1999

An Examination of the Spaced-Retrieval Technique: a Method to Improve Memory in Older Adults With Probable Alzheimer's Disease.

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AN EXAMINATION OF THE
SPACED-RETRIEVAL TECHNIQUE: A METHOD TO IMPROVE MEMORY IN
OLDER ADULTS WITH PROBABLE ALZHEIMER'S DISEASE

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Psychology

by

Shannon S. Simmons-D'Gerolamo
B.S., Louisiana State University, 1993
M.A., Louisiana State University, 1997
August 1999
ACKNOWLEDGMENTS

I owe a tremendous amount of gratitude to my major professor and mentor, Dr. Katie E. Cherry. She has continued to assist my academic and professional growth beyond what I imagined possible. Without her faithful guidance and support, I would not have been able to complete this project.

I would like to recognize my other committee members, Drs. Bob Coon, Gary Gintner, Evanna Gleason, Donald Marzolf and Joseph Witt. Each played a significant role in the revisions and completion of my dissertation. I am very grateful to each one of them.

I would like to extend a heart felt thanks to the staff at St. Francis House Adult Day Health Care, an affiliate of Our Lady of the Lake Regional Medical Center, for their continued support and belief in my work. A special thanks to Diane Kelly, Director of St. Francis House, and Verly Young, LPN, for their genuine interest in my research project. This project could not have been completed without their continued support and enthusiasm.

I would like to give a special thanks to Bernadette R. Kray, M.A., for her help with data collection. Her hard work and special interest in the geriatric population is greatly appreciated.
I would like to dedicate this project to my husband, Chad, and my parents, Charles and Susan Simmons, because of their unconditional love and support during my long and traveled journey. They may never fully understand how grateful I am for their unconditional love for me and never-ending praise.

Ultimately, I give thanks to God, and give Him the glory for the completion of this project. I pray that I will use my skills and knowledge to do good works for Him...
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ABSTRACT

In this study, we used the spaced-retrieval technique as a mnemonic device for those persons with cognitive deficits such as probable Alzheimer's Disease. Three main goals of this research were to gain insight into the long-term effectiveness of the spaced-retrieval technique, examine ways to enhance the overall effectiveness of the spaced-retrieval technique, and adapt spaced-retrieval for applied use in real-world settings. Results indicated that participants did not show savings-in-relearning over a two year follow-up span, but did show it over a one year and six month span. Results provided modest evidence of the effects of exposure to the target-item orientation task. Results also provided initial evidence of the use of spaced-retrieval regarding the applicability of the technique for real-world problem behaviors.
INTRODUCTION

In recent years the proportion of older persons has been growing substantially in the United States. The declining fertility and mortality rates have fostered a demographic transition that has resulted in an aging of the United States population (Grigsby, 1991). Currently, there are approximately 32 million persons aged 65 years and older within the United States. And by the year 2000, there will be nearly 35 million (U.S. Bureau of Census, 1989). Because the elderly population is more likely to have specialized service needs (Sheppard, 1978), these demographic trends warrant special attention.

As the adult population grows older, it is typical for them to experience numerous cognitive changes that are expected in later life. For example, older adults may experience memory failures that can be attributed to internal factors (e.g. fatigue) as well as external factors (e.g. information overload) or possibly a combination of both. It is normal for healthy older adults to experience forgetfulness in daily life more often than younger adults (Gilewski & Zelinski, 1986). Aging in many healthy adults is associated with a moderate slowing of motor, perceptual, and intellectual performance as well as a decline in memory functions. However, these declines emerge gradually and
typically do not interfere with functioning until very advanced stages of old age (La Rue, 1992).

Older adults also become increasingly at risk for a variety of physical and mental diseases, many of which can severely impair their cognitive functioning. For example, the adult dementias affect memory and higher cognitive function (e.g., problem solving, naming, and verbal fluency). During the advanced stages of a dementia, such as Alzheimer's Disease, marked changes also occur in personality and affective states (DSM-IV; American Psychiatric Association (APA), 1994). It is important that practitioners be able to distinguish memory problems of normal aging from those that may be caused by physiological or psychopathological factors. Behaviors that may signal a serious health condition may include forgetting the name of close family members, confusion in space and time, or even difficulties with simple motor tasks. Diagnosis of conditions that produce problems such as these is essential because the cognitive deficits may be responsive to treatment in some cases, whereas deficits observed in the adult dementias are irreversible (see Cherry & Smith, 1998). For example, with Alzheimer's Disease (AD), there is often a great deal of variability in symptom presentation. These symptoms may also overlap with what is presented by normal older adults. Use of the probable AD criteria, which includes, a decline in memory function plus at least one other cognitive decline, appears to improve diagnostic
accuracy in differentiating between normal aging and Alzheimer's Disease (Zec, 1993).

Alzheimer's Disease (pronounced Alz-hi-merz) is the most common form of dementing illness, described as a progressive, degenerative disease that attacks the brain which in turn results in impaired memory, thinking and behavior. More than 100,000 die of AD annually, which makes AD the fourth leading cause of death in adults, after cardiovascular disease, cancer and stroke. Symptoms of AD include a gradual loss of memory, decline in ability to perform routine tasks, impairment of judgment, disorientation, personality change, difficulty in learning, and loss of language skills. There is variation in the rate of change from person to person. This disease eventually renders its victims totally incapable of caring for themselves.

AD is increasingly becoming a public health concern (Gurland & Cross, 1986) due to the approximate 14 million Americans that will suffer from the disease by the year 2050 (ADRDA, 1992). This demographic trend has led to an increase in awareness of the needs of our older adult population suffering from the adult dementias such as AD. Social planners have already begun to feel the pressure to ensure an adequate provision of specialized services for them. Although no cure is available at present, good planning and solid medical and social management can ease the burdens on the patients and family members. Appropriate
medication can lessen agitation, anxiety and unpredictable behavior, improve sleeping patterns and treat depression. Physical exercise and social activity are important, as are proper nutrition and health maintenance. In general, a calm and well-structured environment may help the AD persons to maintain as much comfort, dignity and quality of life as possible during the later stages of this dementing illness.

This paper is organized as follows. In the first section, an overview of adult dementias is provided, including an historic perspective, and mention of other possible conditions which produce cognitive dysfunction in older adults. In the second section, an overview of Alzheimer's Disease is presented, which highlights behavioral and cognitive changes related to AD. This section also mentions practical considerations regarding AD. The third and fourth sections introduce the nursing home environment and cognitive intervention strategies, with special emphasis on memory and interventions to improve retention. In the fifth section, specific aims of the present research are described. The general method, results of the experiments, and general discussion sections follow.
OVERVIEW OF ADULT DEMENTIAS

Historic Perspectives

The most common form of adult dementia is the Alzheimer's Disease (AD), a progressive brain disorder. AD affects approximately 4 million Americans today (ADRDA, 1992). The cause of AD is unknown currently, so an autopsy is required to confirm the diagnosis of the disease. There has been extensive progress made in identifying the clinical symptoms associated with AD. This effort has allowed more reliable antemortem diagnoses (La Rue, 1992).

Societal awareness of AD has substantially increased in recent years, due to the overwhelming growth of published research on AD in the gerontological, clinical, and neuropsychological literatures (see Poon, Kasniak, & Dudley, 1992 for review). The heightened awareness may lead society to presume that AD is a recent form of mental impairment, but AD has had a long history (Reisburg, Ferris, deLeón, Crook, & Haynes, 1987). For example, Aretaeus of Cappadocia described the disease as early as the second century AD (see Adams (1861) & Rush (1793), cited in Cherry & Plauche, 1996). As well, other researchers and physicians from the eighteenth century further noted the progressive deterioration of mental faculties due to AD. In the nineteenth and early twentieth centuries, the neuropathologic features of AD were first observed by
various researchers, including Alois Alzheimer, who attributed the pathogenesis of AD to vascular arteriosclerosis.

These early works provided some insight into the feature of this complicated disease. Despite the advances and progress in our current day knowledge of AD, the exact cause of the disease is still poorly understood. In the future, possible interactions of elements such as, genetic factors, environmental toxins, abnormal protein chemistry, and deficits in certain neurotransmitter systems, may ultimately be shown to be responsible for determining one's susceptibility to AD (Raskind & Peskind, 1992). As for now, there is no cure. Before a diagnosis is made, other conditions must be excluded, which include possible reversible conditions like, adverse drug reactions, metabolic changes, nutritional deficiencies, head injuries, stroke, and mental conditions such as depression or acute grief (Conn, 1991). Ultimately, the disease eventually leaves a person less resistant to infections and other illnesses, which are often the ultimate cause of death of someone suffering from AD (see Cherry & Plauche, 1996, for discussion).

Diagnosis and Neuropathology of Adult Dementias

Before AD can be diagnosed, the possibility that any other disorder may be causing the symptoms must be eliminated. As mentioned above, the symptoms associated with AD can mimic stroke, minor head injury, effects from
high fever, poor nutrition, adverse drug reactions, metabolic changes, and depression, thereby causing misdiagnosis (Conn, 1991). Because there is no single clinical test to identify AD, a comprehensive medical examination must be performed. The evaluation should include a complete medical and health history, physical examination, neurological and psychiatric assessments, as well as other tests when considered necessary (Gurland & Cross, 1986).

Determining the cause(s) of AD has continued to be a major focus of intensive, ongoing scientific investigation. There are several hypotheses that have come to the forefront regarding the possible causes of AD. Genetic predisposition plays a role in some families. It is also thought several factors may act in sequence or in combination to cause AD. Some researchers now believe AD is a cluster of diseases that, like diabetes and heart disease, may have more than one fundamental cause (La Rue, 1992). It is actually easier to say what researchers believe does not cause Alzheimer's disease. For example, researchers have confirmed that AD is not caused simply by old age and is not contagious. Even though we are without a cure for Alzheimer's disease at this time, there is much that can be done to manage the disease and to treat its symptoms to provide a better quality of life for those afflicted.
It is also important for practitioners to understand the basic neuropathology of AD in order to interpret its devastating effects to family members and caregivers of AD patients. The neuropathology of AD specifically affects areas such as the hippocampus, amygdala, the association cortices, and subcortical and brainstem areas protruding to the neocortex. On the other hand, the primary sensory and motor cortices, the thalamus, the basal ganglia, and the cerebellum are presumably constrained from deterioration with Alzheimer's disease (Parks, Haxby, & Grady, 1993). Histopathological examinations confirm the dramatic changes that occur in the neurons in the cerebral cortex. The major neuronal changes are the result of the development of neurofibrillary tangles and senile plaques containing beta-amyloid (Hyman, Arrigada, Van Hoesen, & Damasio, 1993). The topographic occurrence of neuritic plaques and synaptic loss within the temporal, parietal, and frontal lobes in early AD is consistent with the hypothesis that brain regions responsible for memory and language function and motor/psychomotor function may be affected (Kluger, Gianutsos, Golomb, Ferris, George, Franssen & Reisberg, 1997). As well, other neuropathological changes include granulovascular degeneration and neuronal cell loss (Hyman et al., 1993).
Multiple neurotransmitter abnormalities have been found with regards to neurotransmitter changes when examining deterioration due to AD. The most representative and fundamental deficits occur in the cholinergic system. More than 90% reductions in choline acetyltransferase (CAT) have been found. CAT is the enzyme responsible for synthesizing acetylcholine (ACh) from its precursors in AD (La Rue, 1992). This cholinergic decline has been implicated in the memory decline in AD and is attributed to the loss of large cholinergic neurons in the basal forebrain (Blass, 1993). Other decreases include reductions of somatostatin, a peptide neurotransmitter, and smaller decreases in serotonergic and andregnergic systems, which have been consistently confirmed in AD (Blass, 1993). It becomes clear just how important it is for family members and caregivers to be made aware of the changing features in the brain of a loved one suffering from AD in order to provide continued education regarding such a complex disease process.

