THE PRESENCE OF UNIVERSAL DESIGN FEATURES IN CONSUMERS'

CURRENT RESIDENCES AND PLANNED USE IN FUTURE HOMES

by

TERESA L. NUNN

(Under the Direction of Anne L. Sweaney)

ABSTRACT

This study measures both the number of universal design features present in the respondents' current homes and their desire to have these features in a future home as well as housing, household and personal characteristics that predict the incorporation of universal design features. Data were collected from mail survey responses from 444 households selected from a national random sample of U.S. households. Home owners 60 years and older were over sampled.

Descriptive results show that the current selection and future desire for specific universal design elements varies by age. Multiple regression analysis shows that the increased age of the home owner and the newer age of the dwelling predicted more universal design features in a current home. The increased age of the home owner, the presence of a person with mobility impairment in the home and having plans to move predicted the desire for more universal design features in a future residence.

INDEX WORDS: Universal Design, Home Adaptations, Home Modifications, Accessibility, Visitability, Competence-Press Model

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TERESA L. NUNN

B.S., The University of Kentucky, 1976

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TERESA L. NUNN

Major Professor: Anne L. Sweaney

Committee: Brenda Cude
Jan Hathcote

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
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CHAPTER 1

INTRODUCTION

The spectrum of human size and ability is wide. This diversity among people requires a built environment that is safe, comfortable and functional for each individual. People of all abilities are living longer lives and desire to do so as independently as possible. Such independence requires that their living environments be free of safety hazards or functional barriers. Incorporating universal design features and products in a home enhances it by making it safer, more accessible, more adaptable and more comfortable.

Problem Statement and Rationale

Universal design features in housing enhance the quality of life of those who dwell there. Universal design is defined as the design of products and environments to be usable to the greatest extent possible by people of all ages and abilities (Story, Mueller & Mace, 1998). Story (1998) expands this definition as follows:

> Universal design reflects a belief that the range of human abilities is normal and results in inclusion of people with disabilities in everyday activities. The most significant benefits to the proliferation of universal design practice are that all consumers will have more products to choose from that are more usable, more readily available, and more affordable (p. 12).

There are multiple reasons behind the need to promote universal design as a priority in housing design for the 21st century. Current building standards are outdated and do not affirm the individual differences that exist in the population. In addition, the

American population is aging and the number of people with a disability is on the rise because of this longer lifespan and better medical care that promotes longevity. Also, older people have expressed a desire to "age in place." Universally designed homes would benefit everyone but are not yet widely available. Few home design and construction professionals are incorporating universal features and products and few consumers are requesting them.

Our built environment is designed for the "average" person. Who is this "average" person? "Average" standards for Americans were established early in the 20th century. In an effort to set standards for military vehicles, aircraft and guns, a study of human factors was initiated using World War II military research data. This study of human size and form, performed in the 1940's, has provided the standards for the design and engineering of the built environment and products in the 60 years since. Mueller (1995a) found that pervasive use of these data in design education has rendered the designed environment best suited to young, fit Caucasian males. Everyone else is required to adapt to the best of their ability. Ironically, these soldier "standards" that were measured for men in the 1940's who are now in their 70's and 80's and are struggling to adapt to the world created specifically for them 60 years ago. The American population, on the average, has increased in height about one half inch per generation (Morgan, Jesse, Campanis & Lund, 1963).

In the 1960's, home economists Steidl and Bratton (1968) conducted extensive anthropometric research to improve the design of the home as a workplace. Working from a home management perspective, they presented an extensive multidisciplinary work incorporating research in industrial psychology, psychology, industrial engineering, anatomy, physiology, physical education and anthropometry, as well as information from

the composite fields of human engineering and ergonomics. Their work resulted in standards for the design and arrangement of kitchen and laundry workspaces, including fixtures and appliances. Anthropometric data in residential space design led to the introduction of Minimum Property Standards by the Federal Housing Authority (FHA) as criteria for all homes that the FHA insures (DeMerchant & Beamish, 1995). Current kitchen and bath standards continue to identify the space requirements of average size adults (Cheever, 1992a; Cheever, 1992b).

Rather than "average" we find that there is a continuum of young to old and able-bodied to disabled. Age and disability should be accepted as part of the fundamental forces of life rather than treated as adversities (Mueller, 1995b). The products we design and the buildings we inhabit should reflect this continuity and meet as many needs as possible to achieve maximum utility (Wilkoff & Abed, 1994).

These needs will become even more pronounced in the future as age and its accompanying disabilities increase. Americans 65 and older made up 12.4% of the population in the year 2000 (Federal Interagency Forum on Aging Related Statistics, 2000). By 2030, if current rates persist, 20% of the population will be older than 65 years of age (Federal Interagency Forum on Aging Related Statistics, 2000). So, in 30 years the elderly population of the United States is projected to double to almost 70 million people. At the leading edge of this senior explosion is the baby boom generation. Born between 1946 and 1964, they number roughly 76 million people. The oldest cohort of boomers will turn 65 in 2011. By 2030 the oldest surviving baby boomers will be 85 years old while the youngest will be turning 65 (The Boomer Numbers, 2002).

Physical disability is positively related to age. Vanderheiden (1990) reports that age is the major cause of disability or functional limitation in over 30 million American people. The U.S. Census Bureau (1997) gives the criteria for assessing disability:

> A person is considered to have a disability if he or she has difficulty performing certain functions (seeing, hearing, talking, walking, climbing stairs and lifting and carrying), or has difficulty performing activities of daily living, or has difficulty with certain social roles (doing school work for children, working at a job or around the house for adults). A person who is unable to perform one or more activities, or who uses an assistive device to get around, or who needs assistance from another person to perform basic activities is considered to have severe disability. (p. 1)

Kraus, Stoddard and Gilmartin (1996), using 1990 Census data, found that 48.9 million people in the United States, almost 20% of the population, reported at least one disability. Severe disabilities afflicted 24.1 million of these people. Similarly, the U.S. Census Bureau (2000) reported 40 million people, or almost 15% of the population over the age of five years, had a disability. Among older cohorts the proportions were significantly higher. The Administration on Aging (1990) reported that, among adults 60 years of age and older, 6.9% had a mobility limitation only, 4.2% had a self-care limitation only, while 6.2% indicated having both a mobility and self-care limitation. Consequently, a total of 17.3% of this population was considered disabled. Among the 75-84 age group 25.8% reported having either mobility or self-care limitations or both. As more people live to an older age, disability will likely increase as the number of chronic conditions such as arthritis, diabetes, osteoporosis and senile dementia become more prevalent (U.S. Census Bureau, 1995). Progress in healthcare and advances in

medicine have allowed the disabled to live longer and be more productive. Traumas and illnesses that would have demanded institutionalization or would have proved fatal in years past are now supported with improved health care and outpatient services (Mueller, 1995b). Additionally, because of recent changes in policies, home care services are now being funded by Medicare, Medicaid, the Older Americans Act and the Veterans Administration (National Association for Home Care, 1996).

Additionally, about 34.2 million people over the age of 15 in the United States experience a functional limitation. Seventeen and a half million people cannot climb one flight of stairs without resting, 17.3 million cannot walk a quarter of a mile and 16.2 million cannot lift and carry even a bag of groceries (Kraus et al., 1996).

These disability and functional limitation statistics include those born with disabilities and those whose abilities have declined during their lifetime due to disease, accident, aging, or, most likely, a combination of these factors. Actually, there is "no clear line between people who are categorized as 'disabled' and those who are not. A performance or ability distribution for a skill/ability is generally a continuous function rather than a bimodal with distinctive 'able' and 'disabled' groups" (Vanderheiden, 1990, p. 339). Prophetically, the disabled community refers to those without disabilities as "TAB's" or Temporarily Able-Bodied (Vanderheiden, 1990).

Everyone, at some time, is physically disadvantaged, whether it is from a temporary injury or illness or even at an awkward moment with their arms full of packages. Almost everyone experiences some functional restrictions during their lifetime. Broken bones, low back pain, flu--each causes at least minor, temporary impairment that can make even simple tasks troublesome (Mueller, 1990). Everyone has, at one time or another, been hampered by their environment by being either too short or

too tall, has been too young and inexperienced, and will someday be too old and infirm. We are temporarily encumbered in our daily lives while carrying a sack of groceries or maneuvering a baby stroller.

With increasing age and infirmity it has been found that adults, especially senior adults, prefer to remain in their own homes. "Aging in Place" has come to describe this concept of "being able to live independently in one's current residence as the relationship between personal competence and the environment varies as one ages" (McFadden & Brandt, 1993, p. 1). Filion, Wister and Coblentz (1992) found that 87% of seniors wish to remain in their homes as long as they can. The American Association of Retired Persons (2000) survey of 2,000 Americans age 45 and over found that 63% plan to stay in their current residence for the rest of their lives.

The importance of their home takes on added significance to the elderly for multiple and varied reasons. Tremblay (1999) found that, for the elderly, housing provides shelter and security, expresses status in the eyes of the community, provides access to community services, serves as a storehouse of memories, provides a primary location for family interaction, influences enjoyment of life and serves as a major investment. Research has shown that the elderly spend 80 to 90% of their time at home (Gabb, Lodl & Combs, 1991). Lawton (1989) found that residential well-being has considerable bearing on psychological well-being, while Boschetti (1990) found that the home becomes more important in old age due to changes in sensory functioning, modifications in physical abilities and diminishing social roles. These changes subsequently may cause the home to take on increased importance in supporting psychological well being.

Considering their strong attachment to the home and the increased occurrence of dangerous health conditions we would expect to find significant physical adjustments to help support a balance between declining capabilities and the home environment. Filion et al. (1992), in their 1987 survey of community-dwelling older adults, found that as few as 14% of the elderly respondents had made even a single adaptation to their home. They concluded that the elderly do not plan for the future, especially when it comes to housing modifications, preferring to live one day at a time. Sixty-six percent of this sample of individuals, who were 75 years and older, did not foresee making any future housing modifications to accommodate their changing physical conditions. Struyk and Katsura (1988) and Gilderbloom and Markham (1996) both found that even in a home where a physically impaired family member currently resides only ten percent of the elderly headed households and five percent of the nonelderly headed households had undertaken modifications. Only one percent of the subjects studied by McFadden, Brandt and Tripple (1993) indicated that their current residence could accommodate a wheelchair. McFadden and Brandt (1993) in a related study of pre-retiree home owners found that only those who anticipated a greater amount of retirement income exhibited a proactive attitude and were at least thinking about making their home wheelchair accessible.

One of the primary reasons for not making adaptations is that, even though the dysfunctional elements posed serious hazards and disrupted functioning, these flaws evolved slowly over time, and the elder had gradually adjusted his performance rather than adapting his environment (Brent, Lower-Walker & Twaddell, 1983; Wister, 1989). Filion et al. (1992) concluded that the older elderly, those 75 years of age and beyond, have a shortsighted perception of future time, often ignoring impending changes in housing needs all together. Elders may reject assistive technology as a symbol of lost

functions and ability rather than a means to attain independent performance (Gitlin, Levine & Geiger, 1993).

Definitions and Applications

Universal design is a concept that evolved over the last half of the 20th century and emphasizes accessibility, adaptability, aesthetics and affordability (Behar, 1991). Universal design is defined as the design of products and environments to be usable to the greatest extent possible by people of all ages and abilities (Story et al., 1998).

The future demands of an increasingly older population who desire to remain as independent as possible in their own homes can be met through the use of universal design features. Universal design in home planning and construction eliminates barriers for people of all age groups and abilities. "The intent of the universal design concept is to simplify life for everyone by making more housing usable by more people at little or no extra cost. Universal design is an approach to design that incorporates products as well as building features and elements that to the greatest extent possible, can be used by everyone" (McFadden et al., 1993, p. 69).

One of the pioneers of Universal Design, Ron Mace, was an architect and research professor at North Carolina State University, where he founded and directed the Center for Universal Design. He is credited with originating the concept of universal design. The Center for Universal Design (1997b), under a grant from the National Institute on Disability and Rehabilitative Research, has published seven Principles of Universal Design:

1. Equitable Use: the design is useful and marketable to any group of user.
2. Flexibility in Use: the design accommodates a wide range of individual preferences and abilities.

3. Simple and Intuitive Use: use of the design is easy to understand regardless of the user's experience, knowledge, language skills, or current concentration level.
4. Perceptible Information: the design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
5. Tolerance for Error: the design minimizes hazards and the adverse consequences of accidental or unintended actions.
6. Low Physical Effort: the design can be used efficiently and comfortably and with a minimum of fatigue.
7. Size and Space for Approach and Use: appropriate size and space is provided for approach, reach, manipulation and use, regardless of user's body size, posture, or mobility (p. 1).

These principles are easily translated into actual features in homes. The features range from the addition of lever doorknobs and lever faucet controls to wider doors and hallways, to presetting studs in bathroom areas to facilitate the possibility of future installation of grab bars. Universal design in housing uses products that are readily available to the consumer through any hardware store or building supply. Successful integration of universally usable features in products and environments makes them virtually indistinguishable (Story et al., 1998).

Adding these features as part of the initial construction is significantly less expensive than a later attempt to retrofit a home. In 1987, the U.S. Department of Housing and Urban Development estimated that renovation of a single-family dwelling increased the cost by as much as 21% as compared with incorporating universal design

features into a new structure at a cost of two to three percent (McLeister, 1987). By 1990 there was already a decrease in the estimate of the cost of new construction additions to achieve universal design. McLeister (1990) reported that the basic features outlined by the National Research Center of the National Association of Home Builders added only one and one-half to two percent to the cost of newly constructed homes. As an example, a 3'0" door costs about $8 more than a door that is 2'6" (McLeister, 1999).

Use of these same readily available products and generally accepted features also reduces the stigma of "special design." Brown (2000) reports from the Retirement Research Study that elders feared loss of control over their lives. As much as the elderly see a concession to adaptive products as a loss of independence, the Baby Boomers are showing even more reluctance to concede to assistive technology. "Universal design may be intended to improve products for everyone, but it also effectively disguises boomers, huddled at the center, as a marketing target. Using these designs, manufacturers hope to accompany boomers into old age, erasing the seams between stages of life like cream on wrinkles" (Hamilton, 1999, C4).

Builders' reluctance to incorporate universal design into their housing designs has been attributed to several factors. Gabb et al. (1991) found that builders design homes for only their perceived "average" families without analyzing the needs and tastes of specific households because it is simply easier to do so. Belser and Weber (1995) reported that builders tend to be reactive rather than proactive. They stated that home builders were aware of more accessible features than they actually used and those builders only installed accessible features in a residence when the client specifically requested them (Belser & Weber, 1995). Other builders expressed a lack of understanding of either the building codes or the features of universal design construction

(Murdoch, 1999). Builders may lack knowledge because they lack training. Lurz (1997) analyzed 1996 U.S. Bureau of Labor Statistics reports to find that the construction industry, as a whole, ranked eighth out of nine economic sectors when considering the amount of employee training it conducted.

Consumers' lack of awareness and information, not lack of need, contributes to low demand for universal design housing (Center for Universal Design, 1997a). In effect, consumers may not be able to capably visualize and evaluate housing drawings and designs to effectively communicate what they need. They must be trained to analyze the positive and negative impacts of housing characteristics and features on their lives (Gabb et al., 1991). Education of both consumers and builders should be a high priority as universal design contributes to the comfort, convenience and safety of everyone (Gunn, 1988). McFadden et al. (1993) charged housing educators with the responsibility to unite architects, designers, home builders, and realtors to increase the availability of accessible housing.

Purpose and Hypotheses

This study examines consumers' selection of universal design features in their current residences and their plans to include universal design features in their future homes. The purpose of this study is to identify consumers' characteristics related to their selection of universal design features for their homes. The following two hypotheses are made regarding the number of universal design features incorporated in a current dwelling and preferences for these features in a future home:

H_1: There is no statistically significant difference in the number of universal design features consumers have in their current home based on factors in the following four areas:

a) Housing characteristics: whether the consumer rents or owns the current home, building type of the current home, age of the current residence, length of occupancy at the current residence and any plans to move from that home.

b) Household characteristics: total number of residents in the household, presence of elderly persons in the household, presence of children in the household and total household income.

c) Personal characteristics of the principle householder: age, gender and education level

d) The presence of a household member with mobility impairment or health issues that reduces mobility while entering or within the home.

H_2: There is no statistically significant difference in the number of universal design features consumers would like to have in a future home based on factors in the following four areas:

a) Housing characteristics: whether the consumer rents or owns the current home, building type of the current home, age of the current residence, length of occupancy at the current residence and any plans to move from that home.

b) Household characteristics: total number of residents in the household, presence of elderly persons in the household, presence of children in the household and total household income.

c) Personal characteristics of the principle householder: age, gender and education level.

d) The presence of a household member with mobility impairment or health issues that reduces mobility while entering or within the home.

Summary

It is essential that a home is safe, comfortable and functional for each individual which resides within. The expanding older population will certainly place more demands on their home environment. In summary, DeMerchant and Beamish (1995) state that:

> As society ages, as health care costs increase, grown children boomerang back to their original family home, and frail aging parents move to their children's homes, universal design features help people stay in their homes longer and live with family members more comfortably. Universal design enables families with small children, parents and grandparents to share the same living space by allowing independent users of the space (p. 89).

This study will measure both the number of universal design features present in the current home and the number of features planned if the consumer moves to a future residence. The personal characteristics of the consumer, the household and the residence related to the choice of universal design features in the home will also be investigated. The study will be used as a springboard for developing educational programs to teach universal design principles to home owners, home designers, architects and remodelers and home builders

CHAPTER 2

REVIEW OF LITERATURE

Introduction

This study examines the presence of universal design features in the home owners' current home and the universal design features desired in a future home. The literature review discusses first on the theoretical framework used as the underpinning of this study: Lawton and Nahemow's Competence-Press Model. Previous studies about environmental adaptations will then be examined. Following this is an in-depth chronological evolution of both the social and legislative issues that led to the development of accessible and adaptable environments. A step beyond accessible and adaptable, universal design will be introduced next. After a thorough overview of the general concepts and principles of universal design, the focus will shift to universal design in housing. The elements, costs and advantages of universal design in housing will be discussed. Finally, the current research about both home owners' and builders' knowledge and use of universal design features and products, as well as trends in marketing universal design, will be examined.

