

THE EFFECTS OF VISUAL BARRIERS
ON THE EXITING BEHAVIOR OF RESIDENTS
IN A DEMENTIA CARE FACILITY

by

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Department of Housing, Interior Design, and Resource Management

(Abstract)

Unsafe exits from dementia care units present problems for residents and pose ethical dilemmas for caregivers. The purpose of this experimental research was to determine whether visual barriers reduced the exiting behavior of residents in a long-term care facility. A visual barrier was defined as one that appeared to be an obstruction, but that did not impede egress through the door. The study was conducted in a 30-bed dementia care unit and was limited to the emergency exit door where an alarm sounded each time the panic bar was touched. An "exit" was defined as a resident touching the panic bar and sounding the alarm. The sample consisted of 3 females and 6 males who attempted to exit the unit at least once during baseline condition. All residents were diagnosed with some form of dementia.

The tests were conducted under three visual barriers and one baseline condition. Each condition was observed for seven days from 2:00 to 4:00 p.m. The schedule was

as follows:

Baseline Condition: No experimental manipulation was used. This observation provided a comparison for the three test conditions.

Test Condition 1: Mini-blinds that covered the glazing of the door.

Test Condition 2: Cloth panel that covered the panic bar of the door.

Test Condition 3: Both the mini blind and the cloth panel.

During baseline collection, 9 residents triggered the alarm for a total of 120 attempted exits. Test condition 1 decreased exiting to 73 attempts. During test condition 2, 5 attempted exits occurred, and 18 attempted exits occurred during test condition 3. Statistical analysis included Friedman's Rank test for correlated samples and Wilcoxon Sign Rank tests for treatment versus control comparisons. Test conditions 2 and 3 significantly reduced attempted exits while test condition 1 was not statistically significant.

In conclusion, visual barriers were a safe and effective method for deterring resident exiting for this particular nursing home.

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CHAPTER ONE

INTRODUCTION

The population of individuals in the United States who are over the age of 65 has tripled between 1900 and 1980 (Shroyer, Hutton, Gentry, Dobbs, & Elias, 1989). This elderly portion of our population which was once 4% is now 12% and is estimated by the year 2030 to comprise 22% of the population (Blank, 1988). Consistent with this increase will be the number of elderly diagnosed with senile dementia illnesses (Shroyer et al., 1989). Senile dementia is not considered to be part of the normal aging process. The most prevalent form of senile dementia is Alzheimer's disease which has been cited as the fourth leading cause of death among the elderly (Jarvik & Winograd, 1988; Katzman, 1985).

Until recently, the number of individuals afflicted with Alzheimer's disease (AD) was small, and the public was fairly uninformed. However, because of demographic changes, public ignorance and rarity are no longer the case (Jarvik & Winograd, 1988). AD currently affects two to four million older persons, and this number is expected to rise in the future unless a cure is found (Shroyer et al., 1989).

Changes in lifestyle such as the increase in the divorce rate, the number of women in the work force, and geographic mobility as well as cognitive declines seriously

affect AD patients. These changes lead to caregiving problems, and because of the nature of the disease, the likelihood of the individual remaining in the home is small (Jarvik & Winograd, 1988). Consequently, AD patients are typically admitted into nursing home care.

As the number of AD patients continues to grow, the need for special care units will be necessary. This need will be significant to both the architecture and interior design professions. New Alzheimer care units will need to be constructed, and in order for this construction to be successful, an understanding of the complex symptoms of the disease will be necessary (Shroyer et al., 1989).

The design of Alzheimer's units is critical to the well-being of residents, staff, and family members. Interior designers are challenged with providing supportive yet interesting environments for individuals with reduced capacities. In addition, the relationships between staff, resident, and family members must also be resolved (Cluff, 1990). An interaction between design goals, environments, and behavioral characteristics of AD may serve as a basis for planning effective support spaces (Winchip, 1990).

One important aspect of the environment concerns safety issues. When complying with state regulations and building codes for nursing home construction, designers may create environments that cause problems with wandering (Calkins, 1988). Wandering is a behavior that is characteristic of Alzheimer's disease and tends to occur

during the middle stages of the disease when the person is in good physical health (Coons, 1988). The safety threat concerns attempted exits from the unit since egress doors cannot be locked. For example, approximately 20% of staff employed at long-term care facilities were aware of at least one incident where wandering resulted in injury or death (Burnside, 1981).

In many cases, wandering results from changes or factors within the environment. Historically, non-therapeutic settings have treated this behavior as abnormal and have used intervention or force to change the behavior (Coons, 1988). For example, staff have used restraints, such as geriatric chairs, to control wandering behavior (Rader, Doan, & Schawb, 1985; Burnside, 1988; Namazi, Rosner, & Calkins, 1989). These procedures are now viewed as an inappropriate response for a number of reasons. Restraints ethically violate patient rights, cause patients to become sedentary, cause physical harm to the patient because of an increase in falls, tend to further upset the agitated resident, and require additional nursing staff time (Burnside, 1988). Sedentary patients require frequent repositioning, increased skin care, toileting, and increased charting time (Namazi et al., 1989; Burnside, 1988). Residents may also suffer from a loss of bone mass, reduction in strength, decreased mobility, and impaired balance as a result of being restrained (Burnside, 1988).

Medication has also been a frequent solution to the problem of wandering. However, drugs have been known to cause a loss of individual personality and to prevent the resident from responding to the environment or to other people. In addition,

reactions, agitation, and atypical behaviors may also accompany the use of medication (Coons, 1988).

Non-therapeutic solutions are damaging interventions that are used frequently in our health care system today that attempt to change a behavior inherent in the disease. Wandering may not be a negative behavior because it provides exercise and freedom of movement for the resident (Coons, 1988). As a result, staff are challenged with the dilemma of patient rights versus safety. In contrast, a therapeutic approach accepts and recognizes the change in behavior as a response to the environment, and attempts to alter the surroundings instead of the behavior (Coons, 1988).

One alternative therapeutic approach in which to view AD concerns the nature of the disease. Specifically, many AD patients may misinterpret visual input because of deficits in cognition (Namazi et al., 1989). For example, past observations of freely ambulating residents in dementia care units suggest that routes were often interrupted or otherwise affected by stimuli that did not affect non-demented residents (Hussain & Brown, 1987). Residents with progressive dementia would step over points of contrast in the floor, or attempt to pick up gold filler between floor tiles (Hussain & Brown, 1987).

Based on these observations that individuals with dementia may perceive contrasts on the floor as three dimensional, visual barriers consisting of masking tape grid patterns were used in one study in an effort to deter patient exiting. The results indicated a 42% reduction in attempted exits and suggest that visual barriers based on optical illusions can

reduce exiting behavior (Hussain & Brown, 1987). In contrast, the results of a second study indicated increased exiting although the same tape patterns were used (Namazi et al., 1989).

Due to apparent contradictions and lack of solutions in managing wandering behavior, this research focused on the relationship between visual misconceptions in the environment and exiting behavior. Past research has suggested that visual misinterpretation is a symptom of the disease and that this misinterpretation may be the element that can actually stop harmful exits. If used to the designers' advantage, visual barriers may increase the safety of residents by eliminating potentially harmful exits.

Purpose of the Research

The purpose of this research was to determine whether changes in visual barriers affected the exiting behavior of dementia residents in a long-term care facility.

Research Objectives

The primary objective was to determine whether the changes in visual barriers affect resident behavior by comparing wandering behavior before and after planned interventions.

Significance of the Study

This research examined the effects of visual barriers on the behavior of individuals with dementia. Because very few investigators have explored the relationship between visual barriers and exiting behavior of this special population, this study contributed to the existing body of knowledge.

Past methods for controlling wandering have not only been unsuccessful in eliminating exits from dementia care units, but also require additional monitoring time from staff members. This research attempted to determine an alternative method for controlling wandering that successfully reduced exiting behavior.

Finally, this research was conducted at Heritage Hall, a nursing home located in Blacksburg, Virginia which has a serious problem with resident exits. Because the nursing home is located near a major highway, the threat to patient lives is evident. This research project may provide one solution to the life-threatening situations caused by exiting behaviors.

CHAPTER TWO

REVIEW OF THE LITERATURE

This chapter begins with a general background of dementia including the types of dementia as well as symptoms. Since Alzheimer's disease is the most prevalent form of dementia, the symptoms, characteristics, and stages of the disease are detailed. Next a conceptual model is presented to illustrate the relationship between the environment and behavior. In addition, design issues are discussed in order to clarify this relationship. The final section concentrates on wandering and relevant research related to the elderly and Alzheimer's disease.

Dementia

Dementia is defined as a decline in intellectual functioning and cognitive abilities while being in clear consciousness (Baille & Foxworth, 1991). Dementia is caused by 70 or more conditions which are classified into 11 groups. Of the degenerative group, Alzheimer's disease is the most prevalent accounting for 66% of all cases (Baille & Foxworth, 1991). Dementia of the Alzheimer's type (DAT) is a term often used to include two related syndromes; early onset (presenile) Alzheimer's disease and senile dementia of the Alzheimer's type (occurring after age 65). For this particular research the two forms will not be differentiated since the symptoms are similar (Willot, 1990).

Other less common forms of dementia include Pick's disease, Huntington's

disease, Parkinson's disease, and Multi-infarct dementias. Pick's disease is most common between the ages of 40 and 60. It is a very rare disease that has clinical similarities to DAT, but changes in personality, social behavior, and emotionality differentiate the disorder from AD (Willot, 1990). Huntington's disease is a subcortical motor dysfunction accounting for motor disturbances, emotional problems, and cognitive disturbances particularly of the nonverbal thought process (Willot, 1990). Parkinson's disease occurs due to the degeneration of neurons that utilize the neurotransmitter dopamine. The symptoms include tremors, rigidity, and other motor dysfunctions (Willot, 1990). The last type of dementia to be discussed is Multi-infarct dementia which is caused by small lesions resulting from rupture of capillaries of blood vessels within the brain. Multi-infarct dementias have a sudden onset, and the type of dementia that occurs depends on the region of the brain that is effected (Willot, 1990). Since Alzheimer's disease is the most prevalent form of dementia, the next section discusses AD in detail.

Characteristic Changes to the Brain of Alzheimer's Residents

The cause and etiology of Alzheimer's disease is unknown; however, within the past 20 years, progress has been made in not only defining the disease clinically, but in understanding the changes in the brain. AD was first described in 1907 by Alois Alzheimer as alterations in the cerebral cortex and hippocampal regions of the brain (Katzman, 1985; Reisberg, Ferris, & Leon, 1985). Unfortunately, an understanding that these alterations are the major causes of senile dementia has only developed within the

last 15 years (Katzman, 1985).

The research efforts of Alois Alzheimer are responsible for identification of the important biological alterations necessary for diagnosis of AD. These alterations, senile plaques and neurofibrillary tangles, cannot be diagnosed with certainty until death when an autopsy reveals the specific alterations to the brain (Jorm, 1987).

Senile plaques occur in the neurons of the brain which consist of tree-like branches termed dendrites. The dendrites receive chemical messages from other nerve cells which are conducted to the cell body to be transmitted to other neurons (Jorm, 1987). This complex system forms a basic network and communication strategy (Willot, 1990). The plaques, which consist of a protein called amyloid, block and interfere with messages being sent from neuron to neuron and are found in the hippocampus and cerebral cortex areas of the brain (see Figure 1). This is problematic because the hippocampus plays a vital role in memory, and the cerebral cortex is responsible for highly complex processes such as language, speech, perception, and orientation. Thus symptoms of AD such as memory loss, language deficits, and perceptual deficits, may be explained by lack of communication among neurons. Although senile plaques occur through the normal aging process, their increased numbers in AD patients is not a naturally transpiring event and their cause is unknown (Jorm, 1987).

Neurofibrillary tangles are comprised of bundles of thread-like structures, and are found in the cell body of neurons. Because of their increased concentration, neurofibrillary tangles interfere with the transport of essential chemicals to the cell body.

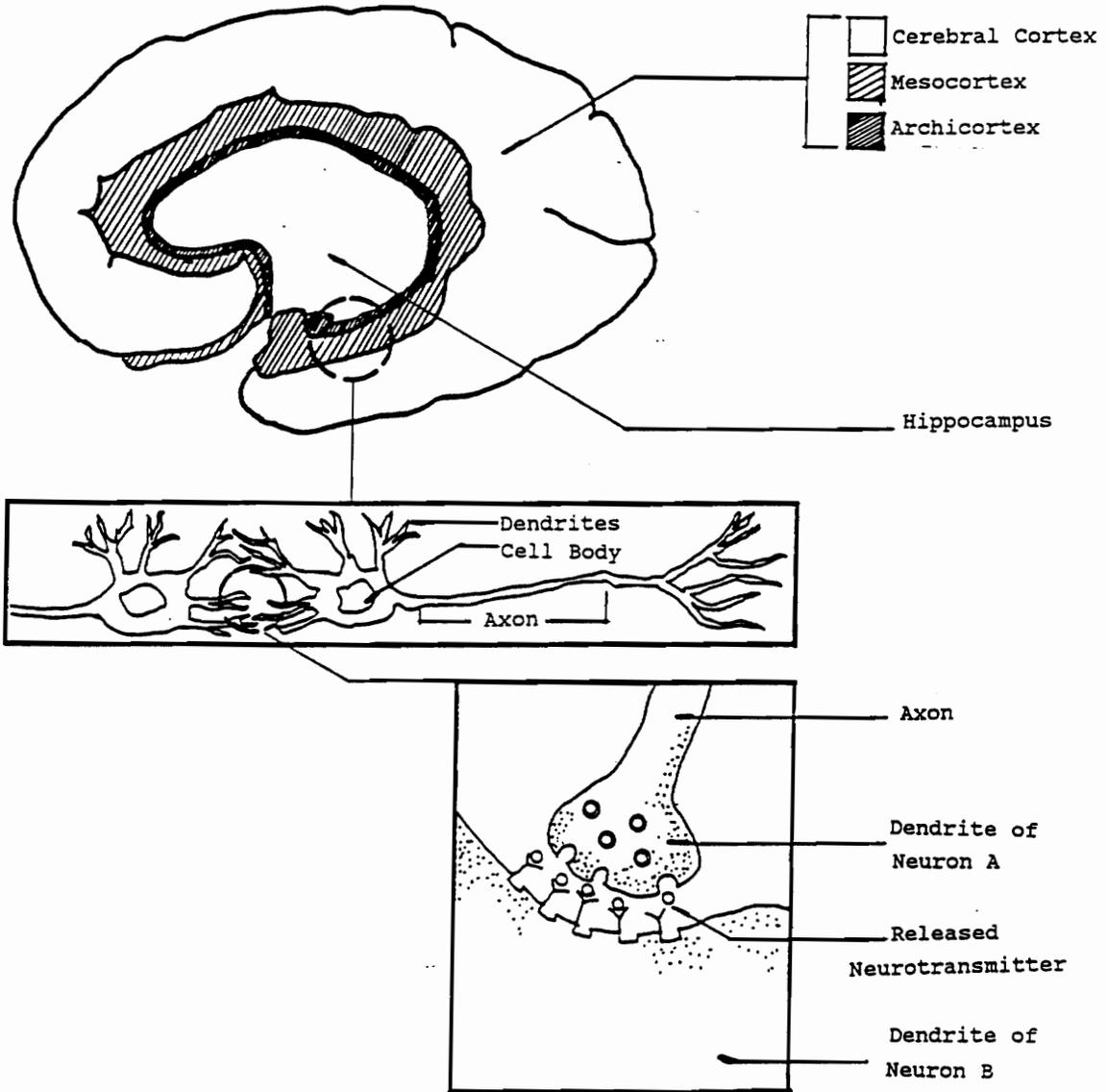


Figure 1. Illustration of the Brain
 (Adapted from Levine & Miller, 1991; Jorm, 1987)

Like senile plaques, they are found in the hippocampus and cerebral cortex regions of the brain, and their cause is unknown (Jorm, 1987).

