Identifying the Most Effective Stimulus to Promote Wayfinding in Elders with Dementia

Allison A. Jay

Follow this and additional works at: https://scholarworks.wmich.edu/masters_theses

Part of the Applied Behavior Analysis Commons

Recommended Citation
https://scholarworks.wmich.edu/masters_theses/4595

This Masters Thesis-Open Access is brought to you for free and open access by the Graduate College at ScholarWorks at WMU. It has been accepted for inclusion in Master's Theses by an authorized administrator of ScholarWorks at WMU. For more information, please contact wmu-scholarworks@wmich.edu.
IDENTIFYING THE MOST EFFECTIVE STIMULUS TO PROMOTE WAYFINDING IN ELDERS WITH DEMENTIA

by

Allison A. Jay

A Thesis
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Master of Arts
Department of Psychology

Western Michigan University
Kalamazoo, Michigan
June 2008
Copyright by
Allison A. Jay
2008
IDENTIFYING THE MOST EFFECTIVE STIMULUS TO PROMOTE WAYFINDING IN ELDERS WITH DEMENTIA

Allison A. Jay, M.A.
Western Michigan University, 2008

When nursing home residents with dementia experience difficulty locating their bedroom, it can create problems for other residents and staff. This study investigated the ability of four elders with severe dementia to recognize various self-referent stimuli (i.e., young adulthood photograph, middle adulthood photograph, current photograph, and printed name). Two of the three participants who were able to complete the assessment recognized their photographs from earlier in life and their printed names but were not able to recognize their current photograph. These two residents then participated in an intervention in which the recognized stimuli were posted outside their bedroom doorway during assessment probes. Neither was able to locate their bedroom when any stimulus was posted (i.e., no stimulus, best recognized stimulus, poorest recognized stimulus). The results of this study suggest that posting relevant stimuli does not produce immediate increases in wayfinding and that discrimination training in the natural environment may be necessary to ensure that the presence of the photograph assumes discriminative properties.
# TABLE OF CONTENTS

LIST OF FIGURES ........................................................................................................... vii

CHAPTER

I. INTRODUCTION ............................................................................................................. 1
   Aging America ............................................................................................................. 1
   Dementia ...................................................................................................................... 1
   Diagnosis ..................................................................................................................... 1
   Neuropathology ......................................................................................................... 2

II. BEHAVIORAL DIFFICULTIES IN NURSING HOME SETTINGS ......................... 4
   Background ............................................................................................................... 4
   Wayfinding .................................................................................................................. 5

III. ENVIRONMENTAL DESIGN .................................................................................. 9
   Effective Discriminative Stimuli and Wayfinding ..................................................... 9
   Stimulus Recognition Literature .............................................................................. 10

IV. PURPOSE OF THE PRESENT STUDY .................................................................. 13

V. GENERAL METHOD ............................................................................................... 14
   Participants and Selection Criteria ......................................................................... 14
   Setting ....................................................................................................................... 14
Table of Contents – Continued

CHAPTER

VI. EXPERIMENT ONE: STIMULUS RECOGNITION ASSESSMENTS 16
   Materials .................................................................................. 16
   Procedure .................................................................................. 16
   Dependent Measures ................................................................... 18
   Interobserver Agreement (IOA) and Procedural Integrity ............ 18
   Results ....................................................................................... 19

VII. EXPERIMENT TWO: WAYFINDING INTERVENTION ANALYSIS 22
   Setting and Procedures .............................................................. 22
   Experimental Design .................................................................. 22
   Dependent Measures .................................................................. 23
   IOA and Procedural Integrity ..................................................... 24
   Results ....................................................................................... 25

VIII. GENERAL DISCUSSION ............................................................... 27
   Experiment One: Stimulus Recognition Assessments .................... 27
   Experiment Two: Wayfinding Intervention Analysis ...................... 28
   Limitations ................................................................................. 29
   Future Research .......................................................................... 31
REFERENCES ................................................................................................. 32

APPENDICES

A.  Map of Facility .......................................................................................... 37
B.  Stimulus Recognition Assessment Data Sheets ........................................... 39
C.  Stimulus Recognition Assessment Procedural Integrity Data Sheet .......... 42
D.  Room Finding Data Sheet ........................................................................... 44
E.  Room Finding Procedural Integrity Data Sheet ........................................... 46
F.  Approval Letter From the Human Subjects Institutional Review Board .... 48
LIST OF FIGURES

1. Sample stimuli from arrays of young adult photographs............................ 17

2. Results of the Experiment 1 presented as the percentage of accurate selections for each stimulus type................................................................. 21

3. Results of the Experiment 2 are presented as cumulative accurate room finding........................................................................................................ 26
CHAPTER I
INTRODUCTION

Aging America

The population of elderly adults in the United States is growing rapidly. Currently about 13% of our population is over the age of 65, and it is projected that by the year 2030 more than 20% of Americans will fall within this age range (Kinsella & Velkoff, 2001). This demographic shift is a result of several factors including lower infant mortality rates (United Nations, 2007), medical advances that have increased the average life expectancy (Forstl, 2005), and the aging of the large generation of adults referred to as the “baby boomers” (Meyer, 2001). As the population of older adults increases, so does the number of older adults with cognitive impairments.