Lawton and Nahemow's Competence-Press Model

Lawton and Nahemow (1973) introduced the concept that individual behavior and satisfaction are dependent on the dynamic equilibrium between the demand of the environment, the environmental press and the specific functional and sensory capabilities of the individual to contend with that demand, expressed as individual competence (Connell & Sanford, 1997; Pollack & Newcomer, 1986). Lawton and Nahemow (1973)

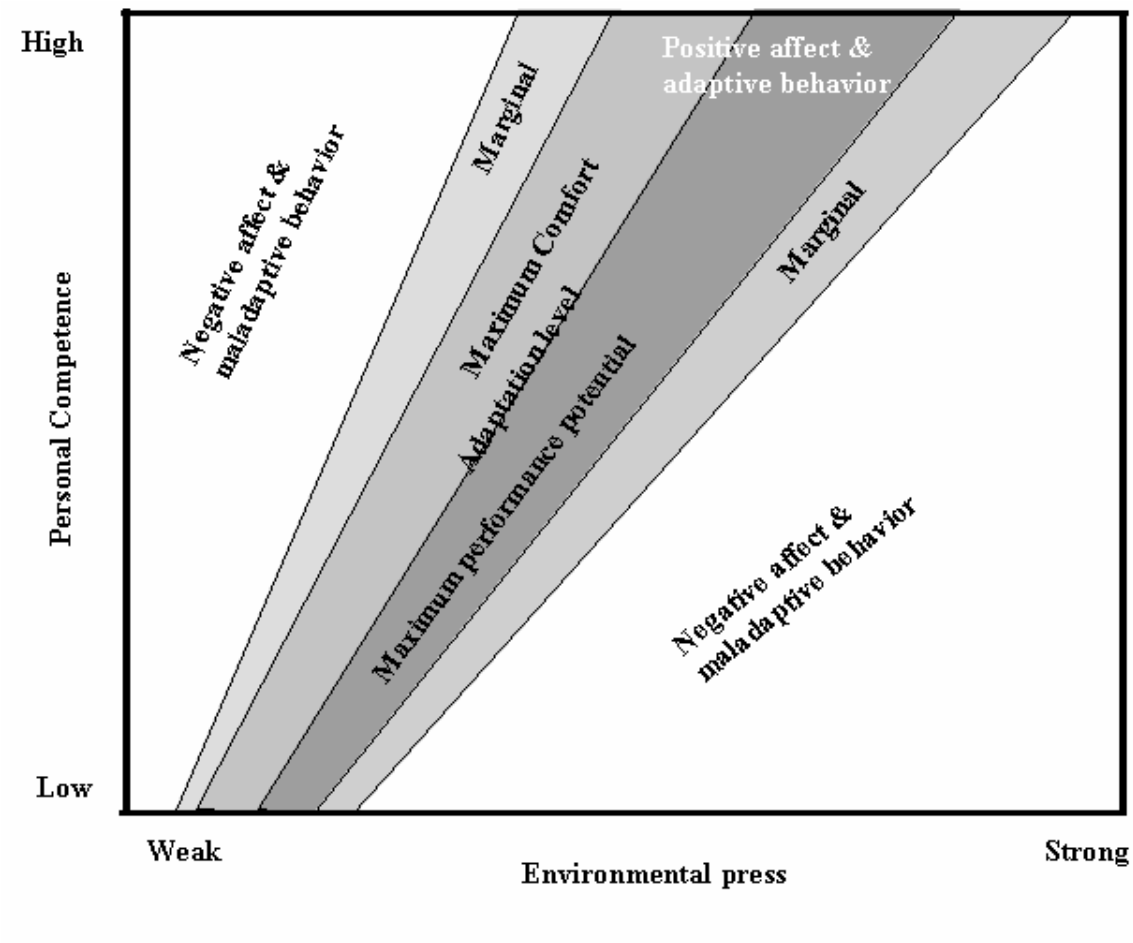
analyzed competence in the areas of biological health, sensory and motor function, cognitive skill and ego strength. Pollack and Newcomer (1986) functionally defined the concept of individual competence as the ability to execute tasks in the areas of life maintenance, functional health, perception and cognition, physical self-maintenance and social role performance. Press is expressed as a function of the physical, social or sociological environment and may be manifested as positive, negative or neutral (Pollack & Newcomer, 1986).

Adaptive behavior and personal satisfaction are the products of a balance between competence and press. The Lawton and Nahemow Competence-Press Model (Lawton & Nahemow, 1973), illustrated in Figure 1, plots competence, ranging from high to low competence, against environmental press, scaled from weak to strong. Any one point describes the outcome of a person/environment transaction. Indeed, this ecological model of aging demonstrates a vast range of combinations of individual competence and environmental press.

The model implies that most often the ordinary individual is barely cognizant of his environment while focusing on more immediate thoughts or behaviors. Awareness returns when individual competence or environmental press shifts to move the individual away from adaptation level. A small increase in press level, indicated by the area to the immediate right of adaptation level, generally produces increased motivation and is indicated as the zone of maximum performance. Larger increases in press level result in personal stress and maladaptive behavior.

When there is a moderate decline in environmental press level the consequences are usually positive (Lawton, 1986). Greater declines in environmental press, where competency significantly exceeds press, result first in boredom, later in atrophy,

Figure 1



The Lawton and Nahemow Competence- Press Model

Source: Lawton, M. P., & Nahemow, L. (1973). Ecology and the aging process. In C. Eisendorfer & M. P. Lawton (Eds.), The psychology of adult development and aging, 661.

and finally in loss of unexercised skills. When press fully overwhelms competence the Individuals are anticipated to restrict or fully withdraw their exposure to that environment (Pollack & Newcomer, 1986).

The level of individual competence has an equally important role in the balance to maintain adaptation. High competence is associated with comparative freedom from environmental press while low competence is associated with greater vulnerability to environmental press. When applied to the concept of aging this idea is known as the "environmental docility" hypothesis and is well illustrated on the schematic model (Fillion et al., 1992; Pollack & Newcomer, 1986). Age-related deficits and decrements contribute to a decline in an individual's level of competence whereby a small change in press has an intensified change on the behavior of a low-competence person. To maintain the delicate balance desired, the low-competence individual is faced with having to improve press, bolster competence or retreat from the environment (Pollack & Newcomer, 1986).

Lawton (1989) asserts that there are three functions of the residential environment that are especially important to the older person—maintenance, stimulation and support. Maintenance is comprised of the repetitive behaviors that establish routine and order to life. Familiarity with routine and environment is essential to a sense of well-being and manifests itself as rote behaviors that are as automatic as they are reassuring. Maintenance is the state in which an individual is the most comfortable and, thus, is the most desirable state. Two factors moderate against an individual limiting his life to the maintenance function. First, both environments and people change over time. Individuals' abilities either improve or decline and preferences and opportunities

develop. Secondly, human nature has imposed a limit of endurance for sameness and predictability whereby monotony is rarely tolerated (Lawton, 1989).

Stimulation is the state whereby the environment comes into awareness because the situation at hand requires an emotional, behavioral or cognitive response to a novel situation. The stimulation condition tests problem-solving thought processes and behaviors. The third state, support, is characterized by the ability to relax within the environment without the need for a response. Support is a continuing process defined by both its relative lack of change and its ready availability of the resources essential to support a meaningful life. The most supportive residential environments present a balanced mix of all three components. Personal fulfillment and increased psychological well-being are the result of a successful combination of maintenance, stimulation and support (Lawton, 1989).

Lawton (1989) concluded that aging, and its accompanying declines in health and abilities, requires a more supportive environment. The disparity between the elderly and their home environment produces concern for their health, safety, comfort and ability to operate in their homes (Brent et al., 1983). Intervention is often necessary to maintain congruence between the individual and the environment. Health care and social services programs are aimed at raising the competency of the individual while environmental designers are focused on the individual's surroundings (Pollack & Newcomer, 1986). Steinfeld, Duncan and Cardell (1977) concluded from their study of the psychosocial effects of accessibility that competence enhancing environments can help improve the adaptive abilities of the disabled.

M. Powell Lawton devoted his career to the study of the environment and how it impacts the lives of its inhabitants. He is personally credited with advancing the field of

home modification—from his estimation of the problems, to his guidelines for assessment of the home, to his definition of the roles of home modification programs and their ability to provide services (Pynoos, Nishita & Perelman, 2003).

Previous Studies about Environmental Modifications

The Lawton and Nahemow Competence-Press Model has been effectively used as the theoretical framework in several studies of peoples' interaction with the home environment. Wister (1989) interviewed 280 seniors to determine what changes they had made in their homes to accommodate declines in physical functioning using the competence-press model as a framework. He found that the older people in his study had not made any design changes in their homes and were not considering future modifications. They were inclined to develop psychological processes of adaptation rather than to alter the physical features of their home. In conclusion, Wister recommended that the Lawton-Nahemow ecological model of aging be expanded to analyze a wider range of personal characteristics for each individual.

Filion et al. (1992) applied this model to guide their study of how elders view housing adaptations. Within this framework they also explored the individual dimensions of elders' adaptation to their environments. The majority of elderly people in their sample expressed a strong desire to age in place and put little thought into future housing alternatives. They were also unlikely to pursue supportive services and housing modifications to support aging in place.

Set within this same framework, McFadden and Brandt (1993) studied a large sample of pre-retirees to ascertain their view of environmental modifications and how these might aid them in their desire to age in place. They tested the relationship between selected demographic characteristics of the respondents and their evaluations of their

current homes to either accommodate a wheelchair or be adapted to wheelchair use. Health status, age, gender and education proved to have no relationship to the possibility of adapting their present homes to accommodate a wheelchair. Using multiple regression analysis, only being married and having multiple sources of retirement income were found to be related to making changes.

Similarly, Connell and Sanford (1997) presented the competence-press model (formerly described as Lawton and Nahemow's Environmental Press Model) as a preface to their in-depth study of people with disabilities. They attempted to determine the need for individualizing home modifications to better facilitate the routines of these individuals' daily lives. This in-depth case study evaluated 40 disabled individuals' competence while performing 27 common household tasks and self-maintenance skills and concluded that housing adaptations should be specific to the individual and his/her unique needs.

Christenson, Mills and Holmes (2000) conducted a survey at a model home, using a convenience sample (n=1,656) and found that 77% of those questioned did not have any universal design features in their present home. Mannion (1992) employed the Lawton-Nahemow Competence-Press theory as her basis for polling Kansas home owners (40-to-60 year olds) to assess their perceptions of universal design features in a home. The assumption presented was that universal design could encourage positive environmental press, or at the least, reduce negative environmental pressures. She tested the independent variables of gender, income and age of the residence in relationship to the respondents' measured perception of attractiveness and likelihood to purchase eight universally designed housing features. None of the variables was significant and most respondents were neutral about the attractiveness of and desire to include these items in

their homes. Mannion's socioeconomic variables will be used in this study to see how they relate to home owners' current incorporation of 25 universal design features in their homes and to see if these variables predict the desire for universal design features in a future home.

The Evolution of Universal Design

Social and Legislative Actions

Story et al. (1998) traced the origins of universal design through a study of both social and legislative actions during the past 50 years. Following World War II the rehabilitative engineering and assistive technology employed for the prosthetics and orthotics needed for injured veterans provided the early innovations that preceded universal design. Rehabilitative engineering incorporated scientific principles and engineering strategies to produce devices to improve the physical, sensory and cognitive abilities of these people with disabilities. Labeled "assistive technology," these innovations enabled people to function more independently in an environment that had no consideration for their particular needs (Story et al., 1998).

The Disability Rights movement paralleled the emerging Civil Rights movement of the 1960's and prompted legislation in the human rights of the disabled in the 1970's, 1980's and 1990's. This legislation forbid discrimination against people with disabilities and increased their access to education, places of public accommodation, telecommunications and transportation (What is Universal Design?, n/d).

Vocational rehabilitation legislation emerged following World War I to provide physical rehabilitation and employment assistance to injured soldiers. New treatments and rehabilitation protocols were adopted as the act was amended in 1945, 1954 and 1965

to serve each new wave of handicapped veterans from World War II, Korea and Vietnam (Welch & Palames, 1995).

These sequential provisions focused on the individual rather than his environment, and reflected changes in how people with disabilities were perceived (Welch & Palames, 1995). In 1961 the American National Standards Institute (ANSI) introduced legislation that outlined practical solutions in precise terms to remove barriers that prevent many individuals from using buildings and facilities. This legislation is referred to as A117.1, the American National Standard Specifications for Making Buildings and Facilities Accessible and Usable by the Physically Handicapped. Since only isolated parts of buildings were featured for adaptation, buildings, as a whole, never became truly accessible or barrier-free as a result of these guidelines (Mace, 1998). No part of this guideline applied to private housing although some minimum specifications were mandated for publicly owned and managed multifamily dwellings.

These became the first systematic guidelines on accessibility to be developed worldwide (Welch & Palames, 1995). A117.1 was the leading step toward making buildings accessible and it became the foundation for all building accessibility codes and regulations that succeeded it (Osterberg, Davis & Danielson, 1995). Unfortunately, the existence of these guidelines resulted in the addition of very few accessible structures because most building owners and architects were either unaware of the standards or did not comprehend the humanitarian advantages of implementation. Not until the late 1960's and early 1970's, when mandated by state ordinance, would these voluntary standards become compulsory (Welch & Palames, 1995).

The National Commission on Architectural Barriers was established under provision of the Vocational Rehabilitation Act Amendments (1965). The commission

took two years to complete its study and concluded that architects were unaware of the problems, manufacturers and suppliers of construction materials did not know about the accessibility standards and there was no reference to architectural barriers in any building code. These problems were the same as those observed with earlier legislation. Residential housing and transportation were excluded from the ANSI standards and there was confusion over exactly what facilities and to what extent they were applicable. Furthermore, there appeared to be little public interest in accessibility (Jeffers, 1977; Welch & Palames, 1995).

The results of this study motivated the legislation of the Architectural Barriers Act (1968) aimed at federal and state governments, mandating that all public use buildings and facilities designed, built, altered or leased with public monies are accessible to the elderly and handicapped (Story et al., 1998; Null & Cherry, 1996; Welch & Palames, 1995). New businesses and industries were instructed to build with accessibility as a priority while existing entities were directed to make accessibility improvements when renovations were required (Jeffers, 1977). Finally, educational programs, both publicly and privately funded, were recommended "so that no longer, merely through thoughtlessness, will millions of citizens be unable to use buildings, parks and other facilities" (Jeffers, 1977. p. 47).

The Architectural Barriers Act of 1968 commissioned three federal agencies to set accessibility standards -- the General Services Administration, the Department of Housing and Urban Development and the Department of Defense. The resulting standards emerged as the Uniform Federal Accessibility Standards, and are enforced by the Architectural and Transportation Barriers Compliance Board.

For the first time disabled Americans were being regarded as valuable and productive citizens and encouraged to enter the mainstream (Jeffers, 1977). Even then, the Architectural Barriers Act had little impact on the larger environment. Many stores, theaters, restaurants and private offices remained inaccessible and there was yet no incentive for that to change (Null & Cherry, 1996).

The Rehabilitation Act of 1973 was the first giant stride toward a more equitable world for the disabled. Modeled after the Civil Rights Act (1964), Sections 502 and 504 of this act encompassed the first civil rights legislation for people with disabilities and made it illegal to discriminate against that segment of the population. The Rehabilitation Act of 1973 applied to all federal agencies, public universities, federal contractors and any other agencies and programs that were federally funded (Story et al., 1998). Under this legislation, the Architectural and Transportation Barriers Compliance Board (A&TBCB) was created to enforce the Architectural Barriers Act of 1968. Handicapped people were now handed the opportunity to move about freely in the built environment.

Thus, with passage of the Rehabilitation Act of 1973, disability was no longer viewed solely from the medical and economic standpoints, but emerged as a sociopolitical issue that centered on the disabling qualities of the environment that limited those people with physical impairments. Disabled citizens emerged as a "minority group" persecuted by conditions and circumstances that could be altered through legislation and political action (Welch & Palames, 1995).

The Rehabilitation Act Amendments (1974) added the Department of Defense as a board member of the Architectural and Transportation Barriers Compliance Board (A&TBCB) as well as commissioned an advisory committee of disabled individuals to provide direction and recommendations to the A&TBCB. More far-reaching, the

amendments allowed Congress to expand the definition of a handicapped person "to include a person who (a) has a physical or mental impairment that substantially limits one or more of such person's major life activities, (b) has a record of such impairment, or (c) is regarded as having such an impairment" (Jeffers, 1977, p. 49).

The Education for All Handicapped Children Act (1975) followed soon after. This legislation, subsequently named the Individuals with Disabilities Education Act (IDEA), insured a free, appropriate and equal education for all children with physical and mental impairments. The educational programs as well as the educational facilities of public schools across America were challenged to meet these mandates (Null & Cherry, 1996; Story et al., 1998; Welch & Palames, 1995).

Null and Cherry (1996) observed that "mainstreaming" handicapped children had two important consequences. First, preconceived ideas about the capabilities of the disabled began to change as people came to interact more fully with this neglected population and began to appreciate the individual rather than seeing only the disability. Second, a whole generation of citizens with impairments had been properly educated within the mainstream of society and had developed the skills and knowledge to advocate for themselves.

In 1978, federally funded independent living services were introduced. With the funds available, people with disabilities were provided more choices in their living arrangements and this support enabled them to be more independent (Welch & Palames, 1995). With these advancements, the 1970's heralded the emergence of three new concepts--program accessibility, mainstreaming and independent living. A key component of all three issues included a restructuring of the physical environment (Welch & Palames, 1995).

