, while 35% of the sample fell within this lower income range. The sample thus over-represented high income levels.

Table 2.--Income Distribution: Comparison of Michigan Households, 1976, and Research Sample, 1978[a]

Income Class	Michigan Households (In Thousands)		Research Sample	
	%	N	%	N
Under $5,000	15.9	(478)	6.0	(26)
$5,000-$9,999	18.8	(570)	13.6	(59)
$10,000-$14,999	21.1	(640)	15.4	(67)
$15,000-$19,999	17.5	(530)	22.3	(97)
$20,000-$24,999	12.0	(365)	19.3	(84)
Over $25,000	14.7	(445)	23.4	(102)
Total	100.0	(3,029)[b]	(100.0)	(435)

Source: David I. Verway, ed., Michigan Statistical Abstract, 14th ed. (East Lansing, Mi: Graduate School of Business Administration, Michigan State University, 1979), p. 347.

[a]Income data for the state pertain to 1975; for the sample to 1977.

[b]Note: column does not equal this total (see Verway, 1979, p. 347).

Table 3.--Age Characteristics: Comparison of Age of Household Heads in Michigan, 1976, and Age of Principal or Oldest Income Earner in the Research Sample, 1978[a]

Age	Michigan Population (in Thousands)		Research Sample	
	%	N	%	N
Less than 25	8.1	(246)	2.5	(11)
25 thru 34	21.6	(655)	21.4	(93)
35 thru 44	18.0	(545)	24.8	(108)
45 thru 54	19.3	(584)	19.1	(83)
55 thru 64	15.9	(481)	16.8	(73)
65 thru 74	10.4	(315)	11.5	(50)
75 and over	6.6	(200)	3.9	(17)
Total	100.0	(3,029)[b]	100.0	(435)

Source: U.S. Department of Commerce, Bureau of the Census, Current Population Reports, Series P-20, No. 334, "Demographic, Social and Economic Profile of States: Spring, 1976" (Washington D.C.: Government Printing Office, 1979), p. 25.

[a]Percentages have been rounded in some instances.

[b]Note: column does not equal this total (see Department of Commerce, 1979, p. 25).

Table 4.--Educational Attainment: Comparison of Michigan Population, 1976, and Research Sample, 1978[a,b]

Educational Attainment	Michigan Population (in Thousands)		Research Sample	
	%	N	%	N
Four years of high school or less	72.2	(3,569)	51.3	(223)
Some college[c]	27.8	(1,376)	48.7	(212)
Total	100.0	(4,945)	100.0	(435)

Source: David I. Verway, ed., Michigan Statistical Abstract, 14th ed. (East Lansing, Mi.: Graduate School of Business Administration, Michigan State University, 1979), p. 156.

[a]Percentages have been rounded in some instances.

[b]Figures are not strictly comparable as the Michigan data include educational attainment of men and women 25 and older (combined in this table), while the research sample includes educational attainment of primary or oldest income earners over 23.

[c]"Some college" designation includes those who have completed college and those with graduate school experience.

Table 5.--Form of Tenure: Comparison of Michigan Households, 1976, and Research Sample, 1978

Form of Tenure	Michigan (in Thousands)		Research Sample	
	%	N	%	N
Owner occupied	74.7	(2,264)	97.7	(425)
Renter occupied	2.4	(716)	2.3	(10)
Total	----	(3,029)[a]	100.0	(435)

Source: David I. Verway, ed., Michigan Statistical Abstract, 14th ed. (East Lansing, Mi.: Graduate School of Business Administration, Michigan State University, 1979), p. 81.

[a]Note: column does not equal this total; source indicates figures are the only current estimates available (see Verway, 1979, p. 81).

Table 6.--Number of Rooms in Dwelling Unit: Comparison of Michigan Households, 1970, and Research Sample, 1978[a]

Number of Rooms	Michigan		Research Sample	
	%	N	%	N
1 room	1.2	(30,619)	---	(0)
2 to 5 rooms	54.9	(1,457,328)	34.0	(148)
6 or 7 rooms	34.4	(911,867)	46.4	(202)
8 or more	9.5	(253,245)	19.5	(85)
Total	100.0	(2,653,059)	100.0	(435)

Source: David I. Verway, ed., Michigan Statistical Abstract, 14th ed. (East Lansing, Mi.: Graduate School of Business Administration, Michigan State University, 1979), p. 81.

[a]Percentages have been rounded in some instances.

Concerning age, the sample adequately represented the 25-34, 45-54, 55-64 and 65-74 age levels. It under-represented the youngest and the oldest age groups, however, while it over-represented the 35-44 age group.

Sample members were high educational attainers in comparison to the general Michigan population. Nearly 50% of the households in the sample were represented by primary or oldest income earners with educations including some advanced form of college training. In the general population, however, approximately 28% of Michigan men and women had attained educational levels this high.

With respect to housing characteristics, the sample was highly representative of homeowners living in larger dwelling units (on a per room basis). Ninety-eight percent of the sample households owned their homes, for example, while in the state as a whole, approximately 75% owned their dwelling units. The majority of Michigan households lived in dwellings consisting of one through five rooms, with 44% living in six or more rooms. Sample households, on the other hand, lived in larger quarters, with 66% having homes with six or more rooms.

In general, the sample was representative of a population of homeowners with accompanying high levels of income and educational attainment. Larger dwelling units were also characteristic. Finally, age was relatively evenly distributed within the sample, with higher representation from

the middle-aged groups, and under-representation of very young (under 25) and older (over 75) households.

The nature of the "Pilot Project Conserve" evaluation study, as it was designed, could account for the distributional differences between the state-wide population and the sample characteristics. In the project, energy conservation information was aimed at homeowners, in particular. And home ownership is often associated with higher levels of income and higher educational attainment. The greater number of rooms within the dwelling units of the sampled households was probably a result of the high rate of home ownership as well. Rental units, often located in multifamily units rather than single family dwellings, are usually smaller in size. Thus it seemed probable that larger dwelling units would be characteristic of a research sample representing homeowners.

Measurement Procedures

Because the purpose of this study was determination of the effect of exposure to historical events characterized by deprivation and shortages on current energy consumption and conservation behavior, chronological age of the household head was used as the measure marking experience level. As suggested in the introduction, consideration of age presented analytical problems, because a number of characteristics related to aspects of the aging process were believed related to energy use as well. Thus it was necessary to

consider the effects of these confounding variables as past esperience was studied. In the remainder of this section, methods used to operationalize and measure influences of the aging process are presented as are methods used to determine level of experience with deprivation and shortages as well as energy consumption and conservation levels.

Independent Variables

Experience with deprivation and shortages

As indicated previously, households were considered for analysis based upon a measure of the chronological age of the principal or the oldest income earner (see pp. 80-81, for a discussion of decision rules used to determine age levels). The distribution of these ages ranged from 23-87 (continuous through 80, with one case at 83 and a second at 87). In order to stratify households for analysis, a comparison was made between the age distribution in its continuous form and a continuous measure of years marked by rationing of goods or general deprivation in the past.

The following procedures were used. First, year of birth was determined for each of the principal or oldest income earners using 1977 as the base year.[2] Second, the span of time marking World Wars I and II and the Great Depression were determined and calculated in terms of

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[2]Age was determined in the first interview conducted in May 1978.

years.[3] Years marked by deprivation and shortages were thus determined to range from 0-19. Finally, the range of past years was matched with year of birth plus 5 years. In other words, 5 years of age served as the match criterion, because it was assumed that direct experience with shortages and deprivation would create more significant and lasting impressions than indirect experience filtered through the views of parents or significant others. Thus a cohort born in 1940 and 5 years of age in 1945 was matched with the first year of shortages or the last year of World War II. At the other extreme, a cohort 5 years of age in 1916 when the United States entered World War I (birth date in 1911) was matched with 19 years of experience and classified as having received the full impact of each event (see Appendix B, Table B-1, for a comparison of year of birth, years of exposure to shortages and deprivation and age level in 1977).

With matching completed, years of experience measured in four-year blocks were used to stratify the sample into categorical levels (see Table 7, p. 92). This resulted in

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[3]If the initial impact of an event occurred within the first 6 months of a year (i.e., World War I), influence from the event was assumed for the entire year. On the other hand, if initial impact occurred within the final 6 months of a year (i.e., the Depression) that year was not considered. In each instance, the event lasted into the second half of its concluding year; thus, those final years were considered. The dates and years of impact included: World War II, December 1941 to late 1945, equaled years 1 through 4; the Depression of the 1930s, October 1929 to late 1941, equaled years 5 through 16; World War I, April 1916 to November 1918, equaled years 17 through 19.

Table 7.--Age Stratification System: Year of Birth, Age in 1977, Years of Experience with Shortages and/or Deprivation and Sample Size

Years of Birth	Age in 1977	Years of Experience with Shortages and Deprivation[a]	Sample Size
1941 thru 1954	23 thru 36	0	140
1937 thru 1940	37 thru 40	1 thru 4	44
1933 thru 1936	41 thru 44	5 thru 8	28
1918 thru 1932	45 thru 59	9 thru 12	115
1914 thru 1917	60 thru 63	13 thru 16	36
1890 thru 1913	64 thru 87	17 thru 19	72

[a]Based upon impact measured at 5 years of age.

six groups, while the mid-point of each experience level was used for analysis.

Biological, psychological and social aspects of aging[4]

The variables discussed in this section are operationalized measures of various aspects of the aging process. They were selected for analysis because previous research has indicated their potential influence on levels of energy consumption. Thus, it was necessary to control for their possible confounding effects as past experience was studied.

Health influences. Within this study, health was viewed as a function of thermo-regulatory processes. It was

[4]Tables describing the cross-distributional characteristics of the age/experiential level stratification system

hypothesized that households composed of older individuals would need higher heating levels as physiological mechanisms regulating body temperature would be less effective in these age groups (Unseld, 1978; Wicks, 1978). In the 1979 interview, households maintaining winter thermostat settings at levels higher than 68^{o}F were asked if they did so for health reasons. Response was analyzed in dummy variable form, with households not asked the question and households answering no to the question coded as 0; households answering yes were coded as 1.

Educational influences. Level of formal educational attainment was viewed as a dimension of psychological functioning, measuring awareness and knowledge of the wider world in general, and relationships between the energy situation and current events such as inflation. It was hypothesized that younger groups, being more highly educated because of life course placement, would consume less energy due to a broader understanding of the issue, while older, less highly educated individuals would be higher consumers. For purposes of analysis, education was measured as a categorical variable. The sample was stratified into five levels: (1) less than high school completed, (2) high school completed, (3) some college, (4) college completed, and (5) education beyond the undergraduate level.

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and the variables used to measure biological, psychological and social aging are found in Appendix C, Tables C-1 to C-7.

Attitude and belief influences. These variables were used to measure psychological attributes of the sample households in relation to attitudes concerning personal responsibility for helping to solve the energy problem and belief that the "energy situation" actually was a problem or would be in the near or distant future. Scales, in a Likert type format, developed by a research team at the Institute for Family and Child Study at Michigan State University, were used to measure the attributes.[5]

Individual items used to create the belief scale were measured with three response categories, while items contributing to the attitude scale contained five categorical responses. All items were coded so high response values reflected pro-conservation attitudes or high belief levels. To obtain a single score, categorical answers were summed and divided by the number of items comprising the scale. Measures assumed a continuous form after this procedure and were used in this manner for analysis. Changes in attitude and belief between 1978 and 1979 were obtained by subtracting the 1978 scores from the 1979 scores.

Income factors. Level of income was perceived as a measure of lifestyle or the way a household chooses to live, as reflected by their resources, behaviors, practices, possessions and values (Gladhart, 1977b; Gladhart & Roosa, 1978;

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[5]A discussion of the development and reliability of the attitude scale was found in Gladhart et al., 1977; for its use and a second reliability test, see Knutson, 1979.

Edelstein, 1979). It was hypothesized that lifestyle differences would be apparent between the age levels, with middle-aged groups being able to lead more energy "extravagant" lifestyles than either the very young or the very old groups.

Income was measured as a categorical variable, with six levels defining the distribution in 1978. The categorical spread was $5,000, so the measures ranged from below $5,000 to over $25,000. In 1979, seven levels were used to determine income, while each level still maintained a $5,000 spread. In this second year, income measures thus varied from below $5,000 to over $30,000. To measure change in income level between the two periods, income level in 1978 was subtracted from income in 1979.