Other Conditions Producing Cognitive Dysfunction

Because most practitioners can expect to encounter older persons and their families with increasing frequency, an understanding of normative developmental issues and transitions is vitally important (Myers, 1990). It is also necessary for them to be able to distinguish between memory...
problems of normal aging from those that may be caused by physiological or psychopathological factors. It was noted by Kluger et al., 1997, that a continuum of loss of cognitive and functional capacity can be defined when comparing normal aging to AD. Cognitive dysfunction due to dementia syndromes and other conditions, are described in detail next.

Dementia syndromes represent a form of organic mental disorders, which include gross cognitive impairment and changes in personality and affective states (APA, 1994). Progressive memory dysfunction is symptomatic of AD as well as other forms of dementia that affect older adults. Table 1 presents a summary of the major types of organic conditions producing adult dementias. As can be seen in Table 1, Parkinson's disease, is a disorder involving loss of motor ability, shows signs of memory impairment and slowness of thinking representing associated dementia. Although, in Parkinson's disease, preserved language ability would be evident (Friedland, 1993). Lewy body disease is another cause of dementia, discovered only in recent years, showing signs of a combination of symptoms included in AD and Parkinson's disease. With Lewy body disease, dementia symptoms are present initially, followed by the abnormal movements associated with Parkinson’s disease (ADRDA, 1997). Cruetzfeldt-Jakob disease is another rare, infectious
Table 1: Forms of Dementia

<table>
<thead>
<tr>
<th>Type of Organic Disorder</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parkinson's disease</td>
<td>Memory impairment, loss of motor ability, slowness in thinking, with preserved language ability.</td>
</tr>
<tr>
<td>Lewy Body disease</td>
<td>Memory impairment, Fluctuations in cognition with notable variations in attention and alertness. Spontaneous motor features of parkinsonism. Well formed and detailed recurrent visual hallucinations.</td>
</tr>
<tr>
<td>Cruetzfeldt-Jakob disease</td>
<td>Memory declines, pronounced mental deterioration, blindness, weakness in arms and legs, possible coma. (Definitive diagnosis only after postmortem examination.)</td>
</tr>
<tr>
<td>Pick's disease</td>
<td>Rare dementing disorder, with changes in personality and orientation. Clinically similar to AD, but the neurochemistry and neuropathology is different.</td>
</tr>
<tr>
<td>Huntington's disease</td>
<td>Intellectual decline that begins in midlife, with personality change, memory declines, slurred speech, impaired judgment, with irregular and involuntary movement of face/limb muscles.</td>
</tr>
</tbody>
</table>

Note. Information adapted from ADRDA (1992) and ADRDA (1997).
disorder, which is caused by a slow-acting virus, with pronounced mental deterioration, involuntary muscle spasms, and rapid death.

Pick's disease is another rare dementing disorder, with primarily changes in personality and orientation, but is also quite different from AD, regarding neurochemistry and neuropathology (Sungaila & Crockett, 1993). Huntington's Disease is similar to AD with signs of memory declines and personality changes, but begins in midlife, with intellectual declines, and irregular and involuntary movements of limbs/facial muscles (Friedland, 1993). These less frequent types of dementia may have similar symptomatology to that of AD, which complicates the accurate assessment of AD. Confirmation of diagnosis of the adult dementias as mentioned above must occur postmortem when specific neurologic features are revealed on autopsy (Jarvik, 1980; Raskind & Peskind, 1992).

**Physiological Conditions**

There are specific physiological conditions that are associated with memory dysfunction that may resemble early AD. Examples of such conditions include metabolic, endocrine, or electrolyte disturbances/imbalances, dietary insufficiencies, alcoholism, and normal-pressure hydrocephalus (La Rue, 1992). As well, signs of confusional states and cognitive deficits due to adverse drug effects,
drug-drug interactions, or drug toxicity are other possible physiological conditions that may resemble early Alzheimer's disease (see Cherry & Morton, 1989). Diagnosis and treatment of these conditions are necessary, because it may be possible to reverse the cognitive deficits in some cases (Jarvik, 1980), such as when the cause of dementia is due to medications: psychotropics (especially lithium, tricyclic antidepressants, benzodiazepines), antihypertensives (i.e., methyldopa, diuretics), anticancer medications, and antibiotics (Salzman & Nevis-Owen, 1992). These medications can impair cognitive abilities by either toxicity effects or alterations in other bodily systems that effect mental functioning. While AD causes irreversible cognitive impairment, dementia caused by medical disorders, as described above, can be reversed if treatment is initiated promptly (Read, 1991).

Pharmacological Agents

Compound health problems and illnesses are typical of the experiences older persons may have. These complex problems may be treated with different drug therapies, if detected early on. For example, a series of physician-prescribed medications, as well as over-the-counter medications, may adversely affect the memory of older adults as well as other aspects of cognition. Antihypertensives, analgesics, antihistamines, and cardiovascular medications
are a few of those medications that have been shown to produce confusion in older persons (see Cummings & Benson, 1983). Memory problems and confusional states due to drug effects, drug-drug interactions, or drug toxicity can potentially be reversed. Therefore, it is necessary to decrease the risks of adverse drug reactions, through careful monitoring and periodic adjustments of therapeutic dosages (Cherry & Morton, 1989).

**Psychopathological Conditions**

Mental health concerns tend to increase with age, including needs for preventive mental health care, as well as needs for assistance with other significant problem areas (e.g., acute grief, paranoid disorders and particularly depression, see Myers, 1990). These disorders mentioned above are examples of some of the psychopathological conditions that may cause memory problems. In fact, clinical depression may be mistaken for probable AD at first, due to the similarity of symptoms (i.e., apathy, psychomotor slowing, difficulties in concentration; see Cherry & Plauche, 1996).

Depressed older adults may complain of memory loss. However, the correspondence between self-reported memory deficits and objective memory performance in depressed older adults tends to be poor (Popkin, Gallagher, Thompson, & Moore, 1982). On the other hand, probable AD patients may
overestimate their memory abilities, when comparing performance on objective memory tests and reports by significant relatives (Gilewski & Zelinski, 1986). The diverse profiles of depressed elderly adults and probable AD patients on objective memory measures may provide a plausible basis for differential diagnosis in these cases (Lamberty & Bieliauskas, 1993). Recent studies also indicate that severe depression may coexist with AD in the early stages, which further complicates the ability to properly diagnose. Future research is needed to clarify the issues surrounding the diagnosis of depression and dementia (Terry & Wagner, 1992).

Gintner (1995) notes several basic questions that examiners may ask themselves when attempting to distinguish between disorders that may be complicated by several factors of resemblance. Questions such as, how does the disorder typically present itself in older adults; what medical or other mental disorders need to be ruled out; what assessment instruments are commonly used for this specific disorder. When clinicians begin by asking these questions, it may lessen the possibility for misdiagnosis. As well, a multimethod assessment (i.e., using various assessment tools in order to gain a more comprehensive appraisal of level of functioning) may be appropriate when clients show clear signs of cognitive impairments (Gurland & Cross, 1986).
Clinicians may need to gather information from appropriate family members or caregivers in order to confirm or disconfirm reports made by the client. Also, a baseline mental status examination would be beneficial for prospective use, in order to track future declines or changes in mental status. A measure of functional capacity (i.e., cooking, shopping, paying bills) would be another useful baseline measure. Lastly, a medical release should be obtained in order to review other medical examinations that the client has been involved in, which will help make the diagnostic procedure more thorough and accurate (Gintner, 1995).

Other Considerations

Another important issue for practitioners to be aware of concerns the environment in which older adults are examined. Researchers have noted that older persons tend to be more sensitive to environmental distraction than younger people, may attend to more nonverbal communication, and may be affected more easily by the lighting and the temperature in the room which they are examined (Gintner, 1995). These recommendations are useful for modifying the diagnostic process for evaluating older adults. More specific recommendations include the suitability of the office setting which should have good lighting with an environment free of interfering noise because often older adults have
some degree of sensory loss and mobility impairment. The older adult should have an easy time sitting and standing. When scheduling an appointment, the frequency and duration should meet the needs of the client. It is typical to allow 40 minutes for examinations, but some older adults showing signs of impairment may benefit from 10 to 20 minute interval sessions or may need more shorter repeated sessions (Gintner, 1995). It is necessary to be aware of these differences so that older adults can receive optimal environmental conditions when being examined, which will ease the stress and anxiety involved in being asked questions or tested (Myers, 1990).
ALZHEIMER'S DISEASE

Overview of Diagnosis

The Diagnostic and Statistical Manual of Mental Disorder IV (APA, 1994) defines the essential features of dementia as the development of multiple cognitive deficits that include memory impairment and at least one of the following cognitive disturbances: aphasia (i.e., partial or total loss of the ability to speak), apraxia (i.e., inability to perform coordinated movements), agnosia (i.e., loss of auditory, sensory, or visual comprehension), or a disturbance in executive functioning (i.e., control processes of the brain). Memory impairment is required to make the diagnosis of a dementia and is a prominent early symptom. Individuals with dementia become impaired in their ability to learn new material, or they forget previously learned material. Individuals showing signs of dementia may lose valuables like a wallet or keys, may forget food cooking on the stove, or may become lost in familiar neighborhoods. In advanced stages of dementia, memory impairment may become so severe that the person forgets his or her occupation, date of birth, names and faces of family members, and sometimes even their own name.

Behavioral Changes in Alzheimer's Disease

The behavioral features required for a clinical diagnosis of AD in the DSM-IV (APA, 1994) include a specific disturbance of cognition in which memory and one or more...
other cognitive impairments (language disturbance, apraxia, agnosia, disturbance in executive functioning) is present. There is a requirement that these problems must be severe enough to interfere with social or occupational functioning and must reflect a decline from a previous level of functioning. AD cannot be diagnosed, for example, if the cognitive disturbance occurs exclusively during the course of delirium or when the symptoms can be accounted for by another Axis I mental disorder, such as depression or delirium. Also, the cognitive deficits cannot be due to other central nervous system conditions that cause progressive deficits in memory or cognition, such as stroke, systemic conditions that are known to cause dementia, such as HIV infection, or the persisting effects of a substance, such as, alcohol.

In addition, the Alzheimer's Disease and Related Disorders Association (ADRDA) has provided additional criteria that ranks AD on a continuum of confidence. The diagnosis of probable AD requires the presence of cognitive impairment in two or more areas, a history of gradual decline, and the absence of medical evidence for any specific causes. A diagnosis of possible AD is initially made when there is no coexisting illness or only a single, progressive cognitive impairment already identified (La Rue, 1992). When utilized with AD, these criteria have been found to be sensitive, reliable, and specific (Friedland, 1993). Autopsy verification rates of at least 80% have been
found for probable AD when using these criteria (La Rue, 1992).

Behavioral symptoms common in Alzheimer's disease, such as paranoia, delusions, depression, agitation, sleeplessness and anxiety can benefit from the wide variety of psychiatric medicines (Cummings & Benson, 1992). In addition to medication to treat the symptoms of AD, physical exercise and social activity are important in maintaining overall good health, as is proper nutrition. Calm and structured surroundings may also help the affected person to continue functioning as well as possible for as long as possible. Modification to the living environment can help the affected person maintain comfort and dignity. Ideally, health care directives and financial, legal and other important decisions should be made while the person with AD is able to do so.