Dementia

Dementia is a type of cognitive impairment that affects more than five million Americans (Alzheimer’s Association, 2007). The word dementia is derived from the Latin terms de and mens meaning “out of one’s mind” (Henderson & Jorm, 2002). This translation depicts the changes people with dementia may experience, including a decline in abstract thinking and problem solving abilities, difficulty recalling past experiences, deterioration of language skills, and a change in personality and behavior (Binstock, Post, & Whitehouse, 1992). It is projected that the current number of people with dementia will triple by the middle of the century (Alzheimer’s Association).

Diagnosis
The DSM - IV offers guidelines for diagnosing dementia that include an impairment in memory abilities in addition to at least one of the following: aphasia (i.e., vague or empty language, inability to label familiar objects), apraxia (i.e., impaired motor abilities), agnosia (i.e., failure to recognize familiar objects despite intact sensory functioning), or disturbances in intellectual functioning (i.e., inability to plan, organize, or think abstractly) (American Psychiatric Association, 1994). These cognitive deficits must be severe enough to impair the person’s daily functioning, and must represent a clear decline when compared to previous abilities.

The International Classification of Diseases (ICD-10), published by the World Health Organization (1992), proposes similar guidelines for the diagnosis of dementia. These guidelines recommend that a diagnosis of dementia should be reliant on (1) an impairment in memory that interferes with daily life, (2) a decline in executive functioning and planning abilities that makes it difficult to live independently, (3) an initial awareness of surroundings, and (4) a change in social behavior or a loss of emotional control. Although these diagnostic criteria are comparable, they may produce different prevalence rates when applied to the same population sample. The evidence suggests that the ICD-10 guidelines may be more rigorous and therefore identify fewer cases (Erkinjuntti, Ostbye, Steenhuis, & Hachinski, 1997).

Neuropathology

The progressive cognitive decline associated with dementia is a result of neurological changes produced by damage or infection. The most common causes of dementia are Alzheimer’s Disease (AD), followed by vascular dementia, mixed
dementia, Lewy Body Dementia, and fronto-temporal dementia (Henderson & Jorm, 2002). Each type of dementia shows a slightly varied progression, behavioral pattern, and pathology of central nervous system structure and functioning. The risk for most types of dementia increases with age (Jorm & Jolley, 1998; U.S. General Accounting Office, 1998). For example, Alzheimer’s Disease is known for a gradual onset and increasing deterioration over a period of years (Henderson & Jorm). Alzheimer’s Disease features characteristic neurological changes that include the development of amyloid plaques and neurofibrillary tangles, atrophy of the hippocampus (Henderson & Jorm) which is important in memory functioning, reduced synthesis of the neurotransmitter acetylcholine (Clarke & Francis, 2005), and deterioration of neuronal processes within the cerebral cortex (Masters, 2005) which plays an important role in complex processes such as memory, language, and attention. These changes results in atrophy of other affected regions, including the temporal and parietal lobes, and restricted regions within the frontal cortex and cingulate gyrus (Wenk, 2003).
CHAPTER II

BEHAVIORAL DIFFICULTIES IN NURSING HOME SETTINGS

Background

Although the specific neuropathology varies across types of dementia, certain clinical cognitive impairments and behavioral difficulties are observed across almost all types. Individuals with dementia lose important functional skills that allow them to access reinforcers (e.g., escape from demands, attention, preferred items and activities) and as a result are more likely to develop problem behaviors. Common behavior problems include aggression, irritability, repetitive vocalizations, inappropriate sexual behaviors, and wandering. The evidence suggests that the presence of behavior problems can predict early placement in nursing homes (e.g., Knopman, Kitto, Deinard, & Heiring, 1988; O’Donnell et al., 1992; Steele, Rovner, Chase, & Folstein, 1990).

Currently, 1.6 million Americans are living in nursing homes (National Center for Health Statistics, 2002) and approximately 42% to 67% (Pandya, 2001; Rovner et al., 1990) of these individuals have dementia. Many of the same behavioral difficulties that precipitated nursing home placement continue and may even be worsened when a person with dementia moves into a new and unfamiliar environment. In this new setting, a person does not have a learning history, and is surrounded by other residents that may exhibit problem behavior. Two surveys found that 60-75% of nursing home residents exhibited at least one significant behavior problem (Rover, Kafonek, Filipp, Lucas, & Folstein, 1986; Zimmer, Watson, & Treat, 1984). Managing these difficult behaviors requires an enormous amount of
staff resources. Rovner and colleagues found that nursing home staff spent most of their time tending to difficult behaviors of residents with dementia, as opposed to any other work-related task.

**Wayfinding**

One common problem exhibited by people with dementia is the inability to find their way. According to staff interview, more than two thirds of residents with severe dementia living in a long-term care facility had difficulties with wayfinding (Passini, Pigot, Rainville, & Tetreault, 2000). Cognitively impaired nursing home residents who are independently mobile and have wayfinding difficulties may be at risk for safety hazards, including wandering into dangerous or restricted areas. In addition to endangering themselves, people that wander can pose a threat to other residents (Rosswurm, Zimmerman, Schwartz-Fulton, & Norman, 1986). For example, if an individual wanders into another resident’s bedroom and behaves as if it is their own (e.g., rifling through the individual’s personal items), the actual resident of the room may respond as if their space and property were being invaded and aggress towards the wanderer. Ineffective wayfinding abilities can negatively affect the nursing home staff as well (Everitt, Fields, Soumerai, & Avorn, 1991). A confused resident may hound staff with repetitive questions forcing them to stop what they are doing and guide the confused resident to their destination. Determining interventions to effectively promote the wayfinding abilities of nursing home residents will increase the safety and independence of wandering residents, better the lives of residents who do not wander, and lighten the load for the staff who provide care for them.
One of the first scholars to address wayfinding was Tolman (1948) who introduced the construct of cognitive maps. Based on this principle, wayfinding was conceptualized as the process of identifying your spatial orientation within a cognitive map and adjusting your position relative to this image. This is similar to how you would use a road map to navigate your way through an unfamiliar place. Since then, research in this area shifted towards the study of cognitive maps and images, and away from the investigation of spatial behavior and wayfinding (Passini, 1980).