Household size and number of rooms. Two variables included in the study measured stage in the family life cycle (i.e., the changing compositional and size patterns a family undergoes over time (Zimmerman, n.d.; Duvall, 1977)). Each variable was believed highly related to both age level and energy use in much the same manner as income. It was hypothesized that households of middle-aged groups would be larger, necessitating larger dwelling units, while households of younger and older age groups would be smaller and dwelling unit size reflective of this.

Both household size and number of rooms were measured as continuous variables. Household size in 1978 ranged from 1 to 10 members, while number of rooms ranged from 2 to 16.

Change in both variables between the 2 survey years was determined by subtracting the 1978 measure from the 1979 measure.

Technical modifications

Installation of a new furnace. Fuel used to supply the heating system represents a major component of the energy consumed within a household. Keith (1977) found that installation of a new furnace appeared to be a strong predictor of lower energy consumption due to the increased heating efficiency resulting from this addition. Thus it seemed safe to assume that installation of a new furnace would be a significant factor in accounting for change in consumption between two periods. To determine if this was so, installation of a new furnace was included in the analysis of change in behavior in order to control its effect.

Dependent Variables

Household energy consumption

Household energy consumption levels were determined by measuring the total, direct amount of energy used within the dwelling unit in the heating years 1976-77 and 1978-79. To determine consumption, measures for each source used within the household (i.e., electrical only, or electrical and natural gas, fuel oil or propane) were converted to the standardized measuring unit, British Thermal Units (Btu's), in

order to ease computation and comparison. The following conversion factors were used:

Electrical: 1 kilowatt hour = 3,412.8 Btu's

Natural Gas: 1 cubic foot = 1,031 Btu's

Fuel Oil: 1 gallon = 138,800 Btu's

Propane: 1 pound = 21,000 Btu's
(Harris et al., 1980a)

Once sources were converted, total, annual consumption was computed by summing Btu's across the various household sources. This procedure resulted in a precise estimate of the total amount of direct energy consumed per household for each of the years (see pp. 79-80, for decision rules concerning consumption data).

Weather-adjusted energy consumption. As weather conditions have varied from year to year, annual energy consumption has varied directly, making attempts to determine household level change in energy use more difficult. Comparison of total annual consumption between years, for example, has captured not only behavioral change, but environmentally induced change as well. To achieve a more reliable comparison measure, total annual energy consumption levels were standardized to reflect changes in weather conditions between years.

Because Michigan winters are relatively severe, requiring heavy heating loads, the number of annual heating degree days[7]

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[7]Heating degree days were defined as the number of degrees the daily average temperature fell below 65°F. They

in 1976-77 and 1978-79 were used to standardize total consumption levels for the 2 years. Total consumption was simply divided by the number of degree days. The resulting variable, in its continuous form, was used for analysis (see Appendix A, Tables A-9 and A-10, for the distributional characteristics).

As pointed out in the last chapter, overall levels of energy consumption and conservation were hypothesized to be a function of the age level of the household head, in general. Before moving into analysis to determine the effects of the various factors related to aging, it was helpful to clarify the zero-order relationship between consumption and age. To accomplish this, a breakdown by age strata was done on mean levels of Btu's consumed per heating degree day in both 1976-77 and 1978-79.

The results are illustrated in Figure 5, indicating that a curvilinear relationship existed. Younger age groups appeared on the average, to consume less energy than middle-aged groups, with increase culminating in the 41-44 age group in 1976-77 and in the 37-40 age group in 1978-79. A sharp decline then ensued in each year, indicating a substantially lower level of energy was consumed (in comparison to the other age groups), by the older groups ranging in age

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were determined by subtracting the average daily temperature below 65^{o}F from the base temperature 65. Degree days per year were then summed to achieve an annual measure (Newman & Day, 1975, p. 252).

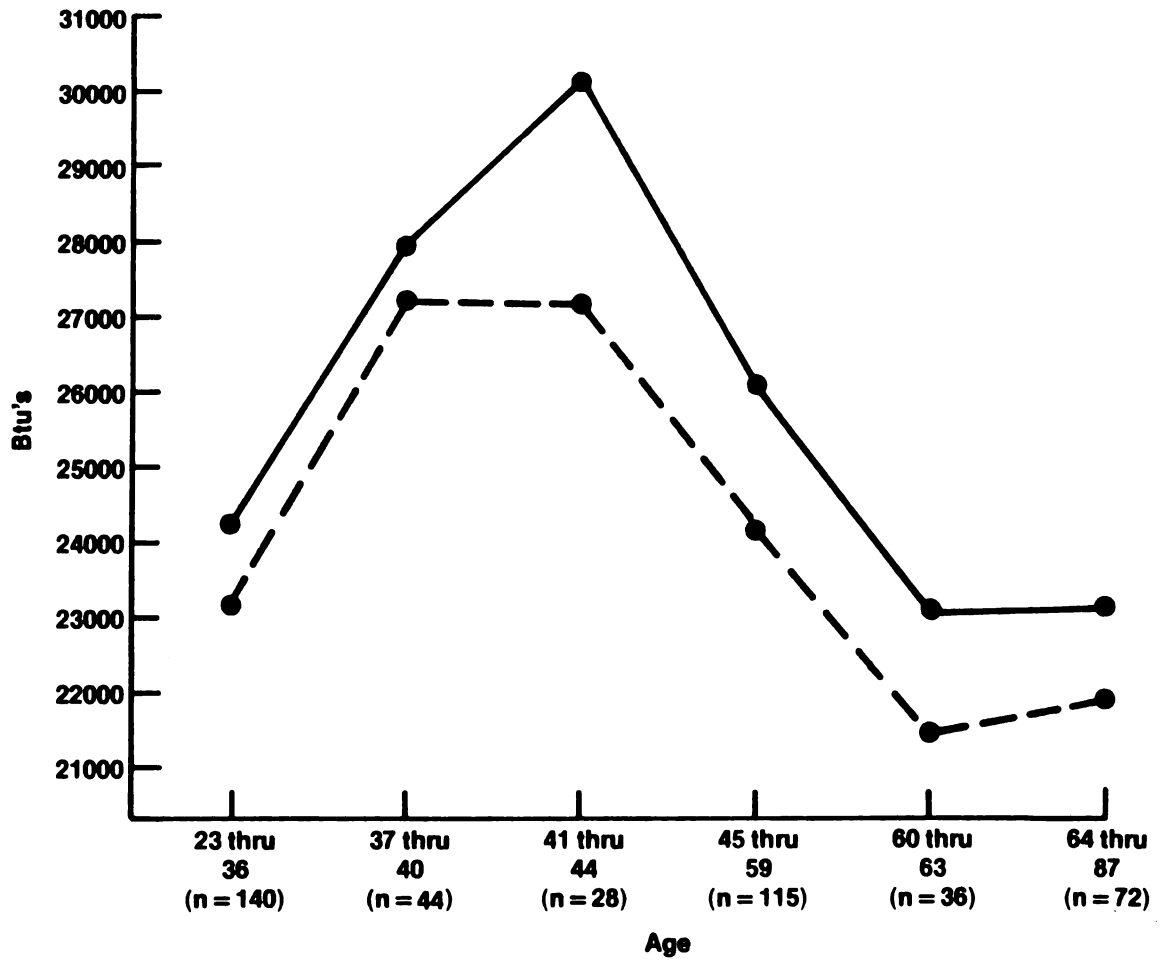

Figure 5.--Comparison of Mean Total Btu's Consumed per Heating Degree Day, 1976-77 to 1978-79, by Age Group

from 60-87. What was especially interesting to note in both years was the small, but apparent, increase in consumption between the younger and older "old" groups (those 60-63, in comparison to those 64-87).

To visualize the process involved more clearly, a second breakdown was done, this time to determine mean level of consumption at each age level. The results are shown in Figure 6. Although reliability was questioned due to small sample size in some age levels, the general pattern indicated that a more complex process seemed involved. In general, it appeared that the relationship was strongly linked to the family life cycle. Younger age levels in both years appeared to consume less energy, with consumption levels increasing across the years until approximately 45. A rather sharp drop was then evident. These patterns were assumed to result from increases in household size, dwelling unit size and income, which described the expanding stage of the family life cycle, while the sharp drop was believed related to the contraction stage. Interestingly, in both years the pattern did begin an upward thrust once again as aging occurred across the later stages of life. It was assumed that this pattern was related to decreases in physiological functioning and increased reliance on non-human energy. Alternatively, it could have been related to behavior patterns reflecting past experience with periods of shortage and deprivation.

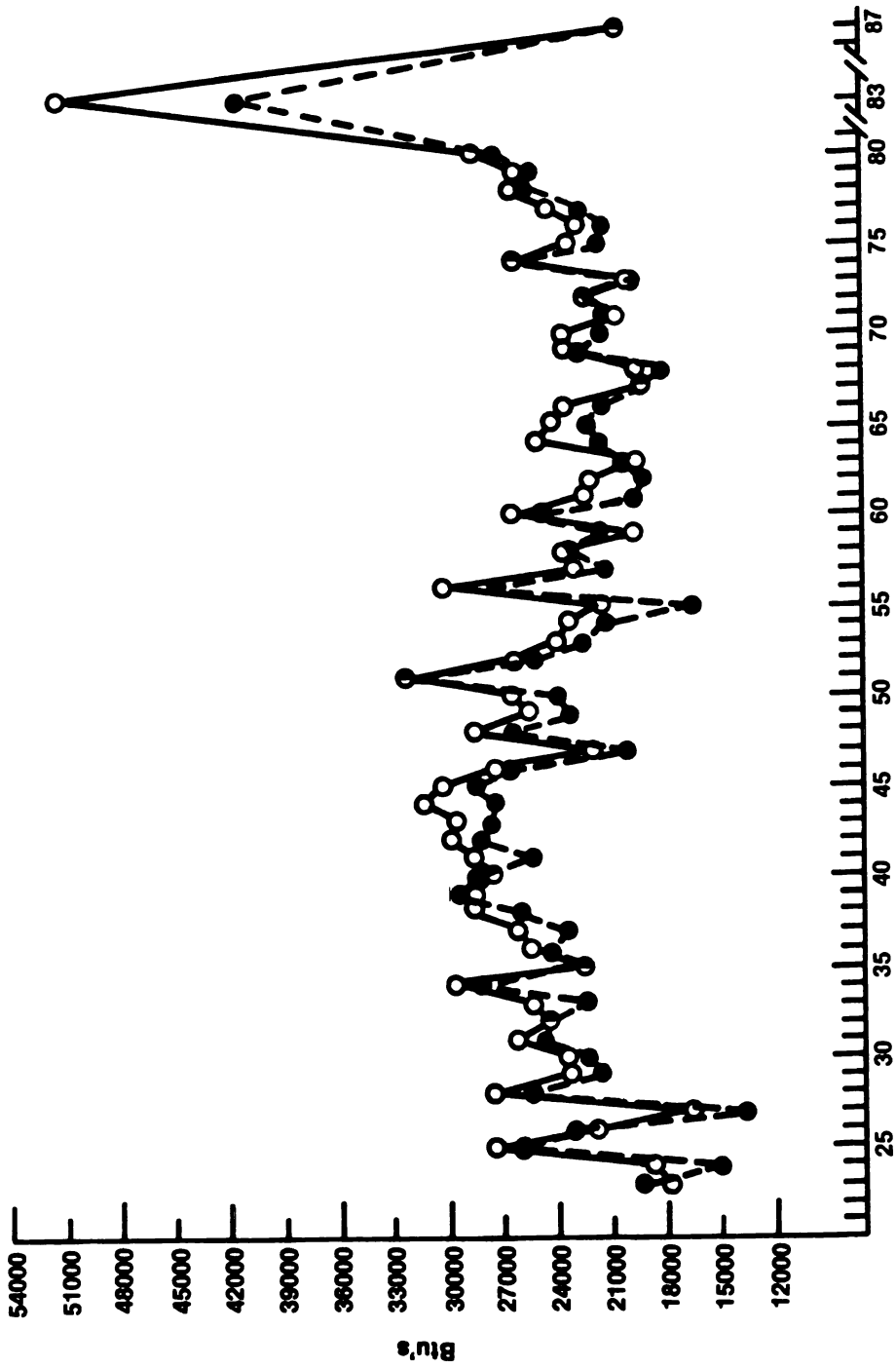

Figure 6.--Comparison of Mean Total Btu's Consumed per Heating Degree Day, 1976-77 to 1978-79, by Age

Total change in annual consumption levels

To derive a figure representative of change in consumption between 1976-77 and 1978-79, total Btu's consumed per heating degree day in the first year were subtracted from 1978-79 totals. Change in consumption resulted in the saving of 1,400 Btu's per heating degree day on the average, with values ranging from a savings of 20,000 Btu's per heating degree day to an increase of 14,000 Btu's (see Appendix A, Table A-11, for the distributional characteristics).