In addition to the formation of senile plaques and neurofibrillary tangles, neurotransmitter processes may also be affected. When messages are sent from the axon to the dendrites of other neurons, they pass through a small gap termed the synapse. The gap is bridged when the neuron sending a message releases a chemical called a neurotransmitter which the second neuron must uptake. Alzheimer's disease causes deficiencies in certain neurotransmitters thus resulting in faulty messages. In particular, cholinergic neurons of the basal forebrain degenerate causing deficiencies in the neurotransmitter acetylcholine (Willot, 1990; Jorm, 1987). Acetylcholine plays a role in cognitive functioning and may be correlated with the symptoms of AD (Willot, 1990).

Based on these pathological changes, AD is believed to be very different from the typical aging process. Surprisingly, the difference between the two is a matter of degree (Willot, 1990; Jorm, 1987). Plaques and tangles appear with age, but are greatly exaggerated in AD. One way to view these similarities is to consider a continuum with normal aging at one end and severe AD at the other end. Aging moves individuals along this continuum, but because some may move faster than others, symptoms of AD may develop (Jorm, 1987).

Changes in Cognitive Behavior

Pathological changes in the brain may be the causes for deficits in cognitive behavior. Because the disease influences the cortex and hippocampus differently,

generalizations about the symptoms are difficult to formulate. However, the most recurring changes are believed to be related to memory loss and deficits in these areas; language, perception, organization of movement, attention, judgment, and the ability to abstract (Zgola, 1987).

Memory

Memory loss is typically the first symptom to be noticed by family members and has been defined as thoughts that cannot be retrieved (Calkins, 1988). Frequently, the person is unaware of their failing memory and may use notes or other reminders, but eventually this ability of note taking is lost. Personal items that are misplaced or forgotten and failure to recall friends and family are examples of the types of memory impairment that may be expected (Zgola, 1987). Interestingly, short term memory is affected first, while long term memory is not altered until the later stages of the disease (Calkins, 1988; Jorm, 1987). Short term memory involves recollection of events within a matter of minutes or hours. For example, asking an individual what they had for breakfast that morning would entail short term memory use. Long term memory is recollection of events that have occurred in the past. Remembering your wedding day or past birthdays all involve long term memory use (Jorm, 1987).

Language Deficits

Many individuals who have been diagnosed with AD have little difficulty in the articulation of words; however, two types of language deficits may occur. Aphasia is characterized by a difficulty in word finding which results in the inability to recall the

appropriate word. Empty and vague words are typically used in conversation to conceal the incapacity to recollect more appropriate words. For example, phrases and words such as "you know" , "that", or "it" are empty words (Zgola, 1987). Paraphasia involves exchanging words that sound alike or that fall into similar categories such as nurse with purse or sister with daughter. Aphasia and paraphasia are difficult to recognize and are identified typically with the help of a family member (Zgola, 1987).

Perceptual Deficits

Perception is the process in which the brain interprets information from the sensory receptors (Zgola, 1987). According to Jorm (1987), the five senses are not affected by the disease, but the normal aging process must be taken into consideration. Normal aging does in fact influence the sensory receptors and, in many cases, causes decline (Marsh, 1980). An understanding of age related changes is necessary in order to determine whether normal aging or diseased aging is occurring.

AD produces perceptual deficits which alter interpretation (Jorm, 1987). For example, one area in which perception may be affected is the visual-spatial processing involving the ability to distinguish direction, distance, and the spatial relationship between objects and one's own body. Because of deficits in this area, the person may become disoriented, lost, and unable to find their way in a familiar environment (Zgola, 1987).

One specific visual-spatial deficit is agnosia, the inability to recognize familiar objects. Some individuals suffer from visual agnosia where they do not recognize the

object by sight, but once able to touch the object they comprehend its use. Conversely, an individual with tactile agnosia cannot interpret an item by touch and must be visually aware of that item in order to recognize it (Zgola, 1987).

Organization of Movement

Organization of movement concerns the ability to translate ideas into a logical sequence of motor movements (Zgola, 1987). Deficits in this function are termed apraxia. The disease is progressive and causes deprivation of previously performed skills (Winchip, 1990). For example, manipulation of simple equipment, activities of daily living such as bathing, grooming, dressing, and eating, and instrumental activities of daily living such as grocery shopping or phone dialing are gradually lost (Baille & Foxworth, 1991).

Other Symptoms

Other symptoms of AD include the inability to form and understand abstract concepts, the incapacity to initiate or maintain a particular activity, and poor judgment (Zgola, 1987). For example, if an Alzheimer's patient was asked, "What would you do if the trash can was on fire?", the individual may be unable to answer. This particular example illustrates that poor judgment may lead to life threatening situations (Winchip, 1990).

In summary, pathological changes in the brain may cause deficits in cognitive processes. The most recurring changes are memory loss and deficits in language, perception, organization of movement, attention, judgement, and the ability to abstract.

The next section describes the behavioral symptoms of AD. It is believed that because of cognitive declines both behavioral and psychological symptoms may occur.

Behavioral and Psychological Symptoms

The cognitive changes described above can cause feelings of frustration, boredom, paranoia, depression, apathy, delusions, and agitation. Tasks that were once simple become complicated and impossible. An example may illustrate this situation. In order to make one's bed, motor and cognitive steps occur:

- the individual understands and remembers the verbal command (memory);
- the individual conceptualizes the task and does not assume the literal interpretation of "make" (abstract thinking);
- the individual organizes the task into a logical sequence and completes it in this order (organization of movement);
- the individual relies upon an ability to perceive accurately the objects that are seen and touched throughout the task (perception);
- decisions are made if a problem is encountered (judgement) (Jorm, 1987).

In light of cognitive and motor changes, these steps may not be formulated or followed. Further, inability to perform the task may lead to a number of behavioral and psychological characteristics (Shroyer et al., 1989).

Suspiciousness and Paranoia

Because of memory loss, AD patients may become unreasonably suspicious or paranoid (Mace & Rabins, 1981). For example, they may accuse others of stealing their money, their possessions, or perhaps items that others would not remove typically. To prevent the loss of possessions, an individual may hide or hoard possessions. Frequently, problems with suspiciousness and paranoia may be explained by the

individual's misinterpretations of visual and auditory input. Consequently, the impaired person may become overwhelmed by the emotions raised by the suspicion or by the inability to make sense of these emotions. The confused and disoriented individual may no longer assess the situation realistically, and lacks the ability to either remember or to control panic. In this light, accusations may often be an expression of the individual's overwhelming feelings of loss, confusion, and distress (Mace & Rabins, 1981).

Depression

Depression is considered one of the most common complaints among the elderly whether or not they suffer from AD (Schefft & Lehr, 1990). The diagnosis of depression may be complicated by numerous factors including physical illness and cognitive impairment causing difficulty in distinguishing depression from AD (Schefft & Lehr, 1990). However, symptoms of clinical depression among Alzheimer's patients includes weight loss, a change in sleep patterns, feelings of self worthlessness, and a preoccupation with health problems (Mace & Rabins, 1981; Schefft & Lehr, 1990).

Delusions and Hallucinations

Delusions are beliefs that are not true. They may be suspicious in nature or self-blaming. They may appear to result from a misinterpretation of information and may be associated with the individual's past experience. In contrast to delusions, hallucinations derive from sensory experiences and may include hearing voices or seeing things that others do not. Both are characteristic symptoms that may occur in the later stages of Alzheimer's disease (Mace & Rabins, 1981).

Agitation, Frustration, and Anxiety

People with AD may also become worried, agitated, frustrated, and anxious (Winchip, 1990). They may pace, fidget, and become increasingly restless. Agitation may be part of depression, anger, anxiety, restlessness, boredom, a symptom of pain caused by medications, or an explicable part of the illness. Frequently, agitation occurs due to the insecurity created by diminishing coping capabilities (Winchip, 1990; Mace & Rabins, 1981).

Catastrophic Reactions

Finally, the cognitive changes experienced by the individual may result in feelings of frustration. In some cases, these feelings become so overwhelming, that the individual suffers from a catastrophic reaction that may be characterized by loud shouting or inappropriate behavior due to the overreaction to a seemingly minor problem (Calkins, 1988; Cluff, 1990).

The behavioral and psychological symptoms described above are because of cognitive deficits experienced by the individual with AD. Both cognitive and behavior changes vary from individual to individual. As a result, this next section describes the stages of AD.

The Stages of Alzheimer's Disease

Individuals with AD progress through the disease at various rates. One patient may enjoy years of stability while another may advance rapidly. As a result, four characteristic stages have been developed; the early, middle, late, and terminal stage.

Early in the disease, decreased energy, forgetfulness, lack of interest in activities, and increased anxiety are typical. As the disease continues, memory loss, disorientation, language deficits, personality changes, wandering, and difficulty in motor movements are indicative of the middle stage. In the late stage of the disease, the person typically suffers from incontinence, the inability to perform simple tasks, and limited language usage. In the last stage of the disease, the individual is usually bedridden and unaware of the environment around them (see Table 1; Winograd, 1988).

Possible Causes of the Disease

Currently, there is no cure for Alzheimer's disease. Numerous hypotheses have been developed concerning the cause of the disease, but no certain explanation has resulted. There are however, several risk factors associated with the disease which include; old age, family history, head trauma, and Down's syndrome (Jorm, 1987).

Old age is believed to be the primary risk in developing AD. The chance of having plaques and tangles in the brain greatly increases as the population ages. In a longitudinal study conducted in one community of southern Sweden from 1947 to 1972, each member was examined over a 25 year period. Although, no members of the community developed the disorder between the ages of 50 to 59, the annual probability of developing AD increased. For people in their eighties, 2% of males and 3% of females developed Alzheimer's disease (Jorm, 1987; Hagnell, Rorsman, Lanke, Ohman, & Ojesjo, 1983).

Table 1. Characteristics of Patients in Each Stage of AD

(Adapted from the Alzheimer's Resource Center, 1988 and Winograd, 1988).

STAGE 1

- Less energy, drive, and initiative
- Slower reaction time
- More difficulty learning new things
- Desire to be with familiar people, places, and things
- Easily provoked anger
- Awareness of memory problems and attempts to disguise
- Depression

STAGE 2

- Misunderstanding of what is heard
- Difficulty following conversation, TV, jokes, and stories
- Difficulty making decisions
- Problems calculating
- Difficulty in planning ahead
- Increased self-absorption
- Suspiciousness and jealousy
- Need for supervision to function properly
- Wandering

STAGE 3

- Loss of orientation to time and space
- Inability to recognize and identify familiar people
- Need for repetitive instructions and close supervision
- Little warmth for close relatives
- Problems remembering words so invents own words
- Unexpected behaviors which are often bizarre
- Some clear memories of the past
- Paranoid behavior
- Depression, sadness, withdrawn
- Incontinence

STAGE 4

- Extreme apathy
- No ability to find way around familiar surroundings
- Need for help with activities of daily living
- Continued loss of recent and past memories
- Repetitive language
- Inability to recognize self in mirror
- Delusions, depression, delirium
- Loss of personal dignity and self confidence
- Eventually bedridden

A second influence believed to cause Alzheimer's disease is heredity. Hereditary factors have been suspected for over half a century. In fact, first-degree relatives of individuals afflicted with AD have a threefold chance of developing the disease (Jarvik, 1988). A twin study conducted by Kallman (1953) found an accordance rate of 43% for identical twins and 8% for fraternal twins. These findings indicate a genetic propensity for developing AD may exist.

A third risk factor associated with the disease is head trauma. Repeated head injury experienced by professional boxers or serious blows to the head resulting from a car accident are positively correlated with the occurrence of AD (Jorm, 1987; Jarvik, 1988).

The fourth risk factor is Down's syndrome which is a disorder caused by an extra chromosome at birth resulting in mental retardation. Individuals diagnosed with Down's syndrome are believed to develop plaques and tangles in their brain before they reach the age of 40. Although Down's syndrome is an uncommon disorder, individuals with the syndrome are predisposed to developing changes characteristic of Alzheimer's disease. The reason for this relationship is unknown, but it may provide clues as to the cause of AD, and again tends to support a genetic component (Jorm, 1987).

Four risk factors have been associated with developing Alzheimer's disease. These are age, heredity, head trauma, and Down's Syndrome. Currently, there is no cure for AD, and the description of the symptoms of the disease illustrates how the

diminished abilities of the residents causes hardship when interacting with the environment. This next section concentrates on the environment and behavior relationship.

The Environment and Behavior Model

Considerable attention has focused on the relationship between the individual and the environment. The work of Lawton and Nahemow (1973) has focused on the demands of the environment and the extent to which the individual is able to meet them (Kaplan, 1983). As a result of their work, a competence press model has been developed. This model consists of two variables: (1) the person's competence and ability to use the physical space and (2) the demands the space places on the individual. These variables were placed on the X and Y axes of a graph to represent a continuum. The goal of the model is to determine whether individuals are properly matched with their housing situation. If people "fit" their environment, then individual satisfaction and ability to use the space increases. Likewise, if a "fit" does not occur, then problems of frustration or boredom arise (see Figure 2).