Cognitive maps were studied as if they were individual entities, independent of any underlying conceptual framework. Similar practices have not been conducive to the expansion or effective application of a discipline (Baer, Wolf, & Risley, 1968). Cognitive images were discussed as inherent things often with invariable properties (e.g., to have a cognitive map or to be spatially oriented), which lead to circular reasoning (i.e., he found his way because he has a good cognitive map, and we know he has a good cognitive map because he found his way). Cognitive maps are difficult to quantify or measure, but perhaps more importantly, they do not provide any information about how to effectively promote wayfinding.

Passini (1980) recognized these issues and proposed a new conceptualization of wayfinding that focused on the problem-solving process involved in getting from one place to another. Passini explained that although a person may be very effective in navigating a complex setting and knowing how to behave in order to reach a destination, they may have no idea where they are in relation to the space surrounding them. That is, a person may be able to find their way without being spatially
oriented. This generated a new research methodology to evaluate the wayfinding process. The first component was a wayfinding protocol in which a participant was asked to go from one destination to another and verbalize their problem-solving process along the way (e.g., prompted to identify information they relied on, describing the decisions they made). The second evaluative tool is a post-test interview in which the participant would describe their familiarity with the location and report their impressions about the wayfinding task (Passini). The results of these assessments would provide descriptive information about the various steps involved in the wayfinding process. Passini et al. (2000) used this methodology with nursing home residents with severe dementia. Residents were asked to complete a wayfinding task by going from one location to another within the facility. Residents were prompted throughout the duration of the task to share their thoughts and report any information that affected their decisions. Afterwards, nursing home staff members were interviewed about the environmental and logistical aspects of the facility (e.g., circulation of patients, signage, place identification, policies about restricting patient movement) and how each feature contributed to the wayfinding abilities of the residents. The results suggested that a lack of reference points or landmarks in the environment hindered the wayfinding abilities of residents. Additionally, signage posted throughout the facility was not always helpful as some residents read the sign but were unable to tell if it was important. Nursing home staff suggested that personalizing the residents’ bedrooms with decorative items such as curtains and bed cover might help residents be more effective at recognizing their own space (Passini et al.).
Although this type of observation strategy may yield some interesting information, the verbal report of nursing home staff and residents may not be the best way to accurately measure the behavioral components that contribute to wayfinding. Resident reporting may be particularly inaccurate as language abilities often suffer as dementia progresses. More importantly, this methodology does not tell us any quantifiable information about the best way to rehabilitate patients or optimize their wayfinding abilities. However, a related literature on environmental design and use of effective discriminative stimuli offers an alternative approach to intervening with wayfinding difficulties.
CHAPTER III
ENVIRONMENTAL DESIGN

*Effective Discriminative Stimuli and Wayfinding*

Designing nursing home environments to promote independence and minimize problem behavior can have therapeutic benefits that promote the quality of life (Brawley, 2001) and functioning (Day, Carreon, & Stump, 2000) of residents with dementia. Experimenters have explored the effects of manipulating various environmental cues in order to create more effective discriminative stimuli that evoke room finding. Namazi, Rosner, and Rechlin (1991) investigated the ability of nursing home residents to identify their bedroom when personal items of long-term significance were displayed in a showcase outside their room. Items were selected based on information provided by the family, and a wide range of personal items were used. Memory aids included photographs, collectibles, medallions, war memorabilia, and leisure items. These items had a reference point of 3 to 50 yrs from the time of the study. The control condition involved placing insignificant items in the showcase (e.g., dried flowers, sea shells). The results of the study showed that the room finding ability of residents was correlated with the severity of cognitive impairment, as scored by the Clinical Dementia Rating (Hughes, Berg, Danziger, Coben, & Martin, 1982). Residents with mild dementia were effective at locating their room when both significant and insignificant items were present. Four out of five residents with moderate dementia were more effective in finding their room when significant items were displayed. Only one resident with advanced dementia participated in the study, and neither significant nor insignificant items were effective
at evoking room identification for that person. One limitation to this study is that the experimenters never systematically identified which items the participants recognized.

Several experimenters have examined the features of effective textual and photographic discriminative stimuli for elders with dementia. Hanley (1981) evaluated the effects of signposts containing a printed description of the room’s function (e.g., dining room, kitchen, bedroom) on the ability of long-term care residents to locate those rooms. The results indicated that when signs with textual cues were posted outside of various locations, two residents with dementia only exhibited minimal improvements in their ability to locate these areas compared to baseline levels.

Nolan, Mathews, and Harrison (2001) investigated the effects of a written stimulus (i.e., “This is [name]’s room”) combined with a photograph on the room finding abilities of three long-term care residents with severe dementia. Portrait-style photographs from early adulthood were used, and the experimenters assessed recognition abilities by having participants select their picture from an array of similar photographs. A correct selection was required to participate in the study. Their picture and printed name were hung outside the respective bedroom, and all three residents were able to identify their bedroom more frequently. These results indicate that a picture from earlier adulthood in combination with a printed sign hung on a resident’s door can be an effective way of improving room finding.