Percentage change in annual consumption levels. The distributional ranges established for consumption per heating degree day indicated that variation between households was extreme (see Appendix A, Tables A-9 and A-10). In 1976-77, for example, consumption levels ranged from 3,400 Btu's per heating degree day to 61,300 Btu's, indicating that households consuming high levels could be using up to 18 times as many Btu's per heating degree day as low-use households.

In order to take this factor into consideration, percentage differences in Btu's consumed per heating degree day between the 2 years were calculated. This figure, derived by dividing total change in Btu's consumed per heating degree day by the original level of consumption per heating day in 1976-77, thus captured the amount of energy conserved in relation to the amount consumed. Values ranged from a decrease of 65% to an increase of 72%; the mean percentage level was much less extreme, however, averaging -4.9%

(see Appendix A, Table A-12, for the distributional characteristics).

The zero-order pattern of age strata in relation to percentage change in consumption between 1976-77 and 1978-79 is illustrated in Figure 7. The relationship appeared basically curvilinear; the middle-aged groups, especially those from 41-44, were conserving proportionately more energy, with the young elderly group (60-63) conserving proportionately high levels as well. The elderly (64-87) and the two youngest groups (23-40) were conserving less.

Study of the age level pattern in Figure 8 revealed the same basic relatonship, although the extremes in variability were more evident. In general, middle-aged groups, from approximately 40-60, appeared to be conserving somewhat more energy proportionately than age groups at either extreme. The relationship could be explained by both ability and desire to conserve, with all age groups perhaps feeling pressured into conservation due to increasing energy costs. Younger age levels, with more flexibility in budgets due to limited family-related responsibilities, could feel the pressure less intensely, however. At the other end of the age spectrum, the elderly, while feeling pressured to conserve by monetary constraints, could be less able to conserve due to health factors or less willing due to historical influences. Middle-aged groups, on the other hand, with the expense of larger households and the related costs of

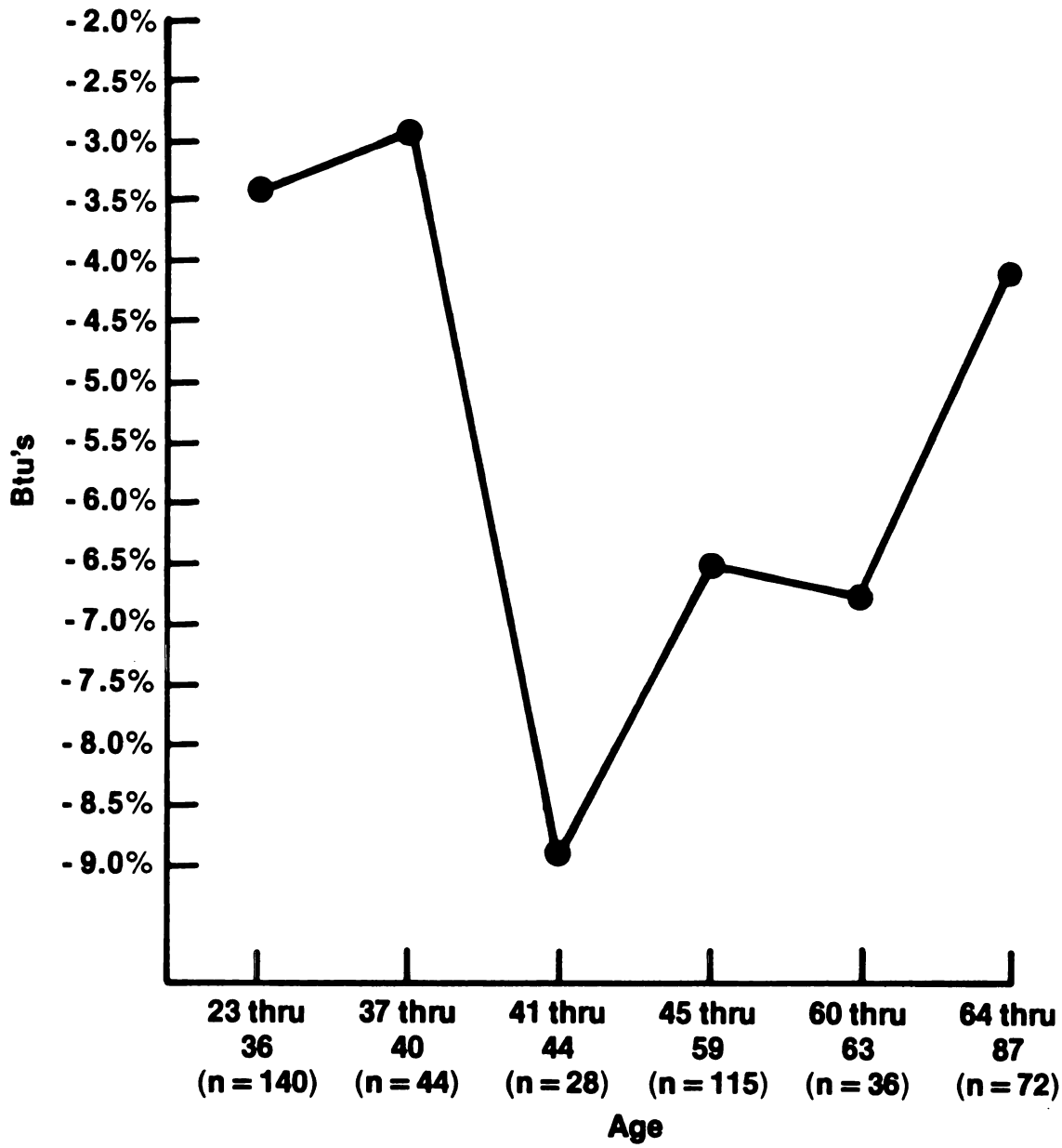

Figure 7.--Mean Percentage Change in Btu's Consumed per Heating Degree Day, 1976-77 to 1978-79, by Age Group

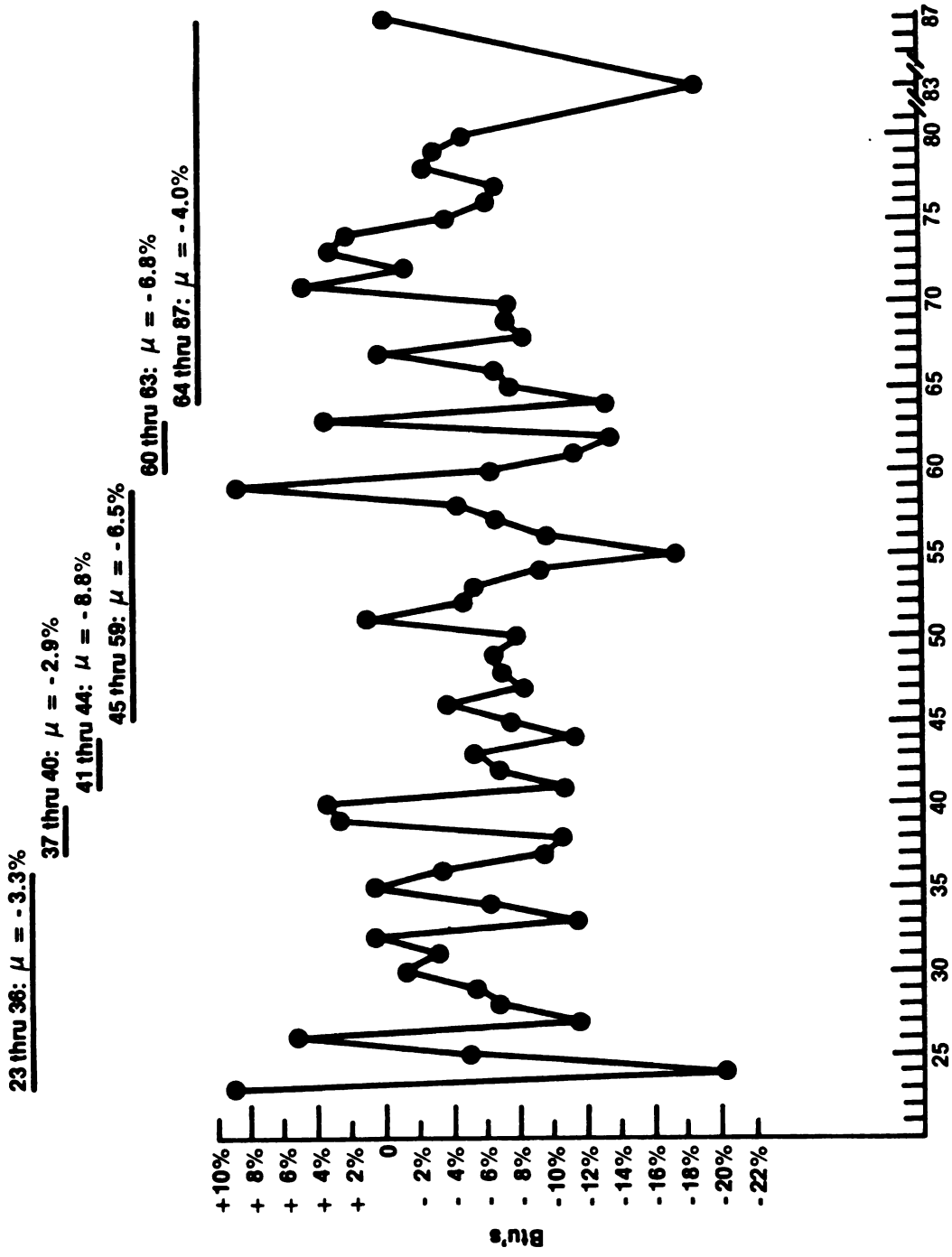

Figure 8.--Mean Percentage Change in Btu's Consumed per Heating Degree Day, 1976-77 to 1978-79, by Age

supporting teen-age and college-age children, could be more pressured to conserve energy dollars.

Research Hypotheses

To test the research questions posed for this study in the introductory statement, two hypotheses were developed. The research questions are repeated below, and the hypotheses, stated in the null form, follow.

Question 1. Did exposure to shortages and deprivation in the past influence current energy consumption behavior?

Question 2. Did exposure to shortages and deprivation in the past influence change in energy consumption behavior over time and, most particularly, reduced consumption (i.e., conservation) behavior, given the urgency placed upon conservation at the local and national levels?

Hypothesis One

Years of past experience with deprivation and shortages has no linear effect on energy consumption level during 1976-77, when controlling for the effects of the following variables:

1. Health status
2. Educational attainment
3. Attitude regarding responsibility for helping to solve the energy crisis
4. Belief that the energy situation is or will be a problem
5. Income level
6. Household size
7. Dwelling unit size, measured in number of rooms

Hypothesis Two

Years of past experience with deprivation and shortages has no linear effect on percentage change in energy consumption (i.e., conservation) between the heating years July through June 1976-77 and 1978-79, when controlling for the effects of the following variables:

1. Health status
2. Educational attainment
3. Attitude regarding responsibility for helping to solve the energy crisis
4. Change in attitude regarding responsibility for helping to solve the energy crisis, 1978 to 1979
5. Belief that the energy situation is or will be a problem
6. Change in belief regarding the energy situation being or becoming a problem, 1978 to 1979
7. Income level
8. Change in income level, 1977 to 1978[8]
9. Household size
10. Change in household size, 1978 to 1979
11. Dwelling unit size, measured in number of rooms
12. Change in dwelling unit size, measured in number of rooms, 1978 to 1979
13. Installation of a new furnace
14. Energy consumption level in 1976-77

Assumptions

Four assumptions underlay this research effort:

1. The primary focus was consideration of the impact of past experience with deprivation and shortages on household energy use. To determine experience levels, it was appropriate to use the age of the principal or oldest income earner (i.e., household head), as this individual's decision making power would allow exertion of subtle pressure to insure conformity to his/her desires.

2. Categorizing primary income earners on experience with events in the past characterized by physical or material

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[8]Data were collected in 1978 and 1979 and reflected income levels in the previous year.

resource shortages or inability to obtain resources due to contextual constraints was appropriate for exploratory research concerning the effects of past experience on current behavior.

3. Survey research methods were appropriate for gathering sociodemographic measures of household characteristics and objective measures of technical and behavioral changes undertaken to conserve energy.

4. For purposes of determining energy consumption and conservation behavior, data gathered from utility, propane and fuel oil companies, indicating actual energy use patterns, were the most precise and reliable measures available.