This model may also illustrate the relationship between persons with AD and their immediate surroundings. Depending on the stage of the disease, a number of different environments may be involved. For example, early in the disease, the individual may remain at home. However, upon the progression of symptoms, this type of environment will become too demanding and other options may have to be explored. Clearly, by the middle stages of the disease, the individual may be unable to control their surroundings

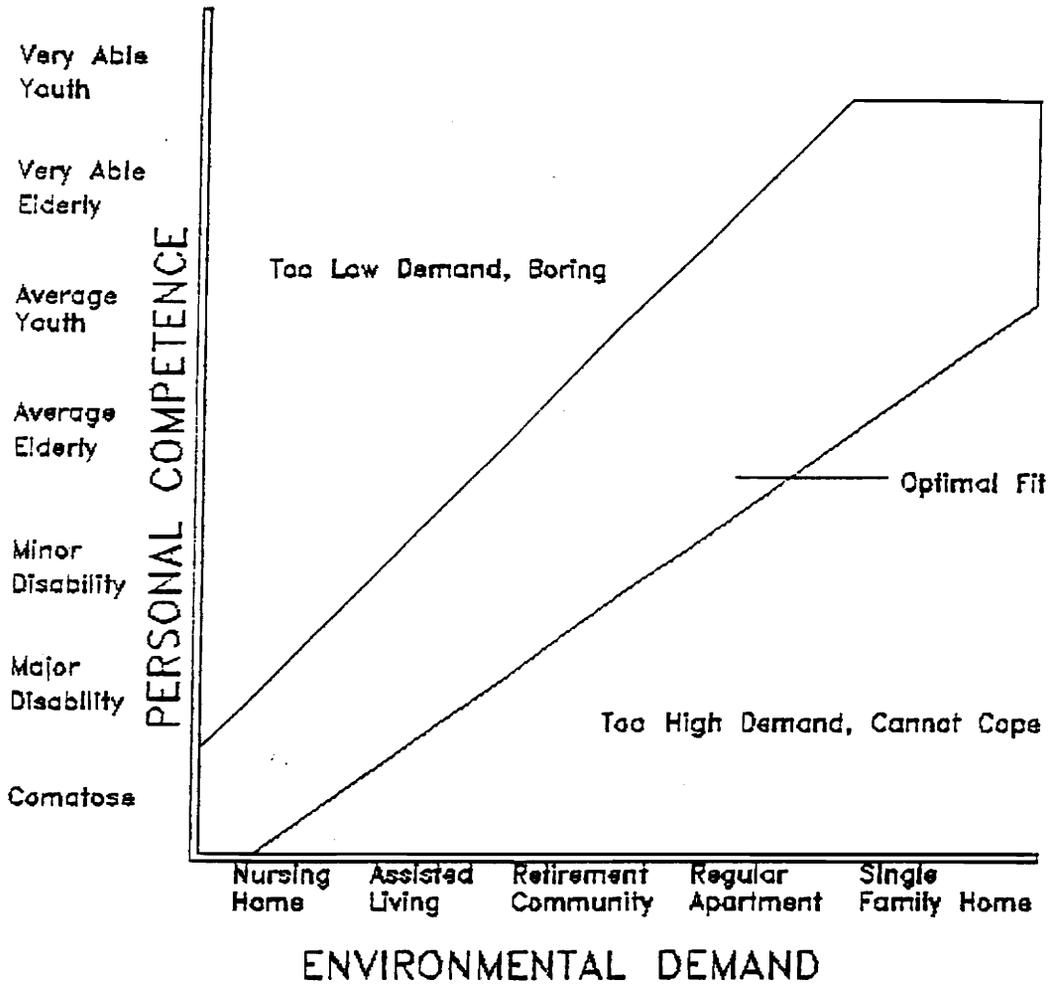


Figure 2. Lawton's Competence Press Model
(Adapted from Blank, 1988).

and less environmental demand, such as nursing home care, may be required. Ultimately, the challenge requires that all individuals (i.e. nurses, designers, and family) involved adjust the environment to adapt since the residents cannot (Ronch, 1987).

An illustration of the relationship between the environment and behavior involves a patient who was observed recently (Ivers, 1992). A resident asked the observer where the bathroom was. The observer escorted him to the activity room where the bathroom was located. Unfortunately, since the bathroom door was not visually distinctive, the resident could not find it and incontinence occurred (Ivers, 1992). This example inevitably strengthens the relationship between the environment and the behavior of Alzheimer's patients. A simple modification to the environment such as signage on the door could have possibly eliminated this undesirable behavior.

The competence press model developed by Lawton and Nahemow illustrates the relationship between the environment and the competency levels of individuals. AD causes many declines in individual ability. As a result, special attention should be focused on the design features of long-term care facilities which is discussed in the next section.

General Design Issues

Due to the diminished competencies of AD patients, increased sensitivity to their immediate surroundings occurs (Blank, 1988). The example above illustrates how easy modifications may aide dementia residents in fundamental activities such as using the restroom facilities. Features of the environment that have been found to be important

for the well-being of dementia residents include; personalization, orientation and wayfinding, safety and well-being, socialization and privacy, and competence in daily activities (Calkins, 1988).

Personalization

The desirability of personalizing one's immediate surroundings cannot be overemphasized. Personalization not only creates a residential environment, but also contributes to a sense of territory in an institution that may lack privacy (Zeisel, 1981). In addition, designers must remember that this space is the residents's home, therefore, elements that may contribute to a homelike atmosphere are encouraged. One area in which to provide personalization is in the bedroom. Allowing residents to bring in their favorite piece of furniture, designing space for family pictures or personal mementos, and giving residents a choice of color scheme are ways in which the patients may express their individuality (Calkins, 1988). This aspect of uniqueness may increase feelings of control and familiarity which may help reduce the anxiety associated with nursing home admittance (Calkins, 1988).

Orientation and Wayfinding

Because of short term memory loss, Alzheimer's patients do not have the capability to remember specific pathways. For example, the inability to remember the pathway to the bathroom may occur. To further complicate the situation, people with the disease deteriorate at different levels. For example, some residents may still be able to read while others cannot. Consequently, several cuing devices are needed in order to aid with

familiarization. A cuing device is a mechanism used to signal or prompt specific information to an individual (i.e. signage or color). This type of multiple cuing provides the same information in a variety of ways. The use of color, texture, symbols, personal mementos, and signage are all design elements that can enhance orientation (Calkins, 1988).

Color is one of the strongest and easiest design tools that may support reduced cognitive functioning. Further, individuals with dementia recognize color during later stages of the disease (Cluff, 1990; Calkins, 1988). Color may be applied in a variety of methods. Painting doorways a distinct color, providing contrast between floor and wall surfaces, placing brightly colored awnings throughout the space, and creating color schemes for individual rooms all aid in wayfinding (Calkins, 1988). The emphasis should be placed on the contrast between colors so that residents can distinguish the difference because of age related changes (Sanders & McCormick, 1987). The normal aging process causes the lens of the eye to thicken and yellow which prompts difficulty in perceiving colors not only in the blue end of the spectrum, but also colors with similar intensities (Hiatt, 1981).

Signage is an essential orientation device not only for the residents, but for the staff and family members as well. Multiple cuing may again be necessary. Use of an individual's name, personal mementos, and color should be considered. The key to wayfinding is to create as many devices as possible which share the same information. The patient may no longer recognize a name, but may recall a picture of family members

(Calkins, 1988; Stevens, 1987). For example, a distinctively colored canopy over a door or a recognizable symbol can create a unique orientation clue (Cluff, 1990).

Other design tools such as changes in texture, lighting, ceiling heights, pattern, and furniture create differences in mood which enhance wayfinding (Cluff, 1990). For example, high, even levels of light result in cheerful spaces conducive to activity and alertness, while dimmed lighting creates relaxing, and subdued environments. These design fluctuations in ambience may be correlated with behavior and use of space resulting in wayfinding (Cluff, 1990).

Socialization and Privacy

Individuals living in a nursing home have lost the ability to manage many aspects of their lives. Allowing residents to decide what levels of interaction they desire is one way to provide a sense of control (Dunkle & Kart, 1990). One way to furnish different levels of interaction is through the development of both casual and structured activities in the environment. Seating arranged in sociopetal (seating that promotes interaction) configurations and recessed doorways furnish opportunities for individuals to socialize. In some cases, residents may have their own private bedrooms, but in other situations they may not. Therefore, secluded areas need to be addressed. Sociofugal (seating that promotes privacy) arrangements give residents the opportunity to watch activities without participation. A separate quiet room may provide additional private space and can also serve as a family visiting room or a calm space for individuals who suffer from catastrophic reactions. The successful integration of both private and active spaces is

essential for the well-being of residents (Calkins, 1988; Hall, 1966).

Competence in Daily Activities

One aspect of design concentrates on providing manageable environments since self esteem and competence are measured by our ability to complete tasks (Calkins, 1988). As AD progresses, the skill to achieve basic responsibilities such as dressing, bathing, and grooming begins to diminish. A manageable environmental demand is necessary to promote a sense of independence among patients. Providing prosthetic devices such as handrails in the corridors and grab bars in the bathrooms may aid individual autonomy. In addition, activities of daily living should be confronted as well. Difficulty in dressing and grooming will eventually occur. Providing enough space for dressing, large clothes closets that are labeled and organized, and signage that illustrates and reminds the patient of the morning rituals to be performed are necessary (Calkins, 1988; Cluff, 1990).

Safety and Well-being

Furnishing a safe environment for residents is also an important design issue. In addition to state regulations and building codes, other guidelines are necessary because of the distinctive needs of this population. Included are:

- clear circulation paths
- nurses must see residents at all times
- non-slip surfaces
- sturdy furniture with rounded edges
- conformance to handicap accessibility regulations
- prevention of distracting glare through the use of fluorescent and incandescent lighting
- contrast between floor, wall, and furniture surfaces (Calkins, 1988).

In addition to these safety precautions, wandering must also be addressed as a risk to residents. Due to the seriousness of this behavioral symptom, this next section concentrates on wandering.

Wandering

Wandering has been defined in a number of ways creating confusion about its meaning (Saltzman, Blasch, Morris, & McNeal, 1991). In fact, the research conducted by Saltzman, Blasch, Morris, and McNeal (1991) observed wandering behaviors of demented versus non-demented individuals in order to reliably define wandering patterns. Observations revealed four distinct patterns of independent travel including: (1) direct travel from one location to another without diversion, (2) random travel, roundabout or haphazard movement to many locations within an area without repetition, (3) pacing, repetitive back and forth ambulation within a limited area, and (4) lapping, characterized by repetitive circling of large areas (see Figure 3). As cognitive skills decline and Alzheimer's disease progresses, these four patterns of travel become more prevalent. Specifically, for this proposed research, wandering will be defined as independent, repetitive, roundabout ambulation that leads to exiting from an unprotected dementia care unit.

Contributors to Wandering

Continuity theory hypothesized that in the process of becoming an adult, people develop habits and preferences (Covey, 1981). As individuals age, they are inclined to adhere to routines that have been developed over a lifetime and will continue these

routines and activities into old age. AD patients are no different, and vigorous attempts to maintain one's lifestyle may occur. For example, a wanderer who responds well to preestablished patterns may attempt to achieve a particular goal such as going to work. The individual may vividly remember the place of work, but be unable to recall their present location or the route to the new destination. Resulting disorientation may cause the person to become frightened which promotes continuous wandering. Wandering of this type happens independently of external environmental cues, and is goal oriented (Synder, 1978).

A second contributor to wandering is stress. Admission into a nursing home may be a traumatizing experience, and researchers tend to agree that moving individuals from a familiar environment into an institution may create anxiety (Dunkle & Kart, 1990). In addition to unfamiliar surroundings, the resident is exposed to a large group of unknown people (Blank, 1988). This environmental discontinuity not only strains nursing home residents, but may facilitate the development of a mechanism such as wandering to reduce the stressful situation (Dunkle & Kart, 1990; Coons, 1988).

The third contributor to wandering is boredom. Many institutional environments lack visual stimulation, opportunities for involvement, a sense of belonging, and meaningful use of time (Coons, 1988). Consequently, the self initiated activity of restless wandering occurs (Coons, 1988).

Methods for Controlling Wandering

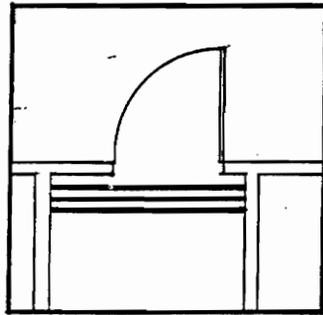
As discussed previously, methods for controlling wandering have included restraints and medication (Coons, 1988; Namazi et al., 1989). Other strategies consist of modifying the behavior rather than attempting to eliminate it. These strategies utilize tracking systems that are worn by the residents and fire door alarms. Again, this has not proven to be successful in eliminating actual attempts to leave the unit and requires monitoring time from the staff members because each time the alarm is triggered, a staff member must escort the resident away from the door and must reset the alarm. In addition, the sound of alarms is not only distracting to residents, but alarms have been turned off in order to eliminate the annoyance (Namazi et al., 1989; Ivers, 1992).

One area of growing interest is in the visual misinterpretation of dementia residents. Individuals with dementia perceive visual input differently. For example, dementia residents mistake glare on the floor for spilled water, step over points of contrast in the floor, and attempt to pick up gold filler between floor tiles. These observations have lead some researchers to question whether objects that are two-dimensional appear three-dimensional to AD residents (Hussain & Brown, 1987). Further, individuals with AD suffer from visual agnosia (Zgola, 1987). As a consequence of these indicators of limitations in the visual field, a number of investigators have explored the use of visual barriers as a method to managing wandering behaviors.

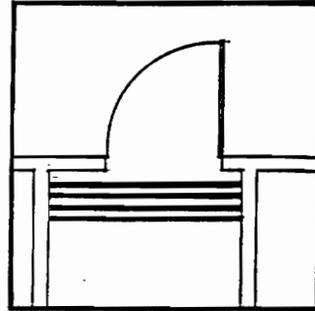
Since Alzheimer's residents seem to perceive two-dimensional patterns as barriers, the Hussain and Brown (1987) study was conducted to determine whether tape patterns would deter patient exiting. Eight males served as the sample residing on a ward of a public mental hospital. The researchers observed exiting behavior under six test and two baseline conditions. Test conditions consisted of beige masking tape applied to the floor extending the width of the hallway in front of the exit door, 1 1/2" apart in one of the following configurations; three strips horizontally, four strips horizontally, six strips horizontally, eight strips horizontally, and ten strips vertically (see Figure 4). The observers recorded whether the grid pattern was crossed or not (Hussain & Brown, 1987).

Results indicated that horizontal configurations were more successful than vertical grid patterns and reduced exiting by 42%. During the first baseline condition, 94% of the opportunities ended in attempts to exit. Three, four, and six strips reduced exiting from 94% to 55%, and with eight strips only 30% of crossings occurred (Hussain & Brown, 1987).

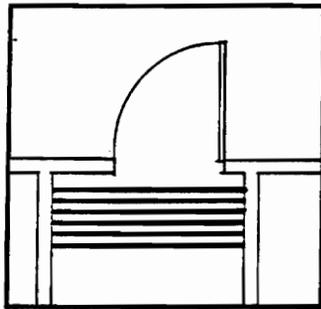
Based on these results, the investigators concluded that a relatively safe and economic visual barrier can limit potentially dangerous exits from the unit. They recommend that other grid patterns should be tested, especially an increase to strip-to-floor contrast. Furthermore, studying the effects of grids that establish an apparent optical illusion should be explored (Hussain & Brown, 1987).



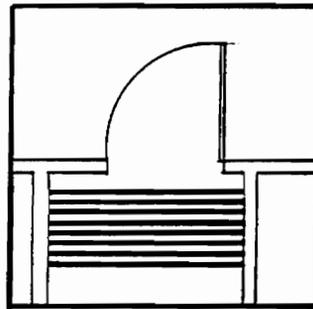
3 Strips Horizontally



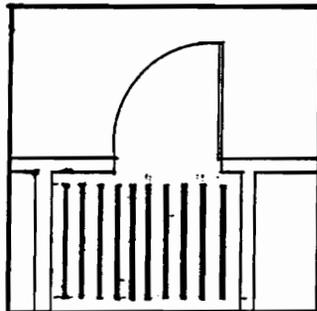
4 Strips Horizontally



6 Strips Horizontally



8 Strips Horizontally

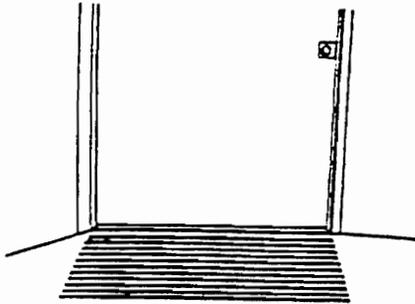


10 Strips Vertically

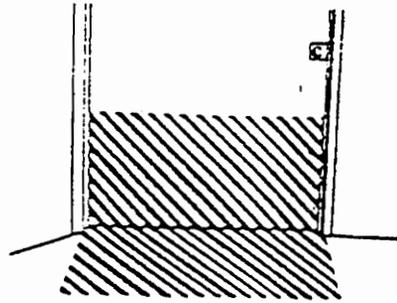
Figure 4. Grid Patterns
(Adapted from Hussain & Brown, 1987).