*Stimulus Recognition Literature*
Gross and colleagues (2004) investigated the accuracy with which nursing home residents with dementia could recognize their own printed names and current photographs. Experimenters displayed three comparable stimuli and asked residents to select the one that was theirs (i.e., “Can you point to your picture/name, [first and last name]?”). The results of the study indicate that on average, the printed name was correctly identified marginally more than the current photograph. Potential limitations to this study include the arrangement of the stimuli during the stimulus recognition assessment. Stimuli were presented in a pyramid layout with two items placed on the table in front of the resident, and one item above the others. Side biases and differential response effort may affect participant selection without deliberate counterbalancing. No attempts to counterbalance stimulus presentation were reported in the manuscript.

Hehman, German, and Klein (2005) published a case study in which they examined the ability of one woman with late-stage Alzheimer’s disease to recognize herself in photographs taken in various time periods throughout her life. The experimenters gathered two photographs from each decade of her adult years (i.e., 20s, 30s, 40s...80s). In each trial, a photograph was presented by itself, and the participant was asked, “Do you recognize this person?” which could potentially be followed by, “Who is it?” Participant responses were coded as correct or incorrect identifications. The participant recognized herself in pictures from her 20s and 30s more frequently (7/8 opportunities) than photographs of her in her 40s through 80s (2/20 opportunities). The application of these findings to wayfinding may be limited as the photograph recognition assessment was conducting by having the participant
name the person featured in each individual photograph. The skill set required for this task may be different than that required for wayfinding, which may require the participant to distinguish their own photograph from several other choices.
CHAPTER IV
PURPOSE OF THE PRESENT STUDY

Wayfinding difficulties can pose a threat to nursing home residents that wander, their neighboring residents, and the staff to whom their care may be burdensome. The literature suggests that posting various discriminative stimuli at doorways may assist residents in finding their way. Namazi et al. (1991) found that seemingly significant personal memorabilia increased the room finding abilities of residents with moderate dementia. Hanley (1981) discovered that signposts with textual descriptions of the room’s purpose were only minimally effective in evoking room finding for residents with dementia. However, Nolan and colleagues (2001) demonstrated that a written stimulus in combination with a photograph from early adulthood was an effective discriminative stimulus for evoking room finding. Little information is known about the best type of discriminative stimulus to evoke room finding. Preliminary studies suggest that current photographs may be slightly less effective than printed names (Gross et al., 2004) and that photographs from earlier adulthood may be more effectively recognized than current photographs (Hehman et al., 2005). The purposes of the current study were to systematically investigate (1) which type of self-referent stimulus (i.e., young adult photograph, middle adult photograph, current photograph, and printed name) is most readily identified out of a stimulus array, and (2) whether identification in a stimulus recognition assessment predicts the utility of the stimulus in a room finding intervention.
CHAPTER V
GENERAL METHOD

Participants and Selection Criteria

Four elderly Special Care Unit (SCU) residents participated in the study. Each of them had severe dementia, as indicated by a score of 10 or lower on the Mini-Mental Status Exam (Folstein, Folstein, & McHugh, 1975). Mrs. A was an 82-yr-old woman who was independently mobile and had been living in this nursing home for 10 mos. She had an MMSE score of 8. Mr. B was an 89-yr-old male who was in a wheelchair that he moved independently with his legs. He had been living in the facility for 9 mos and had an MMSE score of 3. Mrs. C was an 84-yr-old woman who was independently mobile and had been living in the facility for 16 mos. She had an MMSE score of 10. Mrs. D was a 78-yr-old woman who was independently mobile and had been living in this nursing home for 36 mos. She has an MMSE score of 0. All participants were nominated by nursing home staff as having a history of difficulty finding their bedroom as evidenced by presence in another resident’s bedroom (while behaving as if it was their own) or indications of confusion (e.g., repeatedly asking for directions). Additionally, all participants were able to emit a selection response (i.e., selecting a requested neutral object out of an array of several options) in order to demonstrate instructional control.

Setting

The research facility was a SCU of a nursing home in Northern Michigan that contained two identical wings connected by an arboreal atrium. On either side of the atrium was a commons area, consisting of a living room with several couches,
reclining chairs, and a television. There was also a dining area and an activity room with tables and chairs. A long hallway was attached to the commons area, with bedrooms lining both sides. See Appendix A for a map of the facility. Participants resided in either a single or double bedroom unit. Single units included a bed, dresser, television, and a bathroom near the doorway. Double units were larger rooms that are divided by a wall yielding two separate bedroom areas. Residents of each double unit shared a bathroom located near the hallway entrance, but had their own bed, dresser, and television.
CHAPTER VI
EXPERIMENT ONE: STIMULUS RECOGNITION ASSESSMENTS

Materials

The materials consisted of portrait-style (i.e., shoulders up) pictures that featured the elder from an anterior view and were presented in a sepia tone color and printed first and last names presented in black 72-point bold Arial font on white paper. The experimenter took current photographs at the time of the study against a neutral background. Photographs from young and middle adulthood were provided for Mrs. A, Mr. B., and Mrs. D. The family of Mrs. C was not able to provide a middle adult photograph, so only a young photograph, a current photograph, and a printed name were presented in stimulus arrays. The young adult photographs featured the elder between the ages of 20-40 years old. All middle adult photographs featured the elder between the years of 40-60. Distracter stimuli were photographs and names of other residents in the facility for the female participants and famous people (i.e., Ronald Regan, Paul Newman) for Mr. B (no other male participants were identified). Using familiar people in distracter stimuli increased the likelihood that all stimuli were reasonably familiar and that correct responding would be controlled by self-recognition rather than familiarity.