In 1982 the Architectural and Transportation Barriers Compliance Board issued its Minimum Guidelines and Requirements for Accessible Design. These guidelines had been rescinded a year earlier but public opinion forced reconsideration and passage. Legislation subsequently served as the foundation of the Uniform Federal Accessibility Standards (UFAS) that was written by four federal agencies: the General Services Administration, the Department of Defense, the Department of Housing and Urban Development and the U.S. Postal Service.

In 1988, after 11 years of work, the Department of Housing and Urban Development finally issued its 504 regulations in response to the 1977 revisions to the Rehabilitation Act. That same year several things happened in the civil rights arena to also bolster the position of people with disabilities. The Fair Housing Amendments Act (1988) expanded the shelter of the Civil Rights Act of 1964 to protect both people with disabilities and families with children. All new multifamily housing units with four or more units built with public funds or not, had to be accessible to the handicapped. This served to significantly increase the stock of accessible housing (Story et al., 1998; Welch & Palames, 1995; Wylde, Baron-Robbins & Clark, 1994). Also in 1988, the National Council on Disability, under President Ronald Reagan, presented the first draft of the Americans with Disabilities Act (ADA) to Congress.

The Americans with Disabilities Act (1990) was signed into law on July 12, 1990, its purpose being to move away from the existing social welfare mentality to a reappraisal and reaffirmation of equal opportunity and equal rights for the disabled (Welch & Palames, 1995). The actual text of the ADA states that people with disabilities should be ensured "equality of opportunity, full participation, independent living, and economic self-sufficiency" (Wylde et al., 1994, p. 251). The ADA served to inform the general

public of the civil rights of the disabled. Under its five sections, it forbid bias in the areas of employment, access to places of public accommodation, public services and programs, public transportation and communications (Story et al., 1998). It also describes the roles and responsibilities of various federal agencies in the implementation of the ADA (Wylde et al., 1994). Null and Cherry (1996) state that "in much the same manner as the Civil Rights Act established protection on the basis of race, color, national origin, sex and religion, the ADA provides protection against discrimination on the basis of disability in the areas of employment, public accommodation, state and local government services and telecommunication services" (p. 2).

The Americans with Disabilities Act serves as a body of consistent national regulations that supercede local ordinances and attitudes. The Access Board (Architectural and Transportation Barriers Compliance Board) issued comprehensive Accessibility Guidelines in 1991. The U.S. Department of Justice adopted these guidelines as the ADA Standards for Accessible Design (Story et al., 1998). Enforcement by the U.S. Department of Justice can result in damages to an aggrieved person in the amount of $50,000 for a first offense. Civil fines for subsequent violations can be assessed up to $100,000.

Two reasons are given for the development and passage of the Americans with Disabilities Act. First, it was deemed that discrimination against people with disabilities was based on past segregation, misunderstanding and prejudice. This was declared unfair and contrary to the spirit of the U.S. Constitution (Null & Cherry, 1996). Second, such discrimination was projected to be expensive. Policy makers saw that managing the costs of increasing numbers of potentially dependent residents would be prohibitive (Null & Cherry, 1996; Welch & Palames, 1995).

Markedly different from other civil rights legislation, where people are classified by race or gender, the ADA encompasses all segments of society. Any person could become a constituent of this protected category at any time in his or her life (Welch & Palames, 1995). Almost every American will realize some positive benefits from this legislation in their lifetime since their projected longer lifespan will be accompanied by an increased number of impairments.

Accessible Design

The barrier-free mandates of early legislation, targeted solely at those in wheelchairs, evolved to become accessible design. Accessible design is a broader interpretation of a barrier-free environment. The Fair Housing Amendments Act, the American National Standards Institute (ANSI), and the Uniform Accessibility Standards (UFAS) all specify national standards for accessible design. At the state and local levels compulsory additions and modifications to achieve accessibility vary widely with individual state and local building codes (Mace, 1990).

The term "accessible" that is specified in much of this legislation refers to features that are permanently installed elements of the home. These include wider doors, open floor spaces, loop or lever hardware on doors and cabinets, knee space under counters and sinks, installed grab bars in the bath and a no-step entrance (Mace, 1990). These features are all permanent structural elements of the dwelling.

Accessible housing that has been mandated by law is built to be rented or sold to anyone and not reserved for inhabitants that require these special features. Some of these features are branded as being "for the handicapped" and consequently are undesirable to many potential occupants. Steinfeld (1994) found those "special" products and surroundings are stigmatizing and often encourage a negative self-image in those who use

them. Even those with disabilities are unique and usually do not require the specific set of special features that define accessibility (Mace, 1990).

Adaptable Design

The concept of adaptable design was developed to overcome some of the stigma of accessible design. Adaptable design has many of the basic structural features of accessible design—wide doors, a no-step entrance, and strategically placed switches and controls—but forgoes components that can be easily added later. This is more in keeping with the occupant's specific needs (Mace, 1990). The bathroom walls are reinforced for the installation of grab bars, should they become necessary, and the cabinetry doors can be easily modified to allow knee space for a seated user. Adaptable designs are easily adjusted (Mace, 1990). Unlike accessible housing, which tries to target all disabled, adaptable housing is a conventional design aimed at accommodating the needs of the individual user (Story, 1998).

Universal Design

Universal design is "the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptations or specialized design" (Connell et al., 1996, p. 435). Not a design style in and of itself, universal design is indoctrination to a method of design (Adaptive Environments Center, 2000). The universal design concept focuses on individuals of all ages, sizes, mental abilities and physical abilities, and is applicable to all people (National Association of Home Builders, 1999). "In the best examples, universal design features go unnoticed because they have been fully integrated into thoughtful design solutions that are used by a full spectrum of the population" (Story, 1998, p. 4). Universal design is accessible and adaptable as well as safe and supportive (Null, 1995).

The Principles of Universal Design can be applied to all design practices ranging from landscape planning, architecture and interiors, to product design, graphic arts and communications (Story, 1998). The Center for Universal Design (1997b) presents the seven Principles of Universal Design, a concise definition of these principles and guidelines to further establish the essential elements of each. These principles are presented in an expanded format in Figure 2.

Universal design has already been established as supportive, adaptable, accessible and safe (Null, 1995). It is also invisible (Mace, 1998: Story, 1998). Universal design is inclusive design (Sanford, Story & Ringholz, 1998). Bednar (1977) adds that universal design should also be aesthetically pleasing and affordable. Null (1995) provides numerous other benefits of universally designed objects and environments:

1) Reduced cost of a device due to greater economies of scale realized by mass production.
2) Greater availability of usable designs that were produced in quantity and marketed through a variety of common channels.
3) Longevity of a device that continues to serve people even as their abilities change.
4) Better reliability of devices that were mass-produced.
5) Easier repairability of common device
6) Inclusion of a person with a disability in using the same tools as everyone else in the family for everyday activities.
7) Lack of stigma associated with devices that are used by everyone (p. 1).

Various researchers have found that universally designed devices and environments that were developed to meet the needs of some were beneficial to all

Figure 2

The Principles of Universal Design

Principle One: Equitable Use

The design is useful and marketable to people with diverse abilities.

Guidelines:

(1a) Provide the same means of use for all users: identical whenever possible, equivalent when not.
(1b) Avoid segregating or stigmatizing any users.
(1c) Make provisions for privacy, security, and safety equally available to all users.
(1d) Make the design appealing to all users.

Principle Two: Flexibility in Use

The design accommodates a wide range of individual preferences and abilities.

Guidelines:

(2a) Provide choice in methods of use.
(2b) Accommodate right- or left-handed access and use.
(2c) Facilitate the user's accuracy and precision.
(2d) Provide adaptability to the user's pace.

Principle Three: Simple and Intuitive Use

The use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

Guidelines:

(3a) Eliminate unnecessary complexity.
(3b) Be consistent with user expectations and intuition.
(3c) Accommodate a wide range of literacy and language skills.
(3d) Arrange information consistent with its importance.
(3e) Provide effective prompting and feedback during and after task completion.

Principle Four: Perceptible Information

The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

Guidelines:

(4a) Use different modes (pictorial, verbal, tactile) for redundant presentation of essential materials.

Figure 2, continued

4b) Maximize legibility of essential information.
(4c) Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions).
(4d) Provide compatibility with a variety of techniques or devices used by people with sensory limitations.

Principle Five: Tolerance for Error

The design minimizes hazards and the adverse consequences of accidental or unintended actions.

Guidelines:

(5a) Arrange elements to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated, or shielded.
(5b) Provide warnings of hazards and errors.
(5c) Provide fail-safe features.
(5d) Discourage unconscious action in tasks that require vigilance.

Principle Six: Low Physical Effort

The design can be used efficiently and comfortably and with a minimum of fatigue.

Guidelines:

(6a) Allow user to maintain a neutral body position.
(6b) Use reasonable operating forces.
(6c) Minimize repetitive actions.
(6d) Minimize sustained physical effort.

Principle Seven: Size and Space for Approach and Use

Appropriate size and space is provided for approach, reach, manipulation, and use regardless of the user's body size, posture, or mobility.

Guidelines:

(7a) Provide a clear line of sight to important elements for any seated or standing user.
(7b) Make reach to all components comfortable for any seated or standing user.
(7c) Accommodate variations in hand and grip size.
(7d) Provide adequate space for the use of assistive devices or personal assistance.

Center for Universal Design. 1997. The principles of universal design (version 2.0). Raleigh, NC: Author.

Caplan (1992) found that articles that were well designed to meet specific needs of an individual almost always satisfy the general requirements of many. Sanford et al. (1998) expressed the opinion that it simply makes more sense to design products and environments for everyone rather than specialty designs for the disabled. Vanderheiden (1990), in his study of aging, found that "disability" design can improve the activities of able-bodied persons. Likewise, Gunn (1988), in his study of housing and aging, concluded that housing features to provide accessibility for older people may also be viewed as improvements by younger groups. Hare (1992), while observing frail elders in suburban neighborhoods, also concurred that adaptations made to enhance life for the elderly were often readily accepted by younger persons as being convenient.

Examples of design elements and products that fit the universal design criteria are becoming more prevalent. The microwave oven is particularly usable by a majority of consumers. Most models have accessible controls on the front of the oven, side-opening doors that are convenient for almost anyone and can be custom installed at the appropriate height for any user (Williamson, 1992). The intended use of curb cuts was to make it easier for people in wheelchairs to transition onto sidewalks. However, it also makes things easier for bicycles, shopping carts, baby strollers and delivery dollies. Even pedestrians have shown a preference to use the curb cut rather than risk tripping over a curb (Vanderheiden, 1990).

Universal Design in Housing

Universal design in housing greatly exceeds the requirements and confines of accessible and barrier free designs (Mace, 1998). Universal design in personal residences is not mandated, and most likely cannot be mandated, except when public monies are used (Mace, 1998). Technically, only apartment complexes with four or more units built

after 1991 must comply with federal Fair Housing Accessibility Guidelines. When universal design is used in a home it is by the choice of the designer, the builder or the home owner. McLeister (1996) observed that government regulations that apply to public buildings, private offices and apartment buildings have drawn attention to what can be done with single-family dwellings.

Features

Universal design features in a home are derived from various sources. Some are readily available products that are purposively selected for their universal design characteristics, as in choosing lever type doorknobs over the conventional round ones. Some features are made more universal by their placement, as when electrical outlets are placed 18" from the floor rather than the usual 12". Other items achieve universal design status by being adjustable, as in adjustable closet rods and moveable shelves in cabinets. Often areas of the homes are dimensioned differently. Open spaces within rooms and three-foot wide door openings would be examples of alternative uses of space and walls. Finally, some items, such as remote controls and touch sensitive switches, are unique items and must be sought from specialized sources (Mace, 1998; National Association of Home Builders, 1999).

There is no specific set of features in a home that give it the title "universally designed." Three elements are essential--one no-step entrance into the home, one bedroom and full bath on the entry level floor, and doors that open to provide at least 32" clear space to pass through (Easy Living Home™, 2002). Beyond these three components additional features are at the discretion of the home owner. A list of the most common elements of universal design in housing is recorded in Figure 3. The

Figure 3

Universal Design Features in Housing

Feature	Structural	Nonstructural
Entrances		
Accessible route from vehicle drop off or parking	X	
Maximum slope of 1:20 to entry door	X	
Covered entryway	X	
5x5 foot minimum maneuvering space	X	
Package shelf or bench to hold parcels, groceries, etc.		X
Full length sidelight at entry door	X	
Movement sensor light controls		X
Ambient and focused lighting (at keyhole)		X
High visibility address numbers		X
General Interior		
5-pound maximum force to open doors		X
32-inch minimum clear door opening width	X	
18-inch minimum space at latch side of door	X	
Flush threshold (maximum of 1/2" rise)	X	
Lever door handles		X
Adjustable height closet rods and shelves		X
Accessible route (42-inch minimum) throughout	X	
Light switches at 44/48-inch maximum height	X	
Electrical receptacles at 18-inch maximum height	X	
View windows at 36-inch maximum sill height	X	
Crank operates (casement) windows	X	
Loop handle pulls on drawers and cabinets		X
High contrast, glare free floor surfaces and trim		X
5 x 5-foot maneuvering space in all rooms	X	
Bathrooms		
Toilet centered 18 inches from side wall	X	
30 x 48-inch area of approach in front of all fixtures	X	
Grab bar blocking in walls around toilet	X	
Grab bars in tub or shower		X
32-inch minimum lavatory counter height	X	
Knee space under lavatory	X	
Lever-type faucets		X
Mirror to backsplash at lavatory		X
18-inch maneuvering space at both ends of tub or shower	X	
Offset controls in tub or shower	X	
Integral transfer seat in tub or shower	X	
Adjustable height shower head		X
Mixer valve with pressure balancing and hot water limiter		X

Figure 3, continued

Feature	Structural	Nonstructural
Kitchens		
Knee space under sink and near cooktop	X	
Lever type faucets		X
Variable height work surfaces	X	
Contrasting border treatments on countertop		X
Stretches of continuous counter for sliding heavy objects	X	
Full-extension pull-out drawers		X
Pull-out shelves in base cabinets		X
Adjustable height shelves in wall cabinets		X
Full height pantry cabinets for up and down storage	X	
30 x 48-inch area of approach in front of all appliances	X	
Front-mounted controls on appliances		X
Cooktops with staggered burners to eliminate dangerous reaching		X
Glare-free task lighting		X

Center for Universal Design. (n/d). Universal design features in housing. [Brochure]. Raleigh, NC: Author.

Center for Universal Design (n/d) has developed this inventory which includes specific features for the entrance, general interior, bathrooms and kitchen.

Cost

The cost of universal design features in the home varies widely with the actual features selected and the timing of the addition of these elements. Stone (1998) states that perceptive architects and designers estimate that universal design features add between one and two percent to the cost of a home when these specifications are drawn into the original house plans. Accordingly, the Home Store, a producer of modular homes, adds 20 standard universal design features to several of their home choices. A 1,600 square foot home sells for about $100,000 with the universal design features adding about $1,500 to the price (Bradford, 1996).

Ron Weitzel, a builder who often incorporates universal features in his Cincinnati, Ohio homes, finds that adding a no-step entrance and reinforcing walls for the future installation of grab bars adds about two percent to the cost of constructing his homes (Perry, 1999). Dommer (1998) finds that the universal design elements increase the hard costs of construction about three to four percent, which translates to about one point seven percent of the home's sale price. Most of this expense is accounted for by the grading of the lot to facilitate a no-step entrance and the additional square footage required to increase ease of movement within. Malizia (1993) argues that universal design elements do not have to add expense. Better use of wasted space and better planning of the location of many housing elements add no cost.

When retrofitting an existing structure the costs are significantly more. Malizia, Duncan and Reagan (1993) report that the addition of the most basic elements of a

universally designed residence--grab bars, handrails, small ramps, hand-held shower heads and new door hardware--can cost $100 to $500 per addition to the existing structure. New exterior entrances and widening doorways can cost $500 to $1,000 per modification. Long ramps and full-scale renovations of bathrooms and kitchens could cost upward of $20,000. It is agreed that as universal design elements become more accepted and readily available these costs will decrease (Connell et al., 1996; Dommer, 1998; Malizia, 1993).

Visitability

The first move toward the increased use of universal design in housing began in the early 1990's with the adoption of visitability ordinances by numerous state and local governments. Visitability "moves from that long undifferentiated list of full, fixed access requirements to a short, prioritized list of the most essential features that the largest number of people can use" (White, in press, p. 1). Visitability aims for just what it indicates--that all people will be able to enter and visit any home to which they are invited. The three components of visitability are: one no-step entrance to the residence, an entry door that allows for at least a 32" clear opening, and a bathroom on the main floor that has an entrance wide enough to accommodate a wheelchair and a toilet area that is manageable for a wheelchair user (Easy Living Home™, 2002; Smith n/d; White, in press).

Austin, Texas, in 1990, Atlanta, Georgia, in 1992, and Urbana, Illinois, in 2000, were the first municipalities to require visitability for all new homes built with local government funding (Kochera, 2002). State legislation has mandated visitability requirements for new homes built with state allotments in the states of Georgia, Texas and Minnesota (Kochera, 2002). Vermont has gone even beyond this to require

accessibility of most unsubsidized single-family homes under construction (Kochera, 2002). More recently Naperville, Illinois and Pima County, Arizona have joined the ranks of those places that promote more adaptable living environments (Kochera, 2002; Wilgoren, 2002). The Naperville ordinance requires all new homes to have 32" door openings on the first floor, reinforced walls on the bathroom for future installation of grab bars, grab bars already in place in tub or shower, light switches that are a maximum of 48" from the floor and electrical outlets that are a minimum of 15" off of the floor (Kochera, 2002). The Pima County ruling requires a no-step entrance, widened doors, lever hardware on some doors and grab bars in the bathroom (Kochera, 2002).

Some states and municipalities have opted to make their programs voluntary rather than mandatory. The city of Irvine, California provides home builders with a list of 32 universal design features as suggestions for making homes more accessible. The builder then must disclose to the potential buyer which of these options are already included in the home, which are available as an added option and those that are unavailable (Kochera, 2002). As an incentive, the city of Freehold, New Jersey promises to reduce the building permit fees for those dwellings that include access features (Kochera, 2002).