Based on the recommendations made by Hussain and Brown (1987), the purpose of a second study conducted by Namazi, Rosner, and Calkins (1989) was to determine whether visual barriers would stop exiting behavior. This study was conducted in a 30-bed dementia care unit with the sample consisting of four males and five females diagnosed with senile dementia of the Alzheimer's type. An emergency exit door was the test site where seven visual barriers were observed. The conditions were as follows; (1) baseline, (2) strips of brown tape, 1 1/2" wide, placed parallel to the door 1 1/2" apart, starting at the base of the door and extending 35" into the hall, (3) strips of beige masking tape placed in the same configuration as test condition 2, (4) strips of black tape, 1 1/2" wide, placed 1 1/2" apart at a 45 degree angle to the door extending 36" into the hall from the base of the door and continuing 28" up the door, (5) a beige cloth, 18" wide, was attached with hook and loop to the sides of the door to conceal the doorknob, (6) second baseline, (7) same test condition as 5 except a green, patterned cloth was used, (8) the doorknob was painted the same color as the door to minimize the contrast, and (9) a doorknob cover which allows the knob to turn only when pressure is applied (see Figure 5; Namazi et al., 1989).

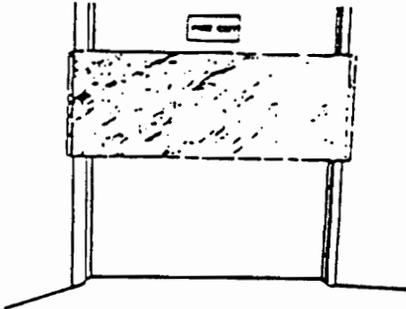
The results indicated that visual barriers based on optical illusions, (test conditions two, three, and four) did not impede, but actually increased exiting. These results contradict those of Hussain and Brown (1987). Conditions five, seven, eight, and nine were based on visual agnosia. Conditions five and seven eliminated all exits, and



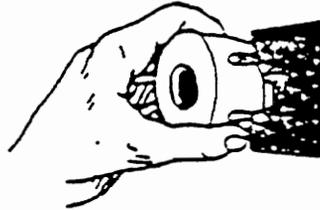
Condition #2: Brown tape
#3: Masking tape



Condition #4: Black tape at diagonal



Condition #5: Beige cloth
#7: Green, patterned cloth



Condition #9: Knob cover

Figure 5. Visual Barrier Test Conditions

(Reprinted, permission from Dr. Namazi, November 29, 1993).

conditions eight and nine were less successful, however, they were more effective than optical illusion barriers (Namazi et al., 1989).

The researchers concluded that concealment of the doorknob was the most successful condition. When the knob is concealed, a person with visual agnosia may be unable to interpret the panel. This study suggested that determent of wandering can be achieved through the patients themselves (Namazi et al., 1989).

Hussain and Brown (1987) reported that tape patterns reduced exiting and Namazi, Rosner, and Calkins (1989) indicated an increase in exits. Based on these discrepancies, an investigation by Hamilton (1993) again focused on tape grid patterns as a means of deterring exits. This study was conducted at a nursing home in Blacksburg, VA, which has a separate 30-bed dementia care unit that served as the experimental site.

The sample for this study included 12 residents. One baseline and two test conditions were observed. Test condition one consisted of strips of 1 1/2" wide black tape applied to the floor in front of the fire door at intervals 1 1/2" apart. The pattern extended the width of the hallway and extended 36" from the base of the door. Test condition two used the same procedure, however, red tape was used instead of black tape (Hamilton, 1993).

The results appear to support the findings of Namazi, Rosner, and Calkins (1989). The tape patterns did not increase exits, but the decreases noted were not statistically significant. Test condition one, the black tape, reduced exiting by 19.05% and the red

tape reduced exiting by 11.12%. Hamilton (1993) also noted that the emergency door that served as the test site has a glazed area that not only provides a view to the outdoors, but also produces one of the few sources of natural light to the corridor. One explanation of the wandering behavior may be that the residents were attracted to the view and/or the light source. Elimination of these attractions may prevent exits from the unit (Hamilton, 1993).

Summary

In summary, Alzheimer's disease is the most prevalent form of dementia afflicting 2 to 4 million individuals. The symptoms include memory loss, suspiciousness, paranoia, delusions, hallucinations, depression, agitation, and deficits in perception, language, and organization of movement. Currently there is no cure for AD (Jorm, 1987).

One of the behaviors which is characteristic of the disease and other forms of dementia is wandering. Wandering is not necessarily a negative behavior because it provides the individual with exercise and freedom of movement. However, the dilemma that staff experience is the attempted exits from dementia care units by freely ambulating residents (Coons, 1988).

Past methods for controlling wandering have included restraints, medication, tracking systems, and fire door alarms. These have proven to be unsuccessful in eliminating attempts to leave the unit and require monitoring time from staff members (Namazi, Rosner, & Calkins, 1989).

Although the current literature indicates that wandering may be goal-oriented or stress induced, there may be many other factors within the environment that cause wandering and reasons for attempting to exit (Coons, 1988). In order to illustrate these relationships a conceptual model has been formulated (see Figure 6). The model suggests that wandering leads to exiting behavior because of: (1) goal-orientation (i.e. the resident wants to exit), (2) attraction to light, (3) attraction to protruding panic bar or door handle, or (4) no reason except that the door is located in the path of travel. In all cases, the resident encounters the door and attempts to exit.

As previously mentioned, wandering may occur because the resident wants to achieve a particular goal such as going to work. The individual may vividly remember their place of work, but be unable to recall their present location or the route to their new destination. Resulting disorientation may cause continuous wandering which could potentially lead to an attempted exit (Snyder, 1978; Coons, 1988).

Other contributors to wandering include stress, boredom, and the need for exercise (Coons, 1988; Dunkle & Kart, 1990). Because of the design of many nursing homes, wandering may lead to exiting merely because the exit door is located in the path of travel. This situation is typical of double loaded corridor designs (see Figure 7; Calkins, 1988).

Another reason for resident exiting may be the attraction to the light or view. In the Hamilton (1993) study, observations lead the researcher to believe that exits may be decreased if the view or light source was eliminated.

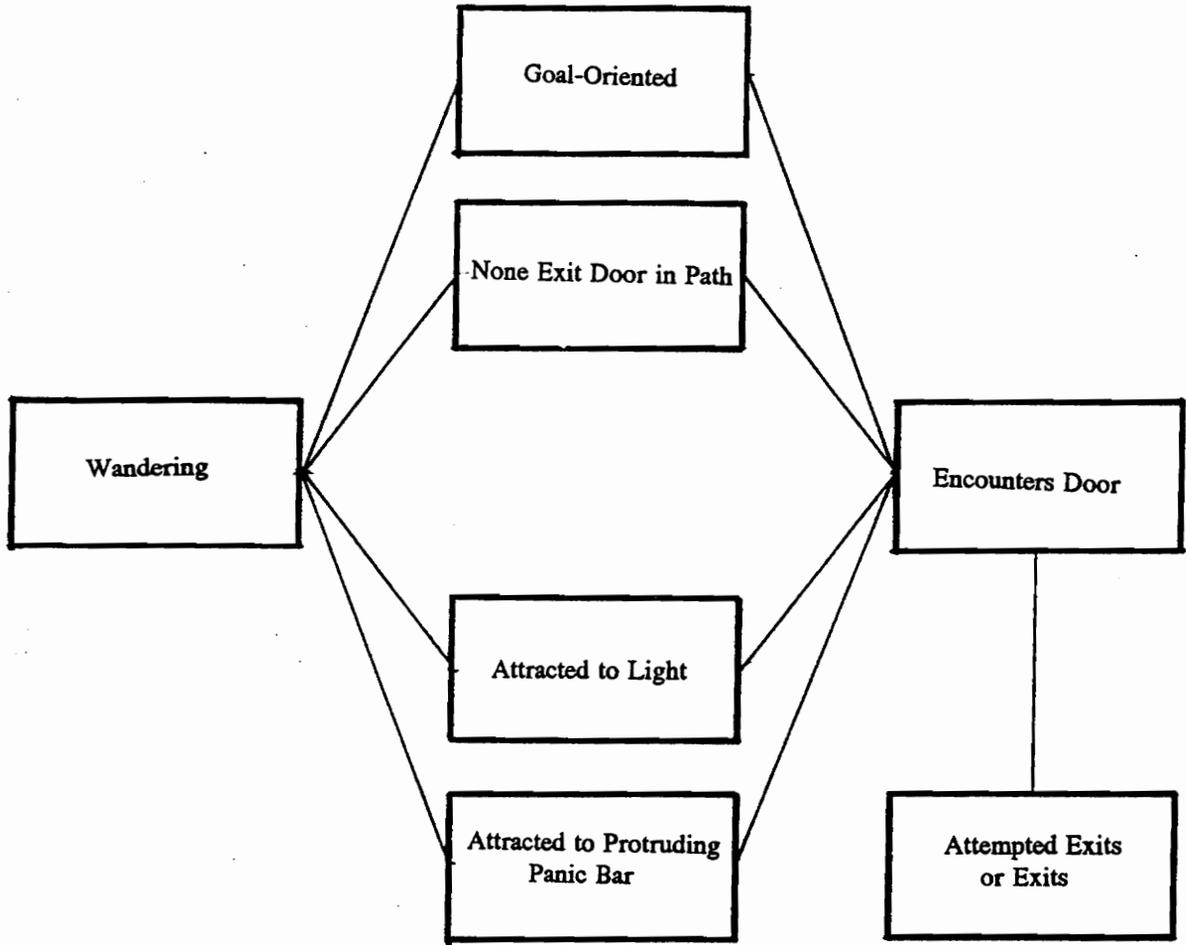


Figure 6. Conceptual Model.

The last reason for attempted exits that is addressed in the conceptual model is resident attraction to the panic bar. This reason is based on the results of the Namazi, Rosner, and Calkins (1989) study in which all exiting was eliminated when the doorknob was concealed.

Although this model addresses some of the reasons as to why residents might attempt to exit, the difficulty in determining all possibilities is apparent because of the severe cognitive declines experienced by the residents. In any case, the goal is to eliminate many of these reasons for exiting. For this particular research, three visual barriers were tested that addressed attraction to the light and to the protruding panic bar.

CHAPTER 3

METHODOLOGY

This chapter outlines the methods for a field experiment that examines the exiting behavior of dementia residents when exposed to three visual barriers. The methodology is based on the methods used by Namazi, Rosner, and Calkins (1989) and Hamilton (1993).

The investigation combined many of the recommendations made by the previous researchers. The first test condition consisted of mini-blinds purchased by Heritage Hall that covered the glazing in the door. This was based on the suggestions made by Hamilton (1993) in which she observed resident attraction to the view and natural light source.

The second test condition included the use of a cloth barrier that covered the panic bar of the door, a recommendation of Namazi, Rosner, and Calkins (1989). Recall that this research indicated a termination of all exits when the doorknob was covered.

The third test condition combined the cloth barrier as well as the mini-blind.

Hypotheses

This study examined whether differences in visual barriers have an effect on the exiting behavior of dementia residents in a long-term care facility. The following research hypotheses have been generated in order to answer this question:

- H1:** Test condition 1, the mini-blinds, will reduce resident exiting attempts.
- H2:** Test condition 2, the cloth panel, will reduce resident exiting attempts.
- H3:** Test condition 3, the cloth panel and the mini-blinds, will reduce resident exiting attempts.

Setting

The study was conducted at Heritage Hall, a nursing home located in Blacksburg, VA. Heritage Hall is a 194 bed, intermediate care facility with a separate Dementia Care Unit (DCU). The DCU, which is termed the "Grove", has a 30 bed capacity, an activity/ dining room, a centrally located nurses station, a toilet-training area, and a janitors closet. Since the unit opened, repeated attempts to exit have been made by residents. Currently, the unit relies on an alarm system to detect exits since the door cannot be locked due to fire/safety codes. However, the alarm has proved to be unsuccessful and exits have occurred. Due to the fact that the door is located near a driveway and major highway, exits pose a serious threat to the lives of the residents (Hamilton, 1993). The experiment was limited to the emergency exit door where an alarm sounded each time the panic bar was touched. If a resident pressed the bar for 15 seconds, and a nurse did not reach the door, the door opened, and the resident was free to exit (see Figure 7).

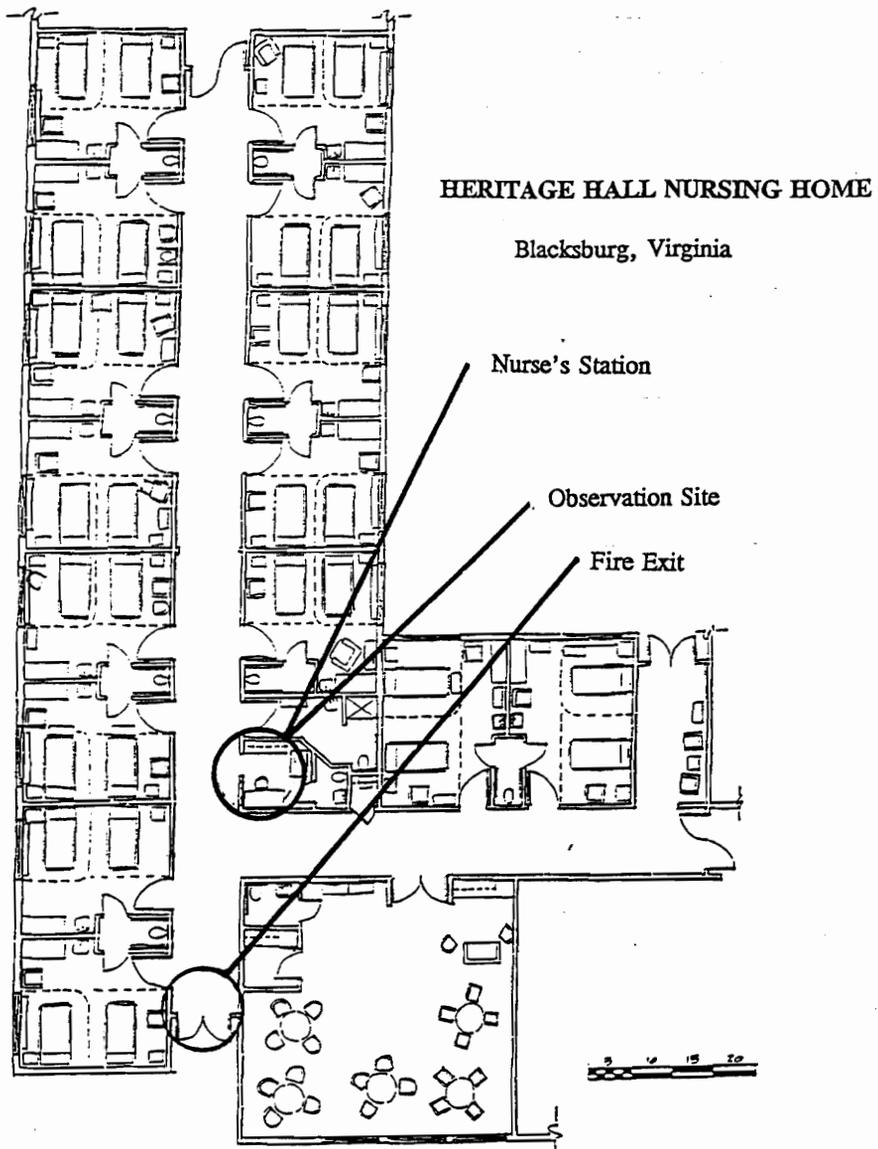


Figure 7. Illustration of experimental site
(Hamilton, 1993).