Procedure

The experimenter sat at a table directly across from the participant and conducted stimulus recognition assessments with up to four separate stimulus arrays: a) current photographs, b) young adult photographs, c) middle adult photographs, and d) printed names. Each stimulus group included a target stimulus, (i.e., the
photograph or written name of the participant), and two distracter stimuli. Three items were presented to minimize the need for an extensive scanning repertoire. A trial consisted of placement of three stimuli from an array type (e.g., three photos of young adults) directly in front of the participant equally spaced to control for response effort. See Figure 1 for sample stimulus trial presentations. The experimenter made eye contact to initiate the trial but did not address the participant by name. The experimenter asked the primary question, "Are any of these you/yours?" and potentially followed-up with a question based on the participant's response. The experimenter allowed 10 s for a response to each question and collected all primary data. The experimenter responded to a "Yes" without physical selection of a photograph with the follow-up query, "Which one?" The experimenter responded to a "No", an "I don't know", or no response within 10 s by initiating the next trial. The experimenter did not provide differential consequences for correct responding, but reinforced all selections (e.g. "Thank you for making a choice," or "This game is fun!").

Figure 1. Sample stimuli from arrays of young adult photographs.
The experimenter presented six trials of each stimulus group, yielding a total of 24 trials with all possible stimulus placements. The presentation of stimuli within groups was counterbalanced to prevent selection based on side bias and order of array type was counterbalanced to prevent order effects.

**Dependent Measures**

The percentage of correct identifications was the primary dependent variable. A trial was scored as correct if the participant touched, pointed to, or verbally selected (i.e., "the middle one") the target stimulus (i.e., their photograph or name) from an array. A trial was scored as incorrect if the individual selected a distracter stimulus, indicated that none of the stimuli were theirs, indicated that they didn’t know the answer to the question, or made no selection in response to the follow-up question within 10 s. See Appendix B for a sample data sheet. The number of correct identifications was divided by the total number of trials for that array type and multiplied by 100% to yield the percentage accuracy.

**Interobserver Agreement (IOA) and Procedural Integrity**

All stimulus recognition sessions were coded live and scored by independent observers for IOA and procedural integrity. A trained independent observer coded participant responses for 97% of stimulus selection trials and their data were compared with that of the primary data collector. An agreement was scored if both observers recorded the same outcome (i.e., correct or incorrect) for a trial. The point-by-point method was used to calculate IOA. The number of agreements was divided by the number of agreements plus disagreements and multiplied by 100% to yield
percentage accuracy. Agreement was 83% for Mrs. A, 100% for Mr. B, 100% for Mrs. C, and 94% for Mrs. D yielding an overall average of 94.3%.

A trained observer collected data on the experimenter’s behavior (see Appendix C for sample data sheet). The observer measured whether or not the experimenter (1) counterbalanced the stimuli, (2) placed the stimuli at equal distance from the participant, (3) presented the correct questions, (4) allowed up to 10 s for a response, and (5) responded accurately to the participant’s behavior (e.g., “no” followed by next trial, “yes” with no selection followed by next question, no differential consequence). A trial was considered implemented accurately if each and every step was scored as correct. Procedural integrity was scored for 69.5% of trials across participants (100% of trials for Mrs. A, 100% of trials for Mr. B, 62.5% of trials for Mrs. C, 15.7% of trials for Mrs. D). Procedural integrity was scored at 100% correct for Mrs. A, 87.5% correct for Mr. B, and 100% correct for Mrs. C, and 100% correct for Mrs. D yielding an average of 96.8% of trials implemented correctly.

Results

Figure 2 shows the percentage of accurate selections for each stimulus type. Mrs. A (top panel) was not able tomeaningfully recognize any self-referent stimuli with the selection percentages for a recent photograph and her printed name (17% accuracy for each), and middle and young photographs (0% accuracy for each) falling below chance responding for a three item stimulus array (i.e., 30%). Mr. B (middle panel) recognized his middle photograph most often at 83% accuracy followed by his young photograph and printed name at 67% accuracy for each, but did not recognize
his current photograph (0% accuracy). Mrs. C (bottom panel) was able to recognize her young picture and printed name in 83% of trials, and her current photograph in only 17% of trials. Mrs. D. (not graphed) was unable to complete the assessment due to distractibility (i.e., beginning conversations, walking away, manipulating other items in the room) and non-responding during multiple attempts to present the trials. Mr. B and Mrs. C each had at least one stimulus type that produced an accuracy percentage above 50% rendering them eligible to continue in Experiment Two to compare the effectiveness of the most accurately identified stimulus to one with a low identification percentage and a control condition with no additional stimulus at all.
Figure 2. Results of the Experiment 1 presented as the percentage of accurate selections for each stimulus type.
CHAPTER VII

EXPERIMENT TWO: WAYFINDING INTERVENTION ANALYSIS

Setting and Procedures

The researcher approached the participant when he or she was seated or standing in a commons area of the SCU (i.e., farther than seven m from their room, doorway not in line of sight). The experimenter interacted socially with participants for 2-3 min and then asked, “Will you show me your room?” If assent was provided, the experimenter waited until the participant was standing, or began forward motion in their wheelchair and began the observation. The experimenter walked beside and slightly behind the participant and observed until a) the participant identified a bedroom, b) three min elapsed and the participant was headed away from their bedroom, or c) three min elapsed and the participant passed their bedroom. The experimenter ended the observation by thanking the participant for the walk and offering the choice to stay there, or return to the commons area. The experimenter did not provide differential consequences for room finding to decrease the possibility that subsequent trials were influenced by the participant’s reinforcement history.