A coalition of forward thinking organizations in Atlanta, Georgia has developed a certification for builders that adopt its EasyLiving Home™ features. These builders can feature the EasyLiving Home™ logo in their advertising and signage by incorporating a zero-step entrance, minimum 32" passage doors and one bedroom and full bath on the main floor of any home they build (Easy Living Home™, 2002).

Builders and others who oppose visitability rights legislation contend that, in addition to increasing construction costs, these mandates violate the constitutional rights

and freedom of choice for most of their customers (Mellen, 2002; Wilgoren, 2002). Wilgoren (2002) views this as a battle of minority rights versus property rights.

Use of Universal Design Features by Housing Professionals

Only moderate attention has been given to the role of home designers, home builders and residential contractors and their use of universal design features in single-family homes. Blanco (1994) polled a national sample of home builders to find that, while 38.7% indicated that in the following ten to twenty years there would be an increased demand for accessible and adaptable feature in homes, the majority did not see this as an immediate concern. Belser and Weber (1995) found that home builders were knowledgeable of universal design features but chose not to use them unless the home owner specifically requested these items. Wolford (2000) reiterated this problem in the results of her study of housing contractors in Oregon.

Housing professionals have expressed an understanding of the relationship between user need and environmental design but few have given it consideration when designing or building a house (Gabb et al., 1991). Eighty-six percent of the builders that Blanco (1994) studied agreed that accessible housing is salient to living independently. On the other hand, 86.1% of these same professionals said that they did not actively promote universal design features, while 52.7% of these builders gave the reason for this behavior as "universal design was not applicable." Wolford (2000) found that almost 60% of the builders she surveyed had seldom or never discussed universal design features with their clients.

Most builders agree that accessible features are workable options in homes but incorporation of these features is dependent on consumer awareness and consumer demand (Belser & Weber, 1995). Wolford (2000) found that 55% of the housing

contractors in her study had not received a single request for an adaptable or accessible feature to be added to a home in the past year. Only three of the 25 universal design housing features listed in the Blanco (1994) study were used "occasionally" by the builders, and these were most often at the request of the client.

Builders are characterized as being reluctant to break from traditional building practices (Belser & Weber, 1995). Gabb et al. (1991) found that many builders and contractors are more interested in selling the designs and products that they are most familiar with and which are most convenient. Home builders themselves cite several reasons for failing to use universal design features in dwellings. The most common aversion was the belief that these features add to the cost of the residence. The respondents to Belser and Weber's (1995) survey felt that adding universal design features and products to a new home would increase the construction costs by six to ten percent. Over 30% of the housing contractors in the Wolford (2000) study cited added cost as the most important deterrent to incorporating universal design into a house. Almost as many, 29.9%, cited lack of demand as their primary restraint (Wolford, 2000). Other reasons included limitations imposed by the site, client preference, the uninformed nature of the builder, and builders' distaste for the appearance of universal design features (Belser & Weber, 1995: Wolford, 2000).

Use of Universal Design Features by Consumers

Again, there has been little empirical research to evaluate the actual use of universal design features in the home. Research demonstrates that the majority of the population refrains from planning for future needs for their environment (Filion et al., 1992). This is particularly true of older people who have gradually, and somewhat effectively, adapted to their present environment (Sohn, 1997). Consumers show a

propensity to "make do" rather than adjust to something unfamiliar--especially when the alterations or elements are related to aging or infirmity (Filion et al., 1992; Gilderbloom & Markham, 1996). Sohn (1997) studied older consumers' perceptions of residential universal design features. He found that when consumers actually tried out universal design features and products, it increased their perceptions that these features were useful and attractive but failed to overcome the perception that they were expensive.

Gilderbloom and Markham (1996) observed that consumers were apprehensive about ruining the appearance of their homes and therefore reducing the market value or resale price of their home. In addition to these reasons, Wolford (2000) stated that many home owners feared that addition of universal design features would render their homes more institutional-looking. Older home owners also had a fear of unethical workmen and shoddy workmanship (Wolford, 2000).

Gabb et al. (1991) observed that consumers have limited contribution to the design of their environment, and the little input they do have tends to be reactive rather than proactive. In the absence of consumer input and sound research, designers have depended on their personal insights and experiences to develop products and features to address specialized needs (Connell & Sanford, 1997). Sanford et al. (1998) recommended the inclusion of consumers in the universal design process so that these products better meet the user's needs.

Marketing Universal Design

Historically, the marketing of universal design products and features has been aimed at the aging and disabled populations. This has led manufacturers and suppliers to view the market as small and specialized (Connell et al., 1996). Products that are marketed as "special" will always be perceived as looking different, being more costly

and carrying the stigma of disability (Connell at al., 1996). Rather, the concept of universal design for people of all ages, sizes and abilities needs to be marketed. Mass production of universally designed items will not only help to improve overall acceptance but will also reduce the cost of these products (Connell et al, 1996). Sohn (1997) suggested that the most timely and cost-effective marketing strategy should focus on safety issues and prolonged independence for older consumers. More adherent to the spirit of universal design, Mannion (1992) emphasized that marketing plans for universal design features and products need to completely disregard their "assistive qualities" and accentuate convenience, optimal use of space and affordability. Weisman (1999) suggests that "if the movement for universal design is to effectively generate impacts in the coming century that are worthy of its life sustaining goals, universal design educators and practitioners must go beyond the concern for aging and disability that currently dominates most of our thinking and designing" (p. 4).

Blanco (1994) suggests that marketing efforts be directed to the consumer, since it has been shown that housing professionals are not inclined to promote universal design and do not make any effort to incorporate its features without specific request of the home owner. Confino-Rehder (2001) predicts that the use of universal design by builders and remodelers should be particularly lucrative. Universal design presents the building industry with both a broader market and a new and different expression of design that will enhance its profits.

Story (1998) sees industry as the next frontier in the promotion of universal design. Most importantly, companies need to be presented with statistical proof that the practice of universal design will be both beneficial and profitable. The customer's willingness to pay for these features needs to be investigated. Additionally, industries

need a set of universal design performance measures to effectively adapt their products to benefit the diverse population. Finally, proponents of universal design need direction to market their products properly without stigmatizing the product, the company or the consumer (Story, 1998).

Summary

The Lawton and Nahemow Competence-Press Model served as the framework for this study to illustrate that human conditions--age, size and ability--require that people alter their environments to better meet their needs. Universal design features and products in the home are essential to overcome environmental detriments to living safely and comfortably. The requirements of each individual within the home should be accommodated.

Universal design is the product of the simultaneous evolution of both social and legislative progress and goes even beyond the range of the Americans with Disabilities Act. "Simple compliance does not invite the quality and scope of creative problem solving envisioned by universal design. Universal design focuses on the power of the environment to shape human experience" (Adaptive Environments Center, 2000, p. 2).

When applied to housing, universal design features and products have proven to be both beneficial and cost-effective. In spite of all of this, universal design features are neither widely recommended by building professionals nor are they being sought by the consumer. Few empirical research studies have been conducted to answer the questions about what segment(s) of the population are currently using universal design features in the home, which features they incorporate most often and what may motivate them to do so. This study tries to locate those groups in the population who are currently including universal design features in their homes, those who plan to add these features to a future

home and those segments who are either uninformed or choose not to include these items. Additionally, it will provide quantitative data about specific universal design features currently in use in the respondents' homes and itemize the features that are favored for use in a future home. This information will be used to aid in developing education and marketing programs for consumers, designers and builders who choose to build a universally designed residence or retrofit an existing structure. In conclusion, Behar (1996) eloquently states:

> "The principles of universal design are powerful in their simplicity; they are held within a simple formula that uses thinking and understanding of the varying abilities of people as its base. The four A's--accessibility, adaptability, aesthetics, and affordability--are its dictums; independence, freedom of choice, normalization, value, flexibility, and self-esteem are its excellent results. Marketing tools for success and survival are to creatively produce structures with furnishings, interior finishes, and products that enable these results" (p. 280).

CHAPTER 3

METHODS

Introduction

The purpose of this study was to determine the personal characteristics of consumers who currently have universal design features in their homes and the characteristics of consumers who would like to have universal design features in a future residence. No previous studies that measure the actual number of universal design features in homes could be found.

An *ex post facto* multivariate cross-sectional research design was developed to evaluate the number of universal design features present in the home and to determine if the characteristics of the dwelling, characteristics of the household or characteristics of the principal home owner or renter predict their presence. Both current ownership and desires for future incorporation of universal design features were investigated. The samples, survey instrument, data collection procedures, explanation of the variables and data analysis methods are presented here.

Sample Selection

A national random sample of the names and addresses of 2,500 households was purchased from Survey Sampling, Inc. (SSI). The sampling frame from which the sample was selected was compiled by SSI and consisted of a core compilation of the white pages from every phone book in the United States. These records are transferred and maintained electronically and are updated with each new edition of every phone

book. The core records from the phone books are then overlaid with voter registration records, vehicle registration records and census data, as they become available, to round out the list and correct as many omissions and discrepancies as possible. The list of 2,500 households was computer generated as a proportionate stratified random sample. The number of records from each of the 50 states was proportional to the number of total records from that state in the database (N. Cicogna, personal communication, March 29, 2002). Thus, a state with three percent of the records in the database provided three percent of the records in the sample and a state with one percent of the records made up one percent of the selected sample.

A sample of 2,500 was used with a projected return rate of 30%, or a yield of 750 completed, usable surveys. This was attempted using an initial mailing of the survey and one follow-up contact with the survey recipients.

The major limitation of this sample was the fact that sampling frames taken from phone listings cannot ever be absolutely complete or accurate. The households that tend to not be listed in the phone book have certain characteristics that may be significant. Those incorrectly listed tend to be a younger and more mobile group of the total population. The unlisted households are characterized as being poorer, often minority households, or the affluent that choose to be unlisted for privacy considerations. In this age of cell phones, about two percent of households choose to not have residential phones in lieu of exclusive use of their cell phone. Cell phone numbers are not published so this segment of the population is excluded (N. Cicogna, personal communication, March 29, 2002).

Survey Instrument

The survey instrument used in this study was a fourteen-item mailed survey questionnaire developed by the researcher (Appendix A). It was designed to collect data on the various factors related to the use of universal design in the home. Additionally, it was designed to provide quantitative data about the specific number and elements of universal design in the respondents' current homes and those they desired to incorporate in a future home.

The first two questions established the fact that the respondent was either a home owner or was renting the current residence and the actual type of housing--single family detached, single-family attached, multifamily or manufactured home. Question three asked the age of that structure while question four determined the householder's length of residence in the current home. Question five queried about any plans to move within one year, two years, in more than two years or not at all.

Questions six and seven were developed to determine the presence of someone in the household that has either mobility impairment or a medical condition that makes it difficult to enter and "get around" within the residence. Item six established the presence of such a person while item seven asked for further information about the age-specific nature of any impairment.

Section eight was designed to measure the two dependent variables, the number of universal design features in the present home and the number of universal design features planned for a future home. The format of this section was modeled after the survey questionnaire in the National Home Builders Association's (2002) publication "What 21st Century Home Buyers Want." Twenty-five universal design features were listed. These features were compiled from a review of the literature (AARP, 1999; Belser

& Weber, 1995; DeMerchant & Beamish, 1995; Kochera, 2002; Wolford, 2000) and were selected following the criteria outlined by Wolford (2000). Items were selected because they were the items most frequently found in the literature, were the most appropriate for single-family dwellings, were items beneficial to the widest range of users and best embodied the seven Principals of Universal Design set by the Center for Universal Design (Story et al., 1998). The number of universal design features was indicated for the current residence in a column to the left of the features and a score was calculated from the yes/no responses indicated, where 0=no, this feature is not present in the current home, and 1=yes, this feature in currently installed in the home. The score for the number of universal design features in the present home could range from 0 to 25.

The responses for the number of universal design features planned for a future residence were chosen from four responses listed to the right of the housing feature. The choices to the question "Would you like in a future home?" ranged from "no" to "must have." These responses were coded from 0 to 3 and produced a score that reflected a measure of desire for universal design features proposed in a future home. Scores ranged from 0 to 75, allowing for significant variability in the responses.

Questions nine through fourteen required reporting of more detailed and sensitive socioeconomic variables: the total number of people in the household, the number of persons in each of ten different age categories, the principal householder's age, gender, education level and, finally, the total household income. The categories established for the ages of each member of the household were selected to correspond to the stages of the family life cycle. It was especially beneficial to break down the results by age categories that indicate the presence of children, pre-retirees, early retirees, retirees and different levels of the older age groups to examine how age relates to consumers' use of universal

design features at various stages of life. The items relating to education level and household income were also categorized to correspond to very specific groups within society.

The survey was used only after the University of Georgia Human Subjects Board approved the use of human participants in this study. The questionnaire was submitted to faculty members in the Department of Housing and Consumer Economics at the University of Georgia to assess its content validity, format and clarity. Twenty seven participants from the university and the local community completed the survey in a pilot test of the questionnaire. Following the pilot, the researcher modified several items that appeared confusing or ambiguous.

Data Collection Procedures

The data collection process was conducted throughout the months of July, August, September and October, 2002. The mailing consisted of a cover letter (Appendix B), a universal design information sheet (Appendix C), the survey instrument (Appendix A) and a postage-paid return envelope. Fifty-four of the addresses on the list were not complete enough to be deliverable by the mail service, so the initial mailing was 2,446 pieces.

Three weeks after the initial mailing a follow-up letter (Appendix D) was sent to those who had not yet returned the survey. This second mailing was posted to all those in the sample who had not yet responded and consisted of a follow-up cover letter, a universal design information sheet, a second copy of the survey and a postage-paid return envelope. First-class postage was used on all correspondence so undelivered envelopes were returned and recorded. The survey reply envelopes were stamped with postage

guaranteed marks so that the researcher paid postage for only those that were returned by mail. Surveys were accepted through the second week of October, 2002.

Each entry on the original mailing list was numbered and a corresponding survey was discretely numbered to track which questionnaires were returned. A duplicate set of labels was used to mark off those that had responded and to note those that were undeliverable by the post office because of either incomplete addresses or the addressee had moved away. The participants whose surveys were undeliverable were removed from the sample. To assure anonymity to the respondents, once the survey collection step was complete, the mailing list was destroyed.

Statistical Analyses

Dependent Variables

Two dependent variables, the number of universal design features present in the current home and a score representing the amount of desire for universal design features in a future home, were evaluated. These two factors were used as a measure of the consumers' desire to create a more supportive environment. This was outlined in the Lawton and Nahemow Competence-Press Theory, the theoretical framework for this research. Universal design features for a home are desired to increase the convenience, safety and comfort of all that live there. Incorporation of these elements serves to promote positive environmental press, thereby lowering the demands of the environment and raising individual competence.

Both dependent variables were measured on a continuum. The number of universal design features in the current residence was a summed total of responses to the list of 25 universal design housing features and the question "Do you have in your current home?" The responses were "yes" or "no", with yes coded as 1 and no coded as 0. The

items not answered were coded 9 in the initial data entry and were later replaced with that item's mean score from the entire group of respondents. The possible scores could range from 0 to 25.

The choices of responses to measure the level of desire for universal design features in a future home were presented on a four item Likert-type scale. In answer to "Would you like in a future home?" the choices ranged from "no" to "must have." These responses were coded 0=no, 1=don't know, 2=would be nice and 3=must have. The total score had a possible range from 0 to 75 for this assessment. A higher score indicated a desire for more features. Missing data were initially coded 9 and later replaced with the mean score for all the respondents for that specific question.

Independent Variables

The independent variables in this study can be grouped into four categories: 1) characteristics of the housing structure, 2) household characteristics, 3) personal characteristics of the principal householder or renter, and 4) presence of a household member with mobility impairment. These four groups represented the four constructs being measured. Table 1 lists a description of the dependent and independent variables and the range of responses for each.

The 13 independent variables selected for analysis in this study were selected based on the review of literature, the researcher's personal knowledge of universal design and observation of those who have included universal design features in their homes. Little scientific evidence and few anecdotal studies could be found to determine the factors influencing the inclusion of universal design features in homes. We know that the American population is aging (Bouvier & DeVita, 1991; U.S. Census Bureau, 1995),

Table 1

Variables Measured by Type and Range of Response

Dependent Variables	Variable Type	#	Range of Response
Number of universal design features in current home	Continuous	9	0-25
Number of universal design features desired for future home	Continuous	9	0-75
Independent Variables	**Variable Type**	**#**	**Range of Response**
Housing Characteristics			
Ownership	Dichotomous	1	rent; own
Building type	Categorical	2	single family detached; single family attached; multifamily; manufactured home; other
Age of current home	Continuous	3	0-infinity
Length of occupancy	Continuous	4	0-infinity
Plans to move	Categorical	5	no plans; within 12 months; 1 to 2 years; more than 2 years
Household Characteristics			
Number of residents in home	Continuous	10	0-infinity
Number of elderly in home	Continuous	11	0-infinity
Number of children in home	Continuous	11	0-infinity

Table 1, continued

Variables Measured by Type and Range of Response

Dependent Variables	Variable Type	#	Range of Response
Total household income	Categorical	14	less than $14,999; $15,000 to $29,999; $30,000 to $44,999; $45,000 to $59,999; $60,000 to $74,999; $75,000 to $89,999; $90,000 to $104,999; $105,000 to $119,999; over $120,000
Personal Characteristics of Principal Householder			
Age	Continuous	6	0-infinity
Gender	Dichotomous	1	male; female
Education level	Categorical	13	grade school; some high school; high school graduate; some college or associate degree; bachelor's degree; graduate work or degree
Presence of a person with Mobility Impairment			
Mobility Impairment	Dichotomous	7	yes: no

disability increases with age (U.S. Census Bureau, 1995; Vanderheiden, 1990) and people prefer to age in place. Based on these factors, the necessity of home modifications and universal design features is evident. Christenson et al. (2000) conducted a survey at a model home, using a convenience sample (n=1,656) and found that 77% of those questioned did not have any universal design features in their present home. Descriptive statistics were noted only for the presence (or absence) of universal design features. Christenson et al. (2000) did not analyze the data to test the relationship between the use of these features and any socioeconomic or demographic characteristics of the respondents.