Cognitive Changes in Alzheimer's Disease

AD is associated with extensive cognitive deficits with symptoms specifically affecting memory. Other affected areas include; orientation, abstract thinking, personality, judgment, emotional control and functional capacity. These cognitive deficits make it difficult for persons suffering from AD to fulfill social obligations in everyday life and may lead to an increase in the number of embarrassing social situations. Even those suffering from AD still wish to maintain a certain level of social responsibility, which
remains significant in some instances, throughout later stages of the disease.

Lawton and Brody (1969) created an index in order to examine changes in cognitively impaired older persons' ability to function when affected by numerous factors, such as physical illnesses, affective states, and environmental factors. The index is titled the Instrumental Activities of Daily Living (IADL). This index examines the following activities: using the telephone, preparing meals, taking medications, and handling finances. It is clear that certain activities may hold different meanings for persons who are cognitively impaired when compared to those without cognitive impairments. For instance, using the telephone requires both ambulation or getting to the phone, as well as remembering which number to dial and knowing what to say once the person on the other end answers the phone. These instrumental activities of daily living have been reported as being jeopardized in those persons suffering from AD and related dementing disorders (Kosloski, Kercher & Redford, 1998). Ultimately, tasks of instrumental activities of daily living become increasingly more difficult with passage of time, therefore making it difficult for cognitively impaired older persons to maintain an acceptable degree of social competence.

It is important that practitioners are sensitive to the fact that caregivers and family members of those suffering from AD are emotionally affected when their loved one begins
to forget such things as the names of their own children or grandchildren. As well, it can be frightening for both the family members and the person suffering from AD when the person becomes lost in their own neighborhood or cannot find their way to the familiar neighborhood grocery store. Often times families find themselves trying to decide whether it is even safe for the person to continue driving. When instances like these occur, it can be overwhelming for all parties involved, particularly when levels of independence must be stripped away from individuals with AD for safety purposes. For practical reasons, it is critical that we find ways to maintain the dignity of those suffering from diseases such as AD and continue to search for ways to improve the quality of their life.

**Practical Considerations**

Currently, an increasing number of older adults are receiving services within their communities. Home-delivered meals, through home-care services, council on aging programs, and adult day-care services, are just a few examples of ways in which elderly persons are able to remain as independent as possible with community support (Wells, 1992). It is expected that changes in demographics of our population will lead to increases in the number of individuals needing such care as adult day care or possible nursing home care (Kruzich, Clinton, & Kelber, 1992). Adult day care as well as nursing homes will become an overwhelmingly dominant provider of basic medical and
custodial care and will provide a variety of levels of intensive supervision for those being appropriately assessed as needing day care treatment compared to those needing eventual long-term institutionalization (Williams, 1992).

For the very old, adult day care facilities and nursing homes seem to be the primary options that local communities are able to offer to those who are no longer capable of total independent living. Perhaps our energies should be devoted to improving the quality of day care facilities and nursing homes in order to maintain the independence levels of our mounting population of very old (Sheppard, 1978).
NURSING HOME ENVIRONMENT

Nursing home residents have become of special interest to gerontologists and applied researchers. The number of older adults needing long-term care is expected to more than triple in the coming decades. Nursing homes are certainly a necessary part of any long-term care system, and are essential for those elderly persons whose disabilities demand 24-hour-a-day medical supervision, such as the elderly person in the last stages of a progressive disease like the adult dementias (see Table 1). Although there has been an emphasis on the development of day-hospital and community provisions, there is presently a lack of evidence that such facilities can provide alternatives to hospital care, or nursing home care (Lemov, 1994).

Thorough functional and social assessments used as steps in decision making for long-term care are often needed, but are sometimes neglected, which may result in inappropriate choices of long-term care. Thus, demented elderly people may end up in nursing homes when it may have been possible for them to live in less restrictive settings such as at home with support services or attending day care while continuing to live in the home in order to maintain a certain level of independence. At the same time, the elderly adult with unassessed needs may not be provided with the type of long-term care that is required, which may result in accelerated burnout on the part of family
caregivers as well as hastened deterioration of the elderly adult. Careful use of comprehensive assessments, recommendations, and assistance in arranging for long-term care has been shown to result in care that is most appropriate to meet the special needs of elderly adults, particularly those with AD, needing long-term care (Williams, 1992).

**Needs within the Nursing Home**

Dependency needs are quite high in institutional settings, overall. The most common causes of the need for long-term care assistance are typically due to the limitations of a person's physical ability to carry out ordinary daily physical activities (Williams, 1992). Physical dependence can be defined as the reliance on someone else for support or aid (Moffat, 1989). The traditional and useful measures of physical dependence focus on function, described as activities of daily living (ADL). As can be seen in Table 2, the institutionalized elderly, especially those suffering from AD, may need help with ADL's such as: walking, bathing, dressing, using the toilet, grooming, and eating (Wells, 1992). The therapeutic goal for nursing home staff is to provide these older adults with assistance in order to compensate for the functional disability or disabilities that have been identified, and to assure continued independent living to the maximum extent possible (Williams, 1992). Issues of eating, incontinence, falling, pain, and confusion are challenging tasks that
Table 2: **Assessment of Activities of Daily Living**

Assess whether the person can accomplish each activity independently, whether he/she needs partial supervision or assistance, or whether he/she is fully dependent on others.

<table>
<thead>
<tr>
<th>Personal self-care</th>
<th>Feeding</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bathing</td>
</tr>
<tr>
<td></td>
<td>Toileting</td>
</tr>
<tr>
<td></td>
<td>Dressing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mobility</th>
<th>Ability to move from bed to a standing position or to a chair</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ability to walk (with or without assistive devices) or use of wheelchair</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Continence</th>
<th>Continent of urine, always or rarely incontinent, or frequently continent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Continent of feces</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dressing</th>
<th>Ability to dress oneself</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ability to dress oneself with partial assistance or total assistance</td>
</tr>
</tbody>
</table>

**Note.** This material was adapted from Williams, (1992).
nursing home staff must attend to 24 hours a day in order to ensure safety and comfort for the patients (Wells, 1992).

**Behavioral Problems and Treatment Strategies in the Nursing Home**

Older adults in institutionalized settings often present a variety of behavioral problems. For example, pain may increase physical dependence, causing sleeplessness and fatigue, or may be camouflaged as combativeness or noncooperation, withdrawal, or depression. These problems appear to be related to strokes and other chronic conditions (Fisher & Carstenson, 1990). Researchers have specifically examined some troublesome and disruptive behaviors typical of AD patients, such as, aggression, angry outbursts, paranoid ideas, wandering, repetitive manipulation of objects, and vegetative disorders, such as disturbed sleep and incontinence (see Burgener, Jirovec, Murrell, & Barton, 1992).

Several researchers have examined appropriate guidelines for dealing with disruptive behaviors in nursing home settings. For example, Burnside (1979) concluded that 12 environmental parameters, including stable staff and routines, generous use of touch and affection when appropriate, skilled nonverbal behavior, and qualified nursing staff can help increase therapeutic care. Based on clinical observation, Ridder (1985) also suggests some guidelines for interacting with cognitively impaired elderly adults. Included in his suggestions was the use of verbal...
cues that have individual meaning for the older adult, and the use of environmental stability through consistent staffing and physical surroundings. Application of Ridder's guidelines may improve the quality of life of institutionalized older adults.

Because of the increase in dependence on others while institutionalized, elderly adults may feel vulnerable and may feel that their dignity and freedom has been stripped away. Adults who have defined their own space, made their own living, and chosen their own companions are suddenly at the mercy of other people for assistance. Therefore, the most serious loss can literally be loss of self. The various therapies offered are ideal tools to approach the total or partial loss of self. Researchers should never lose sight of the common goal, which is to provide the demented elderly adult with the best care possible whether restorative or palliative (Wells, 1992). Several types of interventions for improving the well-being of institutionalized older adults have been developed. Cognitive interventions exist also, which are discussed next.
COGNITIVE INTERVENTIONS

Background Information

Before designing a memory intervention for an elderly individual, it is necessary to first determine if the change in memory ability represents a true functional deficit in memory, or if it may be due to some other factor, such as a possible drug side-effect, etc. A multimodal, comprehensive assessment of physical, cognitive, and affective functioning through objective measures is necessary (Kotler-Cope & Camp, 1990). An important question to ask is whether cognitive functioning can be modified through relatively brief, experimental interventions (McKitrick, Camp & Black, 1992). Recent studies suggest that memory intervention strategies are helpful for healthy older adults, and in some cases, benefits are obtained for older adults with early AD (see Cherry & Smith, 1998 for review). Treatment for specific memory declines has become an increasingly important area of geriatric rehabilitation research. One of the difficulties in using mnemonic techniques is that such strategies are often based on the assumption that individuals still maintain some organizational and memory abilities, which is not always the case (Hill et al, 1987).

Mnemonic Techniques

As discussed previously, AD is characterized by concentrated cortical deterioration, particularly in the regions of the brain responsible for memory and learning.
Without a cure for AD, research over the last 30 years or more has focused on the development of intervention strategies to lessen the problems faced by AD patients. To illustrate, several interventions are discussed next.

Some mnemonic training interventions are based on the traditional internal mnemonic devices (e.g., visual imagery techniques, semantic elaboration) and verbal organization interventions (Schacter, Rich, & Stampp, 1985). The visual imagery-based mnemonics are the most frequently used forms of internal mnemonic strategies for normal and memory-impaired older adults (Schacter, et al., 1985). Visual imagery entails the formation of mental images of to-be-remembered items. Some researchers have had some degree of success in training individuals with cognitive impairments to use such techniques as the visual imagery intervention (Schacter, et al., 1985). With these special populations, only moderate success has been achieved due to the combination of the complexity of the mnemonic as well as the limited cognitive resources present in the population (Camp, 1989).

Some evidence suggests that imagery pre-training may enhance recall of mnemonic strategies used with demented populations during training (Kotler-Cope & Camp, 1990). However, those mildly demented individuals who are capable of some use of complex mnemonic strategies during training sessions will seldom use the ability in other circumstances (Schacter, 1992), so generalizability is limited. While
memory improvement is possible with mnemonic training in demented populations, the cost and minimal degree of effectiveness of such interventions may outweigh the potential benefits, suggesting that less complex techniques be explored (Cherry & Smith, 1998). One such alternative, spaced-retrieval, is discussed in the following section.

**Spaced-Retrieval**

The spaced-retrieval technique, is a less demanding mnemonic technique that can aid memory functioning without making excessive demands on patients' cognitive resources (Camp, 1989). The spaced-retrieval effect was first demonstrated in a study with college students (Landauer & Bjork, 1978), where the spaced-retrieval technique facilitated learning in normal populations. The procedure has since been adopted for use with memory-impaired elderly adults (see Camp, 1989; Schacter, 1992). In fact, Camp (1989) found that by using this technique, individuals with AD could retain face-name associations for up to 1 week when previously they could not retain such associations for more than a few seconds (Camp & Schaller, 1989).

The spaced-retrieval procedure is essentially a shaping paradigm applied to memory. The spaced-retrieval technique involves testing for the recall of information at increasingly longer retention intervals. The ultimate goal of this training is to promote retention of a new piece of information. Individuals with memory impairments have been found to experience high levels of success at remembering
when trained using spaced-retrieval (Camp & Schaller, 1989). Spaced-retrieval training takes place in a social setting, and time during recall intervals is spent chatting or playing games, so that training sessions take on the characteristics of a social visit. As well, the use of shaping in a memory task creates a large number of successful recalls, which is reinforcing to individuals with memory deficits. Learning seems to occur without much expenditure of cognitive effort, to the extent that the ease of learning is obvious even to some participants (Kotler-Cope & Camp, 1990).