Experimental Design

Baseline and one or more intervention conditions were rapidly alternated in a multi-element design. One to two trials of each condition were conducted per day based on participant schedule and assent, with the order of conditions counterbalanced across days.

Baseline. No additional stimuli were posted outside the room.
*Best discrimination stimulus.* The stimulus from Experiment One that produced the highest accuracy percentage above 50% was hung outside the resident’s room at eye level. Mr. B’s stimulus was his middle adulthood photograph. Mrs. C’s stimulus was her young adulthood photograph, which she selected when asked to choose between the two stimuli tied for highest accuracy in experiment one (i.e., young photograph, printed name).

*Poorest discrimination stimulus.* The stimulus from Experiment One that produced the lowest recognition percentage at or below 50% was hung outside the participant’s room. For both Mr. B and Mrs. C, this stimulus was the current photograph.

**Dependent Measures**

*Accurate room identification.* A correct room identification was scored if a participant identified their bedroom verbally (e.g., “Here it is,” or “This one’s mine,”), gesturally, or by crossing the threshold of the doorway. An incorrect room identification was scored if a participant identified a room other than theirs or did not identify a room within the observation period (see Appendix D for sample data sheet).

*Latency to room identification.* A timer was started once the participant reached a standing position, or begun forward motion in their wheelchair after the experimenter provided the discriminative stimulus (i.e., “Will you show me your room?”). For trials with successful room finding, the timer was stopped when the participant identified their room correctly, identified another’s room as their own, passed their bedroom after three min of observation, or walked away from their bedroom after three min of observation (see Appendix D).
IOA and Procedural Integrity

All IOA and procedural integrity data were collected from live observations interspersed throughout all conditions and across both participants. The coding of the two independent observers was compared for each trial and the point-by-point method was used to calculate IOA for room finding trials. A trial was scored as an agreement if both observers recorded the same outcome (i.e., correct or incorrect identification). The number of agreements was divided by the number of agreements plus disagreements and multiplied by 100%. Agreement measures were calculated for 57.65% of room finding trials (58% with Mr. B, and 57% with Mrs. C). Agreement was 100% for each participant. Interobserver agreement for the latency measure was calculated by dividing the smaller latency for a trial by the longer latency for a trial and multiplying by 100%. Agreement was 100% for both participants.

A trained observer collected data on the experimenter’s behavior during room finding trials. The observer measured whether the experimenter (1) hung the appropriate stimulus outside the resident’s doorway, (2) approached the resident when they were at least seven m from their room and could not see their bedroom, (3) provided the instruction, (4) walked beside and slightly behind the resident, (5) observed the individual for the duration of the trial, and (6) provided a general statement (e.g. “Thank you for the walk”) at the completion of the trial with no differential consequence for accuracy. A trial was implemented accurately if each and every step was scored as correct (see Appendix E for sample data sheet).
Procedural integrity data were collected for 75% of trials for Mr. B and 64% or trials for Mrs. C and was 100% correct for each participant.

Results

Figure 3 shows accuracy of room identification data for Mr. B (top panel) and Mrs. C (bottom panel) when various stimuli were posted outside their bedroom door during observations. Neither participant was able to find their bedroom during any trial in any condition. No latency measures are reported because no successful room finding occurred. Since no condition resulted in improved wayfinding with stimulus posting, two brief training sessions were conducted with each participant with each stimulus type.

Training sessions involved actively “coaching” residents to find their room through a process of shaping the necessary pre-requisite skills (e.g., scanning) and facilitating exposure to learning trials. We did this by asking the participant to show us their bedroom, and then encouraged them to look for clues (i.e. pictures on the wall) that might indicate which room was theirs. When we found a photograph, scanning was praised (e.g., “Good eyes! You found the clue!”) and the resident was asked if they recognized the person in the picture. If they did, we went inside their bedroom to see if it was theirs. Upon entering the correct room, we provided praise (e.g., “Great job! You found your room!”) and pointed out familiar personal items (e.g., items with their name on it, pictures of family, etc.) that proved we were in fact inside the correct room. Due to time constraints, we were not able to achieve effective wayfinding with our participants but we did see some improvement in the use of room finding strategies after teaching was introduced.
Figure 3. Results of the Experiment 2 are presented as cumulative accurate room finding.
CHAPTER VIII
GENERAL DISCUSSION

Previous studies have indicated that posting of personally relevant stimuli can increase wayfinding (Nolan et al., 2001) and that adults with dementia may be more likely to identify photographs of themselves from younger ages than recent ages (Hehman et al., 2005). The purpose of this study was to identify which self-referent stimuli were best recognized when presented in an array and to determine whether recognition in this type of assessment would be predictive of treatment utility of that stimulus in a room finding intervention.