The descriptive statistics for the 13 independent variables were presented; the means of each variable were compared between the two groups that were divided by age. Independent-samples *t* tests were conducted on the continuous variables to determine if the means of the two groups were statistically significantly different.

Each of the 13 independent variables and a discussion of the anticipated results of the analysis follow. This includes a projection about the existence and direction of their relationship with the number of universal design features in current homes and the score of the desire for universal design features in a future home. The units of study were the housing structure, the household and the primary home owner or renter, defined as the first person listed on the mortgage contract or rental agreement. The personal characteristics of the primary home owner or renter that were examined were age, gender and education level. Based on the literature, all three of these variables were expected to show no relationship with the number of universal design features in either a current or future home. McFadden and Brandt (1993) found that neither age, gender nor education level were factors that predicted pre-retirees' assessment that their present home should

be modified to accommodate the future use of a wheelchair. Wister (1989) found that age and gender were not significant to consumers' propensity to alter their housing environment while Mannion (1992) found gender was not related to consumers' likelihood to purchase universal design features for their homes.

The characteristics of the dwelling that were analyzed were: whether the home is owned or rented, the type of structure, the age of that structure, the length of occupancy and any plans the inhabitants have to move from that home. No literature was found that addressed the issue of renting versus owning a home and the occupants' use of universal design features. Therefore it was hypothesized that home owners would have no more universal design features in their homes than renters. Single-family homes were expected to have more universal design features because the inhabitants usually have more freedom to make changes than those in multifamily dwellings where stricter covenants may apply. Wister (1989) found that those who lived in single-family homes had made more adaptations than those that had lived in apartments. No previous studies have evaluated the age of the structure, the length of occupancy in that dwelling and the inhabitants' plans to move and their relationship to the number of universal design features present in the home. It was therefore hypothesized that no relationship would be found.

The household characteristics category included the total number of inhabitants of the household, the presence of elderly residents (60 years and up), the presence of children (12 years and younger) and total household income. Wister (1989) found that individuals who did not live alone were more apt to alter their environments to accommodate advancing age. Therefore, it was hypothesized that a greater number of inhabitants in a home would be positively correlated to a larger number of universal

design features in that home. The presence of either children or elderly people had not been evaluated so it was hypothesized that no relationship exists between these age variables and the number of universal elements in the home. Wister (1989) and Mannion (1992) both found that household income was not significant in the likelihood that the housing environment would be altered or that universal design features would be desired. McFadden and Brandt (1993) found that those home owners who anticipated multiple sources of retirement income were more likely to think that their home could presently accommodate or be made to accommodate a wheelchair. Consequently, no relationship between total household income and the presence of universal design features in the present or future dwelling was anticipated.

Finally, the presence in the home of a person with one or more mobility impairments was expected to be positively related to the number of universal design features in the current home and any future residence. Wister (1989) found that health status was inversely related to home owners' inclination to alter their housing environments.

These 13 independent variables served to measure characteristics that encompassed aspects of both individual competence and housing tendencies that may be related to the respondents' desire to have universal design features in their homes. The presence of a person with mobility impairment is a direct measure of individual competence while age and gender are characteristics that also have a direct bearing on personal capabilities. The attributes of the dwelling and the composition of the household served as measures of characteristics that were also hypothesized to have a direct bearing on the desire to create a more supportive environment with universal design components. Lawton and Nahemow's Competence-Press Model leads one to

predict that age and disability will be positively related to the number of universal design features in the home.

Table 1 indicates that both dependent variables and seven of the thirteen independent variables were continuous variables with an interval level of measurement. The remaining five were either dichotomous or categorical variables and were treated as dummy variables in the data analysis.

Pearson correlation coefficients were calculated for the 13 independent variables to determine the strength of the linear association of each pairwise set of variables. The values of Pearson correlation coefficients range from -1 to 1, with -1 being a perfect negative correlation, 0 being no correlation and 1 indicating perfect positive correlation. Variables that are highly correlated, or multicolinear, are assumed to be measuring the same construct and it becomes necessary to maintain only one of these variables in the analysis.

Multiple regression was the method of data analysis using the Statistical Package for the Social Sciences 9.0 (SPSS) as the statistical computer software. Multiple regression was the choice for statistical analysis because it provides insight into how each of the 13 independent variables influences the two dependent variables individually and how they collectively predict the ownership and desire for universal design features. Kerlinger and Lee (2000) validate this choice stating "multiple regression analysis is a method for studying the effects and the magnitudes of the effects of more than one independent variable on one dependent variable, using the principals of correlation and regression" (p. 755). In this study there were two complete sets of statistical analyses, one to correspond to each of the two dependent variables.

Statistical Models

The two statistical models for this study were the regression equations:

$$Y_1 = a + b_1x_1 + b_2x_2 + b_3x_3 \ldots\ldots\ldots + b_{13}x_{13} + e$$

$$Y_2 = a + b_1x_1 + b_2x_2 + b_3x_3 \ldots\ldots\ldots + b_{13}x_{13} + e$$

Y_1 Dependent variable 1, the number of universal design features in the current home.

Y_2 Dependent variable 2, the number of universal design features planned for a future home.

a Y-intercept, a constant indicating where the regression line intercepts the Y axis, represents the amount the dependent Y will be when all the independent variables are 0.

b_1 - b_{13} Regression coefficients representing the amount each dependent variable (Y) changes when the independent variable changes one unit.

x_1 - x_{13} Values of the independent variables.

e Error term reflected in the residuals.

The two sets of statistical analyses were conducted in the same manner. The dichotomous variables of rent or own, gender and presence of a person with mobility impairment were binary coded and assigned a value of 1 when the condition of measure was present, 0 when that condition was absent. The categorical variables of education and income were converted to continuous variables. The other categorical variables, building type and plans to move, were converted to dichotomous variables. Building type was categorized as 0=single family detached dwelling and 1=all other types. Plans to move was categorized as 0=no plans to move and 1=have plans to move. Once the SPSS procedure was complete it was possible to determine the effect, if any, and the

magnitude of any effect that each of the independent variables exerted on each of the dependent variables. Additionally, where appropriate, descriptive statistics, including frequencies and means, were used to describe the data.

Summary

A questionnaire was mailed to households selected as a national random sample of the U. S. population to measure the effect of the 13 characteristics of that dwelling, household and home owner or renter on the number of universal design features in their homes, both the present home and one desired for the future. Descriptive statistics as well as inferential statistics were employed to determine the independent variables that were related to each of the two dependent variables.

CHAPTER 4

RESULTS AND DISCUSSION

Introduction

This study was designed to evaluate the number of universal design features that consumers have in their present homes, how many they may desire to include in a future home and the characteristics of the consumer that predict the use of current and future universal design features in the home. Descriptive data about the distribution of the national sample and the demographics of this sample will first be discussed. The 25 housing features from the Universal Design Housing Survey will then be evaluated to determine those that are most often included in consumers' current homes and those most desired for a future residence. A multiple regression analysis will determine how characteristics of the home, of the household and of the principal home owner or renter as well as the presence in the home of a person with a disability predict the presence of universal design features in current homes and desire for universal design features in a future home.

The Sample

The mailing list represented a proportionate stratified random sample of the population of the United States. After removing all incomplete addresses, a mailing consisting of a cover letter, universal design information sheet, survey and postage-paid envelope was mailed to 2,446 addresses. Three weeks later a second complete mailing with a revised cover letter was sent to all households that had not yet returned the survey.

Two hundred eighty four surveys were returned by the post office as undeliverable. Four hundred fifty two surveys were returned by respondents. Of these, 444 were complete enough to use in the analysis, a return rate of 20.5%.

The proportionate stratified random sample was selected to reflect the overall distribution of the U.S. population, the number of each state's records corresponding to their percentage of the total population. Appendix E shows the distribution, by state, of the sampling frame, the returned surveys and how these figures compare to 2000 US Census data. The distribution of the responses closely matched the distribution, by state, of the overall population of the United States.

Two thousand surveys went to a random sample of all households in the United States, while the remaining 500 were randomly selected to oversample households headed by those 60 and older. When the completed surveys were evaluated, it was found that a large portion of the surveys intended for householders 60 years and older had actually gone to households headed by those under 60. Due to the nature of the samples the surveys were redistributed resulting in two almost equal-sized groups—230 surveys from those under 60 years and 214 completed surveys from households headed by persons 60 years and older. These two groups were analyzed separately when evaluating the number of universal design features in the home and in the descriptive data of the independent variables.

Description of the Dependent Variables

Universal Design Features Currently in the Home

The 25-item list of universal design features allowed the householder to indicate by circling "yes" or "no" if these features were present in their current home. Items were scored with a 1 for all "yes" answers and a 0 for "no". The resulting scores gave a basis

for comparison of the number of features each residence possesses, as well as a mean score for each housing feature that can be ranked to determine which items are most popular in homes. Any missing data for these questions were replaced with the mean score for all answers to that question. Table 2 shows the resulting scores indicated for households where the principal home owner or renter is under 60 years of age and in those cases where the owner or renter is 60 years and older. This table also indicates the actual percentage of respondents who had the universal design feature in their current home.

Among the group of households headed by those under 60 years of age, the top five most included items were, in order of popularity: 1) One bedroom and full bath on the main floor, 2) Microwave oven at counter height, 3) Light switches 36-45" from the floor, 4) Lever controls on faucets, and 5) 34" or wider interior doors. Sixty-six percent of these younger households had a bedroom and full bath on the main floor, 56% had a microwave oven at counter height, 49% had light switches that could be reached from a sitting position, 49% had lever control faucets in the kitchen and 47% had 34" or wider interior doors. The homes owned by those in the older category had the same five features most often found in their current homes, but in a slightly different order of prevalence: 1) one bedroom and bath on the main floor, 2) lever controls on faucets, 3) light switches 36-44" from the floor, 4) microwave oven at counter height, and 5) 34" or wider interior doors. Among these older home owners and renters, 79% had a bedroom and full bath on the main floor, 64% had lever control on the kitchen faucets, 58% had light switches 36-44" from the floor, 53% had a microwave oven at counter height and 47% had 34" or wider interior doors.

Table 2

Universal Design Features in Current Home

Housing Feature	Owner/Renter Under 60 years			Owner/Renter 60 Yrs & Over		
	Mean	s. d.	% Y	Mean	s. d.	% Y
General Housing Features:						
One entrance with no steps	.260	.437	26	.307	.456	30
Lever door hardware	.310	.456	30	.267	.431	25
34” or wider interior doors	.491	.490	47	.497	.486	47
Electrical outlets 18” from floor	.290	.446	28	.368	.475	36
Light switches 36-44” from floor	.506	.495	49	.595	.485	58
Rocker light switches	.185	.387	18	.246	.425	24
Adjustable closet rods and shelves	.143	.346	14	.180	.377	17
Stair handrails on both sides of the stairs	.192	.376	17	.227	.385	19
One bedroom and full bath on the main floor	.669	.468	66	.816	.378	79
Kitchen Features:						
Countertops of varying heights	.106	.306	10	.190	.390	19
Lever controls on faucets	.501	.497	49	.646	.475	64
Base cabinets with pull-out shelves	.243	.427	24	.310	.459	30
Base cabinets with “lazy-susan” shelves	.299	.456	30	.237	.419	23
Removable base cabinets	.002	.146	2	.003	.178	3
Adjustable shelves in wall cabinets	.379	.483	37	.410	.485	40
Under cabinet task lighting	.234	.421	23	.268	.439	26
Microwave oven at counter height	.569	.491	56	.544	.492	53

Table 2, continued

Universal Design Features in Current Home

Housing Feature	Owner/Renter Under 60 years Mean	s. d.	% Y	Owner/Renter 60 Yrs & Over Mean	s. d.	% Y
Kitchen Features, continued:						
Dishwasher elevated off of the floor	.006	.231	6	.009	.285	9
Bathroom Features:						
Sink with lever faucet	.371	.478	36	.436	.488	42
Hand-held shower head	.285	.447	28	.375	.478	36
Grab bars in the tub/shower	.153	.355	15	.310	.458	30
Anti-scald device on water controls	.009	.282	9	.009	.285	9
Open-front space below sink	.289	.449	28	.330	.466	32
Shower with a minimum of 3’ x 5’ space	.324	.465	32	.454	.490	44
Raised toilet seat	.161	.363	16	.192	.390	19

Likewise, the five features that were found least often in the homes were identical for both age groups. They were: 5) adjustable closet rods and shelves, 4) countertops of varying heights, 3) anti-scald device on water controls, 2) dishwasher elevated off of the floor, and, the least popular, 1) removable base cabinets. Fourteen percent of the younger group and 17% of the older group had adjustable closet rods and shelves. Ten percent of the younger group and 19% of the older group had countertops of varying heights. Nine percent of both groups had anti-scald devices on their bathroom water controls. The dishwasher was raised off the floor in six percent of those homes occupied by owners or renters less than 60 years of age compared to nine percent of those 60 years and older. Finally, removable base cabinets proved to be the least popular item. Only two percent of the younger group and three percent of the older group had this feature in their current home.

There were some interesting differences in the ranking of several items that fell into the middle group. The presence of grab bars in the tub or shower was the twentieth most popular item in the evaluation of the households where the principal home owner or renter was younger than 60 years but ranked twelfth in popularity in the older households. A handheld shower head was found less often in the households where the principal owner or renter was less than 60 years, ranking thirteenth compared to the older group's rank of ninth. The older group ranked base cabinets with "lazy-susan" shelves as their eighteenth most frequently included item compared to a ranking of tenth among the group of principal owners/renters below 60 years of age. Also significant, lever door hardware was the sixteenth most-incorporated item on the older subjects' tally while ranking ninth on the younger owner's or renter's list.

Universal Design Features Desired in a Future Home

The features desired in a future home were expressed as a score derived from rating each of the 25 universal design housing features as 0=do not want, 1=indifferent, 2=would be nice, 3=must have. Thus, the scores could range from 0 to 75 possible points. Any missing data were replaced with the mean score for that item. Table 3 shows the mean scores for this set of dependent variables. As this is a continuous number it is difficult to determine where the dividing line exists between those who desire these features and those who do not. Therefore percentages of those who desire each universal design feature were not listed.

The top five items for the two groups differed in this evaluation. Among the group of subjects in the younger segment the top five items desired in a future home were, in order of importance: 1) one full bedroom and bath on the main floor, 2) adjustable shelves in wall cabinets, 3) under cabinet task lighting, 4) base cabinets with pull-out shelves, and 5) adjustable closet rods and shelves. The households with the principal owner or renter 60 years and older preferred 1) one bedroom and full bath on the main floor, 2) base cabinets with pull-out shelves, 3) grab bars in the tub or shower, 4) adjustable shelves in wall cabinets, and 5) lever controls on faucets. The least-preferred items for both groups, although ordered differently, were the same. The least-preferred features were: removable base cabinets, open-front space below the sink and dishwasher elevated off of the floor. By far the most important difference was the desire for grab bars in a future home. While this feature ranked third on the list of those owners or renters over 60 years of age, grab bars were listed as seventeenth in the order of preference for the younger subjects. The older segment also rated the desire for handrails on both sides of the stairs as a more preferred item. Those owner or renters 60 and older

Table 3

Universal Design Features Desired in a Future Home

Housing Feature	Owner/Renter Under 60 years Mean	s. d.	Owner/Renter 60 Yrs & Over Mean	s. d.
General Housing Features:				
One entrance with no steps	1.611	.819	1.788	.765
Lever door hardware	1.471	.798	1.713	.760
34” or wider interior doors	1.834	.775	1.941	.720
Electrical outlets 18” from floor	1.404	.864	1.684	.815
Light switches 36-44” from floor	1.522	.844	1.798	.726
Rocker light switches	1.599	.756	1.652	.795
Adjustable closet rods and shelves	1.910	.652	1.854	.755
Stair handrails on both sides of the stairs	1.561	.891	1.903	.765
One bedroom and full bath on the main floor	2.138	.791	2.462	.648
Kitchen Features:				
Countertops of varying heights	1.420	.827	1.648	.745
Lever controls on faucets	1.709	.762	2.008	.661
Base cabinets with pull-out shelves	1.913	.635	2.058	.626
Base cabinets with “lazy-susan” shelves	1.784	.782	1.830	.819
Removable base cabinets	1.114	.842	1.368	.790
Adjustable shelves in wall cabinets	1.976	.702	2.037	.612
Under cabinet task lighting	1.972	.705	1.941	.697
Microwave oven at counter height	1.588	.828	1.721	.796

Table 3, continued

Universal Design Features Desired in a Future Home

Housing Feature	Owner/Renter Under 60 years Mean	s. d.	Owner/Renter 60 Yrs & Over Mean	s. d.
Kitchen Features, continued:				
Dishwasher elevated off of the floor	1.188	.827	1.299	.795
Bathroom Features:				
Sink with lever faucet	1.620	.785	1.891	.703
Hand-held shower head	1.596	.885	1.668	.834
Grab bars in the tub/shower	1.548	.882	2.039	.715
Anti-scald device on water controls	1.707	.811	1.849	.772
Open-front space below sink	1.182	.889	1.328	.878
Shower with a minimum of 3’ x 5’ space	1.883	.709	1.931	.719
Raised toilet seat	1.244	.890	1.467	.850

ranked this feature ninth in their list of preferences while the younger group rated it sixteenth. These older people also ranked lever control faucets higher on their list of preferences. On the other hand, the younger segment desired hand held showers, rocker light switches and base cabinets with "lazy-susan" features more often then the older group of subjects.

Comparing the records of universal design features in the current home to those desired in a future home, the one feature most desired in a future home and most often included in the present dwelling was a bedroom and full bath on the main floor of the residence. This held true for both age groups. Removable base cabinets was the feature rated as the least desired and least utilized component, ranking twenty-fifth by both age segments as being present in their current homes and twenty-third and twenty-fifth in the lists of features desired in a future home.