Camp's research has shown clear demonstrations of how the spaced-retrieval technique can be applied to facilitate new learning and long-term retention in persons with AD (Kotler-Cope & Camp, 1990). Spaced-retrieval training involves systematically increasing the amount of time between the recall of a target, such as the name of a caregiver or the recognition of an object. The initial recall interval is 5 s, then 10, 20, 40, and 60 s. Increments of 30 s are used following successful recall. If the participant cannot recall the name of the caregiver or object, the correct name is provided and the next recall interval is decreased to the longest previous interval of which recall was successful. The participant is engaged in casual conversation or other unrelated activities during the retention intervals in order to prevent rehearsal of the name of the caregiver or the object. Initial research
findings indicated that individuals with AD who could not previously retain new association for 60 s could successfully recall information presented via spaced-retrieval for intervals up to 5 weeks (Kotler-Cope & Camp, 1990).

Camp and his associates have shown that even moderately demented patients can retain some information over relatively long periods of time, using spaced-retrieval techniques (McKitrick, Camp, & Black, 1992). Due to the capacity for individuals with AD to retain new learned information, there is a potential for the effects of intervention to be maintained. One study points out, however, that retention is limited, so enduring benefits may require 'booster sessions' over time (Little, Volans, Hemsley & Levy, 1986).

McKitrick et al. (1992) argue that spaced-retrieval can be used to train people with AD in the use of memory strategies. For example, individuals with AD tend to forget to use external memory aids. Specifically, spaced-retrieval is currently being examined to enable individuals with AD to use the strategy of looking at a calendar to find out what appointments they have for the day. As noted by the authors, even individuals with AD still feel the need to meet their social obligations, as well as perform appropriate social behaviors, and maintain a good reputation among peers and family. Interventions of this type can enable them to do so more effectively.
SPECIFIC AIMS

Even though practitioners are aware of the steady declines in cognitive functioning associated with AD, it is still possible to design interventions based on the remaining cognitive capabilities of those persons. In particular, the spaced-retrieval technique has been used successfully to improve memory for individual item information in persons with AD (see Camp, 1989; Cherry, Simmons, & Camp, in press). The spaced-retrieval technique requires the participant to make active attempts to recall to-be-remembered information over increasingly longer periods of time, as previously discussed. The McKitrick et al. (1992) and Cherry et al. (in press) results lend further validation to the spaced-retrieval technique as a suitable memory enhancement for AD patients.

The present research was designed to address three issues with respect to the topic of memory intervention in cognitively-impaired older adults (i.e., those suffering from AD.) The first aim of the present studies was to examine the long-term effectiveness of the spaced-retrieval technique. Our second aim was to extend the original Cherry et al. (in press) research by examining ways to enhance the effectiveness of the spaced-retrieval technique. The third aim of the present research was to demonstrate the effectiveness of the technique in an applied setting (e.g., an adult day care facility) for addressing the specific
memory problems that often arise in that setting. The three goals of the present research are discussed more fully in the sections that follow.

Long-Term Effectiveness of Spaced-Retrieval

Gaining insight into the long-term effectiveness of spaced-retrieval as a mnemonic technique for those with cognitive deficits such as AD is an important challenge for gerontological researchers. Longitudinal comparisons must be made in order to describe the long range effects of spaced-retrieval. Without evidence of long-term effectiveness, the use of spaced-retrieval to address practical problems in applied settings would be limited. Therefore, the present research was an initial attempt to demonstrate the long-term effectiveness of the technique, a topic that has not yet been addressed in the scientific literature so far.

In Experiment 1, we examined the long-term effectiveness of the spaced-retrieval technique by making comparisons between data collected two years ago with current data that was gathered on a selected number of those original participants. We also included a control group of new participants that have not been exposed previously to the spaced-retrieval training for comparison purposes. The control group was matched to the experimental group according to age, gender, and Mini Mental State Examination scores (Folstein, Folstein & McHugh, 1975). The procedures for both the experimental and control groups were the same.
as the original procedures used two years ago (cf. Cherry et al., in press). We were interested in determining whether savings-in-relearning would occur in the experimental group. That is, we expected that the experimental group would show fewer failures across trials, initially, compared to the control group. In addition, we added three further sessions of spaced-retrieval training in order to evaluate differences between the performance of the experimental and control groups over extended training sessions.

**Enhancing Effectiveness of Spaced-Retrieval**

A second aim in the present research was to explore ways to enhance the effectiveness of spaced-retrieval. We examined ways to improve the technique by using a procedure called the target-item orientation task (Cherry & Simmons-D’Gerolamo, in press). The target-item orientation task was designed to not only enhance the effectiveness of the spaced-retrieval technique, but to examine possible use for future real-world application.

The target-item orientation task is defined as a task which allows specific conversation to take place between the experimenter and the participant regarding the to-be-remembered object, as described in detail on page 56. When the to-be-remembered objects are later introduced, the participant should show improved memory for the to-be-remembered objects, as reflected in better performance on the spaced-retrieval task per session compared to those participants who were not given the target-item orientation.
task. Pilot data has verified the influence of the target orientation task. For example, participants who were given the target-item orientation task showed fewer failed recall trials, initially, and longer retention of the object relative to the control participants. We intended to provide further confirmation of these initial findings in Experiments 2A and 2B, which will allow us to make future applications of the technique (e.g., use in adult day care facilities, use at home with caregivers).

An additional goal in Experiment 2 was to replicate and extend the findings from Experiment 1 regarding long-term effectiveness of spaced-retrieval. We examined variations in the long-term effectiveness of spaced-retrieval by making comparisons between different longitudinal spans (one year vs. six months) to pinpoint the maximum limitations of spaced-retrieval. Experiment 2A consisted of a replication study based on pilot data collected approximately one year and six months ago. The same participants were tested as in the original study; half served as control subjects and the other half were given the target-item orientation task. Three additional sessions of spaced-retrieval training were given, just as in Experiment 1, in order to replicate the expected benefit of additional training sessions.

Experiment 2B was a conceptual replication. It included a new group of six participants that have not been exposed previously to spaced-retrieval training for comparisons purposes. Those in Experiment 2B were tested
under the same procedures as those in Experiment 2A (i.e., three control participants and three participants who were given the target-item orientation task). Comparisons were made between the two sets of data, permitting more precise inferences to be made on the long-term effectiveness of the spaced-retrieval technique. Experiment 2B was designed to replicate the positive effects of the target-item orientation task on performance.

**Application of Spaced-Retrieval**

We suspected the spaced-retrieval technique would be useful in real world settings, such as adult day care facilities, to decrease problem behaviors typical of those persons suffering from AD (e.g., asking repetitive questions). It was of value to document the functional use of the spaced-retrieval technique to facilitate achievement of a potential treatment regimen for difficult behaviors often seen in such applied settings as adult day care. However, there is presently very little research that addresses this issue.

We examined the usefulness of spaced-retrieval in the context of a behavioral intervention program. Other researchers have already begun to use the spaced-retrieval technique in applied settings such as with persons with dementia associated with Parkinson's disease to remember new motor tasks (Hayden & Camp, 1995). The technique is also being explored to determine ways to use spaced-retrieval to teach compensatory techniques for swallowing, motor speech,
voice disorders, as well as teaching any memory-impaired persons new information.

In Experiment 3, we expected to demonstrate the usefulness of the spaced-retrieval technique when adapted for application in real world settings. It is important to demonstrate that the spaced-retrieval technique can be adapted for use as a behavioral intervention program in real world settings. We utilized a modified form of the technique to deal with problem behaviors in day care facilities, focusing on such problems as constant questioning of the staff regarding the time, the location of the bathroom, as well as, continued questions regarding when the client is being picked up by their caregiver. This technique will ultimately be intended to help provide a source of relief to day care workers when dealing with the difficulties of cognitively-impaired persons. The application of the spaced-retrieval technique may ultimately increase the quality of care given to patients with typical behavioral problems in the day care setting, such as those patients suffering from Alzheimer's disease.
GENERAL METHOD

Participants

A total of 19 persons with probable AD were recruited from an adult day care center in the Baton Rouge, Louisiana, area. All participants have a chart diagnosis of probable AD. We screened their level of impairment based on the DSM-IV (American Psychiatric Association, 1994) and the Global Deterioration Scale (GDS) criteria (Reisberg et al., 1987). Those with scores characterized as Stage 4-5 dementia on the GDS (see Table 3) were included in the proposed studies. Self-reported health and demographic characteristics of the sample (e.g., social activities, educational attainment, and occupational status) was obtained from the participants and their legal guardians.

Individual Difference Measures

A series of individual difference measures was given to provide a cognitive profile of the participants (see Table 4). The Mini-Mental State Exam (MMSE, Folstein, Folstein, & McHugh, 1975) was administered as a measure of mental status. The maximum total score on the MMSE is 30 (for healthy older adults, scores range between 27 and 30). All participants were tested on the Geriatric Depression
Table 3: Functional Assessment Stages in Normal Aging and Alzheimer’s Disease

<table>
<thead>
<tr>
<th>Global Deterioration Scale Stage</th>
<th>Clinical Diagnosis</th>
<th>Functional Assessment Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. No cognitive decline</td>
<td>Normal</td>
<td>No functional decrement.</td>
</tr>
<tr>
<td>2. Very mild cognitive decline</td>
<td>Normal for Age</td>
<td>Complains of forgetting location of objects.</td>
</tr>
<tr>
<td>3. Mild cognitive decline</td>
<td>Borderline impairment</td>
<td>Decrease in functioning in demanding work settings; difficulty in new locations.</td>
</tr>
<tr>
<td>4. Moderate cognitive decline</td>
<td>Mild AD</td>
<td>Decreased ability to perform tasks. (complex tasks).</td>
</tr>
<tr>
<td>5. Moderately severe cognitive decline</td>
<td>Moderate AD</td>
<td>Requires assistance in clothing; may require coaxing to bathe.</td>
</tr>
<tr>
<td>6. Severe cognitive</td>
<td>Moderately severe AD</td>
<td>Requires total assistance in dressing, bathing, and toileting.</td>
</tr>
<tr>
<td>7. Very severe cognitive decline</td>
<td>Severe AD</td>
<td>Limited ability to speak, loss of ambulatory ability, loss of ability to sit up, smile, hold head up; total care needed.</td>
</tr>
</tbody>
</table>

Note. This material was adapted from Reisberg et al. (1987).
### Table 4: List of Individual Difference Measures Given To Participants

<table>
<thead>
<tr>
<th>Measure/Reference</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| Mini-Mental State Exam [MMSE]  
  Folstein, Folstein & McHugh, 1975 | Cognitive screening measure |
| Geriatric Depression Scale (GDS)  
  Yesavage et al., 1983 | Affect screening measure |
| Vocabulary test, short form  
  Jastak & Jastak, 1965 | General intellectual functioning |
| Forward Digit Span (FDS) | Short-term memory |
| Backward Digit Span (BDS)  
  (WAIS, 1955) | Working memory |
| Subject-performed tasks (SPT)  
  Cherry, Moore & Kelley, 1998 | Secondary memory measure |
Scale-Short Form (GDS; Yesavage et al., 1983), because clinical depression is commonly observed in early AD (Benedict & Nacoste, 1990; Terry & Wagnor, 1992). Scores of 6-10 represent a mild level of depression on this scale. A short-form of the WAIS Vocabulary Subtest (Jastak & Jastak, 1965) was administered as a measure of verbal ability and as an index of general intellectual functioning. We measured verbal ability here, because the verbal factor is an important component of language competency and contributes to the quality of word definitions.

On the Vocabulary Subtest, the maximum total score is 40. Prior research using this measure with healthy older adults has yielded mean verbal scores of 29.7 and 16.1 for higher and lower education older adults (cf. Cherry & Park, 1993). As well, Cherry et al. (in press) found a range of 4-13 on the vocabulary subtest for persons with probable AD, which is suggestive of a significant deficiency in verbal ability, as well as in general intellectual functioning.