Experiment One: Stimulus Recognition Assessments

Similar to the findings of Hehman et al., 2 of 3 participants who were able to respond to the arrays recognized themselves in younger pictures but not older pictures, although the most recognized photograph was different for each person. Additionally, two of those three residents were able to recognize their printed name, even though they were not able to recognize their current photograph which supports the findings of Gross et al. (2004) who also found that printed names were recognized more accurately than current photographs. It is interesting to speculate whether the current pictures were completely unrecognizable or whether the stimuli actually had aversive qualities that lead to non-selection. That is, it may be aversive for participants to identify themselves as old. During the assessment, several participants made comments that suggested some type of aversive feature when presented with recent photographs (e.g., when asked, “Are any of these you?” Mrs. B said, “Oh no, they’re too old!”).
Experiment Two: Wayfinding Intervention Analysis

The two participants in experiment two were both unable to find their bedroom even when readily recognized self-referent stimuli were posted during observations. This finding stands in contrast to a previous study by Nolan et al. (2001) in which three nursing home residents with severe dementia were better able to find their rooms when early life photographs were posted by their bedroom door. At least two factors may contribute to the differences in findings. First, the procedure in the current analysis differed slightly from those used by Nolan et al. in that pictures were taken down between observations and in that observations occurred over a few days instead of several weeks. The participants in the current study did not have experience with the pictures outside of observations and the discrepant findings may suggest that regular contact with the stimuli in the natural environment is important to increasing wayfinding.

Second, there may have been differences in the room finding repertoires of the current participants and those in the Nolan et al study prior to intervention. Under baseline conditions, the participants in the Nolan et al. study were able to locate their room on average 34% of opportunities, but participants in the current investigation never found their rooms in baseline trials. A photograph may only evoke room finding if the participants have certain pre-requisite skills (e.g., the ability to remember the task for 3 minutes, relevant scanning and search repertoires). For example, the current participants often looked at the floor throughout the entire room finding trial, which limits opportunities to contact the photo as a relevant discriminative stimulus.
These findings and those of Nolan et al (2001) indicate that the beneficial effects of posting personally relevant stimuli are not immediately observed. Rather this intervention appears to exert its effects as photographs assume discriminative properties after repeated exposure and a reinforcement history. That is, the picture itself does not evoke remembering or wayfinding other than serving as a newly established or reestablished discriminative stimulus. Since simply posting the pictures was not effective, the experimenter conducted two training trials for each stimulus type (i.e., best discrimination, poorest discrimination) with each participant. Subsequent probes did not result in accurate room finding but many pre-requisite behaviors seemed to be happening more frequently (e.g., active visual scanning) after only a few training trials. Participants with severe dementia may need to have some experience with the photograph and formal re-training or pre-requisite searching skills to ensure that the photographs or names function as effective discriminative stimuli. The pre-requisite skills may weaken as a product of living in an environment where few natural opportunities occur to independently locate a bedroom. Well-meaning staff may begin guiding residents to their bedroom when they begin to have difficulties finding their way and the lack of opportunities may contribute to excess disability. Although no formal data were collected in this study, the experimenters noted that staff typically guided clients directly to their rooms and created few opportunities for independent room finding.

Limitations

Several limitations of this study are worthy of note. First, data were collected for only a nine-day span and this time restriction prevented us from determining
whether improvements may have occurred over time as they did in the Nolan et al study. Second, no data were collected on behaviors that may serve as pre-requisites (e.g., attending to stimuli, scanning) to enhancing wayfinding with these stimuli. Anecdotal data indicated that these behaviors increased when training trials were conducted but an extensive evaluation of these effects was not possible. Information about these variables should be collected in future studies to more closely examine the learning processes occurring for those with severely limited repertoires. Third, the assessment probe procedure may be inadequate for assessing wayfinding for all participants. Individuals with very impaired language may not be able to respond to the question, “Will you show me your room?” though they still might be able to perform in the natural environment when the relevant motivating operations (Michael, 1982) are present (e.g., if they are tired and looking for their bed, if they are cold and looking for a sweater). For example, Mrs. D did not qualify to participate in Experiment Two because she did not consistently respond to any stimuli in the Recognition Assessment, but the experimenters did conduct one wayfinding probe with her. During this observation, her young adult photograph, which was recognized during 40% of trials, was hung outside of her bedroom. Mrs. D agreed to show the experimenter her room and proceeded to walk and talk with the experimenters for the entire observation period. After three minutes of walking and talking, the experimenter ended the observation and excused herself, and Mrs. D turned and walked directly into her bedroom. Mrs. D was able to find her room when the motivating operation was present (i.e., social interaction complete and possible fatigue from walking), but not in response to a verbal stimulus, (i.e., “Will you show
me your room?”) and in the presence of a distraction or other reinforcing event (i.e., someone to talk to).

**Future Research**

Future research should investigate the use of discrimination training in conjunction with relevant stimuli to promote room finding in individuals with severe dementia. The effects of formal training should be compared to simply posting the picture or name and leaving it up so participants can naturally contact contingencies. Additionally, it would be interesting to know if recognition of pictures impacts the number of trials to room finding criterion. That is, would stimuli that were recognized more consistently in the assessment procedure result in fewer training trials to establish discriminative properties? Such studies might shed light on whether it is important to post a recognized photograph from a specific time period or if any stimulus could be as readily established as a discriminative stimulus (e.g., blue triangle, picture of duck).