Sample

The sample consisted of 9 individuals who attempted to exit the unit at least once. Baseline collection determined the choice of residents. The demographic profile was determined after the observations were completed. Of the 9, 6 were male and 3 were female. The age of individuals ranged from 70 to 87 with a mean age of 78.4. Three were diagnosed with Alzheimer's disease, 3 were diagnosed with senile dementia, 1 was diagnosed with Parkinson's disease, and 1 was diagnosed with Multi-infarct dementia (see Table 2). Recall from chapter two, that senile dementia is a frequent diagnosis made since AD cannot be determined until death when an autopsy is performed. In the summer of 1993, resident 5 was transferred to the V.A. hospital located in Salem, Virginia, therefore, no descriptive statistics are available for him.

Baseline collection determined the final sample for this investigation. If someone had become ill and could no longer use the experimental site, a variable sample size would have been determined for every test condition. This situation did occur during test condition two.

Measure

Systematic, non-participatory observations served as the data collection method. The researcher recorded the frequency of exits during test and baseline conditions (see Appendix A). The observer was seated in the nurses station disguised as a staff member in order to account for reactivity (see Figure 7). During test condition 2, a second observer, who was blind to the investigation, observed with the primary investigator on

Table 2. Sample Characteristics.

RESIDENTS	AGE	GENDER	DIAGNOSIS	MONTHS
Resident 1	79	Male	SD	12
Resident 2	74	Female	PD	11
Resident 3	70	Female	MID	13
Resident 4	82	Male	SD	41
Resident 5		Male		
Resident 6	77	Female	AD	3
Resident 7	77	Male	AD	43
Resident 8	87	Male	AD	53
Resident 9	82	Male	SD	4

NOTE: SD = Senile Dementia

AD = Alzheimer's Disease

PD = Parkinson's Disease

MID = Multi-Infarct Dementia

MONTHS = Months refers to the number of months the individual has been a resident in Heritage Hall.

Saturday. Prior to the observation, the second observer was trained to record the frequency of exits. The definition of an exit was thoroughly explained ($r = 1.0$). A third observer who was not blind to the investigation was used on Friday for test condition 3. The same training procedures were utilized ($r = 1.0$).

Procedure

The investigator used an experimental format with the manipulation of the independent variable to determine the change in the dependent variable.

Dependent Variable

The dependent variable was exiting behavior. An exit was operationalized as a resident touching the panic bar thus sounding the alarm. The investigator only recorded an attempt to exit the unit if the door alarm sounded.

Independent Variable

The independent variable for the study was the use of three visual barriers. A visual barrier is defined as one that appears to be an obstruction, but that does not impede egress through the door (Namazi et al., 1989).

Baseline Condition (Week 1)

The baseline condition was observed for seven days (March 22 - 28, 1993) from 2:00 to 4:00 p.m. everyday. The residents are most active at this time, and many of the attempted exits occurred during this time frame. During this collection, no experimental manipulation was used, and the emergency exit door remained as is. This observation provided a comparison for the three test conditions. In addition, the sample was finalized

this week.

Test Condition 1 (Week 2)

The first test condition occurred during the second week of the study, following the same schedule as the baseline collection (March 29 - April 4, 1993). The visual barrier was applied to the emergency door in the evening when the residents were asleep. This test condition consisted of blue mini-blinds that covered the glazing in the door (see Figure 8). This visual barrier was based on the recommendations given by Hamilton (1993).

Open Week (Week 3)

A second baseline occurred during week 3 to reduce any learned effects from the previous test condition (April 5 - 11, 1993). The emergency door remained as is, and no data was collected during this week.

Test Condition 2 (Week 4)

Test condition 2 occurred during the fourth week of the study following the same schedule as the previous conditions (April 12 - 18, 1993). The visual barrier was applied to the emergency door in the evening when the residents were asleep. This test condition consisted of a blue cloth that covered the panic bar of the door (see Figure 9). The panel was attached with velcro, a pvc (polyvinyl chloride) pipe, and hooks. Because of the length of the door, a plastic pole was used to give the cloth stability which was supported with velcro and hooks at either end of the door. This visual barrier was based on the results from the research completed by Namazi, Rosner, and Calkins (1989) in

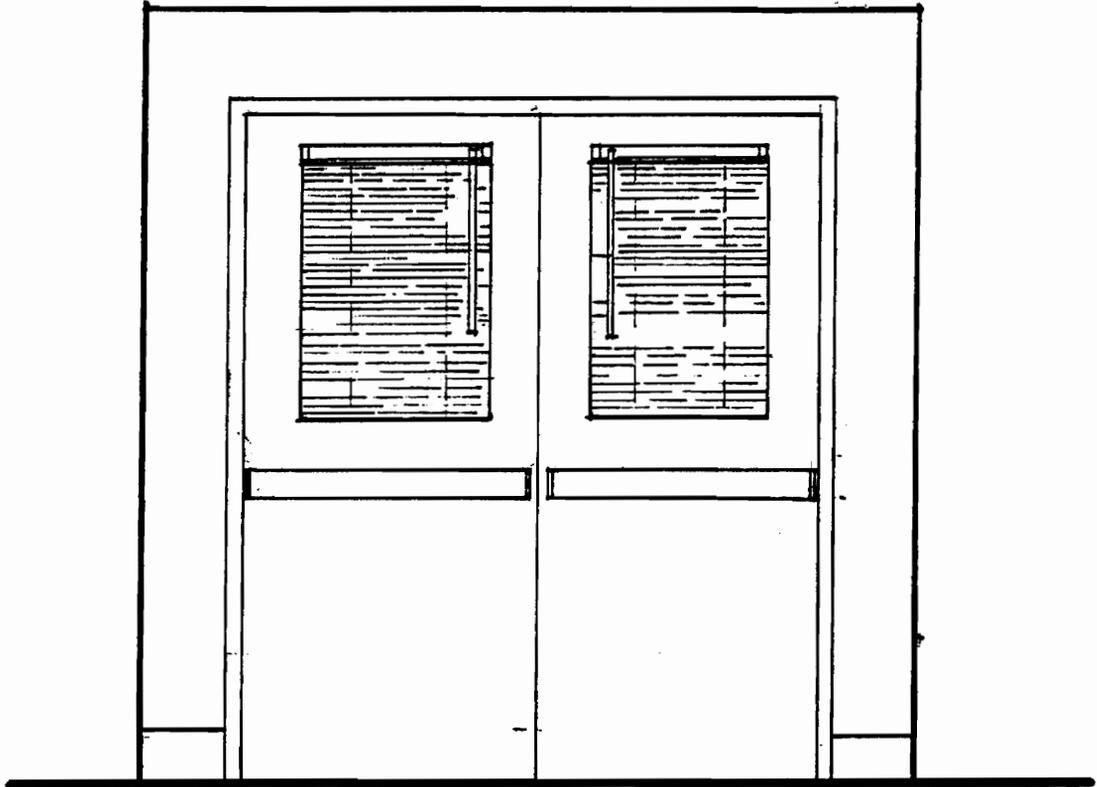


Figure 8. Test Condition 1.

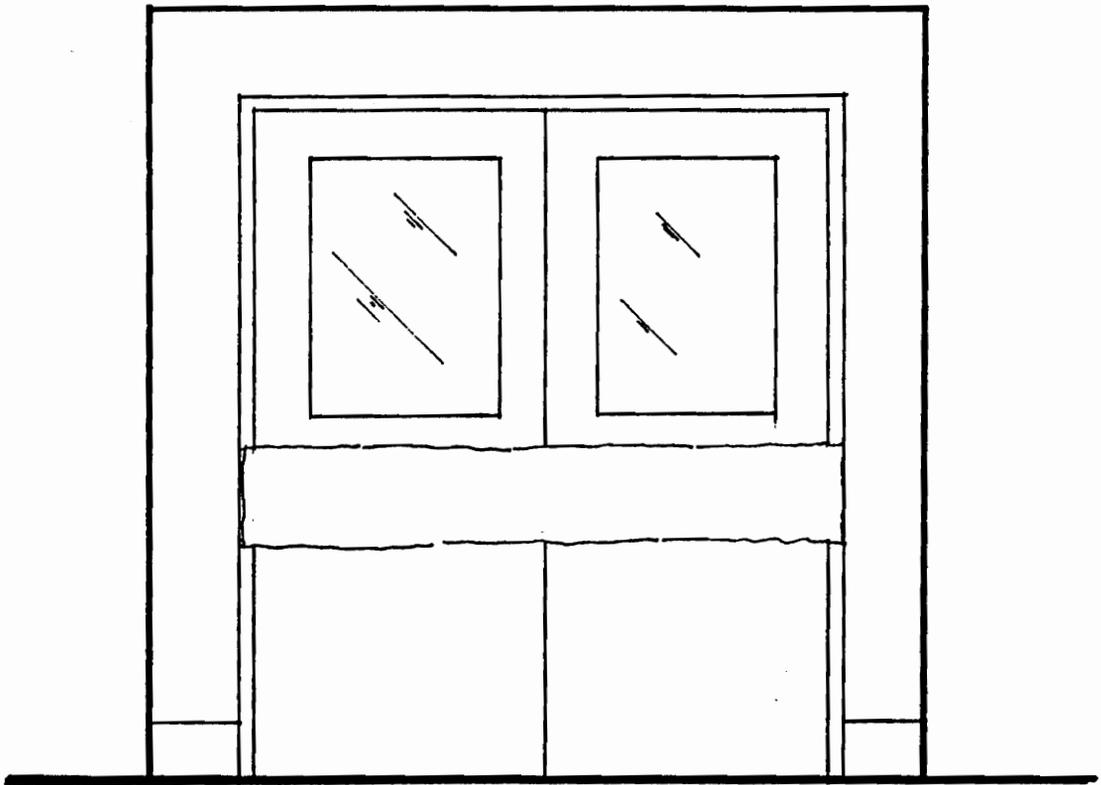


Figure 9. Test Condition 2.

which cloth panels covering the doorknob eliminated all exits from the unit. The color blue was used to reduce the contrast between the blue door and cloth panel.

Open Week (Week 5)

A third baseline collection occurred during week 5 to reduce any learned effects from previous test conditions (April 19 - 25, 1993).

Test Condition 3 (Week 6)

Test Condition 3 was structured the same way as test conditions 1 and 2 with the exception of the visual barrier used (April 26 - May 2, 1993). In this observation, the visual barriers in test condition 1 and 2 were combined. Thus, the door had both the mini-blind and cloth barrier applied (see Figure 10 and 11).

Limitations

The principal limitation of this study was the lack of generalization to the population due to the small sample size. In addition, the findings can only be applied to experimental sites that are similar to the one used in this research.

Assumptions

In order to analyze the data, the researcher assumed that the behavior changes in residents were due to the changes in the surroundings, and that the time frame of 2:00 to 4:00 p.m. was representative of the exiting behavior of residents.

Data Analysis

Frequency distributions were calculated for each exit, per resident, and test/baseline condition (see Appendix B). Due to the small sample size, nonparametric

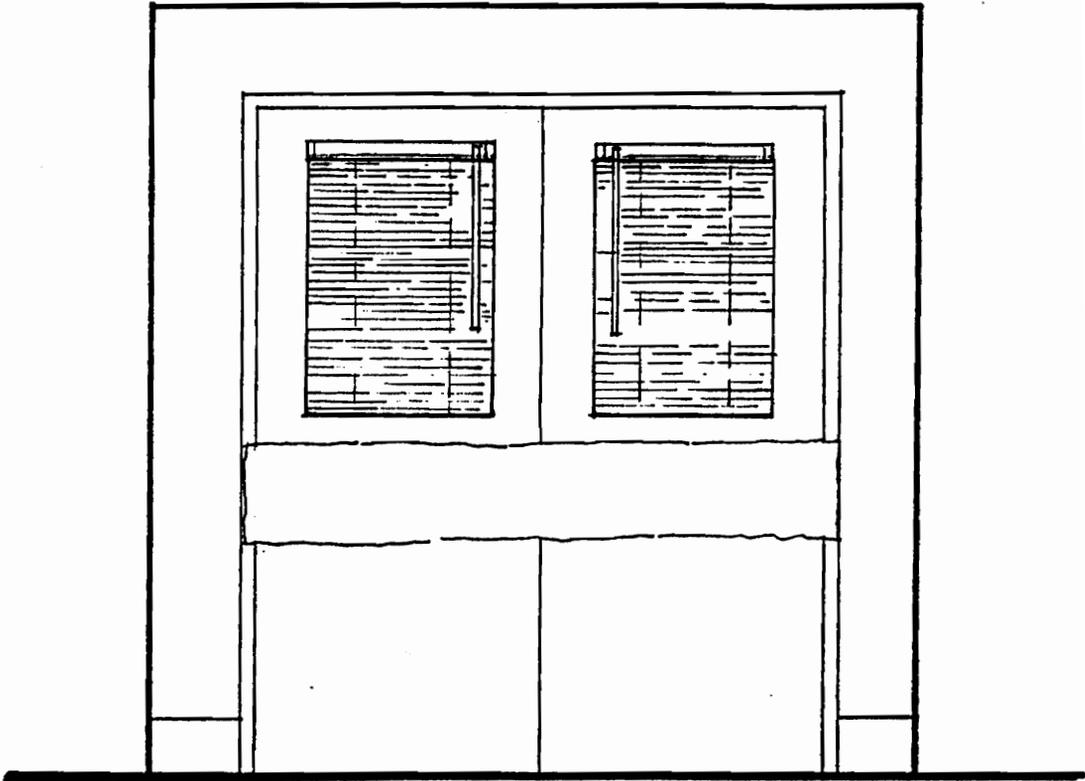


Figure 10. Test Condition 3.