Participants also completed the Forward Digit Span (FDS) and Backward Digit Span (BDS) tests (WAIS, 1955) as estimates of short-term memory and working memory, respectively. The total score on the FDS is 9.0 and the BDS is 8.0.

As a measure of secondary memory ability, participants were given the Subject-Performed Task (SPT) Measure,
developed by Cherry, Moore, and Kelley (1998). In this task, participants were instructed to pay close attention to a set of 10 objects (e.g., "toothpick") that are presented one at a time. Participants were told to perform a specific action with each object (e.g., "break the toothpick"). Later, they were asked to free recall the objects and what they did with each one. For items that were not recalled, the object was represented as a cue and participants were asked to describe what they did with the object. Scoring was based on a strict (i.e., verbatim) and lenient (i.e., semantically parallel) criteria for free-recall and cued-recall of the objects and the actions.

**Baseline Measures of Memory**

In each training session, 2 additional measures of secondary memory were given: a) the prospective name-tag task, and b) the shirt-color task. The purpose of the prospective name-tag task was to obtain a measure of memory for carrying out an intention. That is, this task was designed to provide a baseline measure of memory for a simple association without the benefit of spaced-retrieval training (i.e., remembering to perform a simple motor task in response to a verbal cue). The purpose of the shirt color naming task was to have a baseline measure of delayed recall (48-hour) of a single piece of information without the benefit of spaced-retrieval training (i.e., remembering
to tell the experimenter the color of the shirt he/she wore in the previous session at the beginning of the next session). These tasks are described more fully next.

**Prospective Name-Tag Task.** The prospective name-tag task was given at the start of each of the 9 training sessions. First, the experimenter gave the participant a name-tag to wear throughout the entire session (both participant and experimenter wore name-tags). The participant was instructed to remember to give his/her name-tag back to the experimenter once the session was over. The participant would know the session was over when the experimenter would say, "We are finished for the day." The participant would then be asked to repeat the cue phrase and the instructions back to the experimenter to verify their understanding of the task.

The name-tag was handed out at the beginning of every session and turned in at the end of each session. If the name-tag was not returned after the cue phrase "We are finished for the day" is stated, then the participant was prompted several more times. Each prompt and response was recorded and scored as follows. If the participant remembered to turn in their name-tag on the first cue, "We are finished for the day", a total of 4 points was awarded. If the participant turned in their name-tag after the cue, "We are finished for the day" is repeated twice, 3 points
was awarded. If the participant turned in their name-tag, but only after the experimenter had touched her own name-tag (as a cue) and repeated the cue phrase a third time, 2 points was awarded. If the participant remembered to turn in their name-tag, but only after the experimenter had touched her own name-tag (as a cue), after having repeated the cue phrase four times and took off her own name-tag and put it away (another cue), 1 point was awarded. If the participant did not remember to turn in their name-tag after the experimenter had given all of the above cues, 0 points was awarded. The participant was asked if they remember what they were suppose to do when they hear the experimenter say, "We are finished for the day". All answers were recorded each day, and points were awarded. Scores from all 9 days were summed to obtain a total score for each participant (maximum score of 36).

**Shirt-Color Naming Task.** At the end of each training session, participants were told to remember the color of the shirt that the experimenter was wearing that day. The experimenter always wore a plain, solid colored shirt (e.g., pink, white, brown, red, and black) and would name the shirt color for the participant. The participant was instructed to report the color of the shirt as soon as they would see the experimenter the next day of training. Participants were asked to repeat the instructions to verify their
understanding of the task. In the next session, if the participants did not immediately name the color of the shirt, the experimenter would then prompt the participants (to see if they remembered what they were supposed to tell the experimenter when they first saw them). If the participants still did not remember, they were prompted to name the color of the shirt. This baseline measure of memory was scored as either pass or fail.

**Summary of the Spaced-Retrieval Training Program**

The spaced-retrieval training program was administered as follows. At the beginning of each training session, the experimenter would chat briefly with the participant to establish rapport. Next, participants were presented with a flat, wooden board (29 x 29 cm) that was scored with thick lines to represent a 3 x 3 matrix. Nine items were then placed on the board, one at a time, in front of the participant. The experimenter would then name each item aloud as it was placed on the board in order to familiarize the participants with the set of objects. Each item would occupy its own square on the matrix. Each item was drawn from a different taxonomic category (e.g., carrot—exemplar of vegetable; see Appendix A for a complete listing of taxonomic categories and exemplars). After all objects had been presented, the experimenter would then demonstrate the sound of the beeper. The purpose of this was to ensure that
all participants could hear the sound of the beeper and to familiarize them with the sound that they would be trained to respond to during the spaced-retrieval recall trials.

On each day of training, one item was designated as the "correct" item; the experimental task would be for the participant to select the correct item and then present it to the experimenter on cue. For example, "When the beeper goes off, I want you to hand me the "carrot." The trained target response consisted of a visual cue associated with a correct motor response. Both had to be demonstrated within a trial in order to be considered a success.

To train the visual cue/motor response association, the experimenter would say, "Here are some objects on the board. When my beeper goes off I want you to hand me the "carrot" (correct item). Okay?" The motor response required was the participant would select the "carrot" (correct item) and hand it to the experimenter on cue. The position of the target item within the 3 x 3 matrix was changed after each recall trial.

This response combination was trained using the spaced-retrieval method, previously described. The presentation of recall trials was controlled by a hand-held stop watch according to the following expansion schedule: the initial retention intervention was 5 s; subsequent intervals increased to 10, 20, 40, and 60 s. After a 60 s retention
was demonstrated, the intervals expanded by 30 s following each successful recall, after Camp's (1989) original procedure. After a 180 s (3 min) retention was demonstrated, the intervals expanded by 60 s following each successful recall. After a 360 s (6 min) retention was demonstrated, the intervals were expanded by 120 s following each successful recall (see Cherry & Simmons-D’Gerolamo, in press). The proposed expansion schedule is an adaptation to the original Camp (1989) methodology. This new interval expansion was designed to allow participants the opportunity to reach their maximum time interval before tiring.

Implicit Memory for the Trained Object

We have developed a measure of implicit memory for the object trained via spaced-retrieval to provide further evidence on the contribution of implicit memory to spaced-retrieval effects (see Cherry et al., in press). The implicit task was a category exemplar generation task, adapted from Light and Alberton (1989). The experimenter asked the participant to name some items that belong within a specific taxonomic category. For example, the experimenter would say, "I would like you to name as many items as you can think of that belong to the category, "Vegetable".

Implicit memory for the trained item was revealed if the participant named that item in the category exemplar
generation task. That is, the "correct item" (e.g., carrot) would be included in the list of objects that the participant named from the category, "Vegetable". As a manipulation check, we administered the same category exemplar generation task as a pretest, prior to spaced-retrieval training. The category exemplar pretest was given to determine if the participants would spontaneously produce the name of the to-be-trained object before spaced-retrieval training begins.

**Explicit Memory for the Trained Object**

To measure participants' retention of the objects trained via spaced-retrieval, we administered three different measures of explicit memory: a) immediate recall and recognition of the trained object (within-session explicit control task), b) 48-hour delayed recall of the trained object (from one training session to the next), and c) final recall and recognition across the three training sessions (recall of all items across-sessions). These three tasks are described more fully next.

**Immediate Recall/Recognition.** At the end of each training session, the participants were asked to free recall the object that they had just been trained on within that session. If participants were unable to recall the object, then all 9 of the objects were placed on the board and they were asked to pick out the object that they remembered
working with that day. Responses were recorded on a prepared sheet.

**Delayed Recall.** On subsequent training sessions, the experimenter asked the participants to recall the object used in training from the previous session (i.e., approximately 48 hour delay of testing). The purpose of the delayed recall task was to determine whether participants would remember the trained object from the session before. If so, this evidence could be interpreted to suggest that the benefit of spaced-retrieval training maintains over time. If participants were unable to recall the object, a score of zero was assigned. We did not re-present the trained object for recognition after delayed recall, because we did not want to confound the final recognition measure (described next) by having repeated exposures to the trained item after the initial spaced-retrieval training session.

**Final Recall/Recognition.** The final delayed recall was given on day 6 and day 9 of training in order to determine whether the participants were able to recall or recognize any of the three "correct objects" used during the spaced-retrieval training trials from days 3-5 and days 6-8. If participants were unable to name all three target objects, then all objects were placed on the table, and they were told to pick the 3 objects they had worked with during the training sessions. Participants were told to hand the
experimenter the objects they chose. Responses were recorded on a prepared sheet. This procedure was administered on day 6 (after training sessions 1-3) and on day 9 (after training sessions 4-6) with the same set of objects.
EXPERIMENT 1

The primary aim of Experiment 1 was to gain insight into the long-term effectiveness of spaced-retrieval as a mnemonic technique for those with cognitive deficits such as AD. Longitudinal comparisons were made to describe long range effects of spaced-retrieval. Comparisons were made between data collected two years ago with current data collected on a selected number of those original participants, as well as, data collected on control participants (not previously exposed to the spaced-retrieval training task). With this information, researchers can make recommendations for the future use of spaced-retrieval.

Procedure

All training sessions were conducted at the adult day care facility. Prior to participating in the training session, informed consent was obtained from each participants' family member or legal guardian. We administered a total of 9 one-hour sessions. The sessions were held on alternate days within a three-week period. The activities that were conducted within each session are summarized in Table 5 and described briefly below.

**Days 1 and 2**: On the first day, we obtained informed consent from the participants. We administered 3 of the individual difference measures (FDS, MMSE, GDS, see Table 4). The two baseline measures of secondary memory were also
Table 5: **Summary of Experimental Procedure**

**Day 1:**
- Informed Consent obtained
- Prospective Name-Tag Task
- Forward Digit Span (FDS)
- Mini-Mental State Exam (MMSE)
- Geriatric Depression Scale (GDS)
- Prospective Posttest Name-Tag Task

**Day 2:**
- Shirt Color Naming Task
- Prospective Name-Tag Task
- Backward Digit Span (BDS)
- Subject Performed Task (SPT)
- Vocabulary Test
- Prospective Posttest Name-Tag Task

**Days 3-5:**
- Shirt Color Naming Task
- Prospective Name-Tag Task
- Delayed Recall (Days 4-5)
- Category Exemplar Pretest
- Target-Item Orientation Task (Exp. 2B)
- Spaced-Retrieval Training
  - Matrix Presented
  - Instructions Given
  - Expansion Trials
- Implicit Control Task/Category Exemplar Posttest
- Explicit Control Task/Prospective Posttest Name-Tag Task

**Day 6:**
- Shirt Color Naming Task
- Prospective Name-Tag Task
- Delayed Recall
- Final Delayed Recall
- Category Exemplar Pretest
- Target-Item Orientation Task (Exp. 2B)
- Spaced-Retrieval Training
  - Matrix Presented
  - Instructions Given
  - Expansion Trials
- Implicit Control Task/Category Exemplar Posttest
- Explicit Control Task/Prospective Posttest Name-Tag Task
**Days 7-8:**

Shirt Color Naming Task  
Prospective Name-Tag Task  
Delayed Recall  
Category Exemplar Pretest  
Target Item Orientation Task (Exp. 2B)  
Spaced-Retrieval Training  
   Matrix Presented  
   Instructions Given  
   Expansion Trials  
Implicit Control Task/Category Exemplar Posttest  
Explicit Control Task/Prospective Posttest Name-Tag Task

**Day 9:**

Shirt Color Naming Task  
Prospective Name-Tag Task  
Delayed Recall  
Final Delayed Recall/Recognition  
Demographic Questionnaire  
Prospective Posttest Name-Tag Task  
Certificate of Appreciation handed out
given: the prospective name-tag task (administered at the beginning and end of a session), and shirt-color task (administered at the end of one session and the beginning of the next), as described previously. On the second day, we administered 3 more individual difference measures (BDS, SPT, Vocabulary test, see Table 4). Again, the two baseline measures of secondary memory were given (the prospective name-tag task and the shirt-color task), just as on day 1.