Analysis

Both research hypotheses were analyzed using regression procedures because the focus of the research was determination of the effect of one variable while controlling the influence of an array of interrelated variables believed correlated with the criterion variable.[9] For each hypothesis, in order to determine if intercorrelation was present and thus masking the influence of the major predictor variable, simple bivariate regression coefficients were determined

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[9]Multicollinearity (i.e., high levels of intercorrelation, in the range of .8 to 1.0) was apparent between some of the variables, such as the 1978 and 1979 measures of household size and number of rooms in the dwelling unit, as well as measures of consumption in each of the years. These variables were not used simultaneously in regression equations, however, and thus did not cause estimation problems (see Nie et al., 1975, pp. 340-341).

between each independent variable and the dependent variable under study. The dependent variables were then regressed simultaneously on the mix of independent variables. The multiple regression procedures answered the research questions, indicating the direction and extent to which the major independent variable seemed to influence consumption and conservation behavior when the influence of the confounding variables was removed.

In the following chapter, where findings are discussed, the results of both the simple bivariate and the multiple regression analyses have been presented. Although not standard procedure, it seemed appropriate in this situation because of the particular focus of the study and the emphasis placed upon confounding factors masking the effect of the primary independent variable under consideration.

CHAPTER V

FINDINGS AND DISCUSSION

Findings related to the two research questions guiding this study are reported in this chapter. They are discussed in two sections: Consumption of Energy and Conservation of Energy.

Consumption of Energy

The first objective of this research was determination of the net effects of an array of variables measuring aspects of the aging process on energy consumption levels. The ultimate purpose, however, was to control or hold the effect of each variable constant in order to determine the magnitude, direction and statistical significance of the variable measuring level of experience with deprivation and shortages during the life course.

Because the relationships between the independent variables were believed intercorrelated and thus capable of confounding past experience, multiple regression procedures were deemed the most appropriate and powerful statistical tool available for analysis. The following assumptions underlying the statistical significance tests associated

with multiple regression were considered: (1) the sample being random, (2) each array of the dependent variable for a given combination of the independent variables following a normal distribution, with the error terms being randomly distributed about the composite independent measure, (3) the relationship between the independent and dependent variables being linear, and (4) the dependent variable displaying homogeneity of variance for each array of the independent variables, with the error terms being independent and having a mean of zero at each level (Nie et al., 1975; Kerlinger & Pedhazur, 1973; Blalock, 1979).

As pointed out in the previous chapter, within each of the "Pilot Project Conserve" participating and non-participating groups, sample members were drawn at random, thus making the total sample and the research subsample random. The second assumption regarding the distributional characteristics of the dependent variable can be violated without serious consequences, especially if sample size is large, as it was within this study (Nie et al., 1973, p. 341).

The final two assumptions concerning linearity of the relationship between the independent and dependent variables and homogeneity of variance across the independent variables were explored by a scattergram plotting the residuals against the consumption variable. The relationship was distinctly linear. In addition, no patterns with respect to the error terms seemed evident, indicating that the final assumption

concerning homogeneity of variance around the array of independent variables had not been violated.

The hypothesis tested to determine the influence of aspects of the aging process on energy consumption is stated below in the null form.

Hypothesis One

Years of past experience with deprivation and shortages has no linear effect on energy consumption level during 1976-77, when controlling for the effects of the following variables:

1. Health status
2. Educational attainment
3. Attitude regarding responsibility for helping to solve the energy crisis
4. Belief that the energy situation is or will be a problem
5. Income level
6. Household size
7. Dwelling unit size, measured in number of rooms

The alternate hypothesis, or the one of interest, was that level of experience with deprivation and shortages in the past would have a statistically significant effect, net of the influence of the additional variables. Because this was an exploratory study, no directional estimates were hypothesized.

Bivariate Regression Analysis

To assess the general impact of the predictor variables, the criterion variable of total, direct energy consumed within the household per heating degree day in 1976-77 was regressed separately on each. By using bivariate regression procedures in this manner, estimation of the zero-order

influence of the variables could be determined and thus provide a base line for comparative appraisal when the multivariate regression was done.

The results of the bivariate analysis are shown in Table 8. At the zero-order level, stage in the family life cycle and lifestyle factors (i.e., social processes of aging) appeared to be the major influences determining level of consumption. Number of rooms, number of occupants and income level were the first, second and third strongest predictors, each was statistically significant ($p < .000$, $< .000$, and .000 respectively), and each was related to consumption in a positive way. Interestingly, however, in terms of magnitude of influence, unit changes in income level produced much smaller incremental increases in consumption, while house size and household size were more dramatic. Consideration of the standardized regression coefficients somewhat reduced these differences, however, as standard deviation unit changes in household size and income both produced nearly the same level of change in consumption (.29 and .21 respectively).

Next in order of importance were psychological aspects of aging, with educational attainment and belief in the energy problem both appearing to influence consumption levels to a significant degree (significant at $p < .05$). The most interesting aspect regarding their impact, however, was the directional effect. Both were positive, indicating that the higher the level of education and awareness and the greater the belief in the reality of the problem, the higher was

Table 8.--Simple Bivariate Regression Analysis of Total, Direct Btu's Consumed per Heating Degree Day, 1976-77, on Independent Variables: Unstandardized Regression Coefficients, Standard Errors, Standardized Regression Coefficients, F-Ratios and Probability of Sampling Error

Independent Variables	Btu's Consumed per Heating Degree Day, 1976-77				
	Unstandardized Regression Coefficient	Standard Error	Standardized Regression Coefficient	F	Probability of Sampling Error
Number of rooms	2309.02	196.46	.492	138.130	<.000
Number of occupants	1505.25	240.72	.288	39.102	<.000
Income level	.20	.04	.213	20.666	.000
Educational attainment	453.94	144.75	.149	9.835	.002
Belief in the energy problem	1336.52	634.39	.101	4.438	.036
Past experience-deprivation and shortages	-82.71	56.83	-.070	2.118	.146
Health factors	-916.17	962.39	-.046	.906	.342
Attitude towards energy conservation	-322.90	660.16	-.023	.239	.625

df regression: 1 df residual: 433

consumption. These findings were opposite to intuitive expectations regarding their influence and suggested a "get mine now while it lasts" feeling on the part of households. Some strength for this interpretation was given in that attitude regarding responsibility for helping to solve the problem (the final psychological measure) was the weakest predictor of consumption level, coming in last as an insignificant predictor, even though it was related to consumption in the expected negative direction. Finally, cognizance must be taken of the fact that both educational attainment and belief could have been highly related to income level, which, to the extent that it influenced higher consumption, could have "washed out" the expected effect of these two variables. Pearson product moment correlations between income and belief and education were .09 and .41 respectively, which somewhat supported this argument with regard to educational attainment. It did little to explain the belief finding, however.

The two final aspects of aging, level of past experience with deprivation and shortages and biological functioning, both appeared poor predictors of consumption ($p = .146$ and .342 respectively). In addition, even though statistically insignificant, both appeared to have a negative effect on consumption level, indicating that as experience increased, consumption was apparently depressed (i.e., past experience with shortages limited profligate use of energy resources). The negative direction of the health factor was somewhat more problematic, as intuition would have seemed to indicate

that if health was poor, energy would have been consumed in higher quantities to compensate. The influence of income, however, could have intervened, thus moderating use of energy. Two factors related to income level came to mind. To the extent that income was needed to maintain health, less was available for energy consumption. In addition, if lower income households, in general, appeared to have health problems, the budgetary squeeze could have influenced the amount spent for energy. Indeed, this appeared to be the case, as the relationship between health and income was negative, although quite low ($r = -.22$).

Multiple Regression Analysis

Results of the multivariate analysis depicting the interactive influence of the variables are found in Table 9, indicating that some rather significant shifts in the ordering of influences as well as in the direction and magnitude of the variables' influences had occurred.

The two measures of social aging related to stage in the family life cycle identified as major influences on consumption level in the bivariate analysis retained their first and second order rankings. Number of rooms and household size, thus, both continued to appear as major contributors to consumption level. In addition, their influence remained positive, although their effect had been somewhat lessened (Beta = .443 and .229 respectively in comparison to .492 and .288 in the bivariate analysis). The effect of

Table 9.--Multiple Regression Analysis of Total, Direct Btu's Consumed per Heating Degree Day, 1976-77, on Independent Variables: Unstandardized Regression Coefficients, Standard Errors, Standardized Regression Coefficients, F-Ratios and Probability of Sampling Error[a]

Independent Variables	Btu's Consumed per Heating Degree Day, 1976-77				
	Unstandardized Regression Coefficient	Standard Error	Standardized Regression Coefficient	F	Probability of Sampling Error
Number of rooms	2081.68	204.75	.443	103.367	.000
Number of occupants	1199.58	250.62	.229	22.909	.000
Past experience-deprivation and shortages	135.49	58.14	.114	5.431	.020
Attitude towards energy conservation	-1245.64	598.21	-.091	4.336	.038
Belief in the energy problem	655.12	585.53	.050	1.290	.257
Income level	.04	.05	.044	.856	.355
Health factors	-514.67	852.26	-.026	.365	.546
Educational attainment	81.58	148.23	.027	.303	.582
Overall F				22.594	.000
Multiple R: .546			df regression: 8		
R Square: .298			df residual: 426		

[a]Standard forward regression method was employed to test the interactive character of the independent variables.

income level, on the other hand, appeared to have been diminished. The variable shifted from third to sixth place, and its Beta weight was reduced to .044 from .213 in bivariate regression form. The statistical significance of income was lowered as well, thus indicating that probability was low regarding its ability to predict consumption level ($p = .355$).[1]

Concerning psychological aspects of aging, the effects of the various measures were transposed. Educational attainment and belief in the problem both became insignificant predictors of consumption level ($p = .582$ and .257 respectively), while retaining their positive directional influences. Attitude regarding conservation, on the other hand, was elevated to fourth place and appeared, in its negative directional orientation, to have a significant influence on consumption ($p = .038$), indicating that households identified as feeling greater responsibility for solving the energy crisis seemed to be consuming less energy.

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[1]The effect was not as dramatic in the analysis conducted on consumption in 1978-79 (see Appendix D, Table 2). Although the magnitude of the income effect was reduced (Beta = .117 versus .264 in the bivariate analysis), income level retained third rank in the ordering of variable influence. In addition, it still appeared as a significant predictor of consumption ($p = .022$). Part of the difference in rank ordering of the variables between the 1976-77 and 1978-79 multiple regression runs could possibly be explained by changes in the level of income measurement between the two interviews used to collect data. In the 1978 interview, for example, six income categories were employed, while in the 1979 interview seven categories were used. The range in 1979 thus captured more variability in income, and the wider spread could account for the differences.

Biological aspects of aging still appeared as insignificant predictors of consumption. Any effect from the health factor, in fact, was reduced further in the interactive analysis (Beta = -.026, p = .546; versus Beta = -.046, p = .342 in bivariate analysis), indicating other factors were apparently more meaningful predictors of consumption.

Finally, rather important shifts took place with regard to level of experience with shortages and deprivation in the past. In the multivariate analysis its effect was heightened, as past experience did appear as a statistically significant predictor of consumption level (p = .020). Thus, the multiple regression analysis supported rejection of the null hypothesis and acceptance of the alternate hypothesis that net of influences relating to dimensions of the aging process, level of experience with deprivation and shortages appeared to affect current consumption behavior in a positive direction. Thus it seemed that the greater the level of exposure to deprivation and shortages in the past the greater the propensity to consume energy.

Discussion

The findings of this hypothesis suggested that with regard to temporal dimensions, two mutually interactive influences were important considerations in determining levels of energy consumption. The first influence concerned social aspects of aging, while the second pertained to exogenous factors influencing the life-span development of

household members and, in turn, contributing to consumption behavior.

The magnitude of the relationships between dwelling unit size, household size and energy consumption were indications that changes in size and composition of the household over time (i.e., the family life cycle) appeared to play a role in consumption behavior.[2] Beyond this influence, however, the findings suggested that consumption behavior was influenced by the locational juxtaposition of the household head with respect to the historical events taking place during his or her life-span. In essence the findings implied that factors associated with perceptions and memories of events in the past when access to resources was blocked or basic resources were in short supply tended to influence current behavior.

Conservation of Energy

The second objective of this research was similar to the first, and thus procedures were conducted in exactly the same manner.[3] In the second instance, however, the focus

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[2]Note that in the analysis concerning energy consumption in 1978-79, income, the third factor defining social processes of aging, was found related to consumption as well.