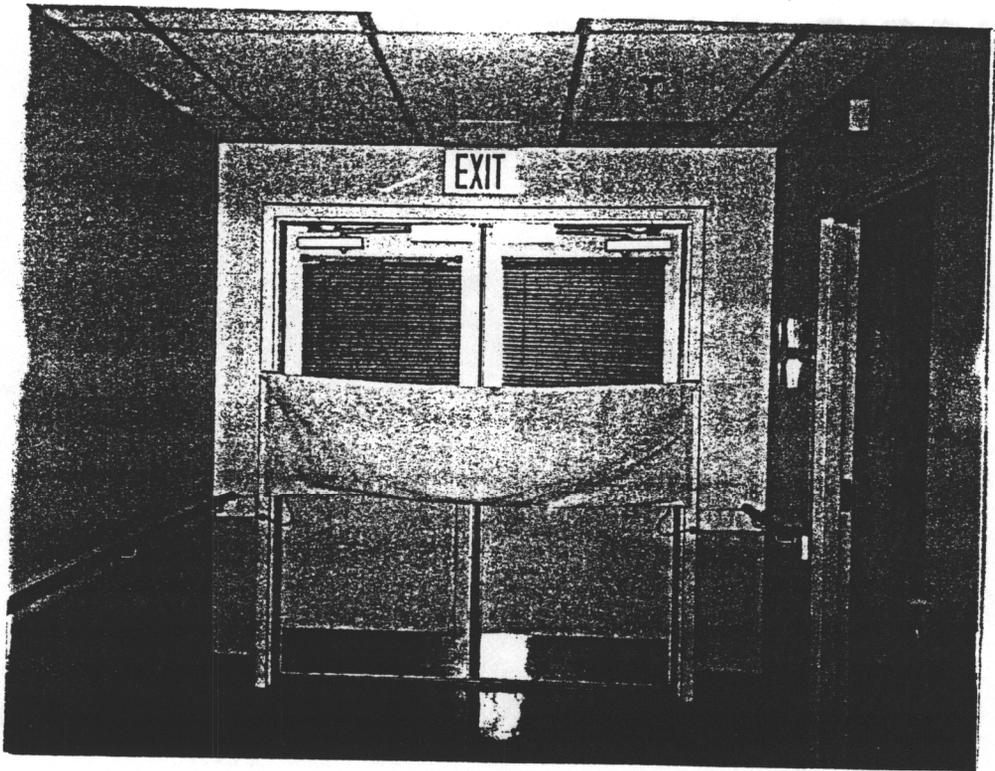


Figure 11. Photograph of Test Condition.

statistics were used. Nonparametric statistics do not rely on population estimation or distribution assumptions. Since there may be two or three residents who account for the majority of the exits, a statistical procedure that considers the median instead of the mean in its calculation was used (Hollander & Wolfe, 1973; Hamilton, 1993).

The statistical procedure is the Friedman's Rank Test for correlated samples. This is a nonparametric statistic similar to the one-way repeated measures ANOVA, however it is applied to ranks and not raw scores (Hamilton, 1993).

The Friedman requires that the different observations on the one individual must be capable of being ordered or ranked. In other words, the individual did the "best" under one condition of the study, and "second best" under a different condition. Thus, the individuals are ranked from 1 to k where k is the number of conditions (Hollander & Wolfe, 1973).

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter discusses the results for this investigation and consists of three sections. In section one, the data are described in terms of frequency distributions. In section two, the null hypothesis has been analyzed using Friedman's Rank test for k correlated samples. The third section details and discusses observations and limitations made during the data collection process.

Frequency Distributions

As mentioned in Chapter 3, data were collected for four weeks, from 2:00 to 4:00 p.m., seven days a week, for a total of 56 hours. During baseline collection, 9 residents triggered the alarm for a total of 120 attempted exits. Daily attempts ranged from 6 to 34 (see Tables 3 and 4 and Figure 12).

During the second week of the investigation, test condition 1, the mini-blind, was installed. The residents triggered the alarm for a total of 73 attempted exits. Daily attempts ranged from 2 to 21 (see Tables 4 and 5).

The third week of the study consisted of a baseline condition during which no data were collected. Test condition 2, the cloth panel, was installed during week four of the investigation. The residents triggered the alarm for a total of 5 attempted exits. Daily attempts ranged from 0 to 3 (see Tables 4 and 6).

TABLE 3

BASELINE CONDITION

Resident	M	T	W	H	F	S	S	Total
1	4	0	0	0	0	0	0	4
(2)	2	0	1	0	0	0	0	3
3	8	0	12	13	2	0	8	43
4	1	0	1	0	0	0	0	2
5	0	3	0	5	4	5	0	17
6	0	16	5	15	0	0	6	42
(7)	0	0	2	0	0	0	0	2
8	0	0	1	0	2	0	2	5
9	0	0	0	1	0	1	0	2
TOTAL	15	19	22	34	8	6	16	120

Note:

M = Monday, T = Tuesday, W = Wednesday, H = Thursday,
 F = Friday, S = Saturday and Sunday.

(2) and (7) indicates that residents 2 and 7 were eliminated from the statistical analysis.

TABLE 4 **TOTAL EXITING ATTEMPTS BY RESIDENT**

Resident	Baseline	Test 1	Test 2	Test 3	Total
1	4	0	0	0	4
(2)	3	2	0	0	5
3	43	30	4	1	78
4	2	1	0	0	3
5	17	5	1	1	24
6	42	23	0	4	69
(7)	2	7	0	4	13
8	5	5	0	5	15
9	2	0	0	3	5
TOTAL	120	73	5	18	216

n = 7

(2) and (7) indicates that residents 2 and 7 were eliminated from the statistical analysis.

Total Exiting Attempts

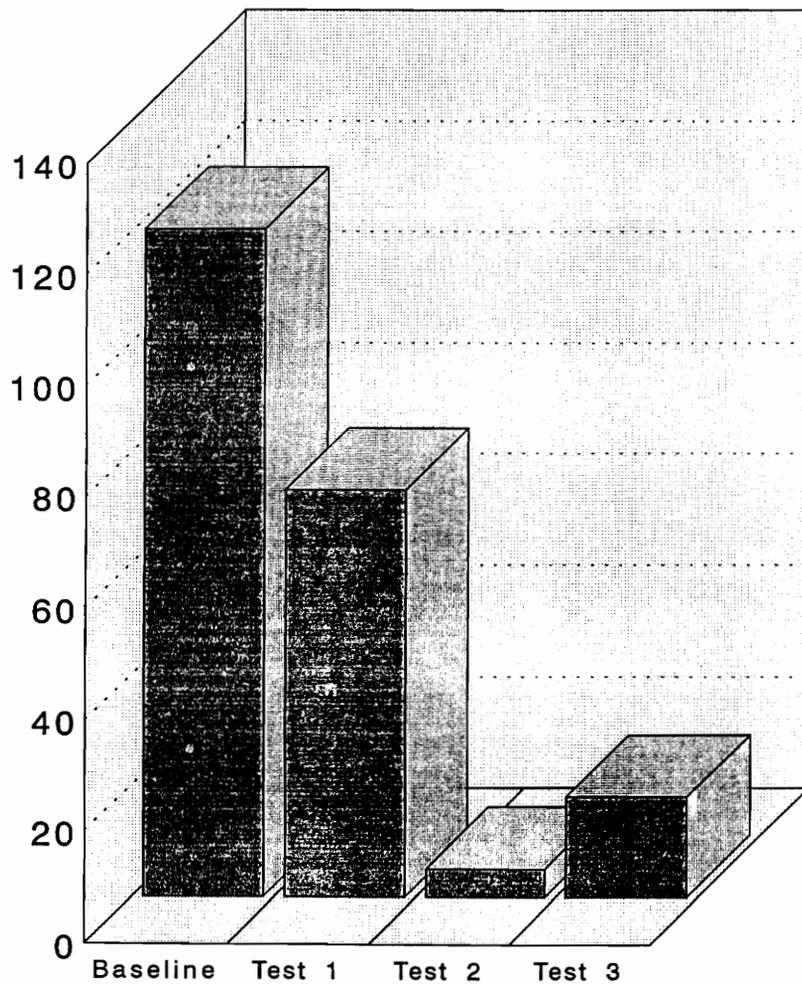


Figure 12. Total Exiting Attempts.

TABLE 5 **TEST CONDITION 1**

Resident	M	T	W	H	F	S	S	Total
1	0	0	0	0	0	0	0	0
(2)	0	1	1	0	0	0	0	2
3	9	3	10	4	0	4	0	30
4	0	0	0	0	0	1	0	1
5	1	0	1	1	0	0	2	5
6	9	0	6	6	1	1	0	23
(7)	1	2	0	0	0	4	0	7
8	1	0	0	0	3	1	0	5
9	0	0	0	0	0	0	0	0
TOTAL	21	6	18	11	4	11	2	73

Note: M = Monday, T = Tuesday, W = Wednesday, H = Thursday,
 F = Friday, S = Saturday and Sunday.
 (2) and (7) indicates that residents 2 and 7 were eliminated from the
 statistical analysis.

TABLE 6

TEST CONDITION 2

Resident	M	T	W	H	F	S	S	Total
1	0	0	0	0	0	0	0	0
(2)	0	0	0	0	0	0	0	0
3	0	0	0	1	3	0	0	4
4	0	0	0	0	0	0	0	0
5	1	0	0	0	0	0	0	1
6	0	0	0	0	0	0	0	0
(7)	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
TOTAL	1	0	0	1	3	0	0	5

Note:

M = Monday, T = Tuesday, W = Wednesday, H = Thursday,
 F = Friday, S = Saturday and Sunday.

(2) and (7) indicates that residents 2 and 7 were eliminated from the statistical analysis.

Week 5 consisted of a third baseline in which no data was collected.

During the final week of the study, test condition 3 was installed which consisted of both the mini-blind and cloth panel. The residents triggered the alarm for a total of 18 attempted exits. Daily attempts ranged from 1 to 5 (see Tables 4 and 7).

It should be noted that during week four of the investigation, resident 2 broke her hip and was restrained to a wheel chair for the remainder of the study. Consequently, she was not included in the statistical analysis. In addition, resident 7 was restrained during week four due to violent behavior. Again, he was not included in the statistical analysis (see Table 8).

Statistical Analysis

This section concentrates on the statistical analysis. The null hypothesis (HO1) stated that there will be no difference in resident exiting behavior when exposed to changes in the following visual barriers; mini-blinds, cloth barrier, and mini-blinds and cloth barrier. That is, the effects of the baseline = the effects of test condition 1 = the effects of test condition 2 = the effects of test condition 3. In other words, all the treatments have the same effect. The data were analyzed using Friedman's Rank test at the .05 level of significance. As mentioned previously, Friedman's Rank test is a nonparametric procedure similar to the one-way ANOVA, however, it is applied to ranks and not raw scores.

TABLE 7

TEST CONDITION 3

Resident	M	T	W	H	F	S	S	Total
1	0	0	0	0	0	0	0	0
(2)	0	0	0	0	0	0	0	0
3	0	0	0	1	0	0	0	1
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	1	1
6	0	3	0	0	0	0	1	4
(7)	0	2	1	0	0	1	0	4
8	1	0	0	2	1	0	1	5
9	1	0	0	0	0	2	0	3
TOTAL	2	5	1	3	1	3	3	18

Note:

M = Monday, T = Tuesday, W = Wednesday, H = Thursday,
 F = Friday, S = Saturday and Sunday.

(2) and (7) indicates that resident 2 and 7 were eliminated from the statistical analysis.

TABLE 8 TOTAL EXITING ATTEMPTS EXCLUDING RESIDENT 2 AND 7

Resident	Baseline	Test 1	Test 2	Test 3	Total
1	4	0	0	0	4
2					
3	43	30	4	1	78
4	2	1	0	0	3
5	17	5	1	1	24
6	42	23	0	4	69
7					
8	5	5	0	5	15
9	2	0	0	3	5
TOTAL	115	64	5	14	198

n = 7

The formula for the Friedman's Rank test is as follows:

$$S' = \frac{12 \sum_{j=1}^k (R_j - nR_{..})^2}{nk(k+1) - [1/(k-1)] \sum_{i=1}^n \left\{ \left(\sum_{j=1}^k t_{i,j}^3 \right) - k \right\}}$$

where:

Σ = is the sum of

k = is the number of treatments

n = is the sample size

j = is the jth measurement in each block (i.e. baseline, test condition 1, etc., are considered blocks).

i = is the block for the ith resident

g = is the number of tied groups in block i

$t_{i,j}$ = is the size of the jth tied group in block i, and untied values within a block are counted as ties of size 1.

R_j = is the sum of the ranks

$$R_{..} = \frac{k+1}{2}$$

The statistical package used was Number Cruncher. A p-value of .012 was obtained, and the null hypothesis (H_0) was rejected. The effects of the test conditions did make a difference in resident exiting behavior (see Table 9).

The overall analysis compared all 4 conditions simultaneously, therefore, the cause of the rejection is unknown. In order to determine the cause for the rejection,

treatment versus control, multiple comparisons have been made. The following hypotheses have been generated:

HO2: Baseline < Test Condition 1

HO3: Baseline < Test Condition 2

HO4: Baseline < Test Condition 3

HO5: Test condition 2 < Test Condition 3

Each hypotheses were analyzed using a Wilcoxon Sign Rank test for two related samples. A sign rank test is a nonparametric procedure similar to the correlated t-test. Like the Friedman's Rank test, the ranks were calculated for each condition and were subtracted from the baseline rank to determine the critical value. Probability levels were determined by referencing Table A.18 "Critical Values for One-sided Treatments Versus Control Multiple Comparisons Based on Friedman Sums" in Hollander and Wolfe's Nonparametric Statistical Methods (1973, pg. 379).

HO2 compared baseline to test condition 1. A p-value of $.04 < p < .07$ was obtained, and the null hypothesis was retained. Therefore, test condition 1, the mini-blind, did not significantly reduce resident exiting behavior. HO3 compared baseline to test condition 2. A p-value of $p < .000$ was obtained and the null hypothesis was rejected. Test condition 2, the cloth panel, did significantly reduce resident exiting behavior. HO4 compared baseline to test condition 3. A p-value of $p < .01$ was obtained and the null hypothesis was rejected. Test condition 3, the cloth panel and the mini-blind, did significantly reduce resident exiting behavior. HO5 compared test

condition 2 to test condition 3. A p-value of $.20 < p < .28$ was obtained. There was no significant decrease in resident exiting attempts between test condition 2 and test condition 3. In summary, test condition 2 and 3 significantly reduced resident exiting attempts while test condition 1 did not. The mini-blind was not a successful intervention (see Table 10 and Appendix C).

Individual Responses and Limitations

This section details observations made during the four weeks (56 hours) of data collection. The first half describes individual responses to the three test conditions while the second half discusses limitations that occurred during the investigation.

Individual Responses

Resident 1: Resident 1 has been diagnosed with senile dementia and has been in the nursing home for 12 months. He attempted to exit 4 times during baseline collection and 0 times during test conditions 1, 2, and 3. Although resident 1 was not an active wanderer, it is important to note the complete cessation in exiting attempts. Apparently, each test condition was effective, suggesting that he was attracted to both the light/view and the panic bar.

Resident 2: Resident 2 has been diagnosed with Parkinson's disease and has lived in the unit for 11 months. She attempted to exit 3 times during baseline collection and 2 times during test condition 1. Unfortunately, during test condition 2 she broke her hip and was restrained to a wheel chair for the remainder of the investigation. As a result of her injury, she was excluded from the statistical analysis.