**Days 3-5:** The two baseline measures of memory were given at the beginning of the session (prospective name-tag and shirt-color tasks). The category exemplar pretest was given prior to the spaced-retrieval training, as described previously. Then the spaced-retrieval training trials began. A lower limit of 30-min and an upper limit of 1-hour was set for the training session. After the training was complete (or the participant reported fatigue), the category exemplar posttest was given. Next, the posttest name-tag task would be administered. Responses were recorded on prepared sheets.

**Day 6:** The two baseline measures of secondary memory (the prospective name-tag task and the shirt-color task), were given at the beginning of the session, just as on the first five days of training. Next, the delayed recall task and the final delayed recall task for the set of 3 objects used during the training sessions were administered. Then the spaced-retrieval training trials would begin again.
for the same 3 objects (i.e., jacket, bracelet, carrot) just as on days 3, 4, and 5. The posttest name-tag task was administered as well. Responses were recorded on a prepared sheet.

**Days 7-8:** The two baseline measures of secondary memory were given at the beginning of the session (prospective name-tag and shirt-color tasks). The category exemplar pretest was given prior to the spaced-retrieval training, as described previously. Then the spaced-retrieval training trials began. After the training was complete (or the participant reported fatigue), the category exemplar posttest and the posttest name-tag task were administered. Responses were recorded on prepared sheets.

**Day 9:** The two baseline measures of secondary memory (the prospective name-tag task and the shirt-color task), were given at the beginning of the session (same as on the first eight days of training.) A Demographic Questionnaire was administered in order to obtain information on the participants’ own perception of the status of their health (see Appendix C). Next, the delayed recall task and the final delayed recall task for the same set of 3 objects used during the training sessions were administered. The posttest name-tag task was administered as well.

Ultimately, at the end of the last session, a "Certificate
of Appreciation" was handed out to each participant in order to show our gratitude for their hard work and enthusiasm.
RESULTS AND DISCUSSION FOR EXPERIMENT 1

Individual Difference Measures

Results of the individual difference measures, which were given to provide a cognitive profile of each of the participants, appear in Table 6. The MMSE was administered as a measure of mental status (total score of 30.) As can be seen in Table 6, the MMSE scores ranged from 13-22, indicating the presence of cognitive impairment.

All participants were tested on the Geriatric Depression Scale-Short Form because clinical depression is commonly observed in early AD. Scores in the present sample ranged from 4-12, indicating the presence of mild depression in 3 of the 4 participants. One participant (S1) scored within the mild-depressive range at the time of her original testing, but at re-test, her score doubled, bringing her into the moderate-depressive range. Another participant (S3) scored within the normal range, at the time of his original testing, but his score increased at re-test, bringing his score into the mild-depressive range.

On a short-form of the WAIS Vocabulary Subtest, participant's scores ranged from 1-15, which is suggestive of a deficiency in verbal ability, as well as in general intellectual functioning. Participants also completed the Forward Digit Span (FDS) and Backward Digit Span (BDS) tests.
Table 6: Summary of Individual Difference Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Participants</th>
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<tr>
<td></td>
<td>S1</td>
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<tr>
<td>Age</td>
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</tr>
<tr>
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<td>13</td>
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<tr>
<td>Geriatric Depression Scale</td>
<td>06</td>
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<tr>
<td>WAIS Vocabulary</td>
<td>04</td>
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<tr>
<td>Forward Digit Span</td>
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</tr>
<tr>
<td>Backward Digit Span</td>
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</tr>
<tr>
<td>Subject Performed Tasks</td>
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</tr>
<tr>
<td>Free Recall</td>
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</tr>
<tr>
<td>correct (s)</td>
<td>2</td>
</tr>
<tr>
<td>correct (l)</td>
<td>0</td>
</tr>
<tr>
<td>guesses</td>
<td>0</td>
</tr>
<tr>
<td>Cued Recall</td>
<td></td>
</tr>
<tr>
<td>correct (s)</td>
<td>2</td>
</tr>
<tr>
<td>correct (l)</td>
<td>2</td>
</tr>
<tr>
<td>guesses</td>
<td>4</td>
</tr>
</tbody>
</table>

Note. Free recall and cued recall were scored according to a strict (s) and lenient (l) criteria.
as estimates of short-term memory and working memory, respectively. The total score on the FDS is 9.0 and the BDS is 8.0. On the FDS, participants scored between 3.0-6.5, suggestive of deficits in short-term memory. On the BDS, their scores were relatively lower, ranging between 1.0-3.0, suggestive of deficits in working memory. This pattern of higher scores on the FDS, relative to the BDS, is typical for most healthy older adults. It is interesting to note that scores for both participants who were re-tested (S1-R and S3-R) dropped, overall, as expected.

As a measure of secondary memory ability, subjects were given the Subject-Performed Task (SPT) Measure (Cherry et al., 1998). As can be seen in Table 6, free recall scores were quite low, overall, regardless of whether the scoring criteria was strict or lenient. This finding is not surprising, given that AD persons typically show large deficits on measures of secondary memory (Cherry & Plauche, 1996). Performance improved somewhat when the items were represented as prompts in the cued-recall phase (for both strict and lenient scoring). Overall, these findings are suggestive of the presence of gross secondary memory impairment in the present sample. These results also reveal the importance of separating the scores into free-recall and cued-recall phases, as well as using the strict and lenient
criteria for scoring of participants' ability to remember objects and the actions performed with each one.

**Baseline Measures of Memory**

**Prospective Name-Tag Task.** For each participant, the name-tag task scores were summed for a total score from all 6 days (S1 and S3; max=24) and for all 9 days (for S1-R, S2, S3-R, and S4; max=36). The results are as follows: S1=9 pts. out of 6 days, S1-R=3 pts. out of 9 days, S2=4 pts. out of 9 days, S3=11 pts. out of 6 days, S3-R=8 pts. out of 9 days, S4=6 pts. out of 9 days. Most subjects did not initially remember to turn in their name-tags when first cued to do so, although 2 participants (S1 and S3) did show very slight improvements across sessions. Overall, most participants required several cues before they were able to remember to turn in their name-tags, indicating very little evidence of improvement over six and even nine days of training. Note that the scores for S1 and S3 dropped in overall points when these participants were re-tested, when compared to their original scores, even with the increase in the number of days from 6 to 9. Results of the name-tag task indicate that participants performed quite poorly overall, which is similar to results from past research and highlights the idea that repetition alone is not enough to produce memorial benefits for memory-impaired older adults.
**Shirt-Color Naming Task.** The results for the shirt-color naming task again emphasize the deficits found on the other secondary measures of memory. Only two participants remembered the color of the shirt one out of the nine days of training (and one of the participants reported they were guessing). These findings are quite similar to that found with the name-tag task, confirming that repetition alone is not enough to indicate memorial benefits in memory-impaired older adults.

**Summary of the Spaced-Retrieval Training Program**

One of our goals in Experiment 1 was to determine whether savings-in-relearning would occur in the experimental group when re-tested two years later (see Table 7). When comparing the results of S1 and S3 to their performances at re-test (S1-R and S3-R), we initially observed some instability in training over trials during re-test (i.e., increased number of failed trials). However, S1-R and S3-R both showed gradual improvements over training trials, in the longest retention duration achieved, just as expected. Thus, these participants were failing more often, initially, during re-test, but they were able to hold up longer during their training trials at re-test when compared to original training sessions. For example, S1-R was able to last for a longer period of duration during training by
Table 7: **Summary of Spaced-Retrieval Task Performance**

<table>
<thead>
<tr>
<th>Participants</th>
<th>S1</th>
<th>S1-R</th>
<th>S2</th>
<th>S3</th>
<th>S3-R</th>
<th>S4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Session 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FT</td>
<td>6</td>
<td>6</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>TT</td>
<td>22</td>
<td>19</td>
<td>24</td>
<td>15</td>
<td>17</td>
<td>19</td>
</tr>
<tr>
<td>LD</td>
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<td>150</td>
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<td>180</td>
<td>180</td>
<td>60</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>FT</td>
<td>3</td>
<td>7</td>
<td>6</td>
<td>3</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>TT</td>
<td>15</td>
<td>23</td>
<td>22</td>
<td>16</td>
<td>21</td>
<td>19</td>
</tr>
<tr>
<td>LD</td>
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<td>240</td>
<td>270</td>
<td>390</td>
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<td>180</td>
</tr>
<tr>
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<tr>
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<td>--</td>
<td>4</td>
<td>5</td>
<td>--</td>
<td>3</td>
<td>3</td>
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<td>21</td>
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<tr>
<td>FT</td>
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<td>1</td>
<td>--</td>
<td>2</td>
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</tr>
<tr>
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<td>600</td>
<td>600</td>
<td>--</td>
<td>600</td>
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</tr>
</tbody>
</table>

**Note.** FT=number of failed recall trials; TT=total number of recall trials attempted; LD=longest retention duration successfully achieved within each session (in seconds).
trial 2 and 3 (although failing more). S3-R did not hold up as well at re-test, compared to the first 3 sessions of original testing. However, by trials 4-6, S3-R was showing training results comparable to that of S1 at re-test. Overall, it is safe to say that there are only very modest signs of savings-in-relearning when examining scores from original testing to scores at re-test over a 1 and 2 year period of time. It is interesting to note that these participants showed signs of more serious dementia at re-test and scored higher on the GDS when compared with their original scores but were still able to fully complete longer training sessions.

When making comparisons between the experimental group and their matched control group, we found no effects of prior exposure to training. By the third training trial, both the experimental group and the control group were performing basically comparably. For example, by the third training session, both S3-R and S-4 are both failing the same number of times and lasting for the same amount of duration per training session. These comparisons verify that although S1-R and S3-R had prior exposure to training two years before, their performance at re-test does not show any indication that their performance was enhanced due to such prior exposure.
Implicit Memory for the Trained Object

Table 8 presents the results of the category exemplar pretest (administered as a manipulation check) and category exemplar posttest, our measure of implicit retention of the trained object. Our results indicate that approximately one third of the time participants did show evidence of the contribution of implicit retention to spaced-retrieval by generating the target word during posttest only. It is interesting to point out that this percentage increases to fifty percent of the time for two of the participants (S1-R and S-4) during an increased period of training (6 days of training compared to 3). These data provide further evidence of the contribution of implicit retention to spaced-retrieval, insofar as 3 of the 4 participants showed implicit memory for at least 1 item during 3 days of training, and at least 2 out of 6 items during 6 days of training (see Table 8).