[3]The four assumptions underlying regression analysis discussed on pp. 110-112 with respect to the first hypothesis tested were also considered for this hypothesis. The first assumption concerning random selection of the sample was met, as pointed out previously, because the sample was drawn at random. A scattergram plotting residuals from the multiple regression analysis against the conservation variable indicated that assumptions 3 and 4 had been met. The

changed in order to determine the effect of past experience on change in energy consumption levels (i.e., energy conservation) while controlling the effects of the aging process as well as any effects of changes in the processes that had occurred between the two measurement periods.

The hypothesis tested to determine the influence of various dimensions of aging on conservation of energy is stated below in the null form.

Hypothesis Two

Years of past experience with deprivation and shortages has no linear effect on percentage change in energy consumption (i.e., conservation) between the heating years July through June 1976-77 and 1978-79, when controlling for the effects of the following variables:

1. Health status
2. Educational attainment
3. Attitude regarding responsibility for helping to solve the energy crisis
4. Change in attitude regarding responsibility for helping to solve the energy crisis, 1978 to 1979
5. Belief that the energy situation is or will be a problem
6. Change in belief regarding the energy situation being or becoming a problem, 1978 to 1979
7. Income level
8. Change in income level, 1977 to 1978[4]
9. Household size
10. Change in household size, 1978 to 1979

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relationship was distinctly linear and no patterns were evident in the error terms (i.e., they were randomly scattered about the regression line). Finally, sample size was large enough that concern was not warranted regarding assumption 2 and the distributional characteristics of the error term about the sets of combined independent variables (i.e., the multivariate independent variable values).

[4]Data were collected in 1978 and 1979 and reflected income levels in 1977 and 1978 respectively.

11. Dwelling unit size, measured in number of rooms
12. Change in dwelling unit size, measured in number of rooms, 1978 to 1979
13. Installation of a new furnace
14. Energy consumption level in 1976-77

The alternate hypothesis was that level of experience with deprivation and shortages in the past would have a statistically significant effect, net of the influence of the other variables. Because the study was exploratory in nature, no directional estimates were hypothesized.

Bivariate Regression Analysis

To determine the general influence of the predictor variables, the dependent variable of percentage change in direct energy consumed within the household per heating degree day between 1976-77 and 1978-79 was regressed separately on each. The results, shown in Table 10, suggested that no distinct patterns were apparent with regard to the relationships between conservation and social, psychological, biological or historical aspects of aging.

Only two variables had coefficients statistically different from zero at the .05 level or less. The most influential predictor was consumption level in 1976-77, which had a negative relationship with percentage change in consumption (Beta = -.202, p = .000). This finding was expectable due to the statistical phenomenon of regression to the mean; yet, it was also interesting because it suggested that those consuming higher levels in 1976-77 were conserving greater amounts in 1977-78 and 1978-79. Likewise, change in

Table 10.--Simple Bivariate Regression Analysis of Percentage Change in Btu's Consumed per Heating Degree Day, 1976-77 to 1978-79, on Independent Variables: Unstandardized Regression Coefficients, Standard Errors, Standardized Regression Coefficients, F-Ratios and Probability of Sampling Error

Independent Variables	Percentage Change in Btu's Consumed per Heating Degree Day, 1976-77 to 1978-79				
	Unstandardized Regression Coefficient	Standard Error	Standardized Regression Coefficient	F	Probability of Sampling Error
Consumption level, 1976-77	-.337E-05	.786E-06	-.202	18.356	.000
Change in perception concerning belief in the energy problem, 1978 to 1979	-.022	.011	-.095	3.933	.048
Change in number of occupants, 1978 to 1979	.015	.009	.077	2.559	.110
Number of occupants, 1978	-.007	.004	-.076	2.542	.112
Attitude towards energy conservation, 1978	.017	.011	.076	2.509	.114
Past experience-deprivation and shortages	-.001	.001	-.061	1.604	.206
Health factors	.017	.016	.050	1.106	.294
Income level, 1978[a]	-.614E-06	.683E-06	-.043	.810	.369
Change in number of rooms in dwelling unit, 1978 to 1979	-.010	.012	-.041	.713	.399
Belief in the energy problem, 1978	.009	.011	.038	.640	.424
Change in attitude concerning energy conservation, 1978 to 1979	-.008	.010	-.038	.632	.427
Number of rooms in the dwelling unit, 1978	-.003	.004	-.034	.487	.486
Installation of new furnace between 1978 and 1979	-.014	.024	-.029	.357	.551
Change in income level, 1977 to 1978	-.465E-06	.127E-05	-.018	.134	.715
Educational attainment	.472E-03	.245E-02	.009	.037	.847
df regression: 1			df residual: 433		

[a]Impact of income level in 1977 was measured as well; results showed no significant differences (B = -.59E-06; Beta = -.037, F = .607, p = .436).

perception regarding belief in the energy problem had a negative relationship with change in consumption (Beta = -.095, p = .048), indicating that as belief level increased between the 2 years, energy conservation resulted.

No other variables had relationships that could be considered influential, with the exception of three that were close to the .10 level of significance. They included social aspects of aging related to household size and change in household size and a psychological measure concerning attitude towards responsibility for helping to solve the energy crisis. At the zero-order level of analysis, past experience with deprivation and shortages had a significance level of over .20, indicating no apparent relationship to change in conservation behavior.

Multiple Regression Analysis

Results of the multivariate analysis revealing the interactive influence of the variables are shown in Table 11. The findings indicated that original consumption level and change in perception concerning belief in the energy problem retained their first and second rank orders in predicting change in consumption level. Both, in fact, were strengthened with the effects of the other variables held constant (Beta = -.217 and -.125 respectively versus -.202 and -.095 in the bivariate analysis).

Third in rank order contributing to change in consumption was past experience with deprivation and shortages

Table 11.--Multiple Regression Analysis of Percentage Change in Btu's Consumed per Heating Degree Day, 1976-77 to 1978-79, on Independent Variables: Unstandardized Regression Coefficients, Standard Errors, Standardized Regression Coefficients, F-Ratios and Probability of Sampling Error[a]

Independent Variables	Percentage Change in Btu's Consumed per Heating Degree Day, 1976-77 to 1978-79				
	Unstandardized Regression Coefficient	Standard Error	Standardized Regression Coefficient	F	Probability of Sampling Error
Consumption level, 1976-77	-.363E-05	.954E-06	-.217	14.458	.000
Change in perception concerning belief in the energy problem, 1978 to 1979	-.029	.014	-.125	4.162	.042
Past experience-deprivation and shortages	-.002	.001	-.114	3.690	.055
Number of rooms in the dwelling unit, 1978	.005	.004	.067	1.407	.236
Change in number of occupants, 1978 to 1979	.010	.010	.052	.986	.321
Attitude toward energy conservation, 1978	.013	.014	.056	.817	.366
Number of occupants, 1978	-.005	.005	-.054	.766	.382
Health factors	.011	.017	.032	.416	.519
Belief in the energy problem, 1978	-.009	.015	-.040	.352	.553
Installation of new furnace between 1978 and 1979	-.014	.024	-.028	.342	.559
Change in income level, 1977 to 1978	.737E-06	.141E-05	.028	.273	.601
Income level, 1978	-.363E-06	.908E-06	-.025	.159	.690
Change in number of rooms in dwelling unit, 1978 to 1979	-.003	.012	-.014	.082	.775
Educational attainment	-.115E-03	.003	-.002	.002	.969
Change in attitude concerning energy conservation, 1978 to 1979	-.251E-03	.012	-.001	.429E-03	.983
Overall F				2.258	.005
Multiple R: .273 R Square: .075			df regression: 15 df residual: 419		

[a]Standard forward regression method was employed to test the interactive character of the independent variables.

(Beta = -.114, p = .055). Thus in the second multivariate analysis, the effect of level of past experience was again heightened by controlling the effects of factors related to the aging process. This finding led to rejection of the null hypothesis and acceptance of the alternate hypothesis that when controlling the influence of age-related confounding variables, level of experience with deprivation and shortages in the past seemed to influence change in consumption levels in a negative direction. Thus it appeared that the greater the level of exposure to deprivation and shortages in the past, the greater the propensity to conserve energy.

Discussion

In general, it appeared that households at most age levels were conserving energy (see Appendix A, Tables A-11 and A-12), and that underlying this behavior could have been psychological factors motivating increased concern for energy depletion as time has passed, and thus conservation of energy. The relationship between high consumption and conservation led to an additional consideration: that increased prices of energy could have motivated high energy users especially to conserve. Likewise the impact of higher prices could have influenced the various age levels to conserve due to the strain increased energy costs have placed on family incomes, which must be stretched to cover the various expenses households encounter across the family life cycle. For younger families, the expenses involved in rearing and

launching children would be prime examples. While in old age, the pressure of making fixed, limited incomes cover costly energy expenses could have forced conservation.

In addition, however, the findings suggested factors beyond simple family life cycle considerations. It appeared that households with heads having more experience with difficult times in the past were conserving a larger proportion of their initial consumption level than households headed by individuals with lesser experience. Two influences could have accounted for this behavior; the first, a psychological affect, while the second, a practical consideration. Older people, having experienced national crises and knowing the impact of shortages and deprivation, could have willingly been conserving energy with the hope that early individual sacrifice would prevent a larger, more dramatic and forced confrontation with future shortages. On the other hand, the explanation could be that, given increased costs of energy, older individuals were conserving more simply because they knew how, having experienced or witnessed general or forced conservation efforts in the past. Younger individuals, on the other hand, lacking this backlog of skills, may not have been as aware of ways to implement conservation and thus conserved less proportionately.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Overview

Since the Arab Oil Embargo of 1973-74, sporadic shortages of energy have affected some Americans, while the dramatically increased price of energy has affected all. As a consequence of these two factors, this research has viewed the current energy situation facing the nation as a social problem (Schwartz, 1978; Schwartz & Schwartz-Barcott, 1974; Smelser, 1979; Morrison, D., 1977; Newman & Day, 1974; Unseld, 1978). And to the extent that social problems are often accompanied by social change, this research has attempted to determine in what direction and to what degree micro-level change in energy use patterns may be indicative of broader, more extensive change at the societal level. More specifically, it has attempted to determine to what degree micro-level conservation of energy may be indicative of a shift in American attitudes away from profligate consumption of natural resources towards more restrained use.

In order to focus more directly on this process, the research investigated longitudinal patterns of energy use at the household level. Patterns of energy consumption and

conservation evidenced by households stratified by the age of the principal or oldest income earner were studied, in particular.

Temporal Orientation

Selection of the age variable seemed intuitively logical, the reasoning being that age, if viewed as a marker defining a distinct set of life experiences, would necessarily influence current behavior, thus influencing adaptational patterns and change in energy use.

From a macro-level perspective, age-related behavioral change in energy use seemed especially important with respect to the future. Which age levels were conserving energy, for example, and how much? And were these patterns a function of aging-specific or historical experience influences? And if historical experience affected current energy conservation, what were the social implications of additional shortages or still more costly energy in the future when cohorts with differing historical experiences would be forced to deal with these problems?

Older cohorts' lives have included experiences with resource shortages or with resources being highly priced in relation to disposable income and thus ability to obtain them. Their lives have included training, in other words, in how to deal with situations such as shortages of energy, just as they have included experience with hardship and the suffering resource shortages could bring. Younger cohorts,

on the other hand, have not had this experience, in essence, having been prepared for a life of abundance. Did this make a difference? And if so, how?

In effect, in terms of the future and social problems occurring in the future from heightened price levels in relation to declining supplies of fossil fuel sources, focusing on age seemed appropriate in order to determine micro-level change. For if age levels have differed in their adjustments to the energy crisis, social conflict between generations could occur, just as it has seemed to be occurring with respect to inflation (Quinn, 1980).

Study of household level change in energy use patterns from a historical experience perspective posed analytical problems. In order to examine past experience, cohort groups studied within this research were stratified by varying levels of exposure to shortages of resources and inability to obtain resources in the distant past; age level of the cohort acted as the operationalized stratification variable. This resulted in interactional problems because age level defined not only levels of past experience, but energy dependence of the cohorts due to factors related to processes of aging.

To overcome these problems, it was necessary to study each of the various aspects of aging believed related to energy use, along with past experience, which was hypothesized to be accounting for a substantial proportion of current energy use behavior. This was accomplished by study

of the aging process within a temporal framework, which allowed consideration of the dynamic and constant change occurring as aging progresses over and within time. Specifically, three temporal dimensions of aging defined the framework: (1) life time, (2) social time, and (3) historical time.