There were some notable differences in what each age group has in their current residence and what they would want in a new home. In the group where the principal home owner or renter was under 60 years of age, four features appeared to be more desired for a future home than are found in the current abode. The desire for under cabinet task lighting became evident. While ranked sixteenth in the items present in a current home this element was third in importance for inclusion in a future home. Adjustable closet rods and shelves were ranked twenty-first in the list of features found in a current residence but moved up to fifth on the list of items desired in a future home. Base cabinets with pull-out shelves was the feature ranked fifteenth in the list describing the current homes but was elevated to fourth in the list of universal design features desired in a future home. Anti-scald devices on faucets became more important, rated twenty-third on the list of features in the current home and tenth on the list of items

desired in a future residence. Conversely, several housing components often found in the current home were not at all preferred for a future home. Light switches 36-44" from the floor were rated as the third most included element in present homes but dropped to eighteenth in the list of features desired in a future home. Among the younger home owners or renters, other features often found in the current home but less desired in a future residence, were open front space below the sink in bathrooms, lever door handles and elevated electrical outlets.

Among the households where the principal home owner or renter is 60 years or older there were many items that ranked differently when comparing what was actually in the current home and what would be considered optimal for a future home. Six household features were not found to be especially popular in current homes but were ranked as being more desired in a future home. As with the younger sample, base cabinets with pull-out shelves, anti-scald devices on faucets, adjustable closet rods and under cabinet task lighting were features that moved up significantly in the rankings from what was found in the current residence and what was desired in a future home.

This older group also indicated that, while ranking low on their list of current features, rocker light switches and grab bars in the tub or shower were more favored items for a future home. Open front space below the bathroom sink, electrical outlets 18" from the floor and light switches 36-44" from the floor were features that appeared near the top of the list of items found in the current homes of both the older and younger samples, but were ranked much lower in the list of universal design items desired in the future. Additionally, the older group had rated having a microwave oven at counter height as the fourth most prevalent item in their current home but this item became the sixteenth most desired item for the future. The inclusion of grab bars for the tub or

shower also gained in importance for this group, ranking twelfth in the list of items in a current home and third in the list of features desired in a future home.

Description of the Independent Variables

The 13 independent variables were divided into four categories. These categories included the housing characteristics, the household characteristics, the characteristics of the principal home owner or renter and the presence of a person with mobility impairment in the home. Descriptive data from both the principal home owners or renters under 60 years of age and those owners or renters 60 years and older will follow. Independent-samples *t* tests were performed on all of the continuous independent variables to determine if the mean values of the two groups were significantly different. The results of this test can be found in Appendix F.

The Housing Characteristics of the Samples

Table 4 shows descriptive data for the housing characteristics of the respondents. A majority of the respondents from both age groups owned their homes. Among the owners or renters under 60 years of age 80.9% owned their homes. The older age group showed an even higher rate of ownership at 89.3%. Of these, 76.5% of the younger group and 78.5% of the older group lived in single family detached buildings, while the remaining lived in any one of the other choices: single family attached, multifamily, manufactured housing or "other" types of structures. The actual age of the homes surveyed in this study ranged from 1 year to 175 years. The mean age of these structures was very similar for both groups of respondents. The average age of the homes occupied by the younger group was 34.6 years while the mean age of the older subjects' homes was 36.5 years. The independent-samples *t*-test shows that the mean ages of the two groups of homes were significantly different at the $p < .05$ level.

Table 4

Housing Characteristics of Samples

Variable	Owner/Renter Under 60 Yrs. n	%	Owner/Renter 60 Yrs. and Over n	%
Ownership				
Rent	44	19.1	23	10.7
Own	186	80.9	191	89.3
Type of Structure				
Single family detached	176	76.5	168	78.5
Single family attached	10	4.3	7	3.3
Multifamily	27	11.7	27	11.6
Manufactured home	11	4.8	11	5.1
Other	6	2.6	1	.5
Plans to Move				
No response	4	1.7	0	0
In the next year	17	7.4	12	5.6
1 to 2 years	37	16.1	15	7.0
More than 2 years	47	20.4	19	8.9
No plans to move	125	54.3	168	78.0

Variable	mean	s.d.	mean	s.d.
Age of Structure, yrs	34.6*	27.2	36.5*	24.0
Length of Residence, yrs	9.9**	10.9	20.7*	15.5

* $p < .05$ ** $p < .001$

The length of residence at this home differed markedly for the two groups also. The principal home owners less than 60 years of age had lived in their homes an average of about 9.9 years while those 60 and older had resided in their homes twice as long, an average of 20.7 years. These means of 9.9 years and 20.7 years proved to be significantly different on the independent-samples *t* test at the $p < .001$ level. A little over one-half (54.3%) of the younger respondents had no plans to move to a different home in the future while over three-quarters (78.5%) of the older group expressed no plans to relocate.

The Household Characteristics of the Samples

The household characteristics of the sample consisted of the total number of residents in the home, the number of children in the residence, the number of persons older than 65 in the home and the total household income. The results of this are shown in Table 5. The average number of residents in a home where the principal owner or renter was under 60 years of age was 3.2 persons while the mean number of occupants in the homes where the principal owner or renter was 60 or older was 1.9 persons.

The number of children in the younger headed households ranged from zero to seven children. Among these households, 59.6% had no children, 20.4% had one child, 10.4% had two children and 9.1% had three or more children. Predictably, the households where the owner or renter was over 60 had fewer children. Over 96% of these homes had no children, 3.3% had one child, and .5% had two children. No household in this category had over two children.

Over 95% of the homes where the principal home owner was under 60 years of age had no one dwelling there who was 65 years or older. About four percent of the homes had one older person and one percent of these homes had two older persons. In

Table 5

Housing Characteristics of Samples

Variable	Owner/Renter Under 60 Yrs. n	%	Owner/Renter 60 Yrs. and Over n	%
Number of Children				
None	137	59.6	206	96.3
1 Child	47	20.4	7	3.3
2 Children	24	10.4	1	.5
3 or more children	21	9.1	0	0
No response	1	.4	0	0
Number of Persons 65 and Older				
None	218	94.8	57	26.6
1 older person	9	3.9	72	33.6
2 older persons	2	.9	85	39.7
Total Household Income				
Less than $14,999	12	5.2	21	9.8
$15,000 to $29,999	36	15.7	39	18.2
$30,000 to $44,999	28	12.2	36	16.8
$45,000 to $59,999	28	12.2	31	14.5
$60,000 to $74,999	34	14.8	12	5.6
$75,000 to $89,000	24	10.4	19	8.9
$90,000 to $104,999	16	7.0	13	6.1
$105,000 to $119,000	17	7.4	2	.9

Table 5, continued

Housing Characteristics of Samples

Variable	Owner/Renter Under 60 Yrs. n	%	Owner/Renter 60 Yrs. and Over n	%
Over $120,000	20	8.7	7	3.3
No response	15	6.5	34	15.9

Variable	mean	s.d.	mean	s.d.
Total Numbers of Residents	3.2**	1.4	1.9**	.9
Household Income Amount as a Continuous Variable	$63,354*	$34,435	$50,051*	$28,892

* p < .01 **p < .001

contrast, almost 40% of the dwellings where the principal owner or renter was 60 years or older had two persons over 65 residing there. About 34% of these homes had one person present who was over 65 years of age, and 26.6% of the homes where the principal owner or renter was 60 years or older had **no one** 65 or older living there. Among the 214 households headed by residents 65 and older there were 57 residences headed by owners or renters that fell into the 60 to 65 age group.

Total household income varied markedly between the two age group samples. While 5.2% of those households of owners or renters under 60 years of age reported annual incomes of less than $14,999, 9.8% of the households headed by owners or renters 60 and older reported income less than $14,999. Following this same pattern of lower average income in the older group, 23.1% of the younger owners or renters reported an annual household income of over $90,000 compared to 10.3% of the older households

To better use these data in the regression analysis the categorical data were converted to continuous variables by using the median income for each category. The mean income of the households headed by a principal owner or renter under 60 years of age was $63,354 while the average income of those households headed by someone over 60 was lower, $50,051, as shown in Table 5. The independent-samples *t* test determined that the mean incomes of these groups differ significantly at the $p < .01$ level.

The Characteristics of the Principal Home Owner or Renter

Table 6 shows the age, gender and education level of the principal home owner or renter. The mean age of the owner or renter of those less than 60 years of age was 43.9 years while the average age of the owner or renter in the older category was 71.1 years. The mean ages of these two groups were significantly different at the $p < .001$ level. The actual ages of the owners or renters ranged from 22 to 90 years of age.

Table 6

Characteristics of Principal Home Owner or Renter

Variable	Owner/Renter Under 60 Yrs. n	Owner/Renter Under 60 Yrs. %	Owner/Renter 60 Yrs. and Over n	Owner/Renter 60 Yrs. and Over %
Gender				
Male	168	73.0	153	71.5
Female	60	26.1	61	28.5
Education Level				
Less than high school graduate	11	5.2	25	11.6
High School Graduate	44	19.1	44	20.6
Some college/associate degree	69	30.0	67	31.3
Bachelor's degree	48	20.9	27	12.6
Graduate work or degree	57	24.8	51	23.8

Variable	mean	s.d.	mean	s.d.
Age	43.9**	9.7	71.1**	7.5
Education Level Converted to a Continuous Variable	14.8	2.5	14.3	2.8

** $p < .001$

The distribution by gender of the principal home owner or renter was nearly the same for both age categories. As shown in Table 6, the principal home owner in the less than 60 age group was male in 73% of the households compared to almost 72% of the older households. These figures contradict the idea that a large proportion of older households are headed by females, usually older, widowed women.

The education levels of the principal owners or renters in both groups were similar in the categories of higher education. Those having bachelor's degrees varied by group; 20.9% of those less than 60 had a college degree compared to only 12.6% of those 60 and over but those having done graduate work or who had obtained a graduate degree were about equal for the two groups, 24.8% for those less than 60 years old and 23.8% for those 60 and over. Only 5.2% of the younger owners or renters had less than a high school education while 11.6% of the owners or renters 60 and over had less than high school. The groups were about equal when comparing the number of high school graduates. Thirty percent of the younger owners or renters had a high school diploma compared to 31.3% of the older category of respondents. When these categories were converted to a continuous variable by assigning the number of years of schooling completed, the mean education level for the two groups was similar, 14.8 years for those in the younger category and 14.3 years for the older group. The independent-samples *t* test concluded that the mean values for years of education for the two groups were not significantly different.

Presence of a Person with Mobility Impairment in the Household

The incidence of a person with mobility impairment is detailed in Table 7. The households where the principal home owner or renter was less than 60 years of age showed that 9.1% of these households had a person with mobility impairment living

Table 7

Presence of a Person with Mobility Impairment in the Household

Variable	Owner/Renter Under 60 Yrs. n	%	Owner/Renter 60 Yrs. and Over n	%
Presence of an impaired person				
Impaired person present	21	9.1	30	14.0
No impaired residents	208	90.4	183	85.5
No response	1	0.5	1	0.5

there. Among the households of those owners or renters 60 and older, the incidence of a mobility-impaired person rose to 14%. The U.S. Census Bureau (2000) reported that almost 15% of the population over the age of five have a disability.

Correlation of the Independent Variables

Pearson correlation coefficients were calculated for the 13 independent variables to determine the strength of the linear association of each pairwise set of variables. The results of this test are shown in Appendix G. The variable, total number of persons in the household (PERSONS), was highly correlated with the presence of a child in the home (CHILDCAT), with a coefficient of 0.656, and moderately correlated with the variable age of principal home owner or renter (AGEOWN) with a pairwise correlation of -0.424. The variable defining the presence of a person 65 or older in the household (OLDCAT) was very highly correlated with the variable AGEOWN with a Pearson Correlation Coefficient of 0.744.

The variables PERSONS and OLDCAT were not included in the multiple regression analysis because they were so highly correlated with other variables that remained in the multiple regression. The pairs were those correlating the presence of one or more children and the age of the principal owner or renter (CHILDCAT-AGEOWN) with a correlation coefficient of -0.506), the pair correlating the number of years at the residence and the age of the principal owner or renter (TENURE-AGEOWN at 0.474), and the pairwise correlation of years of education and the amount of annual household income (EDUYRS-INCOMAMT at 0.415). These were expected relationships as younger home owners or renters are more likely to have children living in the home. Also, older owners or renters would be expected to have lived in their current residence longer, as aging-in-place becomes more important to this group. The correlation between

income and education was also an anticipated relationship. When a test multiple regression analysis was run that excluded the variables CHILDCAT, TENURE and EDUYRS the variables that were found to be significant in predicting the number of universal design features for both the present and the future remained the same. It was decided to retain these variables.

Results of the Hypotheses Tests

Two multiple regression analyses were performed to test the hypotheses. The first was to determine the effects of the remaining 11 independent variables on the number of universal design features, chosen from a list of 25, present in the current home. The second analysis investigated the relationship between the same set of 11 independent variables and the summed score of the subjects' ratings of their desire for these universal design features in a future residence. The independent variables were stated as null hypotheses and fell into four categories—the housing characteristics, the household characteristics, the characteristics of the principal home owner or renter, and the presence of a person with a mobility impairment in the home.

The regression analysis tested the independent variables outlined in the two hypotheses. These hypotheses were made regarding the number of universal design features incorporated in a current dwelling and preferences for these features in a future home:

H_1: There is no statistically significant difference in the number of universal design features consumers have in their current home based on factors in the following four areas:

a) Housing characteristics: whether the consumer rents or owns the current home, building type of the current home, age of the current residence,

length of occupancy at the current residence and any plans to move from that home.

b) Household characteristics: total number of residents in the household, presence of elderly persons in the household, presence of children in the household and total household income.

c) Personal characteristics of the principal householder: age, gender and education level

d) The presence of a household member with mobility impairment or health issues that reduces mobility while entering or within the home.

H_2: There is no statistically significant difference in the number of universal design features consumers would like to have in a future home based on factors in the following four areas:

a) Housing characteristics: whether the consumer rents or owns the current home, building type of the current home, age of the current residence, length of occupancy at the current residence and any plans to move from that home.

b) Household characteristics: total number of residents in the household, presence of elderly persons in the household, presence of children in the household and total household income.

c) Personal characteristics of the principal householder: age, gender and education level.

d) The presence of a household member with mobility impairment or health issues that reduces mobility while entering or within the home.

Multiple Regression Predicting the Number of Universal Design Features in Current Home

The results of the regression analysis for H_1 regarding the number of universal design features currently in the home is shown in Table 8. Stated in H_1a, five independent variables were examined as housing characteristics, whether the housing unit was rented or owned, whether the structure was a single family home or another type of building, the age of the structure, the length of occupancy and whether the subjects had plans to move in the future. Of these five variables, the only one found to be statistically significant was the age of the structure. The null hypothesis concerning the age of the structure was rejected. Negatively related to the number of universal design features present in the home, it had an unstandardized regression coefficient, or b-value, of -.033. Everything else remaining constant, for every year older the house is, there were .033 fewer universal design features present. The null hypothesis was accepted for the other four housing characteristics.

H_1b is the hypotheses concerning the second group of variables, the household characteristics. Only two of these variables were measured, whether or not the household included children under the age of 12 and the total annual household income. The variables measuring the total number of residents in the household and the presence of elderly persons in the household were found to be too closely related to other variables to be included in the regression procedure. No significant relationship was found to exist between the presence of children in the household or the total household income and the number of universal design features in the current home. The null hypothesis was accepted in these two cases.

Table 8

Regressions on the Presence of Universal Design Features in a Present Home on Housing, Household and Owner/Renter Characteristics (n=444)

Variable	b-value	β	t-value
Housing Characteristics			
Rent or own (1=own)	-.031	-.003	-.050
Type of structure (1=other than single family)	-.334	-.036	-.657
Age of structure (years)	-.033	-.220	-4.344**
Length of occupancy (years)	.007	.028	.464
Plans to move (1=have plans)	-.649	-.079	-1.575
Household Characteristics			
Presence of children (1=yes)	-.156	-.017	-.311
Total household income (dollars)	.0000009	.077	1.367
Characteristics of Principal Owner/Renter			
Age (years)	.044	.182	2.990*
Gender (1=male)	.504	.058	1.208
Education level (years)	-.039	-.026	-.519
Presence of a Person with Mobility Impairment			
Person with impairment (1=yes)	-.154	-.013	-.787
Intercept			
	F-value=4.602**		R^2=.106

* p < .01 ** p < .001

The age of the principal owner or renter, the gender of this person and his/her education level comprised the variables measured as characteristics of the principal owner or renter, of H_1c. Table 8 shows that the only variable significantly related to the presence of universal design features in the home was the age of the principal owner or renter. With a b-value of .044 and everything else remaining constant, there were .044 more universal design features for each year's increase in the age of the owner or renter. The null hypothesis for the age of the owner or renter was rejected while the null hypotheses concerning the gender and education level of this person were accepted.

Finally, H_1d stated that the presence of a person with mobility impairment was not related to the number of universal design features in the current home. This variable did not have significant predictive power on the number of universal design features presently included in the home. Thus, the null hypothesis was accepted.

In summary, only two of the independent variables, the age of the structure and the age of the principal home owner or renter, were found to affect the number of universal design features in the present residence. Only among newer homes do respondents report that they have more universal design features, a finding consistent with trends in home building technology. Older owners and renters tended to have slightly more universal design features. Of the two variables found to be significant, the age of the structure, with a beta of -.220, provided more predictive power than the age of the owner or renter, with a standardized coefficient of .182.

The multiple regression also tested an overall null hypothesis--that there was no relationship between the group of all 11 variables and the number of universal design features present. The F-value for the model was 4.602; therefore, the overall null

hypothesis was rejected at the $p < .001$ level. The R^2 for the model was .106, indicating that all 11 independent variables collectively explain 10.6% of the variance in the number of universal design features present in the subjects' current homes.

Multiple Regression Predicting the Score of the Scale of Desirability of Universal Design Features in a Future Home

H_2 presents the same 11 independent variables that were included in the first regression analysis. The hypotheses were again stated as null hypotheses. These independent variables were tested to determine whether they predicted higher scores on the subjects' perceptions of the desirability of universal design features in a future home. The results of this regression analysis are found in Table 9.