Explicit Memory for the Trained Object

Immediate Recall/Recognition. At the end of each training session, participants were told to free recall (or recognize, if unable to recall) the target object that they had just been trained on. As can be seen in Table 9, only one of the participants was able to free recall the objects
Table 8: Implicit Memory Measures

<table>
<thead>
<tr>
<th>Participants</th>
<th>S1</th>
<th>S1-R</th>
<th>S2</th>
<th>S3</th>
<th>S3-R</th>
<th>S4</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>pre/post</td>
<td>pre/post</td>
<td>pre/post</td>
<td>pre/post</td>
<td>pre/post</td>
<td>pre/post</td>
</tr>
<tr>
<td>Day 3</td>
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<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
</tr>
<tr>
<td>Day 4</td>
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<td>0/1*</td>
<td>0/1*</td>
<td>0/0</td>
<td>0/1*</td>
<td>1/0</td>
</tr>
<tr>
<td>Day 5</td>
<td>0/1*</td>
<td>0/1*</td>
<td>0/0</td>
<td>0/1*</td>
<td>1/0</td>
<td>0/0</td>
</tr>
<tr>
<td>Day 6</td>
<td>-/-</td>
<td>0/0</td>
<td>0/0</td>
<td>-/-</td>
<td>0/0</td>
<td>0/1*</td>
</tr>
<tr>
<td>Day 7</td>
<td>-/-</td>
<td>0/0</td>
<td>1/1</td>
<td>-/-</td>
<td>0/1*</td>
<td>0/1*</td>
</tr>
<tr>
<td>Day 8</td>
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<td>0/1*</td>
<td>-/-</td>
<td>1/1</td>
<td>0/1*</td>
</tr>
</tbody>
</table>

Note: Score of 0 indicates SS did not name target object, whereas, a score of 1 indicates SS did name the target object. A score of 0/1* indicates implicit memory for the target objects.
Table 9: **Summary of Explicit Memory for the Trained Object**

<table>
<thead>
<tr>
<th></th>
<th>Immediate Recall/ Recognition</th>
<th>Delayed Recall</th>
<th>Final Delayed Recall/ Recognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1*</td>
<td>0/3</td>
<td>0</td>
<td>0/2</td>
</tr>
<tr>
<td>S1-R</td>
<td>1/5</td>
<td>0</td>
<td>0/3</td>
</tr>
<tr>
<td>S2</td>
<td>0/6</td>
<td>0</td>
<td>0/2</td>
</tr>
<tr>
<td>S3*</td>
<td>3/0</td>
<td>0</td>
<td>0/2</td>
</tr>
<tr>
<td>S3-R</td>
<td>1/5</td>
<td>0</td>
<td>0/2</td>
</tr>
<tr>
<td>S4</td>
<td>1/5</td>
<td>0</td>
<td>0/2</td>
</tr>
</tbody>
</table>

Note: Scores of 0 indicates the participant was not able to recall the object, and a score of 0/1 or more indicates the participant could recognize the object but not name the object. Scores for S1* and S3* are out of a total of 3 days of training. For S1-R, S2, S3-R, and S4 there were a total of 6 days of training and two separate days of final recall/recognition (on days 6 and 9).
and three other participants were able to free recall the object (one time each). The finding that most participants were only able to recognize rather than free recall the trained object moments after the session was completed is quite impressive. Despite the fact that they had between 15 and 24 training trials with the same object, they were still unable to free recall the object. This finding highlights the gross impairment in secondary memory in older persons with cognitive impairment, such as those with probable AD.

When the array of 9 items was re-presented for the recognition task, participants were quite able to select the correct object from among the others displayed on the table. In fact, every participant successfully recognized all target objects, suggesting that they all had knowledge of the target objects, but may have been unable to access this knowledge during free recall. Thus, the actual re-presentation of the stimulus item was sufficient to prompt their successful recognition of that item. Overall, these results compliment the SPT task data (see Table 6) where free recall performance was poorer than that of recall cued with the actual object.

**Delayed Recall.** Table 9 shows participants' performance on the delayed recall task. As can be seen, none of the participants were able to free recall the target
object when prompted to do so during the next training session. These findings compliment the immediate recall task in that most participants were unable to recall the objects they had just been trained on when they were only permitted to use free recall as an expression of memory. It seems evident that participants, as a whole, were less successful on the free recall task, but were altogether successful when allowed to recognize the objects from an array placed on the table. These results imply that free recall may be too resource-demanding for persons with mild/moderate AD, whereas the recognition task seems to be within their capacity to remember past information.

**Final Recall/Recognition.** As can be seen in Table 9, none of the participants were able to free recall the target items in the final recall/recognition task. However, all participants were able to either recognize two out of three objects or all three objects when the array of 11 items was re-presented and they were asked to select the target items from among the others displayed on the table. These data support the notion that participants retained the objects trained via spaced-retrieval (over a 6 and/or 9 day span), although, they were unable to free-recall that information. This finding replicates the results of the immediate recall/recognition task in that all participants had knowledge of the appropriate target objects, but appeared to

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be less able to access this knowledge in the free recall task. The results of the final delayed recall/recognition task also compliment the SPT task data in that participants were more likely to remember subject-performed actions when cued with the actual object (see Table 6).

Summary of Experiment 1

To summarize, Experiment 1 yielded three findings of interest. First, we found only slight evidence that the spaced-retrieval technique can show long-term effectiveness over a two year span. This modest evidence was only observed when making comparisons between our experimental group's original training trials and their training trials at re-test. We found no evidence of savings-in-relearning when making comparisons between the experimental group and their control group. Our results, however, do confirm the maintenance of spaced-retrieval training across sessions. By including three additional training sessions, we found that participants did become more proficient on the spaced-retrieval task over extended training, reflected by better memory performance by the fifth and sixth sessions.

Second, we found more supportive evidence which indicates that implicit memory does contribute to spaced-retrieval effects. Cherry et. al. (in press) found modest evidence to indicate that implicit memory contributes to spaced-retrieval effects. The results from the present
study confirm and extend those findings by including additional training sessions that allowed for further opportunity for implicit memory to be observed.

Third, the results of this study provide further support toward the idea that explicit memory for the target objects is notably observed during the recognition phase of the sessions. The results from this experiment indicate that when persons with cognitive impairments such as AD are allowed to recognize objects trained via spaced-retrieval rather than using free recall as a measure of explicit memory, their scores are substantially improved.

In general, the primary aim of Experiment 1 was to gain insight into the long-term effectiveness of spaced-retrieval as a mnemonic technique for persons with cognitive deficits such as AD. Our study indicates that a two year follow-up provides little evidence of the long-term effectiveness necessary if the spaced-retrieval technique is to be utilized in more applied settings in the future. It may be necessary to use booster-sessions several weeks and months after original training in order for the long-term benefits of spaced-retrieval training to be observed.
OVERVIEW OF EXPERIMENTS 2A AND 2B

In these experiments, our primary aim was to explore ways to enhance the effectiveness of spaced-retrieval. We used the target-item orientation task in an effort to improve performance on the spaced-retrieval training task. This information will allow for future applications of the technique for possible use in adult day care facilities. We also examined variations in the long-term effectiveness of spaced-retrieval by making comparisons between different longitudinal spans (6 month, 1 year) to pinpoint the maximum limits of spaced-retrieval's effectiveness as a mnemonic aid.

Experiment 2A

In Experiment 2A, we retested those participants from one year and six months ago, which include 3 participants that were introduced to the target-item orientation task and 3 that were control participants. We examined the long-term benefits of spaced-retrieval, as well as the mnemonic benefits of the target-item orientation task, by making comparisons in performance rates on those that were tested previously with their present performance.* We expected that those 3 participants introduced to the target-item orientation task would show greater savings-in-relearning compared to the 3 original control participants.

*S1, S3, S9 were tested 6 months ago, and S5, S7, S10 were tested one year ago.
Experiment 2B

In Experiment 2B, we included 3 new control and 3 new experimental participants (who had not been previously tested) in order to make comparisons with participants from Experiment 2A. Control participants from Experiment 2A and 2B were matched with the experimental participants on MMSE scores, age, and gender. The procedures for testing were the same for both Experiment 2A and 2B.

Procedure

All training sessions were conducted in the same manner as in Experiment 1 (see Table 5 for a summary of experimental procedures). The three experimental participants were given the target-item orientation task in order to replicate the expected benefits of this task on spaced-retrieval performance. A brief description follows.

**Target-Item Orientation Task.** The target-item orientation task was designed to enhance the mnemonic benefit of the spaced-retrieval training (Cherry & Simmons-D'Gerolamo, in press). This task involves introducing the to-be-remembered object, through specific conversation about the object, before the object is presented to the participant. For example, when "jacket" is the to-be-remembered object, questions such as: "You know, my favorite type of clothing is a jacket. I like to wear jackets when the weather is chilly. Do you like to wear
jackets? (Response were recorded.) I have several jackets, but my favorite jacket has a lot of buttons. Do you have a favorite jacket? (Response were recorded.) My favorite jacket has a lot of buttons and is very colorful. What does your favorite jacket look like?” (Response were recorded.)

We expected that the target-item orientation task would lead to decreases in the number of failed trials initially, and increases in the retention intervals observed during the spaced-retrieval training. See Figure 1 for findings/data from a pilot study conducted one year ago which provides evidence of the effectiveness of the target-item orientation task. In addition, we also expected that the mnemonic benefit may also be observed in the other dependent measures (immediate recall/recognition, delayed recall, and final recall/recognition).
RESULTS AND DISCUSSION FOR EXPERIMENT 2A AND 2B

Individual Difference Measures

Results of the individual difference measures that provide a cognitive profile of each participant, appear in Table 10A (for S1-S6: control participants) and 10B (for S7-S11; experimental participants). The MMSE scores, (a measure of mental status; total score 30), ranged from 15-22, confirming the presence of cognitive impairment. All participants were tested on the Geriatric Depression Scale-Short form. Scores in the present sample ranged from 3-8, indicating the presence of some mild depression in five of the eleven participants. Over a six month and one year span, there were no increases in the level of depression for the present sample.

On a short-form of the WAIS Vocabulary Subtest, participant’s scores ranged from 5-17, which is suggestive of a deficiency in verbal ability and in general intellectual functioning. Participants also completed the Forward Digit Span (max=9.0) and the Backward Digit Span (max=8.0). On the FDS, participants scored between 3.5-5.0, suggestive of deficits in short-term memory. On the BDS, their scores were relatively lower, ranging between 3.5-2.0, suggestive of deficits in working memory. This pattern of
Table 10A:  **Summary of Individual Difference Measures**

<table>
<thead>
<tr>
<th>Measure</th>
<th>S1</th>
<th>S1-R</th>
<th>S2</th>
<th>S3</th>
<th>S3-R</th>
<th>S4</th>
<th>S5</th>
<th>S5-R</th>
<th>S6</th>
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<td>17</td>
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<td>05</td>
<td>08</td>
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<td>05</td>
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<td>04</td>
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<td>12</td>
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<td>3.5</td>
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<td>2.5</td>
<td>2.5</td>
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<td>2.5</td>
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<tr>
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<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

**Note.** Free recall and cued recall were scored according to a strict (s) and lenient (l) criteria.
Table 10B: **Summary of Individual Difference Measures**

Experimental Participants

<table>
<thead>
<tr>
<th>Measure</th>
<th>S7</th>
<th>S7-R</th>
<th>S8</th>
<th>S9</th>
<th>S9-R</th>
<th>S10</th>
<th>S11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
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<td>84</td>
<td>85</td>
<td>86</td>
<td>87</td>
<td>77</td>
<td>70</td>
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<tr>
<td>Mini-Mental State</td>
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<td>17</td>
<td>17</td>
<td>15</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>Geriatric Depression Scale</td>
<td>07</td>
<td>04</td>
<td>04</td>
<td>05</td>
<td>05</td>
<td>08</td>
<td>05</td>
</tr>
<tr>
<td>WAIS Vocabulary</td>
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<td>11</td>
<td>13</td>
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<td>05</td>
<td>07</td>
<td>11</td>
</tr>
<tr>
<td>Forward Digit Span</td>
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<td>5.0</td>
<td>4.0</td>
<td>5.0</td>
<td>4.5</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Backward Digit Span</td>
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<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.0</td>
<td>2.0</td>
<td>3.5</td>
</tr>
</tbody>
</table>

**Subject Performed Tasks**

**Free Recall**

<table>
<thead>
<tr>
<th></th>
<th>S7</th>
<th>S7-R</th>
<th>S8</th>
<th>S9</th>
<th>S9-R</th>
<th>S10</th>
<th>S11</th>
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<td>0</td>
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<td>2</td>
</tr>
<tr>
<td>guesses</td>
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<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Cued Recall**

<table>
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<tr>
<th></th>
<th>S7</th>
<th>S7-R</th>
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<th>S9</th>
<th>S9-R</th>
<th>S10</th>
<th>S11</th>
</tr>
</thead>
<tbody>
<tr>
<td>correct (s)</td>
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<td>8</td>
<td>6</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>correct (1)</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>guesses</td>
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<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

**Note.** Free recall and cued recall were scored according to a strict (s) and lenient (1) criteria.
higher scores on the FDS, relative to the BDS, is typical for most healthy older adults (see also Experiment 1 results). It is interesting to note that scores for most participants who were re-tested dropped, overall, particularly on the BDS test, as expected.