More personal aspects of aging were viewed as life time changes, and the processes of change were identified as psychological and biological aging. In turn, psychological aging or life-span growth and development was viewed as occurring within time, while biological aging was perceived as taking place over time. Thus, in terms of psychological aging, stress was placed upon the importance of context and interaction between the aging individual and the physical and social environment encountered within the individual's life time. The influence that this interaction had on current behavioral response was the special consideration.

Specifically, the psychological impact of aging through three recent events in American history was studied. World Wars I and II were considered because during both of these periods Americans were forced to limit consumption of food and fuels, as these resources were rationed by the federal government. The third event considered was the Great Depression, which was phenomenologically distinct from the other two, yet related. During the Depression, people were not faced with macro-level shortages of material resources as much as they were simply faced with inability to purchase goods and resources due to lowered consuming power. Massive

unemployment, affecting approximately 25% of the work force, and drastic wage and working hour cuts reduced purchasing power by at least 60% in the early years of the Depression. Suffering and hardship obviously resulted.

In this research, aging through the World War I, the Depression and World War II experiences were viewed as highly intense situations, capable of creating strong psychological impressions and influencing behavior throughout the life time. Thus experiences with these events were perceived as temporal antecedents, affecting behavioral adaptation in response to the current problems of energy shortages and increased energy prices.

Biological aging was viewed as a process of gradual deterioration taking place over the life course, but manifest most apparently in the later years. This factor was considered because, as physiological functioning declines with age, people could be forced to rely more intensely on environmental support to help them maintain health and independence. Fossil fuel energy, thus, could be an important life-sustaining factor in the lives of older individuals.

Along with biological aspects of aging, social aging was perceived as occurring over time. Special attention was focused on temporal dimensions of moving through age-related stages, changing social roles and responsibilities as transitions between life stages occurred. Of special concern were micro-level turning points related to family

life or the process of expansion and contraction occurring over the family life cycle. Even social roles outside the family orbit were viewed in relation to dimensions of household change over time. Income level, for example, was perceived as an index reflecting family lifestyle changes over time as income increased and decreased with the aging of income earners.

Historical time or the process of aging through twentieth century American history provided the general framework for the study. To the extent that age levels varied with respect to past experience with historical events characterized by deprivation or shortages, response to the energy crises occurring since 1973-74 was expected to differ. The study attempted to determine how and to what degree.

Need for Age-Energy Use Research

A review of the age-energy literature revealed that numerous studies had been conducted attempting to ascertain whether relationships existed between age and energy consumption and conservation (Farhar et al., 1979). The majority of these research efforts focused on the age variable as a general determinant, however, neglecting to consider the various processes of aging which could have accounted for energy use patterns. This study attempted to overcome those deficiencies by decomposing the aging variable and considering its component parts in relation to actual energy consumption and conservation patterns.

Analytical Procedures

Multiple regression procedures were employed to determine the strength and magnitude of the relationships between age and energy consumption and conservation. Two structured linear models were developed depicting energy use behavior and change in behavior over time as functions of aging. These models were then further developed to illustrate the linkages between energy consumption and conservation patterns and the various processes of aging defined as psychological, biological, social and historical aging. This final operationalized model was used to test the hypotheses. The two specific questions addressed concerned the net influence of historical aging on current energy consumption and conservation patterns.

Conclusions

Results of the first multiple regression analysis revealed that historical aging was positively related to energy consumption (Beta = .114, p = .02). Additional aging-related factors identified as influencing consumption level included: (1) size of dwelling unit in rooms (Beta = .443, p = .000), household size (Beta = .229, p = .000)[1] and attitude concerning responsibility for helping to solve the

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[1]In the analysis of consumption in 1976-77, income level was not identified as a significant predictor of energy consumption (Beta = .04, p = .36). However, in the analysis of consumption in 1978-79, income level was a significant predictor (Beta = .12, p = .02).

energy problem (Beta = -.091, p = .038). The amount of variance in consumption accounted for by the overall, age-related linear model was 30% (R^2 = .298).

These findings seemed to indicate that two temporal dimensions related to aging could be influencing energy consumption patterns. The first concerned family life cycle changes occurring over the life-span, with indications that as the family expanded during the early stages of development, energy consumption increased, while it decreased as the family contracted in the later stages of development. The second temporal dimension affecting consumption appeared to be related to the influence of external, contextual forces from the past. The findings suggested that households headed by individuals having higher levels of past experience with deprivation and shortages were currently consuming more energy than equivalent households headed by individuals with less experience. The implication seemed to be that if life course patterns of household heads included resource deprivation or exposure to resource deprivation in the past, energy consumption was somewhat more extravagant in the present.

The findings of the second multiple regression analysis, testing the influence of aging related factors on change in energy consumption patterns (i.e., percentage change in consumption between 1976-77 and 1978-79), revealed that level of past experience with deprivation and shortages was a statistically significant predictor of proportional change

in energy use behavior. The relationship, in this instance, was negative (Beta = -.114, p = .055). The majority of other factors related to aging did not appear to influence change in consumption levels (all probability levels were greater than.20), with one exception. Change in belief regarding the reality of the energy problem showed a negative relationship to percentage change in consumption (Beta = -.125, p = .042). The final factor influencing change was original consumption level, which was negatively related (Beta = -.217, p = .000). The amount of variance in the change variable accounted for by the overall, aging-related linear model was minimal at 7.5% (R^2 = .075).

These findings suggested that factors related to aging, per se, did not appear to have an important influence on energy conservation patterns. There was one exception, however, related to the household head's level of experience with deprivation and shortages in the past. It appeared that households composed of primary or oldest income earners with higher levels of past experience were presently conserving a larger percentage of energy than equivalent households headed by individuals with less experience. Two factors could have accounted for this finding. The most probable explanation could be that households headed by individuals forced to reduce consumption of resources in the past knew how to live more frugally and utilized this knowledge to help them adjust to the current situation.

Alternatively, households headed by individuals who had experienced forced shortages in the past could simply have been determined to forestall a major crisis and, thus, more willing to conserve now to extend current supplies until effective new sources have been found.

Limitations

Limitations inherent within this study were related to both the state of knowledge in household energy research, in general, and to the research design utilized. More specifically, the limitations concerned questions about the unit of analysis as well as measurement and precision factors involved with secondary analysis of the "Pilot Project Conserve" survey data.

Because study of household energy use has only recently received attention, having been actively studied in only the last 7 or 8 years, little has been determined about the nature of decision making processes underlying consumption and conservation behavior at the micro-level. The limited amount of knowledge available had implications for this exploratory study because of the decision to focus on the age of one household member in order to stratify the household into a level measuring its exposure to past events characterized by deprivation and shortages. In conducting the analysis, the assumption was made that the age of the principal or oldest income earner (i.e., household head) would be the logical choice because this person, due to

decision making power, would exert direct or indirect influence, and, in effect, control many energy use decisions. Thus, while the unit of analysis was the household, the energy consumption and conservation decisions of the household were attributed to the household head. This assumption could greatly oversimplify the process involved, as some research efforts have questioned whether various household members have exerted differing control over energy use decisions (i.e., males controlling heating decisions and females regulating household equipment decisions (Hogan, 1976)). Hopefully, future research efforts exploring energy-use decision making at the household level will clarify this question.

The second limitation concerned the fact that precise information measuring the direct impact of each historical event upon the head of the sample households was not available in the data bank. The study, therefore, through using the age of the household head as a measure of exposure to past crises characterized by deprivation and shortages, relied on indirect rather than direct measures of the influence of each crisis. In essence, the variability of the household head's personal experience with each crisis was not considered (Elder, 1974). This was a weakness and hopefully future research efforts can be designed which will allow measurement of experience with past deprivational or resource shortage situations more directly and explore the relationship of this more precise measure to current energy consumption and conservation behavior.

One of the most logical ways to attempt such an analysis would be through recall techniques. In structured interviews, household heads of varying age levels could be asked their perceptions of the effects of the war and the Depression years on them personally and their impressions of the general impact of the events upon their families, neighborhoods and communities. Alternatively, the development of reliable scales measuring perceptions of the severity of past personal experience with deprivation of resources could be considered. The results, in either case, could be used to analyze whether a relationship between perceived severity of past personal hardship and current energy use behavior can be detected. Recall, although often criticized as a highly subjective measurement tool, could, if used along with the type of scale developed in this study, prove a valuable research tool.

Implications

Two implications are suggested by the findings of this research. They concern future research efforts in the area of aging as a factor affecting energy use patterns and educational programming with respect to energy conservation.

Future Research Efforts

The findings of this study suggest that households headed by older individuals are conserving proportionately more energy than households headed by younger age levels. And to the extent that differences in behavioral adaptation are occurring between age groups, social conflict may be a

future problem. Inflation has already caused tension between generations; Quinn (1980) recently indicated that under current economic conditions, our society (meaning employed, income-tax-and-social-security-paying younger generations) can no longer afford to pay the growing bill for the retired. This emerging strain could be exacerbated as increased energy costs or shortages of supply take place in the future, particularly as younger generations are asked to pay the higher energy bills of older generations.

To help understand this tension and monitor its growth, future research seems imperative to clarify further the effects of the various aspects of aging upon energy use patterns. Most particularly, however, the influence of historical experiences on conservation behavior should be understood, as the particular aging pattern of older cohorts seems to have influenced them to conserve proportionately more energy than comparable younger cohorts. In addition, trend analysis of aging-related consumption and conservation behavior should continue to determine stability or changes in patterns in the future.

Such studies, although needed, would not be easy. One inherent difficulty concerns the fact that long-term longitudinal analysis of household energy consumption data is needed from the past and continuing into the future. Research designs based upon historical information of this type would be especially beneficial in helping to determine the magnitude of aging-specific, as opposed to historical experience,

influences on energy consumption and conservation behavior. Studies such as this would be costly, however, involving the collection of data difficult to access, if indeed they exist. The extent to which utility companies keep detailed household consumption records dating into the more distant past is questionable, while attempts to gather sociodemographic data on households serviced by the utilities would be problematic, due to the mobility characterizing American households in the twentieth century.

In addition, further research of a more current nature is needed regarding the relationship between age and energy conservation behavior. If, as this research suggests, older age levels are conserving proportionately more energy, initial factors needing clarification are differences in conservation actions undertaken by various age groups. Are the lower-income elderly saving energy by behavioral adaptation or are they relying on technical modifications? And what specifically are younger age groups doing differently from older cohorts that reduces the impact of their actions?

Further research is also needed to determine causal relationships accounting for energy conservation behavior. To what extent does income level modify the influence of historical experience? Or perhaps more importantly, how does the temporal patterning of the family life cycle influence or interact with historical placement of cohort members? Analysis of these causal linkages was beyond the scope of

this exploratory study. It certainly should be considered in future research, however.

Questions concerning the current energy situation are a rich field of study for understanding processes of behavioral change at the individual or household level (i.e., micro-level change) and their affect on social change at higher levels (i.e., macro-level change). This brief discussion concerning the relationship of age to social change has touched on only three issues relating to the impact of micro-level change on macro-level processes.

Educational Implications

The 1970s marked a turning point for Americans as concern became manifest that diminishing supplies of natural resources, in general, could not continue to support growing world-wide and United States demand in the future (Smelser, 1979). Americans especially have been chastised for their contribution to the problem in an effort to encourage conservation of energy, in particular.[2]

While this study suggests that American households across all age levels have conserved energy since the winter of 1973-74, when the initial energy crisis was felt, it suggests, more specifically, that households composed of older individuals, knowledgeable of ways to live less

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[2]B. Morrison (1975), for example, citing information published in the Scientific American, indicates Americans constitute 6% of the world's population, while they consume over 30% of the world's energy resources.

resource-intensive lifestyles, have conserved proportionately more. Thus they appear to be using this knowledge in order to adapt to the new social and economic circumstances.

Younger households, on the other hand, appear to have conserved less in comparison to their original consumption levels. While this suggests that these households may be less willing to conserve, it also suggests that younger households, having experienced less hardship in the past due to life course placement, could be somewhat ignorant of "how" to lead less resource-intensive lifestyles.

The implications for educational programming are direct, and efforts to reorient thinking regarding priorities in educational outreach have already begun. Renewed interest in skill building, especially among young families, is apparent in state Cooperative Extension Services across the country as well as in adult education classes offered through community colleges or high schools. Examples include in-depth educational workshops on home food production and preservation as well as clothing construction, simple home repairs and maintenance and repair of home furnishings.