The housing characteristics of the households were stated in H_2a. The characteristics were whether the consumer rents or owns the current home, building type of the current home, age of the current residence, length of occupancy at the current residence and any plans to move from that home. Four of the five variables in the housing characteristics category had no statistically significant predictive power regarding subjects' desire for universal design features in a future home. Only the variable that indicated a plan to move proved to be significant. This was a dummy variable, with 0=no plans to move and 1=plans to move. The null hypothesis was rejected at the $p < .05$ level. A b-value of 2.94 indicated that, all things being constant, those that have plans to move had, on average, a score 2.93 points higher on the design features scale than those with no plans to move. The scale was a 75-point scale with ratings of 0 to 3 for each of the 25-items; therefore a score of 2.93 points higher represents about one additional housing feature. The null hypotheses relating to the other four variables, rent or own, type of structure, age of structure and length of occupancy,

Table 9

Regressions on the Presence of Universal Design Features in a Future Home on Housing, Household and Owner/Renter Characteristics (n=444)

Variable	b-value	β	t-value
Housing Characteristics			
Rent or own (1=own)	-.824	-.026	-.434
Type of structure (1=other than single family)	-1.187	-.042	-.778
Age of structure (years)	.027	.058	1.148
Length of occupancy (years)	-.050	-.062	-1.026
Plans to move (1=have plans)	2.940	.117	2.330*
Household Characteristics			
Presence of children (1=yes)	-.083	-.003	-.054
Total household income (dollars)	-.000	.000	-.003
Characteristics of Principal Owner/Renter			
Age (years)	.187	.254	4.141***
Gender (1=male)	-1.734	-.065	-1.357
Education level (years)	-.174	-.039	-.760
Presence of a Person with Mobility Impairment			
Person with impairment (1=yes)	5.163	.140	2.955**
Intercept			
	F-value=4.113***		R^2=.096

* p < .05 ** p < .01 *** p < .001

were accepted. No significant relationship existed between these variables and a difference in the score for desire for universal design features in a future home.

The household characteristics tested, outlined in H_2b, were the presence of children under the age of 12 years and the total annual household income. Neither was predictive of a higher score on the scale of desire for future universal design features. The null hypothesis was accepted for these two variables.

H_2c stated the personal characteristics of the principal home owner or renter that were measured. These were the age, gender and education level of the principal home owner or renter. The owners' or renters' age was found to be statistically significant in predicting a higher score on the scale that measured the desire for universal design features in a future residence. With a b-value of .187, and all other variables remaining constant, there is a .187 point increase in the desirability score for every year increase in the age of the principal home owner or renter. A t-value of .000 allowed the null hypothesis to be rejected at the $p < .001$ level. The remaining two null hypotheses in this category, pertaining to gender and education level, were accepted.

The final variable, stated in H_2d, was concerned with the presence of a person with mobility impairment in the home. This variable proved to be statistically significant. The null hypothesis was rejected; there is an effect of having a mobility impaired person in the home on the respondents' desire for universal design features in a future home. The b-value was 5.163, indicating that in a home with a person with a mobility impairment there was a score, on average, of 5.163 points higher than in a home where there was not a person with mobility impairment. The scale for desired future elements was based on a range of 0 to 3 where three points corresponds to one additional

universal design feature. Therefore, this additional 5.163 corresponds to almost two additional universal design features.

In summary, three variables were found to have a statistically significant effect on respondents' desire for future incorporation of universal design features. The variables were the age of the principal home owner or renter, the presence of a person with mobility impairment in the home and having plans to move. Age, with a standardized regression coefficient, or beta weight, of .254 showed the strongest predictive ability. The presence of a person with mobility impairment, with a beta weight of .140, had the second strongest relationship, while the weakest relationship was the respondents' future plans to move with a beta weight of .117.

With an F-value of 4.113, the overall hypothesis was rejected at the $p < .001$ level. There was a relationship between the group of all 11 independent variables and the score on the scale of universal design features desired in a future home. The R^2 for the model was .096, indicating that all 11 variables collectively explain only about 9.6% of the variance in the score of the desire for universal design features in a future home.

Summary

Descriptive statistics were developed to quantify and define the universal design features found in the homes of the 444 subjects who responded to the Universal Design in Housing Questionnaire. The number and itemization of features desired in a future home were then investigated. Finally, multiple regression analyses uncovered the specific factors, from the 11 that were tested, that relate to the presence of universal design features in a current home and an increased score on the scale that measured the desire for more universal design features in a future home.

The age of the housing structure and the age of the principal home owner or renter were predictive of having more universal design features in a current home. Newer houses included more universal design features. Older home owners or renters incorporated more features in their residences. When evaluating the desire for universal design features in a future home, the age of the principal owner or renter, the presence of a person with mobility impairment and plans to move were all positively related to a higher score on the scale of desire for universal design features.

CHAPTER 5

SUMMARY AND IMPLICATIONS

Introduction

Universal design products and features are developed to make life safer and more comfortable for all. Everyone, especially the aging and disabled populations, benefits from the inclusion of these features in a home. As the overall age of the American population rises, the number of people with a disability increases. Aging-in-place remains the objective of most and the home environment plays a larger role in promoting independence than ever before.

Very little empirical data have been collected to evaluate the extent of the current use or the desire to incorporate universal design features in the home. Up to this point the research directed at the use of universal design in the home has been either focused on home builders or has revolved only around households that include elderly or disabled residents. Additionally, these few studies have primarily used convenience samples to collect the data presented. This study endeavored to measure the number of universal design elements present in the current home, the universal design features desired in a future home, and the personal and household characteristics that relate to the inclusion of these universal design components. It also used a broader sample of the population than previous studies.

A national random sample of 2,500 households in the United States was polled with a response rate of 20.6%, yielding a sample of 444 reports from home owners and renters. The portion of the population 60 years and older was over sampled to assure an

adequate representation of this group. The two groups for analysis, divided by those home owners or renters under 60 years of age and owners or renter 60 years and older, were almost equal in size. Two hundred and thirty surveys were received from home owners or renters under 60 years of age while those owners or renters 60 and older submitted 214 completed surveys. Even though the average age of each group differed, there were few differences in the overall characteristics of the groups.

Descriptive Summary of the Variables

The Characteristics of the Two Samples

Many of the characteristics of the two age groups were similar. About the same proportion of each group lived in single-family detached housing, 76.5% of the younger group and 78.5% of the owner or renters that were 60 or older. The mean age of the residential structure was similar for both groups--34.6 years for those under 60 and 36.5 years for the older group. Seventy-three percent of the principal home owners or renters were male in the younger group. Similarly, 71.5% of the older principal home owners or renters responding to the survey were male. The education levels of the two groups differed in the lower levels, with the younger groups showing larger percentages of educational attainment at each successive level. However, both groups indicated an unusually high proportion of persons having done graduate work—24.8% of the younger group and 23.8% of the older segment.

Besides average age for the groups (43.9 years for the younger group, 71.1 years for the older), there were some other fundamental differences between the characteristics of the two age groups. Predictably, younger people more often rented their residences, 19.1%, with 79.9% of this group owning their homes. A larger portion of the older group owned their homes (89.3%). The younger owners and renters reported that they had lived

in their current residences 9.9 years. This figure more than doubled in the older population who reported having lived in their current homes for an average of 20.7 years.

Universal Design Features in the Current Homes

As a starting point in the evaluation of universal design in the home, it is useful to see exactly which universal design housing features are currently being incorporated in homes. One bedroom and full bath on the main floor topped the list of current features in the homes of both those owners and renters under 60 years of age and those 60 and older. The same four features followed in the rankings by both of the age groups, in slightly different order. They other features topping both lists were having a microwave at counter height, light switches 36-45" from the floor, lever controls on faucets and 34" or wider interior doors.

The five features that were least often found in current residences also were the same for both groups. Adjustable closet rods and shelves, countertops of varying heights, anti-scald devices on water controls, dishwashers elevated off of the floor and removable base cabinets were rarely found in the homes of the respondents. Some distinct differences between the two age groups did emerge. The households of the older group of owners or renters were more likely to have grab bars in the shower or tub and hand-held showers while the younger households more often included base cabinets with lazy-susan type shelves and lever door hardware. These differences existed even though the mean ages of the structures of the two groups were very nearly the same.

Universal Design Features Desired for a Future Home

What universal design features would these residents like to see in a future home? The answer to this question is critical to how universal design will be marketed to the different segments of the populace. Again, both age groups indicated that one bedroom

and full bath on the main floor were essential in any future home they occupied. The two lists diverged from there. The group of principal home owners and renters under 60 completed their top five features with adjustable shelves in wall cabinets, under-cabinet task lighting, base cabinets with pull-out shelves and adjustable closet rods and shelves. The features favored by the older group were somewhat different: base cabinets with pull-out shelves, grab bars in the tub or shower, adjustable shelves in wall cabinets and lever controls on faucets. Both groups emphasized the need for adjustable features in the home. As the definition of universal design points out—the built environment should accommodate those of all sizes and abilities—adjustable items benefit almost everyone.

Equally as important, the list of features that were found to be least-desired in a future home included removable base cabinets, open-front space below the sink in the bathroom and having the dishwasher raised off of the floor. These features are different than those found in most construction and the respondents may not have understood the benefits to all of being able to pull a stool or chair up to the sink while working. Rather, they may have deemed these modifications only applicable to those in wheelchairs. A dishwasher at a higher elevation allows anyone to reach into it more comfortably.

These items that were preferred the least were the same for both groups. They are also the three features that would be the most conspicuous in the home. Gilderbloom and Markham (1996) observed that consumers were apprehensive about altering the appearance of their homes for fear of reducing its market value or resale price. Wolford (2000) found that many home owners shunned the use of universal design features for fear that these modifications would give the home a more institutional appearance. By allowing his consumers to actually try out the universal design features Sohn (1997) was able to enhance consumers' perceptions that universal design features were attractive and

useful but he was unable to overcome the consumers' perceptions that these features were expensive. More frequent incorporation of these housing features and exposure to these adaptations through education and marketing may prove to "desensitize" the public to these objections about value and appearance. Future research might include a focus on the consumers' willingness to pay for universal design features in the home.

Investigating the differences in what universal design features the home owners or renters had in their current homes compared to what they desired in the future, one bedroom and full bath on the main floor was the foremost requirement for everyone. Removable base cabinets was the least-desired item in the list of features in the current home and maintained that position in the list of features sought in a new home.

There is indication that these consumers do plan to make some different choices when planning a new residence and that their choices vary by age. The renters or owners 60 and over expressed an increased desire to have base cabinets with pull-out shelves, anti-scald devices on faucets, adjustable closet rods and shelves and under-cabinet task lighting. Rocker light switches and grab bars in the tub or shower also showed a dramatic rise on the list of universal design features sought by these older persons when thinking about the design of a new home.

The younger group of owners or renters also seemed ready to make some concessions to the need for change. Under-cabinet task lighting became of primary importance. Good lighting is important for everyone, but this younger group may realize that the addition of task lighting will make it easier to see what they are doing. They also showed more concern about their ability to reach and bend with their increased desire for adjustable closet features and pull-out shelves in cabinets.

Implications of Hypotheses Tests

Variables Predicting the Presence of Universal Design Features in the Current Home

Multiple regression analysis was used to determine the housing, household and principal home owners' or renters' characteristics that would predict the presence of an increased number of universal design features in the home. The only variables found to be statistically significant in this analysis were the age of the home itself and the age of the principal home owner or renter. Universal design features in the home were more often found in newer homes, a finding consistent with new home building technology.

The age of the home owner or renter was positively related to the number of universal design features in the current residence. For every year older the principal owner or renter was, there were more universal design features in the current home. This finding reinforces the concepts of Lawton & Nahemow's Competence-Press model. Lawton (1989) concluded that aging, and its accompanying declines in health and abilities, requires a more supportive environment. The housing adaptations manifested in universal design features are an adaptive behavior to produce personal satisfaction through a better balance between personal competence and environmental press.

Whether the home was rented or owned, the type of structure, the length of occupancy and whether the dwellers had plans to move or not had no statistically significant bearing on the number of universal design features in the respondents' current home. Additionally, the presence of children in the home, the total household income, the gender and education level of the principal home owner and the presence of a mobility-impaired person in the home were not found to predict additional universal design features in the present home. The group of all 11 variables did have some

predictive significance, explaining about 11% of the variance in the number of universal design features found in the present residence.

McFadden and Brandt (1993) tested the relationship between selected demographic characteristics of pre-retirees and their evaluations of current homes to accommodate a wheelchair. Health status, age, gender, and education level proved to have no relationship to the home having design features that would accommodate a wheelchair. No other empirical studies were found that measured consumers' current use of universal design features in the home.

Variables Predicting the Desire for Universal Design Features in a Future Home

The second regression analysis sought to isolate housing, household and consumer characteristics that would predict the inclusion of universal design features in a future home. Three variables were found to be statistically significant in predicting an increased desire to include more universal design items in a future residence. The age of the principal home owner or renter, those households that included a person with mobility impairment and those that had plans to move in the future all indicated an increased desire for more features. None of the other eight features tested, whether the home was rented or owned, the type of housing structure, the age of the structure, the length of occupancy, the presence of children, the household income and the gender and education level of the home owner or renter, provided any individual predictive power about an increased desire to incorporate universal design features in a future home.

Mannion (1992) tested three variables, gender of the home owner, income and age of the residence, and their relationship to universal design features. Her effort to determine the respondents' measured perception of attractiveness and likelihood of their

purchasing eight universally designed housing features found no relationship between these variables and a desire to include them in their homes.

Of the three variables that were statistically significant in this research, age was the variable most predictive of the desire to incorporate universal design features. Those that were older would be more likely to realize the need for environmental adaptations. When a person with mobility impairment occupies a home there is an increased desire for universal design features also. By planning basic universal design features in a future residence these home owners or renters may be using universal design features as a base for adding specialized assistive technology or medical equipment in the future.

Again, these two characteristics, being older and having mobility impairment, substantiate Lawton and Nahemow's Competence-Press Model. Both those that are older and those that currently have mobility impairment realize the necessity of modifying their home environments. Pollack and Newcomer (1986) stated that to maintain the delicate balance between competence and the press of the environment the low-competence individual is faced with having to improve press, bolster competence or retreat from the environment. To better accommodate their needs and increase their safety those that have chosen to age in place have also opted to improve their "press."

Those who had plans to move in the future indicated an increased desire for universal design features in their anticipated future residence. By opening themselves to the possibility of a new, improved environment, rather than the mind set of those planning to age-in-place; these home owners have already investigated options to make their new home safer and more comfortable.

Implications of this Study

Implication for Marketing and Educational Programs

The results of this study indicate that universal design features in the home do appeal to a broad range of people. Further, interest in universal design was not specific to any style of structure or whether the structure was rented or owned by its occupants. The gender of the principal home owner, his /her education level and the total household income did not have any bearing on the number of universal design features either currently owned or desired in the future.

The findings that the current ownership and future desire for universal design features is age-specific only points out that the mission of educational programs is to reiterate that universal design is for the safety and comfort of everyone. While allowing that universal design especially aids the older and disabled populations, it is important to overcome the stigma of "handicapped" design. More emphasis needs to be put on the overall excellent design rather than its appeal to special populations. Articles and environments that are well designed to meet the specific needs of an individual almost always satisfy the general requirements of a larger proportion of the population (Caplan, 1992). Marketing and education are the essential components to stimulating the use of universal design features in the home

The key to marketing universal design is in the essential point that universal design is for everyone. Intervention is often necessary to maintain congruence between the individual and the environment. The disparity between people of all ages, especially the elderly and disabled, and their home environment produces concern for their health, safety, comfort and ability to operate in the home (Brent et al., 1983).

Advertising might focus on universal design features as being safer and more adaptable for children rather than for older adults. Lever door handles and rocker light switches are certainly easier for children to use. Limited dexterity is not limited to the old or infirm; it also afflicts the unpracticed and unskilled. And what would be a better incentive for a child to help in the kitchen than a counter just the height for them to work comfortably?

Universal design features might be marketed simply as safer and more comfortable amenities for the home. The term universal design could be downplayed in favor of such terms as "easy living," thus avoiding the negative implications of specialized design.

An indirect approach might be useful. Consumers could be exposed to universal design in model homes. This is especially effective when the home is done with great style and attention to detail. Universal design can be utilitarian—or it can be luxurious. Motels and hotels could use more universal design features, especially in the bath area. A no-threshold shower and integrated grab bars could be incorporated in every bath rather than in "handicapped" rooms only. This short-term exposure to these and other features could be enough to cause consumers to appreciate the benefits of them and desire to use them in their own homes. Another, similar, tactic is to promote the incorporation of more universal design features in the workplace. Everyday exposure and use would certainly raise the consumers' comfort level with the appearance and use of features that were also contributing to their comfort.

Home building is a market-driven industry. Home builders and designers usually take their cue from what the consumer demands for fear that anything out of the ordinary will make their homes hard to sell. Builders might do well to solicit more buyer input

into the design of homes. Consumers would feel more in control of the design of their residence and builders might be surprised at how open the customer is to innovative ideas especially if it is stylish and attractive.

Consumer demand can be enhanced by several means. An aggressive marketing campaign may be in order, but more subtle means might work better. Peer group discussions about housing safety might appeal to older citizens. They might find information presented by their peers more creditable and informative. Testimonials from satisfied customer who have incorporated universal design in their homes could take the place of a lot of expensive advertising.

Home remodeling will be more in demand as more home owners are getting older and more people are living longer lives, preferring to do so in their own homes. Special programs that target remodelers are already being offered by groups such as the National Association of Home Builders with their Certified Aging in Place certificate that focuses on universal design, the specifics of marketing to and serving older clients and emphasizes good business practices.