TABLE 10 MULTIPLE COMPARISONS USING SIGN RANK TESTS

Residents	Baseline	Test 1	Test 2	Test 3
1	4 (4)	0 (2)	0 (2)	0 (2)
2				
3	43 (4)	30 (3)	4 (2)	1 (1)
4	2 (4)	1 (3)	0 (1.5)	0 (1.5)
5	17 (4)	5 (3)	1 (1.5)	1 (1.5)
6	42 (4)	23 (3)	0 (1)	4 (2)
7				
8	5 (3)	5 (3)	0 (1)	5 (3)
9	2 (3)	0 (1.5)	0 (1.5)	3 (4)
RANK TOTALS	RB=26	R1=18.5	R2=10.5	R3=15

$$RB - R1 = 26 - 18.5 = 7.5 \quad .04 < p < .07$$

$$RB - R2 = 26 - 10.5 = 15.5^* \quad p < .000$$

$$RB - R3 = 26 - 15 = 11^* \quad p < .01$$

$$R2 - R3 = 10.5 - 15 = 4.5 \quad .20 < p < .28$$

During the time she was able to wander, resident 2 would typically go to the fire exit door and look out the window. She seemed to be attracted to the view and/or light source since on many occasions she would look out the window, but would not trigger the alarm. Based on these observations, test condition 1 should have been successful, however, it was not. The mini-blind did not prevent resident 2 from approaching the door and she would typically peek out the blinds. Although debilitated by Parkinson's disease, the resident was not deceived by the elimination of the view or light source and understood the function of the mini-blinds.

It should be noted that the spouse of resident 2 is also a resident in the Grove. The two had a tendency to wander together, but when in his company, resident 2 never triggered the alarm. Perhaps her attempts to exit would have been higher without this limitation.

Resident 3: Resident 3 has been diagnosed with Multi-infarct dementia and has lived in the unit for 13 months. She attempted to exit 43 times during baseline collection, 30 times during test condition 1, 4 times during test condition 2, and 1 time during test condition 3. Based on observations and her significant drop in attempts to exit during test condition 2 and 3, resident 3 seems to be attracted to the shininess of the panic bar.

Resident 3 wandered more frequently than any other individual in the unit. Based on the design of the Grove, her wandering was limited to the hallway where she continually wandered from door to door (see Figure 7). While wandering, she would typically rub her hands along the hand rail in the hallway. This is also how she triggered

the alarm. The handrail in the hallway is oak, the walls are painted, and the panic bar is metal. Both the panic bar and handrail protrude and contrast in terms of material and value from the surface on which they are mounted. Resident 3 seemed to be attracted to this change in contrast or material.

During baseline condition, resident 3 was observed trying to pick up the gold filler in the vinyl tile floor. This is consistent with observations made by Hussain and Brown (1987) and supports the theory of attraction to the shininess of the panic bar.

The attraction to the contrast in materials may also be related to the residents prior lifestyle. While rubbing the handrail or panic bar, the motion of hand movements were reminiscent of the same motions made when cleaning. Perhaps this was resident three's motive.

When test condition 2 was installed, her attempts to exit dropped from 43 to 4. While wandering, she continued to rub her hand along the handrail, but when she approached the cloth panel, she would rub her hand along either the bottom or top of the cloth, thus missing the panic bar.

Resident 4: Resident 4 has been diagnosed with senile dementia and has been in the nursing home for 43 months. Resident 4 attempted to exit 2 times during baseline collection, 1 time during test condition 1, and 0 times during test conditions 2 and 3.

Although resident 4 did not wander often, note that all exiting attempts ceased. Because resident 4 did not approach the door frequently, it is difficult to assess his reason for escaping. As mentioned in chapter two (conceptual model), there may be many

reasons for attempting to exit which include; goal-orientation, attraction to light, attraction to the protruding panic bar, or no reason except that the door is located in the path of travel (see Figure 6). The cloth panel addressed attraction to the protruding panic bar. Since all exiting stopped for resident 4 with the installation of the cloth panel, he seemed to be captivated with the shininess of the panic bar.

Resident 5: During the summer of 1993 after the data collection, resident 5 was transferred to the V.A. hospital, therefore, no diagnosis was available for him. Resident 5 attempted to exit 17 times during baseline collection, 5 times during test condition 1, 1 time during test condition 2, and 1 time during test condition 3. During data collection, it became apparent that resident 5 was goal oriented when attempting to exit. On one occasion he wanted to go outside to shovel the snow, on another he believed his wife was having a heart attack, and on another he wanted to cut the grass.

The drop in his attempts to exit may be related to visual agnosia. If resident 5 had agnosia, he would not be able to interpret the fact that the panic bar was behind the cloth panel and thus believe the door was nothing but a dead end (Namazi et al., 1989).

Resident 6: Resident 6 has been diagnosed with Alzheimer's disease and has been in the unit for 3 months. She attempted to exit 42 times during baseline collection, 23 times during test condition 1, 0 times during test condition 2, and 4 times during test condition 3. Based on observations, resident 6 appears to be goal oriented, but may suffer from visual agnosia.

Resident 6 was a very active wanderer. Her reason for attempting to exit was

that she wanted to go home. When she wandered she walked from door to door attempting to get out as she continually said, "I want to go home." Her significant drop in numbers may be correlated to her apparent agnosia. Once test condition 1 was installed her approach to the door decreased. She walked from door to door avoiding the fire exit door. This same phenomena became increasingly apparent with test condition 2 and 3. She approached the nurses station, looked down the hallway at the fire door, but frequently changed her direction of travel (see Figure 7). When the cloth panel was installed, the protruding panic bar was eliminated giving the door the appearance of a solid panel. The effect seemed to deceive resident 6 causing her course of travel to change.

Occasionally, resident 3 and resident 6 would hold hands and wander together. When this happened, resident 6 led resident 3 decreasing total approaches to the door.

Resident 7: Resident 7 has been diagnosed with Alzheimer's disease and has been in the nursing home for 43 months. He attempted to exit 2 times during baseline collection, 7 times during test condition 1, 0 times during test condition 2, and 4 times during test condition 3. Unfortunately, resident 7 was frequently restrained throughout the investigation. In particular, during test condition 2 he was restrained for 4 out of the 7 days. Because of this limitation, he was excluded in the statistical analysis. During test condition 3, he was restrained 2 out of the 7 days. During this week his attempts to exit increased. When wandering he would use the handrail for support because he had difficulty in walking. This is consistent with the symptoms of Alzheimer's disease and

the normal aging process. Once upon the fire door, he would try to use the cloth panel as a support, and, on one occasion, he tore the panel down thus triggering the alarm.

Resident 8: Resident 8 has been diagnosed with Alzheimer's disease and has been in the nursing home for 53 months. He was the only resident in the sample confined to a wheel chair who could still wander. He attempted to exit 5 times during baseline collection, 5 times during test condition 1, 0 times during test condition 2, and 5 times during test condition 3. When resident 8 wandered he also used the handrail to guide him down the hall. When he approached the fire door, he would use the panic bar as a handrail, thus triggering the alarm. This explains why his attempts during test condition 1 remained consistent with the baseline collection.

During test condition 2 his attempts to exit dropped from 5 to 0. The cloth panel seemed to be effective this week and once the panic bar was covered, he seemed to no longer understand the function. In many instances, resident 8 would wander to the nurses station and gaze at the fire door, but would change his course of travel. This reaction was similar to resident 6. Because resident 8 used the handrail as a mechanism for guidance, once at the fire door he may have believed he had nothing to guide him.

Surprisingly, resident 8's attempts to exit increased during test condition 3. During this week of observation he seemed to become increasingly curious with the cloth panel. Unlike test condition 2, he would not change his course of travel and would come upon the fire door and run his hand along the cloth panel in such a way as to trigger the alarm.

Resident 9: Resident 9 has been diagnosed with Alzheimer's disease and has been in the nursing home for 4 months. He attempted to exit 2 times during baseline collection, 0 times during test condition 1, 0 times during test condition 2, and 3 times during test condition 3. The reason for the increase in attempts during test condition 3 is unknown. Perhaps resident 9 was more active in his wandering behavior this week, or perhaps there was a learned affect.

Limitations

This investigation has been classified as a field experiment. Due to the lifelike nature of the setting in which the experiment took place, there were many uncontrollable factors. These limitations included: (1) resident sleeping, (2) resident health, (3) family visits, (4) the use of restraints on residents, and (5) the opening of the courtyard. Each limitation has been discussed below.

Throughout the entire investigation, residents may have been napping during the data collection time. In particular, resident 3 had a tendency to nap from 2:00 to 3:00 p.m. For example, during baseline collection resident 3 slept for 3 hours out of the 14 hours of data collection. Test condition 1 she slept for 5 hours, test condition 2 she slept for 4 hours, and test condition 3 she slept for 6 hours. Because these naps typically lasted for 1 hour, resident 3 still had the opportunity to attempt to exit during the remainder of the observation time.

Another limitation observed was resident health. As mentioned earlier, resident 2 broke her hip during week four of the investigation. During test condition 3, resident

5 became ill and was hospitalized for one day during data collection. He was returned on Tuesday to the Grove. Resident 6 became sick with a cold during test condition 2. Although resident 5 and 6 were ill, they still had the ability to wander and thus trigger the alarm. Therefore, they remained in the sample for the statistical analysis.

Throughout the investigation, family members came to visit. In particular, resident 3 and 5 had numerous visitors. Resident 3's family visited on Sunday during baseline collection, Friday and Sunday during test condition 1, Sunday during test condition 2, and Monday during test condition 3. These visits typically lasted for one hour. Resident 5's family visited on Sunday during baseline collection, Tuesday during test condition 1, Tuesday and Thursday during test condition 2, and Tuesday during test condition 3. Again, these visits were approximately for one hour. Although visitors had a tendency to distract residents from attempting to exit, they did not prevent the resident from wandering. For example, during baseline collection resident 3's family visited on Sunday, however, she still managed to attempt to exit 8 times during the two hour observation period.

Restraints were used in the nursing home to control violent behavior or for medical reasons. Resident 2 and resident 7 were restrained during this investigation. As mentioned previously, resident 2 broke her hip and was restrained due to medical reasons for the remainder of the investigation. Resident 7 was 3 intermittingly restrained throughout the study due to violent behavior. For example, during baseline collection resident 7 hit another resident and was restrained to a geriatric chair. Because resident

7 was restrained for 4 out of the 7 days during test condition 2, he was not included in the statistical analysis.

During test condition 2, the courtyard was opened on Tuesday, Wednesday, and Friday. Resident 5 was the only resident to go outside during the observation times. On Tuesday and Wednesday he was outside from 2:00 to 3:00 pm and on Friday he was outside from 2:00 to 2:50 pm. Again, resident 5 still had the opportunity to attempt to exit during the remainder of the observation period.

CHAPTER FIVE

CONCLUSIONS

This chapter begins with a summary of the study, discusses conclusions and implications which are based on the findings of the investigation, and concludes with recommendations for further research.

Summary

The elderly population in the United States is expected to increase rapidly over the next decade. As this population continues to grow, the number of individuals affected by senile dementia illnesses will also increase (Shroyer et al, 1989). For example, Alzheimer's disease which is recognized as the most prevalent form of dementia afflicts two to four million people (Jarvik & Winograd, 1988; Shroyer et al., 1989). Consequently, the demand for special care units will increase and affect the architecture and interior design industries (Shroyer et al., 1989).

One component of design involves safety threats resulting from attempted exits from dementia care units. These attempts occur due to patient wandering which is symptomatic of dementia (Coons, 1988). For example, approximately 20% of staff employed at long-term care facilities were aware of at least one incident where wandering resulted in injury or death (Burnside, 1981).

Because of the seriousness of this problem, the primary objective of this

investigation was to determine whether changes in visual barriers affected resident exiting behavior by comparing wandering before and after planned interventions.

The sample for this research consisted of 9 individuals who attempted to exit the unit at least once. Baseline collection determined the choice of residents. Of the 9, 6 were male and 3 were female. All residents were diagnosed with some form of dementia.

The study was conducted at Heritage Hall, a nursing home in Blacksburg, Virginia, and was limited to the emergency exit door where an alarm sounded each time the panic bar was touched. The researcher recorded the frequency of exits during test and baseline conditions where an exit was operationalized as a resident touching the panic bar and sounding the alarm.

The tests were conducted under three visual barriers and one baseline condition. Each condition was observed for seven days from 2:00 to 4:00 p.m. The schedule was as follows:

Baseline condition: No experimental manipulation was used, and the emergency exit door remained as is. This provided a comparison for the three test conditions. During baseline collection, 9 residents triggered the alarm for a total of 120 attempted exits.

Test condition 1: This test condition consisted of a blue mini-blind that covered the glazing in the door and was based on the observation of resident attraction to the view and light source (Hamilton, 1993). Seventy-three attempted exits occurred during this observation time.

Baseline condition: A second baseline to reduce learned effects from the previous test conditions.

Test condition 2: A blue cloth that covered the panic bar of the door was installed. This test condition was based on resident attraction to the shininess of the panic bar. Test condition 2 decreased attempted exits to 5.

Baseline condition: A third baseline to reduce learned effects from the previous test conditions.

Test condition 3: In this observation, the visual barriers in test condition 1 and 2 were combined. Thus, the door had both the mini-blind and cloth barrier. During test condition 3, 18 attempted exits occurred.

All three test conditions reduced resident exiting. Of the visual barriers tested, concealment of the panic bar was the most successful intervention. Test condition 2 and 3 significantly decreased resident attempted exits while test condition 1 was not statistically significant.

Conclusions and Implications

On the basis of this investigation, the following conclusions and implications about the effect of visual barriers on the exiting behavior of residents in a dementia care unit were justified:

(1) Attempted exits from Heritage Hall were a serious problem. During baseline collection, 9 residents triggered the alarm for a total of 120 attempted exits during the 14 hours of data collection.

(2) Visual barriers do in fact make a difference in resident exiting behavior. All three test conditions decreased resident exiting attempts. Therefore, visual barriers were a safe and effective method for deterring resident exiting for this particular nursing home.

(3) Test condition 1, the mini-blinds, was not statistically nor clinically significant since 73 attempted exits occurred with the intervention ($.04 < p < .07$). Perhaps attraction to the view or light source was not a reason for attempting to exit, or perhaps the mini-blinds were a window treatment that was familiar to the residents and did not convey an elimination of the view or light source.

(4) Of the three visual barriers tested, test condition 2, the cloth panel, was the most successful intervention ($p < .000$). Resident exiting dropped from 120 to 5. This condition not only addressed attraction to the shininess of the panic bar, but also affected individuals who suffered from visual agnosia. As mentioned previously, the panic bar was a projection that the hand may have sought regardless of the purpose or intent. When the door became a solid panel, the person with visual agnosia was unable to interpret the panel as anything but a dead-end (Namazi et al., 1989).

(5) Test condition 3 consisted of both interventions, the mini-blind and the cloth barrier. This test condition was not as successful as test condition 2 ($p < .01$). Perhaps a learned effect occurred. According to Namazi, Rosner, and Calkins (1989), behavioral learning has been demonstrated in individuals with dementia when the tasks involved are repetitive in nature which the cloth panel was.

(6) Individual residents had various reasons for attempting to exit. Consequently, each resident responded differently to the test conditions. The conceptual model discussed in chapter two suggests wandering leads to exiting behavior because of: goal-orientation, attraction to light or view, attraction to protruding panic bar, or no reason except that the door is located in the path of travel. This particular investigation addressed attraction to light, attraction to protruding panic bar, and unexpectedly, goal-orientation when the individual supposedly suffered from visual agnosia. Taking these factors into consideration changes the conceptual model (see Figure 13).