In a broader sense, emphasis on skill building is renewed recognition of the household as a viable economic unit, one capable of providing for many of its own goods and services through home production, rather than through consumption in the traditional market-place (Burns, 1980). Skill building need not focus strictly on production

activities, however. Emphasis can just as easily be directed towards conservation activities, as this research suggests it should.

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APPENDICES

APPENDIX A

COMPARISON OF TOTAL PILOT CONSERVE SAMPLE, TOTAL ENERGY CONSUMPTION DATA SUBSAMPLE AND RESEARCH SUBSAMPLE

Table A-1.--Household by Age of Principal or Oldest Income Earner: Comparison of Total Pilot Conserve Sample, Total Energy Consumption Data Subsample and Research Subsample, 1978[a]

Age of Principal or Oldest Income Earner	Total Pilot Conserve Sample		Total Energy Consumption Data Subsample		Research Subsample	
	%	N	%	N	%	N
19 thru 36	32.6	(359)	30.5	(184)	32.2	(140)
37 thru 40	9.3	(102)	10.1	(61)	10.1	(44)
41 thru 44	7.2	(79)	6.6	(40)	6.4	(28)
45 thru 59	26.5	(291)	26.0	(157)	26.4	(115)
60 thru 63	7.5	(83)	7.6	(46)	8.3	(36)
64 thru 94	15.4	(169)	17.6	(106)	16.6	(72)
Missing	1.5	(17)	1.5	(9)	---	(0)
Total	100.0	(1100)	100.0	(603)	100.0	(435)
Mean	46.6		47.6		47.1	

[a]Percentages have been rounded in some instances.

Table A-2.--Household by Total Family Income: Comparison of Total Pilot Conserve Sample, Total Energy Consumption Data Subsample and Research Subsample, 1977[a,b]

Total Family Income	Total Pilot Conserve Sample		Total Energy Consumption Data Subsample		Research Subsample	
	%	N	%	N	%	N
Less than $5,000	6.7	(74)	6.1	(37)	6.0	(26)
$5,000-$9,999	10.6	(117)	11.8	(71)	13.6	(59)
$10,000-$14,999	15.5	(170)	13.9	(84)	15.4	(67)
$15,000-$19,999	19.1	(210)	19.9	(120)	22.3	(97)
$20,000-$24,999	14.6	(161)	17.7	(107)	19.3	(84)
$25,000 or more	19.4	(213)	20.7	(125)	23.4	(102)
Missing	14.1	(155)	9.8	(59)	---	(0)
Total	100.0	(1100)	100.0	(603)	100.0	(435)
Median	$17,650		$18,300		$18,375	

[a]Percentages have been rounded in some instances.

[b]Data collected in 1978 reflecting 1977 income level.

Table A-3.--Household by Educational Attainment of Principal or Oldest Income Earner: Comparison of Total Pilot Conserve Sample, Total Energy Consumption Data Subsample and Research Subsample, 1978[a]

Education of Principal or Oldest Income Earner	Total Pilot Conserve Sample		Total Energy Consumption Data Subsample		Research Subsample	
	%	N	%	N	%	N
Less than high school	21.5	(237)	18.9	(114)	20.2	(88)
High school	29.8	(328)	29.7	(179)	31.0	(135)
Some college	20.9	(230)	21.4	(129)	20.7	(90)
Finished college	13.8	(152)	14.8	(89)	14.5	(63)
Graduate school	11.9	(131)	13.8	(83)	13.6	(59)
Missing	2.0	(22)	1.5	(9)	---	(0)
Total	100.0	(1100)	100.0	(603)	100.0	(435)

[a]Percentages have been rounded in some instances.

Table A-4.--Household by Number of Members: Comparison of Total Pilot Conserve Sample, Total Energy Consumption Data Subsample and Research Subsample, 1978[a]

Number in Household	Total Pilot Conserve Sample		Total Energy Consumption Data Subsample		Research Subsample	
	%	N	%	N	%	N
1	8.0	(88)	7.8	(47)	7.6	(33)
2	28.9	(318)	29.2	(176)	29.4	(128)
3 or 4	40.8	(449)	41.8	(252)	42.3	(184)
5 to 7	20.5	(225)	19.4	(117)	19.5	(85)
8 or more	1.2	(13)	1.3	(8)	1.1	(5)
Missing	.6	(7)	.5	(3)	---	(0)
Total	100.0	(1100)	100.0	(603)	100.0	(435)
Mean	3.37		3.37		3.34	

[a]Percentages have been rounded in some instances.

Table A-5.--Housing by Dwelling Unit Type: Comparison of Total Pilot Conserve Sample, Total Energy Consumption Data Subsample and Research Subsample, 1978[a]

Dwelling Type	Total Pilot Conserve Sample		Total Energy Consumption Data Subsample		Research Subsample	
	%	N	%	N	%	N
Single family dwelling	91.5	(1006)	93.4	(563)	94.7	(412)
Single family converted to multiple family	1.8	(20)	1.8	(11)	1.6	(7)
Duplex	1.3	(14)	1.2	(7)	.9	(4)
Two-family dwelling	.8	(9)	1.0	(6)	.2	(1)
Four-plex	.2	(2)	.2	(1)	.2	(1)
Townhouse	.5	(5)	.3	(2)	.2	(1)
Apartment	.6	(7)	.2	(1)	---	(0)
Mobile Home	3.0	(33)	1.7	(10)	2.1	(9)
Other	.4	(4)	.3	(2)	---	(0)
Total	100.0	(1100)	100.0	(603)	100.0	(435)

[a]Percentages have been rounded in some instances.

Table A-6.--Housing by Form of Tenure: Comparison of Total Pilot Conserve Sample, Total Energy Consumption Data Subsample and Research Subsample, 1978

Own or Buying Home	Total Pilot Conserve Sample		Total Energy Consumption Date Subsample		Research Subsample	
	%	N	%	N	%	N
Yes	93.8	(1032)	96.8	(584)	97.7	(425)
No	6.0	(66)	3.2	(19)	2.3	(10)
Missing	.2	(2)	---	(0)	---	(0)
Total	100.0	(1100)	100.0	(603)	100.0	(435)

Table A-7.--Housing by Number of Rooms: Comparison of Total Pilot Conserve Sample, Total Energy Consumption Data Subsample and Research Subsample, 1978[a]

Number of Rooms	Total Pilot Conserve Sample		Total Energy Consumption Data Subsample		Research Subsample	
	%	N	%	N	%	N
2 to 5	36.0	(396)	33.7	(203)	34.0	(148)
6 or 7	42.5	(467)	46.3	(279)	46.4	(202)
8 or more	21.4	(235)	19.9	(120)	19.5	(85)
Missing	.2	(2)	.2	(1)	---	(0)
Total	100.0	(1100)	100.0	(603)	100.0	(435)
Mean	6.33		6.35		6.32	

[a]Percentages have been rounded in some instances.

Table A-8.--Housing by Type of Heating Fuel: Comparison of Total Pilot Conserve Sample, Total Energy Consumption Data Subsample and Research Subsample, 1978

Type of Heating Fuel	Total Pilot Conserve Sample		Total Energy Consumption Data Subsample		Research Subsample	
	%	N	%	N	%	N
Electric	5.0	(55)	4.8	(29)	4.8	(21)
Natural gas	64.7	(712)	73.8	(445)	71.5	(311)
Fuel oil	24.9	(274)	19.4	(117)	22.1	(96)
Propane	2.9	(32)	1.3	(8)	1.6	(7)
Coal	.2	(2)	---	(0)	---	(0)
Kerosene	.1	(1)	---	(0)	---	(0)
Wood	1.3	(14)	---	(0)	---	(0)
Oil and wood	.1	(1)	---	(0)	---	(0)
Missing	.8	(9)	.7	(4)	---	(0)
Total	100.0	(1100)	100.0	(603)	100.0	(435)

Table A-9.--Household by Total Btu's Consumed per Heating Degree Day, 1976-77: Comparison of Total Pilot Conserve Sample, Total Energy Consumption Data Subsample and Research Subsample[a]

Total Btu's per Heating Degree Day, 1976-77	Total Pilot Conserve Sample[b]		Total Energy Consumption Data Subsample		Research Subsample	
	%	N	%	N	%	N
Very low consumption[c]	---	(NA)	4.6	(28)	4.1	(18)
Low consumption[d]	---	(NA)	44.9	(271)	47.6	(207)
Medium consumption[e]	---	(NA)	41.6	(251)	41.8	(182)
High consumption[f]	---	(NA)	8.8	(53)	6.4	(28)
Total	---	(NA)	100.0	(603)	100.0	(435)
Mean			26,000		25,000	
Minimum			3,400		3,400	
Maximum			70,200		61,300	

[a]Percentages have been rounded in some instances.

[b]Data not available for total Pilot Conserve sample.

[c]3,000-13,000 Btu's per heating degree day.

[d]13,000-25,000 Btu's per heating degree day.

[e]25,000-37,000 Btu's per heating degree day.

[f]37,000-71,000 Btu's per heating degree day.

Table A-10.--Household by Total Btu's Consumed per Heating Degree Day, 1978-79: Comparison of Total Pilot Conserve Sample, Total Energy Consumption Data Subsample and Research Subsample

Total Btu's per Heating Degree Day, 1978-79	Total Pilot Conserve Sample[a]		Total Energy Consumption Data Subsample		Research Subsample	
	%	N	%	N	%	N
Very low consumption[b]	---	(NA)	6.1	(37)	4.6	(20)
Low consumption[c]	---	(NA)	50.4	(304)	54.9	(239)
Medium consumption[d]	---	(NA)	37.0	(223)	36.1	(157)
High consumption[e]	---	(NA)	6.5	(39)	4.4	(19)
Total	---	(NA)	100.0	(603)	100.0	(435)
Mean			24,000		24,000	
Minimum			3,200		3,200	
Maximum			69,000		58,000	

[a]Data not available for total Pilot Conserve sample.

[b]3,000-13,000 Btu's per heating degree day.

[c]13,000-25,000 Btu's per heating degree day.

[d]25,000-37,000 Btu's per heating degree day.

[e]37,000-71,000 Btu's per heating degree day.

Table A-11.--Household by Total Change in Btu's Consumed per Heating Degree Day, 1976-77 to 1978-79: Comparison of Total Pilot Conserve Sample, Total Energy Consumption Data Subsample and Research Subsample[a]

Total Change in Btu's per Heating Degree Day, 76-77 to 78-79	Total Pilot Conserve Sample[b]		Total Energy Consumption Data Subsample		Research Subsample	
	%	N	%	N	%	N
High conservation[c]	---	(NA)	11.1	(67)	9.4	(41)
Medium conservation[d]	---	(NA)	16.4	(99)	17.7	(77)
Low conservation[e]	---	(NA)	41.1	(248)	42.1	(183)
No change[f]	---	(NA)	1.3	(8)	1.4	(6)
Increased consumption[g]	---	(NA)	30.0	(181)	29.4	(128)
Total	---	(NA)	100.0	(603)	100.0	(435)
Mean			-1,500		-1,400	
Minimum			-20,000		-20,000	
Maximum			17,000		14,000	

[a]Percentages have been rounded in some instances.

[b]Data not available for total Pilot Conserve sample.

[c]-20,000 through -5,000 Btu's per heating degree day.

[d]-5,000 through -2,500 Btu's per heating degree day.

[e]-2,500 through -10 Btu's per heating degree day.

[f]-10 through 10 Btu's per heating degree day.

[g]10 through 17,000 Btu's per heating degree day.

Table A-12.--Household by Percent Change in Btu's Consumed per Heating Degree Day, 1976-77 to 1978-79: Comparison of Total Pilot Conserve Sample, Total Energy Consumption Data Subsample and Research Subsample[a]

Percent Change in Btu's per Heating Degree Day, 76-77 to 78-79	Total Pilot Conserve Sample[b]		Total Energy Consumption Data Subsample		Research Subsample	
	%	N	%	N	%	N
High conservation[c]	---	(NA)	10.4	(63)	8.7	(38)
Medium conservation[d]	---	(NA)	17.2	(104)	18.9	(82)
Low conservation[e]	---	(NA)	37.5	(226)	37.7	(164)
No change[f]	---	(NA)	8.3	(50)	7.6	(33)
Increased consumption[g]	---	(NA)	26.5	(160)	27.1	(118)
Total	---	(NA)	100.0	(603)	100.0	(435)
Mean			-5.1%		-4.9%	
Minimum			-64.6%		-64.6%	
Maximum			71.9%		71.9%	

[a]Percentages have been rounded in some instances.