In summary, individuals with dementia appear to recognize photographs from their younger years and printed names more readily than recent photographs. Those recognized stimuli might subsequently be posted to increase room finding, but the effects may vary across participants and may take some time and formal training to ensure the fact that these stimuli assume discriminative properties. Further research is needed to distinguish the important variables that contribute to effective wayfinding for elders with severe dementia.
REFERENCES


Appendix A

Map of the Facility
Appendix B

Stimulus Recognition Assessment Data Sheets
## Stimulus Recognition Assessment

<table>
<thead>
<tr>
<th>Trial</th>
<th>Stimulus Type</th>
<th>Stimulus Placement (Circle Selected Response)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Current</td>
<td>1 2 3 N</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Young</td>
<td>2 3 1 N</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Text</td>
<td>2 1 3 N</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Middle</td>
<td>1 2 3 N</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Current</td>
<td>3 1 2 N</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Text</td>
<td>1 2 3 N</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Young</td>
<td>1 2 3 N</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Middle</td>
<td>2 1 3 N</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Text</td>
<td>3 1 2 N</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Young</td>
<td>2 1 3 N</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Current</td>
<td>2 3 1 N</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Middle</td>
<td>1 3 2 N</td>
<td></td>
</tr>
</tbody>
</table>
# Stimulus Recognition Assessment

**Participant:** ______________  **Page 2**  **Data Collector:** ______________

**Date:** ______________  **AM / PM**  **Primary / Reliability**  (circle one)

<table>
<thead>
<tr>
<th>Trial</th>
<th>Stimulus Type</th>
<th>Stimulus Placement (Circle Selected Response)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Text</td>
<td>1 3 2 N</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Current</td>
<td>1 3 2 N</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Young</td>
<td>3 2 1 N</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Middle</td>
<td>2 3 1 N</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Young</td>
<td>3 1 2 N</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Middle</td>
<td>3 2 1 N</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Current</td>
<td>2 1 3 N</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Text</td>
<td>2 3 1 N</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Middle</td>
<td>3 1 2 N</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Current</td>
<td>3 2 1 N</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Text</td>
<td>3 2 1 N</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Young</td>
<td>1 3 2 N</td>
<td></td>
</tr>
</tbody>
</table>

**Stimulus Accuracy:**

- /6 Current Photo
- /6 Middle Photo
- /6 Young Photo
- /6 Printed Name

- % Current Photo
- % Middle Photo
- % Young Photo
- % Printed Name
Appendix C

Stimulus Recognition Assessment Procedural Integrity Data Sheet
# Stimulus Recognition Assessment

## Procedural Integrity

<table>
<thead>
<tr>
<th>Trial</th>
<th>Trial Type Correct?</th>
<th>Equal distance?</th>
<th>Correct Question(s)?</th>
<th>10 s for Response?</th>
<th>Post Response Accurate?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>2</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>3</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>4</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>5</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>6</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>7</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>8</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>9</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>10</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>11</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>12</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>13</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>14</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>15</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>16</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>17</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>18</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
</tbody>
</table>
Appendix D

Room Finding Data Sheet
# Room Finding

Participant: ____________  Data Collector: ______________

Date: ____________  AM / PM  Primary / Reliability (circle one)

Prompt: "Will you show me your room?"

<table>
<thead>
<tr>
<th>Trial</th>
<th>Stimulus Type</th>
<th>Room found?</th>
<th>How long until room found?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Y / N</td>
<td></td>
<td>___ sec.</td>
</tr>
<tr>
<td>2</td>
<td>Y / N</td>
<td></td>
<td>___ sec.</td>
</tr>
<tr>
<td>3</td>
<td>Y / N</td>
<td></td>
<td>___ sec.</td>
</tr>
<tr>
<td>4</td>
<td>Y / N</td>
<td></td>
<td>___ sec.</td>
</tr>
<tr>
<td>5</td>
<td>Y / N</td>
<td></td>
<td>___ sec.</td>
</tr>
<tr>
<td>6</td>
<td>Y / N</td>
<td></td>
<td>___ sec.</td>
</tr>
<tr>
<td>7</td>
<td>Y / N</td>
<td></td>
<td>___ sec.</td>
</tr>
<tr>
<td>8</td>
<td>Y / N</td>
<td></td>
<td>___ sec.</td>
</tr>
<tr>
<td>9</td>
<td>Y / N</td>
<td></td>
<td>___ sec.</td>
</tr>
<tr>
<td>10</td>
<td>Y / N</td>
<td></td>
<td>___ sec.</td>
</tr>
</tbody>
</table>

START TIMER – Once standing
STOP TIMER – Room found OR 3+ min. and wandering away from room, or passed bedroom
Appendix E

Room Finding Procedural Integrity Data Sheet
Room Finding
Procedural Integrity

Participant: ________________  Data Collector: ________________

Date: ________________  AM / PM  Primary / Reliability (circle one)

<table>
<thead>
<tr>
<th>Trial</th>
<th>Appropriate stimulus hung?</th>
<th>Approached when 7m away + can't see door?</th>
<th>Provides instruction?</th>
<th>Walks beside and behind??</th>
<th>Observes for entire trial?</th>
<th>General statement, no differential consequences?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>2</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>3</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>4</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>5</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>6</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>7</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>8</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>9</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
<tr>
<td>10</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
<td>Y / N</td>
</tr>
</tbody>
</table>
Appendix F

Approval Letter From the Human Subjects
Institutional Review Board
Date: November 5, 2007

To: Linda LeBlanc, Principal Investigator
   Allison Jay, Student Investigator for thesis

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number: 07-10-05

This letter will serve as confirmation that your research project entitled “Promoting Wayfinding in Older Adults with Dementia” has been approved under the full category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: October 17, 2008