Consumer education is the key to the spread of the use of universal design features in the home. The perception that universal design is "special" design, and therefore expensive, needs to be dispelled. Stone (1998) states that perceptive architects and designers estimate that universal design features add between one and two percent to the cost of a home when these specifications are drawn into the original house plans. Dommer (1998) found that the universal design elements increased the hard costs of construction about three to four percent, which translated to about one point seven percent of the home's sale price. Most of this expense is accounted for by the cost of

grading the lot to facilitate a no-step entrance and the additional square footage required to increase ease of movement within.

Just who educates the consumer about their housing needs? The role of the realtor immediately comes to mind. Realtors who are properly educated to the benefits of universal design would be tremendously beneficial. They could subtly highlight the universal design features as amenities to enhance the safety and comfort of the home—thus making the home all the more appealing to the consumer.

Pollack and Newcomer (1986) pointed out that other professionals also contribute Interior designers are able to subtly focus on the individuals' surroundings, or "press," while making the space stylish and personal. Health care and social services professionals are charged with raising the competency of the individual and can achieve this with environmental adaptations also.

Environmental assessment to determine the specific housing design needs of a family might become a value-added feature provided by realtors. Additionally, state and local cooperative extension programming could focus on the value and benefits of universal design in the home. Programs could be targeted to school-age children to teach them the benefits of a home that is designed better for themselves, their parents and their grandparents.

Gabb et al. (1991) found that consumers had trouble visualizing and evaluating house plans. New three dimensional computer technologies will enable consumers to better visualize universal design features in their current home or in their selected house plan by bringing it to life on the screen. These technologies could be employed by builders and remodelers and by realtors to better show the benefits of these universal design amenities.

Implications for Future Studies

A stronger case for universal design use might be developed by a more in-depth study using personal interviews and open-ended questions about peoples' perceptions of universal design features in the home. Future research should revolve around consumers' notions about the cost of these universal design features and measure their willingness to pay for these features.

Consumers' lack of awareness, not lack of need, contribute to consumers' low demand for universally designed housing (Center for Universal Design, 1997a). Marketing and education are the keys to the future of universal design adoption. Builders, architects, designers and the general public need to be educated in the concepts of excellent design, where universal use is a key criterion.

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APPENDICES

Appendix A

The University of Georgia

Department of Housing and Consumer Economics

1. Do you own or rent your curre
   - **Rent**
   - **Own**

2. What type of home do you currently live in? **(X ONE Box)**
   - **Single family detached**
   - **Townhouse/single family attached**
   - **Multifamily (condominium or apartment)**
   - **Manufactured (mobile) home**
   - **Other (Specify) _____**

3. How old is this structure? **(Indicate Number)**
   _____ Years

4. How long have you lived in your current home? **(Indicate Number)**
   _____ Years

5. Do you plan to move to a different home within: **(X ONE Box)**
   - **the next year**
   - **1 to 2 years**
   - **More than 2 years**
   - **No plans to move**

6. Do you or anyone in your home have trouble getting into or getting around inside your home? **(X ONE Box)**
   - **Yes (Go to Question 7)**
   - **No (Go to Next page)**

7. Including yourself, how old is each person who has a problem and what illness or impairment causes the problem:
   Person #1 Age _____Illness or impairment _____
   Person #2 Age _____Illness or impairment _____
   Person #3 Age _____Illness or impairment _____
   (list more as necessary) _____

8. In the left column please circle either **YES** or **NO** if your current home has that feature. In the right column please indicate if you'd like to include that feature in a future home.

Do You Have in Current Home?			**Would You Like in a Future Home?**			
YES	**NO**		**No**	**Don't Know**	**Would Be Nice**	**Must Have**
		General Housing Features				
☐	☐	1. One entrance with no steps to the main level of the home	☐	☐	☐	☐
☐	☐	2. Lever door hardware on interior or exterior doors	☐	☐	☐	☐
☐	☐	3. 34" or wider interior doors	☐	☐	☐	☐
☐	☐	4. Electrical outlets placed higher on the wall (at least 18" from the floor)	☐	☐	☐	☐
☐	☐	5. Light switches reachable from a sitting position (36-44" from the floor)	☐	☐	☐	☐
☐	☐	6. Rocker (touch) light switches	☐	☐	☐	☐
☐	☐	7. Adjustable closet rods and shelves	☐	☐	☐	☐
☐	☐	8. Stair handrails on both sides of the stairs	☐	☐	☐	☐
☐	☐	9. One bedroom and full bath on the main floor of the home	☐	☐	☐	☐
		Kitchen Features				
☐	☐	10. Countertops of varying height for use sitting or standing	☐	☐	☐	☐
☐	☐	11. Lever controls on the faucet at the sink	☐	☐	☐	☐
☐	☐	12. Base cabinets with pull-out shelves	☐	☐	☐	☐

Do You Have in Current Home?			Would You Like in a Future Home?			
YES	**NO**		**No**	**Don't Know**	**Would Be Nice**	**Must Have**
☐	☐	13. Base cabinets with "lazy-susan" type revolving shelves	☐	☐	☐	☐
☐	☐	14. Removable base cabinets at sink to be able to work while seated	☐	☐	☐	☐
☐	☐	15. Adjustable height shelves in wall cabinets	☐	☐	☐	☐
☐	☐	16. Under cabinet task lighting	☐	☐	☐	☐
☐	☐	17. Microwave oven at counter height	☐	☐	☐	☐
☐	☐	18. Dishwasher elevated 15-18" off of the floor	☐	☐	☐	☐
		Bathroom Features (in any bathroom in the home)				
☐	☐	19. Sink with lever faucet controls	☐	☐	☐	☐
☐	☐	20. Hand-held shower head	☐	☐	☐	☐
☐	☐	21. Grab bars in the tub/shower	☐	☐	☐	☐
☐	☐	22. Anti-scald device on all faucet controls	☐	☐	☐	☐
☐	☐	23. Open-front space below the sink	☐	☐	☐	☐
☐	☐	24. Shower stall with a minimum of 3' x 5' floor space	☐	☐	☐	☐
☐	☐	25. Raised toilet seat (seat 17-19" from the floor)	☐	☐	☐	☐

9. How many people live in your home (including yourself)? **(Indicate Number)**
   _____ **People**

10. What are their ages? Please list the number of people in each age category that live in your home, including yourself: **(Indicate Number)**
   _____ **younger than 5 years**
   _____ **5 to 12 years**
   _____ **13 to 19 year**
   (continued on next page)
   _____ **20 to 35 years**
   _____ **36 to 50 years**
   _____ **51 to 65 years**
   _____ **66 to 75 years**
   _____ **76 to 85 years**
   _____ **86 to 95 years**
   _____ **96 years or older**

11. How old is the principal home owner/ renter in your current home? The principal home owner/renter is the first person (or only person) listed on the mortgage, ownership or rental documents. **(Indicate Number)**
   _____ **Years**

12. The principal home owner or renter at this residence is: **(X ONE Box)**
   _____ **Female**
   _____ **Male**

13. What is the highest education level achieved by the principal home owner or renter? **(X ONE Box)**
   - **Grade school**
   - **Some high school**
   - **High school graduate**
   - **Some college or associate degree**
   - **Bachelor's degree**
   - **Graduate work or degree**

14. What was your total household income before taxes in 2001? **(X ONE Box)**
   - **Less than $14,999**
   - **$15,000 to $29,999**
   - **$30,000 to $44,999**
   - **$45,000 to $59,999**
   - **$60,000 to $74,999**
   - **$75,000 to $89,999**
   - **$90,000 to $104,999**
   - **$105,000 to $119,999**
   - **Over $120,000**

THANK YOU FOR YOUR HELP WITH THIS STUDY. PLEASE RETURN YOUR COMPLETED QUESTIONNAIRE IN THE ENCLOSED POSTAGE-PAID ENVELOPE AS SOON AS POSSIBLE

Appendix B

Dear Participant:

Your household has been selected, as part of a random sample of 2,500 homes across America, to participate in a research study sponsored by the Department of Housing and Consumer Economics at the University of Georgia. The study is titled "Presence of Universal Design Features in Consumers' Current Residences and Planned Use in Future Homes." All that is required of you is that you take 15 minutes to fill out the enclosed questionnaire and return it in the postage paid envelope provided.

Universal Design features make homes safer and more comfortable for people of all ages, sizes and abilities. You might already have some of these features in your home or may plan to include these in the future. A short information sheet is included that gives a brief overview of universal design and provides a list of the universal design features.

Your input is important to this study. Your answers will be combined with all of the other answers we receive. The results will benefit many--architects and designers, builders and remodelers, product developers and sales people, and future homebuyers.

All participants must be at least 18 years old. Participation is voluntary and all results will be confidential. No risks are foreseen with participation in this study. There is an identifying number on the questionnaire so that we can check off your name from the mailing list when your questionnaire is returned. Your name will never be associated with your answers. After 60 days the mailing list will be destroyed and you will not be recontacted after that time.

Please take a few minutes to read the enclosed information and fill out the questionnaire. We need responses from across America to help us plan for housing into the 21st Century. If you have any questions, please do not hesitate to contact Ms. Nunn (706/542-8854, nunnt@gactr.uga.edu) or Dr. Sweaney (706/542-4877, asweaney@fcs.uga.edu).

Sincerely,

Teresa L. Nunn
Graduate Student

Anne L. Sweaney, Ph. D.
Professor

Center For questions or problems about your rights please call or write: Chris A. Joseph, Ph. D., Human Subjects Office, University of Georgia, 606A Boyd Graduate Studies Research, Athens, GA 30602-7411; Telephone (706) 542-6514; E-mail address IRB@uga.edu.

Appendix C

Universal Design Features Information Sheet

Universal design is the designing of products and environments so all can use them, as much as possible, without adaptation or special design. The intent is to simplify life for everyone by making housing usable for more people at little or no extra cost. Universal design is for people of all size, ages, and abilities.

A universal feature is any part of a house that can be used by everyone. Examples of universal design features in housing are:

Entrance
- Covered entryway
- A no-step entrance
- Package shelf or bench to hold parcels
- Movement sensor light controls

General Interior
- 32" minimum clear door openings
- Electrical receptacles as 44/48" maximum height
- 5 pound maximum force to open doors
- Lever door handles

Bathrooms
- Grab bar blocking in wall around toilet and bathing area
- 30 x 48" area of approach in front of all fixtures
- Lever type faucet handles
- Hand-held or adjustable height shower head

Kitchen
- Variable height work surfaces
- 30-48" area of approach in front of all appliances
- Pull-out shelves in base cabinets
- Front-mounted control on appliances

Universal Design

Appendix D

Dear Participant:

Within the last three weeks you received an invitation to participate in a research study sponsored by the Department of Housing and Consumer Economics at the University of Georgia. The study is titled "Presence of Universal Design Features in Consumers' Current Residences and Planned Use in Future Homes." If you have already responded, thank you for making this project a success. If not, please consider doing so today. For your convenience, a new questionnaire is enclosed. All that is required of you is that you take 15 minutes to fill out the enclosed questionnaire and return it in the postage paid envelope provided.

Universal Design features make homes safer and more comfortable for people of all ages, sizes and abilities. You might already have some of these features in your home or may plan to include these in the future. A short information sheet is included that gives a brief overview of universal design and provides a list of some universal design features.

Your input is important to this study. Your answers will be combined with all of the other answers we receive. The results will benefit many--architects and designers, builders and remodelers, product developers and sales people, and future homebuyers.

All participants must be at least 18 years old. Participation is voluntary and all results will be confidential. No risks are foreseen with participation in this study. There is an identifying number on the questionnaire so that we can check off your name from the mailing list when your questionnaire is returned. Your name will never be associated with your answers. After 60 days the mailing list will be destroyed and you will not be recontacted after that time.

Please take a few minutes to read the enclosed information and fill out the questionnaire. We need responses from across America to help us plan for housing into the 21st Century. If you have any questions, please do not hesitate to contact Ms. Nunn (706/542-3537, nunnt@gactr.uga.edu) or Dr. Sweaney (706/542-4877, asweaney@fcs.uga.edu).

Sincerely,

Teresa L. Nunn
Graduate Student

Anne L. Sweaney, Ph. D.
Professor

For questions or problems about your rights please call or write: Chris A. Joseph, Ph. D., Human Subjects Office, University of Georgia, 606A Boyd Graduate Studies Research Center, Athens, GA 30602-7411; Telephone (706) 542-6514; E-mail address IRB@uga.edu.

Appendix E

Distribution of Mailing and Resulting Sample by State

State	% of Sampling Frame	Number of Returned Surveys	% of Resulting Sample	State's % of Total US Population
Alabama	1.9	8	1.8	1.58
Alaska	0.1	2	0.5	0.22
Arizona	1.4	7	1.6	1.82
Arkansas	1.0	6	1.4	0.95
California	5.6	30	6.8	12.00
Colorado	1.4	14	3.2	1.52
Connecticut	1.5	10	2.3	1.21
Delaware	0.3	1	0.2	0.28
District of Columbia	0.2	0	0.0	0.20
Florida	7.0	29	6.5	5.68
Georgia	3.3	12	2.7	2.91
Hawaii	0.3	3	0.7	0.43
Idaho	0.5	1	0.2	0.46
Illinois	3.8	17	3.8	4.41
Indiana	2.4	8	1.8	2.16
Iowa	1.2	10	2.3	1.04
Kansas	1.1	4	0.9	0.96
Kentucky	1.7	10	2.3	1.44
Louisiana	1.7	8	1.9	1.59
Maine	0.7	0	0.0	0.45
Maryland	1.8	5	1.1	1.88
Massachusetts	2.8	11	2.5	2.26
Michigan	4.0	17	3.8	3.53
Minnesota	2.1	13	2.9	1.75

Appendix E (Continued)

Distribution of Mailing and Resulting Sample by State

State	% of Sampling Frame	Number of Returned Surveys	% of Resulting Sample	State's % of Total US Population
Mississippi	1.1	3	0.7	1.01
Missouri	2.2	9	2.0	1.99
Montana	0.4	2	0.5	0.32
Nebraska	0.7	4	0.9	0.61
Nevada	0.4	1	0.2	0.71
New Hampshire	0.6	3	0.7	0.44
New Jersey	3.0	9	2.0	2.99
New Mexico	0.5	4	0.9	0.65
New York	7.2	32	7.2	6.74
North Carolina	3.6	17	3.8	2.86
North Dakota	0.3	1	0.2	0.23
Ohio	4.4	17	3.8	4.03
Oklahoma	1.3	6	1.4	1.23
Oregon	1.0	8	1.8	1.22
Pennsylvania	5.0	23	5.2	4.36
Rhode Island	0.4	1	0.2	0.37
South Carolina	1.7	8	1.8	1.43
South Dakota	0.3	2	0.5	0.27
Tennessee	2.5	7	1.6	2.02
Texas	6.5	17	3.8	7.41
Utah	0.7	5	1.1	0.79
Vermont	0.3	1	0.2	0.22
Virginia	2.9	11	2.5	2.51
Washington	1.7	9	2.0	2.09

Appendix E (Continued)

Distribution of Mailing and Resulting Sample by State

State	% of Sampling Frame	Number of Returned Surveys	% of Resulting Sample	State's % of Total US Population
West Virginia	0.8	2	0.5	0.64
Wisconsin	2.4	14	3.2	1.91
Wyoming	0.2	1	0.2	0.18
State Unspecified	---	1	0.2	-----
Total	99.9	444	100.1	99.96

Appendix F

Independent-Samples *t* Test

Variable	Levene's Test for Equality of Variance	
	F	Sig .
Age of structure (STRUCAGE)	5.656	.018*
Years at this residence (TENURE)	46.368	.000***
Total number of people in home (PERSONS)	79.151	.000***
Age of principal owner/renter (AGEOWN)	16.291	.000***
Education in years (EDUYRS)	.986	.321
Income in dollars (INCOMAMT)	10.580	.001**

* $p < .05$ ** $p < .01$ *** $p < .001$

Appendix G

Pearson Correlation Matrix

	OWN	TYPECAT	STRUCAGE	TENURE	PLANCAT	DISABLE	PERSONS	CHILDCAT	OLDCAT	AGEOWN	GENOWN	EDUYRS	INCOMAMT
OWN	1.000	-0.035	-0.039	0.286	-0.262	-0.065	0.002	-0.043	0.122	0.183	0.17	0.113	0.307
TYPECAT	-0.435	1.000	-0.141	-0.265	0.149	0.025	-0.155	-0.085	0.045	-0.046	-0.145	-0.134	-0.226
STRUCAGE	-0.039	-0.141	1.000	0.357	-0.056	0.064	-0.019	-0.034	0.024	0.065	-0.028	-0.036	-0.137
TENURE	0.286	-0.265	0.357	1.000	-0.222	0.011	-0.232	-0.278	0.377	0.473	-0.011	-0.082	-0.127
PLANCAT	-0.262	0.149	-0.056	-0.222	1.000	0.044	0.13	0.125	-0.244	-0.305	0.01	0.091	0.082
DISABLE	-0.065	0.025	0.064	0.011	0.044	1.000	0.053	-0.025	0.112	0.127	0.013	-0.068	-0.160
PERSONS	0.002	-0.155	-0.019	-0.232	0.130	0.053	1.000	0.656	-0.320	-0.424	0.253	0.070	0.214
CHILDCAT	-0.043	-0.085	-0.034	-0.278	0.125	-0.025	0.656	1.000	-0.344	-0.506	0.066	0.085	0.119
OLDCAT	0.122	0.045	0.024	0.377	-0.244	0.112	-0.320	-0.344	1.000	0.744	-0.023	-0.176	-0.225
AGEOWN	0.183	-0.046	0.065	0.473	-0.305	0.127	-0.424	-0.506	0.744	1.000	-0.024	-0.166	-0.187
GENOWN	0.170	-0.145	-0.028	-0.011	0.01	0.013	0.253	0.066	-0.023	-0.024	1.000	0.061	0.235
EDUYRS	0.113	-0.134	-0.036	-0.082	0.091	-0.068	0.07	0.086	-0.176	-0.166	0.061	1.000	0.415
INCOMAMT	0.307	-0.226	-0.137	-0.127	0.082	-0.16	0.214	0.119	-0.225	-0.187	0.235	0.415	1.000