[b]Data not available for total Pilot Conserve sample.

[c]-70.0% through -20.0% in Btu's per heating degree day.

[d]-20.0% through -10.0% in Btu's per heating degree day.

[e]-10.0% through -0.5% in Btu's per heating degree day.

[f]-0.5% through 0.5% in Btu's per heating degree day.

[g]0.5% through 80.0% in Btu's per heating degree day.

APPENDIX B

DESCRIPTION OF AGE STRATIFICATION OF PRINCIPAL OR OLDEST INCOME EARNERS: YEAR OF BIRTH, AGE IN 1977, YEARS OF EXPERIENCE WITH DEPRIVATION AND SHORTAGES

Table B-1.--Description of Principal or Oldest Income Earners: Year of Birth, Age in 1977, Years of Experience with Deprivation and Shortages and Sample Size

Year of Birth[a]	Age in 1977	Years of Experience[b,c]	Sample Size	Year of Birth[a]	Age in 1977	Years of Experience[b,c]	Sample Size	Year of Birth[a]	Age in 1977	Years of Experience[b,c]	Sample Size
1954	23	0	3	1932	45	9	10	1910	67	19	5
1953	24	0	2	1931	46	10	4	1909	68	19	7
1952	25	0	6	1930	47	11	7	1908	69	19	3
1951	26	0	7	1929	48	11	14	1907	70	19	8
1950	27	0	6	1928	49	11	11	1906	71	19	9
1949	28	0	9	1927	50	11	6	1905	72	19	4
1948	29	0	9	1926	51	11	4	1904	73	19	4
1947	30	0	24	1925	52	11	13	1903	74	19	2
1946	31	0	17	1924	53	11	8	1902	75	19	3
1945	32	0	3	1923	54	11	6	1901	76	19	3
1944	33	0	9	1922	55	11	5	1900	77	19	3
1943	34	0	9	1921	56	11	7	1899	78	19	2
1942	35	0	22	1920	57	11	9	1898	79	19	2
1941	36	0	14	1919	58	11	8	1897	80	19	2
1940	37	1	6	1918	59	12	3	1896	81	19	0
1939	38	2	13	1917	60	13	12	1895	82	19	0
1938	39	3	11	1916	61	14	2	1894	83	19	1
1937	40	4	14	1915	62	15	13	1893	84	19	0
1936	41	5	6	1914	63	16	9	1892	85	19	0
1935	42	6	5	1913	64	17	5	1891	86	19	0
1934	43	7	7	1912	65	18	2	1890	87	19	1
1933	44	8	10	1911	66	19	6				

[a]Because data were collected in May 1978, the assumption was made that the chronological age level quoted for the principal or oldest income earner was reached in 1977. This allowed 1977 to be used as the baseline year in determining year of birth for income earners.

[b]Years of deprivation and shortage were determined in the following manner. If the initial impact of an event occurred within the first 6 months of a year (i.e., World War I), influence from the event was assumed for the entire year. If initial impact occurred within the final 6 months of a year (i.e., the Depression), that year was not considered. Impact from each event lasted into the second half of its concluding year; thus impact from the final year was considered. The dates and years of impact were: World War II, December 1941 to late 1945 = years 1 through 4; The Depression of the 1930s, October 1929 to late 1941 = years 5 through 16; World War I, April 1916 to November 1918 = years 17 through 19.

[c]Measurement of the impact of the historical event was based upon direct rather than indirect experience (i.e., filtered through the impact upon parents or family). Thus an individual had to be 5 years old during the event's occurrence in order to be included in the group determined to be influenced by the event.

APPENDIX C

TABLES DESCRIBING THE CROSS-DISTRIBUTIONAL CHARACTERISTICS OF THE RESEARCH SAMPLE: BIOLOGICAL, PSYCHOLOGICAL AND SOCIAL VARIABLES BY THE AGE STRATIFICATION VARIABLE

Table C-1.--Health Reasons for High Winter Temperature Setting by Age of Principal or Oldest Income Earner

Health Reasons	Age Groups											
	23 - 36		37 - 40		41 - 44		45 - 59		60 - 63		64 - 87	
	%	N	%	N	%	N	%	N	%	N	%	N
No	84.3	(118)	88.6	(39)	89.3	(25)	84.3	(97)	80.6	(29)	56.9	(41)
Yes	15.7	(22)	11.4	(5)	10.7	(3)	15.7	(18)	19.4	(7)	43.1	(31)
Total	100.0	(140)	100.0	(44)	100.0	(28)	100.0	(115)	100.0	(36)	100.0	(72)

Table C-2.--Educational Attainment of the Principal or Oldest Income Earner by Age of Principal or Oldest Income Earner[a]

Education	Age Groups											
	23 - 36		37 - 40		41 - 44		45 - 59		60 - 63		64 - 87	
	%	N	%	N	%	N	%	N	%	N	%	N
High school or less	33.6	(47)	31.8	(14)	42.9	(12)	66.1	(76)	63.9	(23)	70.8	(51)
Some college	26.4	(37)	29.5	(13)	28.6	(8)	12.2	(14)	25.0	(9)	12.5	(9)
College graduate	21.4	(30)	9.1	(4)	17.9	(5)	13.9	(16)	2.8	(1)	9.7	(7)
Graduate school	18.6	(26)	29.5	(13)	10.7	(3)	7.8	(9)	8.3	(3)	6.9	(5)
Total	100.0	(140)	100.0	(44)	100.0	(28)	100.0	(115)	100.0	(36)	100.0	(72)

[a]Percentages have been rounded in some instances.

Table C-3.--Energy Attitudes by Age of Principal or Oldest Income Earner, 1978[a]

Attitudes	Age Groups											
	23 - 36		37 - 40		41 - 44		45 - 59		60 - 63		64 - 87	
	%	N	%	N	%	N	%	N	%	N	%	N
Very low	4.3	(6)	9.1	(4)	7.1	(2)	6.1	(7)	2.8	(1)	2.8	(2)
Low	41.4	(58)	31.8	(14)	57.1	(16)	48.7	(56)	41.7	(15)	59.7	(43)
High	49.3	(69)	56.8	(25)	32.1	(9)	42.6	(49)	47.2	(17)	34.7	(25)
Very high	5.0	(7)	2.3	(1)	3.6	(1)	2.6	(3)	8.3	(3)	2.8	(2)
Total	100.0	(140)	100.0	(44)	100.0	(28)	100.0	(115)	100.0	(36)	100.0	(72)

[a]Percentages have been rounded in some instances.

Table C-4.--Belief in the Energy Problem by Age of Principal or Oldest Income Earner, 1978[a]

Belief	Age Groups											
	23 - 36		37 - 40		41 - 44		45 - 59		60 - 63		64 - 87	
	%	N	%	N	%	N	%	N	%	N	%	N
Low	11.4	(16)	6.8	(3)	21.4	(6)	20.0	(23)	13.9	(5)	19.4	(14)
Medium	40.7	(57)	31.8	(14)	21.4	(6)	32.2	(37)	27.8	(10)	38.9	(28)
High	47.9	(67)	61.4	(27)	57.1	(16)	47.8	(55)	58.3	(21)	41.7	(30)
Total	100.0	(140)	100.0	(44)	100.0	(28)	100.0	(115)	100.0	(36)	100.0	(72)

[a]Percentages have been rounded in some instances.

Table C-5.--Income Level by Age of Principal or Oldest Income Earner, 1977[a,b]

Income	Age Groups											
	23 - 36		37 - 40		41 - 44		45 - 59		60 - 63		64 - 87	
	%	N	%	N	%	N	%	N	%	N	%	N
Less than $5,000-$9,999	7.1	(10)	4.5	(2)	7.1	(2)	7.0	(8)	27.8	(10)	73.6	(53)
$10,000-$19,999	49.3	(69)	29.5	(13)	32.1	(9)	40.9	(47)	36.1	(13)	18.1	(13)
$20,000-highest	43.6	(61)	65.9	(29)	60.7	(17)	52.2	(60)	36.1	(13)	8.3	(6)
Total	100.0	(140)	100.0	(44)	100.0	(28)	100.0	(115)	100.0	(36)	100.0	(72)

[a]Percentages have been rounded in some instances.

[b]Data collected in 1978 reflecting 1977 income level.

Table C-6.--Number of Occupants in the Household by Age of Principal or Oldest Income Earner, 1978

Occupants	Age Groups											
	23 - 36		37 - 40		41 - 44		45 - 59		60 - 63		64 - 87	
	%	N	%	N	%	N	%	N	%	N	%	N
1 occupant	2.9	(4)	---	(0)	3.6	(1)	2.6	(3)	8.3	(3)	30.6	(22)
2 occupants	15.0	(21)	9.1	(4)	10.7	(3)	28.7	(33)	66.7	(24)	59.7	(43)
3 or 4 occupants	60.7	(85)	40.9	(18)	42.9	(12)	47.0	(54)	22.2	(8)	9.7	(7)
5-7 occupants	20.7	(29)	47.7	(21)	42.9	(12)	19.1	(22)	2.8	(1)	---	(0)
8 or more	.7	(1)	2.3	(1)	---	(0)	2.6	(3)	---	(0)	---	(0)
Total	100.0	(140)	100.0	(44)	100.0	(28)	100.0	(115)	100.0	(36)	100.0	(72)

Table C-7.--Number of Rooms in the Dwelling Unit by Age of Principal or Oldest Income Earner, 1978

Rooms	Age Groups											
	23 - 36		37 - 40		41 - 44		45 - 59		60 - 63		64 - 87	
	%	N	%	N	%	N	%	N	%	N	%	N
2-5 rooms	34.3	(48)	11.4	(5)	50.0	(14)	27.8	(32)	36.1	(13)	50.0	(36)
6-7 rooms	47.1	(66)	52.3	(23)	21.4	(6)	53.0	(61)	55.6	(20)	36.1	(26)
8 or more rooms	18.6	(26)	36.4	(16)	28.6	(8)	19.1	(22)	8.3	(3)	13.9	(10)
Total	100.0	(140)	100.0	(44)	100.0	(28)	100.0	(115)	100.0	(36)	100.0	(72)

APPENDIX D

COMPARISON OF TOTAL, DIRECT BTU'S CONSUMED PER HEATING DEGREE DAY, 1978-79: BIVARIATE REGRESSION ANALYSIS AND MULTIPLE REGRESSION ANALYSIS

Table D-1.--Simple Bivariate Regression Analysis of Total, Direct Btu's Consumed per Heating Degree Day, 1978-79, on Independent Variables: Unstandardized Regression Coefficients, Standard Errors, Standardized Regression Coefficients, F-Ratios and Probability of Sampling Error

Independent Variables	Btu's Consumed per Heating Degree Day, 1978-79				
	Unstandardized Regression Coefficient	Standard Error	Standardized Regression Coefficient	F	Probability of Sampling Error
Number of rooms	1915.95	182.84	.450	109.802	<.000
Income level	.21	.04	.264	32.409	<.000
Number of occupants	1305.27	236.26	.257	30.522	<.000
Educational attainment	481.98	137.04	.167	12.370	.000
Past experience - deprivation and shortages	-98.19	53.88	-.087	3.321	.069
Belief in the energy problem	1014.11	664.61	.073	2.328	.128
Attitude toward energy conservation	-543.43	582.35	-.045	.871	.351
Health factors	-465.24	914.43	-.024	.259	.611

df regression: 1
df residual: 433

Table D-2.--Multiple Regression Analysis of Total, Direct Btu's Consumed per Heating Degree Day, 1978-79, on Independent Variables: Unstandardized Regression Coefficients, Standard Errors, Standardized Regression Coefficients, F-Ratios and Probability of Sampling Error[a]

Independent Variables	Btu's Consumed per Heating Degree Day, 1978-79				
	Unstandardized Regression Coefficient	Standard Error	Standardized Regression Coefficient	F	Probability of Sampling Error
Number of rooms	1602.35	192.97	.376	68.949	<.000
Number of occupants	906.02	261.12	.178	12.039	.001
Income level	.09	.04	.117	5.300	.022
Attitude toward energy conservation	-1211.47	559.18	-.100	4.694	.031
Past experience - deprivation and shortages	107.79	58.84	.096	3.356	.068
Belief in the energy problem	622.82	652.44	.045	.911	.340
Educational attainment	94.24	144.76	.033	.424	.515
Health factors	151.56	835.14	.008	.033	.856
Overall F				17.779	.000
Multiple R: .500			df regression: 8		
R Square: .250			df residual: 426		

[a]Standard forward regression was employed to test the interactive character of the independent variables.