Future Recommendations

Based on the findings and observations made for this investigation, the following recommendations are suggested:

- (1) The increase in attempted exits that occurred from test condition 2 to test condition 3 seems to be related to a learning effect even though a baseline condition existed between the two test conditions. For future research, data needs to be collected during baseline conditions in order to determine if a learning effect is developing.
- (2) A solution to the attempted exits was found for this particular nursing home. Although the cloth panel was an effective intervention, additional research is needed to determine how to install the panel in such a way as to satisfy fire/safety codes and resident abuse. As mentioned previously, during test condition 3, a resident tore the panel down. Ultimately this abuse becomes a burden to the nursing staff who have to reinstall the cloth panel each time it is taken down.

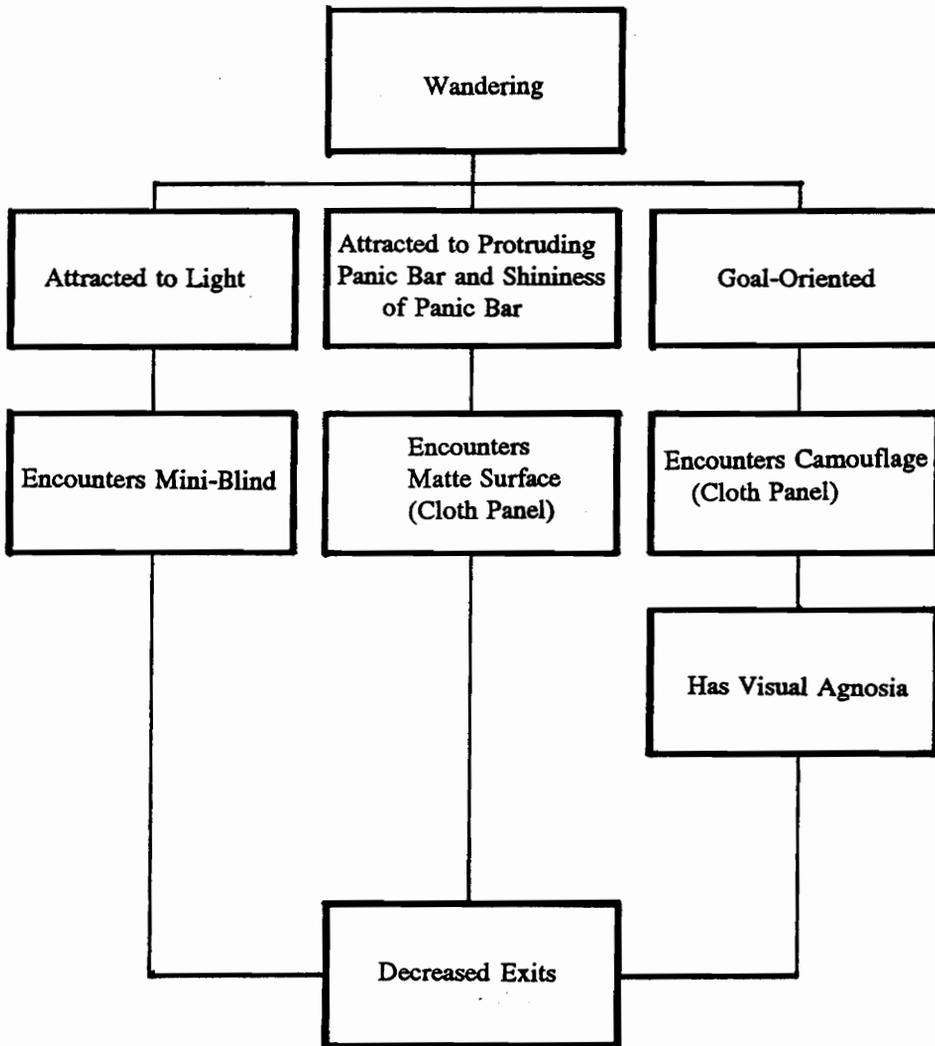


Figure 13. Conceptual Model.

(3) Additional research could investigate whether painting the metallic bar the same color as the door has the same effect as the cloth panel. This solution would solve fire/safety issues and resident abuse. In addition, other methods for eliminating the light source could be explored. Perhaps a cloth panel that extended from the top of the door to the bottom of the panic bar should be installed (i.e. similar to a curtain). This would eliminate resident attraction to the light and panic bar, and would be increasingly difficult to tear down.

(4) On a larger scale, nursing home administrators need to be educated on the use of visual barriers as a means for eliminating harmful exits from the unit. The findings from this research as well as the results from the Namazi, Rosner, and Calkins (1989) study could be implemented in nursing homes across the country.

(5) Because of the seriousness of the problem, interior design educators and practitioners need to be educated on the use of visual barriers as a means for eliminating harmful exits from the unit. The design of dementia care units is critical to the well-being of residents, staff, and family members. Due to the diminished competencies of dementia patients, increased sensitivity to their immediate surroundings occurs (Blank, 1988). When interior environments are improperly designed, the users of the space pay the consequences. Healthy individuals can adapt and maintain activities as before. Dementia residents do not have the same flexibility, and, in some cases, design flaws can lead to injury or death. It seems unfortunate that these situations occur when safe, inexpensive, and effective modifications such as visual barriers can be installed.

References

- Alzheimer's Resource Center. (1988). Characteristics of patients in each stage of Alzheimer's disease.
- Baille, S. T., & Foxworth, J. J. (1991). Alzheimer's patients and their care-givers: A review of literature with housing implications. Housing and Society, 18, 79-89.
- Blank, T. O. (1988). Older persons and their housing - today and tomorrow. Springfield, Illinois: Charles C. Thomas.
- Burnside, I. (1981). Touching is talking. American Journal of Nursing, 73, 2060-2063.
- Burnside, I. (1988). Nursing Care. In L. F. Jarvik & C. H. Winograd (Eds.), Treatment for the Alzheimer patient: The long haul (pp. 39-59). New York: Springer.
- Calkins, M. P. (1988). Design for dementia. Owings Mills, Maryland: National Health.
- Coons, D. H. (1988). Wandering. The American Journal of Alzheimer's Care and Related Disorders and Research, 3, 31-36.
- Covey, H. C. (1981). A reconceptualization of continuity theory: Some preliminary thoughts. The Gerontologist, 21, 628-632.
- Cluff, P. J. (1990). Alzheimer's disease and the institution: Issues in environmental design. The American Journal of Alzheimer's Care and Related Disorders and Research, 5, 23-32.
- Dunkle, R. E., & Kart, C. S. (1990). Long-term care. In K. F. Ferraro (Ed.), Gerontology perspectives and issues (pp. 225-243). New York: Springer.
- Hagnell, O., Lanke, J., Rorsman, B., Ohman, R., & Ojesjo, L. (1983). Current trends in the incidence of senile and multi-infarct dementia. Archives of Psychiatry and Neurological Sciences, 233, 423-438.
- Hall, E. T. (1966). The hidden dimension. New York: Doubleday.

- Hamilton, C. L. (1993). The use of tape patterns as an alternative method for controlling wanderers in dementia care unit. Unpublished master's thesis, Virginia Polytechnic Institute and State University, Blacksburg, VA.
- Hiatt, L. G. (1981). The color and the use of color in environments for older people. Nursing Homes, 30, 18-22.
- Hollander, M., & Wolfe, P.A. (1973). Nonparametric statistical methods. Canada: John Wiley & Sons, Inc.
- Hussain, R. A., & Brown, D. C. (1987). Use of two-dimensional grid patterns to limit hazardous ambulation in demented patients. Journal of Gerontology, 42, 558-560.
- Ivers, J. (1992). Observations of an Alzheimer's unit: Heritage hall. Unpublished paper.
- Jarvik, L. F. (1988). The future: Some speculations. In L. F. Jarvik & C. H. Winograd (Eds.), Treatments for the Alzheimer's patient: The long haul (pp. 186-198). New York: Springer.
- Jarvik, L. F., & Winograd, C. H. (Eds.). (1988). Treatments for the Alzheimer patient: The long haul. New York: Springer.
- Jorm, A. F. (1987). Guide to understanding of Alzheimer's disease and related disorders. New York: University Press.
- Kallman, F. J. (1953). Heredity in health and mental disorders. New York: Norton.
- Kaplan, S. (1983). A model of person-environment compatibility. Environment and Behavior, 15, 311-331.
- Katzman, R. (1985). Current frontiers in research on Alzheimer's disease. In V. L. Melnick & N. N. Dubler (Eds.), Alzheimer's dementia dilemmas in clinical research (pp. 1-11). New Jersey: Humana Press.
- Lawton, M. P., & Nahemow, L. (1973). Ecology and the aging process. In C. Eisdorfer & M. P. Lawton (Eds.), Psychology of adult development and aging (pp. 32-50). Washington, D.C.: American Psychological Association.

- Levine, J. S., & Miller, K. R. (1991). Biology discovering life. Lexington, Massachusetts: D.C. Health Company.
- Mace, N. L., & Rabins, P. V. (1981). The 36 - hour day. New York: John Hopkins.
- Madson, J. (1991). The study of wandering in persons with senile dementia. The American Journal of Alzheimer's Care and Related Disorders and Research, 21-24.
- Marsh, G. R. (1980). Perceptual changes with aging. In E. W. Busse & D. G. Blazer (Eds.), Handbook of geriatric psychiatry (pp. 147-168). New York: Litton.
- Namazi, K. H., Rosner, T. T., & Calkins, M. P. (1989). Visual barriers to prevent ambulatory Alzheimer's patients from exiting through an emergency door. The Gerontologist, 29, 699-702.
- Rader, J., Doan, J., & Schwab, M. (1985, July/August). How to decrease wandering, a form of agenda behavior. Geriatric Nursing, pp. 196-199.
- Reisberg, B., Ferris, S. H., & Leon, M. J. (1985). Senile dementia of the Alzheimer's type: Diagnostic and differential diagnostic features with special reference to functional assessment staging. In R. J. Joynt & A. Weindl (Eds.), Senile dementia of the Alzheimer's type (pp. 18-38). Heidelberg: Springer-Verlag Berlin.
- Ronch, J. L. (1987). Specialized Alzheimer's units in nursing homes: Pros and cons. The American Journal of Alzheimer's Care and Related Disorders and Research, 2, 10-19.
- Saltzman, D. M., Blasch, B. B., Morris, R. D., & McNeal, L. W. (1991). Travel behavior of nursing home residents perceived as wanderers and non-wanderers. The Gerontologist, 31, 666-672.
- Sanders, J. L., & McCormick, E. J. (1987). Human factors in engineering and design. New York: McGraw Hill.
- Schefft, B. K., & Lehr, B. K. (1990). Psychological problems of older adults. In K. F. Ferraro (Ed.), Gerontology perspectives and issues (pp.283-294). New York: Springer.

- Shroyer, J. L., Hutton, T., Gentry, M. A., Dobbs, M. N., & Elias, J. W. (1989). Alzheimer's disease: Strategies for designing interiors. The ASID Report, XV, C4-C7.
- Snyder, L., Rupperecht, P., Pyrek, J., & Moss, T. (1978). Wandering. The Gerontologist, 18, 272-280.
- Stevens, P. S. (1987). Design for dementia: Recreating the loving family. The American Journal of Alzheimer's Care and Related Disorders and Research, 2, 17-22.
- Stichler, J. F., & Peters, J. (1987). Color and long-term care facilities. Contemporary Longterm Care, 10(5), 41-42.
- Willot, J. F. (1990). Neurogerontology: The aging nervous system. In K. F. Ferraro (Ed.), Gerontology perspectives and issues (pp. 58-86). New York: Springer.
- Winchip, S. (1990). Dementia health care facility design. Journal of Interior Design Education and Research, 2, 39-46.
- Winograd, C. H. (1988). The physician and the Alzheimer patient. In L. F. Jarvik & C. L. Winograd (Eds.), Treatments for the Alzheimer patient: The long haul (pp. 3-38). New York: Springer.
- Zeisel, J. (1981). Inquiry by design. New York: Cambridge University Press.
- Zgola, J. M. (1987). Doing things. Baltimore, Maryland: John Hopkins.

Appendix (A)

Sample Data Collection Instrument

BASELINE COLLECTION

DATE:

RESIDENTS

NUMBER OF EXITS

Resident 1

Resident 2

Resident 3

Resident 4

Resident 5

Resident 6

Resident 7

Resident 8

Resident 9

NOTES:

Appendix (B)
Data Analysis Chart

DATA ANALYSIS CHART**Attempted Exits from the Unit**

RESIDENTS	BASELINE	TEST 1	TEST 2	TEST 3
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Resident 1

Resident 2

Resident 3

Resident 4

Resident 5

Resident 6

Resident 7

Resident 8

Resident 9

TOTAL:

Appendix (C)

Table A.18 from Hollander and Wolfe's Nonparametric Statistical Methods

Table A.18. Critical Values for one-sided treatments versus control multiple comparisons based on Friedman rank sums:

$k = 3$

x	n = 2	n = 3	n = 4	n = 5	n = 6	n = 7	n = 8
1	.5000	.3981	.4213	.3976	.3983	.3903	.3879
2	.6111	.5648	.5386	.5185	.5037	.4918	.4821
3	.7778	.7593	.6899	.6664	.6349	.6161	.5976
4	.9444	.8519	.8194	.7719	.7453	.7173	.6967
5		.9352	.8982	.8594	.8288	.8017	.7784
6		.9907	.9537	.9303	.9008	.8777	.8546
7			.9861	.9663	.9476	.9272	.9086
8			.9985	.9869	.9749	.9602	.9456
9				.9972	.9899	.9817	.9714
10				.9997	.9969	.9922	.9861
11					.9994	.9972	.9939
12					1.000	.9993	.9997
13						.9999	.9993
14						1.000	.9998
15							1.000
16							
17							

(Adapted from Hollander and Wolfe, 1973).

VITA

Joan Ivers Dickinson was born on January 7, 1964 in Passaic, New Jersey. She received her Bachelor of Science degree in Interior Design from Virginia Polytechnic Institute and State University in June, 1986. Upon completion of her undergraduate studies, Joan worked as an interior designer for a furniture dealership where she specialized in systems furniture space planning. From May, 1988 to January, 1992, Joan worked as a project designer at an interior architecture firm where she specialized in government corporate headquarters design. In April, 1989, Joan successfully completed the NCIDQ exam and became a licensed interior designer. She is currently a member of the Institute of Business Designers, the Interior Design Educators Council (IDEC), and the American Home Economics Association. In January, 1992, Joan began her graduate studies when she was accepted to the master's program in Housing, Interior Design, and Resource Management. During her graduate studies, Joan received the 1993 Jean M. Lane Scholarship, was a graduate teaching assistant for Two-Dimensional Design and History of Interiors, was accepted to the Certificate of Gerontology Program, and was a member of two honor societies, Kappa Omicron Nu and Phi Kappa Phi. In August, 1993, Joan was hired as a part-time instructor to teach Design Drawing for the year. In November, 1993, her abstracts were accepted by IDEC and the Southern Gerontological Society. Both papers will be presented in the Spring. Her future endeavors include health care design and teaching.

Joan I. Dickinson