Participants were given the Subject Performed Task (SPT) as a measure of secondary memory ability. As can be seen in Table 10A and 10B, free recall scores were quite low, as expected, regardless of whether the scoring criteria was strict or lenient. Performance somewhat improved once the items were represented as prompts in the cued-recall phase (for both strict and lenient scoring). These results confirm the presence of gross secondary memory impairment of the present sample.

Baseline Measures of Memory

**Prospective Name-Tag Task.** For each participant, we calculated a total score for the name-tag task by summing the scores across three days of training (for S1, S3, S5, S7, S9, and S11; max=24) and six days of training (for S1-R, S2, S3-R, S4, S5-R, S6, S7-R, S8, S9-R, and S10; max=36). Total scores on name-tag tasks for S1-S11, in order, were 6, 7, 8, 4, 5, 6, 7, 11, 9, 10, 5, 8, 5, 8, and 7 points. Most participants failed to return their name-tags when first cued, and required several prompts to do so. There was little evidence of improvement over the three and six days
of training. The indication that participants performed so poorly on the prospective name-tag task implies that repetition alone is not enough to produce a memorial benefit for older adults with probable AD. Rather, this is suggestive that spaced-retrieval is necessary in order to observe a memorial benefit. These results confirm and extend the findings from Experiment 1 (see page 63).

**Shirt-Color Naming Task.** Participants never recalled the color of the shirt worn by the experimenter in the previous training session on their own initiative, and seldom remembered when prompted to do so. For example, three participants (S7, S9, and S5) correctly recalled the shirt color on two different days once prompted. Two others (S1, S1-R, and S5-R) were correct on only one day (and both reported they were guessing). Nine of the participants were unable to recall the shirt color for any of the six and nine sessions, respectively. The relatively poor performance on the shirt-color task is consistent with the deficits observed in the free recall portion of the SPT task (see Table 10A and 10B). These results also confirm and extend similar findings from Experiment 1 (see page 64).

**Summary of the Spaced-Retrieval Training Program**

**Target-Item Orientation Task.** One of our goals in Experiment 2 was to determine if the target-item orientation task is an effective way to enhance performance on spaced-
retrieval training. We anticipated this task would prompt activation of the target-item in semantic memory, which would result in increased accessibility of that item. We also expected those that were exposed to the target-item orientation task would show fewer failed recall trials and longer retention of the target object compared to the control participants. Table 11A presents a summary of spaced-retrieval training for the control group (no exposure to the target-item orientation task), and Table 11B for the experimental group (exposure to the target-item orientation task.) Table 11C presents a summary of spaced-retrieval training for participants involved in Experiment 2B (the conceptual replication), which had no prior exposure to training (three control participants and two experimental participants).

When comparing the control participants from Table 11A (S1-R, S2, S3-R) to the experimental participants from Table 11B (S7-R, S9-R, S8), it is evident that all participants performed comparably on Session 1. However, by Session 2, the experimental group (S7-R, S9-R, S8) showed an advantage of having had the target-item orientation task. Specifically, these participants show fewer failed recall trials and a longer retention duration compared to that of S1-R, S2, and S3-R, whom did not receive the target-item.
Table 11A: **Summary of Spaced-Retrieval Task Performance**

<table>
<thead>
<tr>
<th></th>
<th>S1</th>
<th>S1-R</th>
<th>S2</th>
<th>S3</th>
<th>S3-R</th>
<th>S4</th>
<th>S5</th>
<th>S5-R</th>
<th>S6</th>
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<tr>
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<td>4</td>
<td>3</td>
<td>5</td>
<td>1</td>
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<tr>
<td>TT</td>
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<td>18</td>
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<td>16</td>
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<td>0</td>
<td>1</td>
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</tr>
<tr>
<td>TT</td>
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<td>13</td>
<td>--</td>
<td>14</td>
<td>17</td>
<td>--</td>
<td>14</td>
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</tr>
<tr>
<td>LD</td>
<td>--</td>
<td>600</td>
<td>480</td>
<td>--</td>
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</tbody>
</table>

**Note.** FT=number of failed recall trials; TT=total number of recall trials attempted; LD=longest retention duration successfully achieved within each session (in seconds).
<table>
<thead>
<tr>
<th>Session</th>
<th>S7</th>
<th>S7-R</th>
<th>S8</th>
<th>S9</th>
<th>S9-R</th>
<th>S10</th>
<th>S11</th>
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<tr>
<td><strong>FT</strong></td>
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<td>4</td>
<td>4</td>
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<td>2</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td><strong>TT</strong></td>
<td>18</td>
<td>18</td>
<td>16</td>
<td>14</td>
<td>15</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td><strong>LD</strong></td>
<td>330</td>
<td>210</td>
<td>180</td>
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<td>300</td>
<td>90</td>
<td>360</td>
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<td><strong>Session 2</strong></td>
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<td></td>
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<td></td>
</tr>
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<td><strong>FT</strong></td>
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<td>0</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td><strong>TT</strong></td>
<td>15</td>
<td>13</td>
<td>19</td>
<td>17</td>
<td>15</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td><strong>LD</strong></td>
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<td>480</td>
<td>420</td>
<td>360</td>
<td>480</td>
<td>180</td>
<td>360</td>
</tr>
<tr>
<td><strong>Session 3</strong></td>
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<td></td>
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</tr>
<tr>
<td><strong>FT</strong></td>
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<td>0</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td><strong>TT</strong></td>
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<td>14</td>
<td>19</td>
<td>13</td>
<td>16</td>
<td>19</td>
<td>12</td>
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<tr>
<td><strong>LD</strong></td>
<td>540</td>
<td>600</td>
<td>600</td>
<td>480</td>
<td>600</td>
<td>480</td>
<td>360</td>
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<td><strong>Session 4</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>FT</strong></td>
<td>--</td>
<td>0</td>
<td>1</td>
<td>--</td>
<td>1</td>
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<tr>
<td><strong>TT</strong></td>
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<tr>
<td><strong>LD</strong></td>
<td>--</td>
<td>600</td>
<td>600</td>
<td>--</td>
<td>600</td>
<td>600</td>
<td>--</td>
</tr>
<tr>
<td><strong>Session 5</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FT</strong></td>
<td>--</td>
<td>0</td>
<td>2</td>
<td>--</td>
<td>0</td>
<td>0</td>
<td>--</td>
</tr>
<tr>
<td><strong>TT</strong></td>
<td>--</td>
<td>14</td>
<td>18</td>
<td>--</td>
<td>14</td>
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</tr>
<tr>
<td><strong>LD</strong></td>
<td>--</td>
<td>600</td>
<td>540</td>
<td>--</td>
<td>600</td>
<td>600</td>
<td>--</td>
</tr>
<tr>
<td><strong>Session 6</strong></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>FT</strong></td>
<td>--</td>
<td>0</td>
<td>0</td>
<td>--</td>
<td>0</td>
<td>0</td>
<td>--</td>
</tr>
<tr>
<td><strong>TT</strong></td>
<td>--</td>
<td>14</td>
<td>14</td>
<td>--</td>
<td>14</td>
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<td><strong>LD</strong></td>
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<td>600</td>
<td>600</td>
<td>--</td>
<td>600</td>
<td>600</td>
<td>--</td>
</tr>
</tbody>
</table>

**Note.** FT=number of failed recall trials; TT=total number of recall trials attempted; LD=longest retention duration successfully achieved within each session (in seconds).
Table 11C: Summary of Spaced-Retrieval Task Performance

Conceptual Replication

<table>
<thead>
<tr>
<th></th>
<th>Control Participants</th>
<th>Experimental Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S2</td>
<td>S4</td>
</tr>
</tbody>
</table>

**Session 1**

- FT 4 4 3 4 5
- TT 17 15 15 16 16
- LD 180 180 180 180 90

**Session 2**

- FT 5 4 4 3 4
- TT 22 19 19 19 17
- LD 330 270 300 420 180

**Session 3**

- FT 3 2 2 2 3
- TT 19 17 19 19 19
- LD 480 480 600 600 480

**Session 4**

- FT 2 2 1 1 1
- TT 18 19 16 16 16
- LD 480 600 600 600 600

**Session 5**

- FT 0 1 0 2 0
- TT 13 17 14 18 14
- LD 480 600 600 540 600

**Session 6**

- FT 0 0 0 0 0
- TT 14 14 14 14 14
- LD 600 600 600 600 600

Note. FT=number of failed recall trials; TT=total number of recall trials attempted; LD=longest retention duration successfully achieved within each session (in seconds).
orientation task. These findings, together with the earlier Cherry & Simmons-D’Gerolamo (in press) report, confirm the usefulness of the target-item orientation task as a method for improving the effectiveness of spaced-retrieval training.

**Long-term Effectiveness.** Another goal in Experiment 2 (2A) was to provide further evidence on the long-term effectiveness of spaced-retrieval by performing a replication study with participants who had been previously exposed to spaced-retrieval training one year and six months ago. Participants S5, S7, and S10 were tested one year ago. Participants S1, S3, and S9 were tested approximately six months ago. Note that S11 was not available to participate in the re-test one year later, so therefore does not have follow-up date nor a control participant to compare to original data.

When making long-term comparisons of the spaced-retrieval training, it is apparent that participants do show signs of savings-in-relearning in that they are failing less initially, with longer retention durations, overall. For example, a comparison of S7 and S7-R yields evidence to indicate that prior spaced-retrieval training enhanced performance one year later, showing fewer failed recall trials initially, despite further progression of AD and a lower MMSE score (see Table 10A and 10B). When comparing
S7-R to S8 (the matched control), S7-R showed fewer failed recall trials (by Session 2 through 5) and longer trial-to-trial retention intervals across sessions.

As well, when comparing S5 and S5-R, and S9 and S9-R, similar results are found. When S5-R was compared to S6 (the matched control), S5-R showed fewer failed recall trials (even by Session 1) and longer trial-to-trial retention intervals across sessions. Thus, there is indication that savings-in-relearning occurred for these participants due to exposure to not only the spaced-retrieval training one year prior but also possible prior exposure to the target-item orientation task.

**Conceptual Replication.** A final goal was to provide a conceptual replication of effectiveness of the target-item orientation task observed in Experiment 2A. In Experiment 2B, the three control participants (S2, S4, S6) were exposed to spaced-retrieval training for the first time, but were not given the target-item orientation task. The two experimental participants (S8 and S10) were exposed to both spaced-retrieval training and the target-item orientation task (see Table 11C). Each participant was originally chosen as a matched control for participants that had been previously exposed to spaced-retrieval training (see Table 11A and 11B) according to MMSE scores, age, and sex, but
will be compared to one another for the replication portion of the study.

Overall, the results of the conceptual replication indicate only modest evidence that exposure to the target-item orientation task enhanced spaced-retrieval performance. For example, when making comparisons between the control participant (S2) and the experimental participant (S8), it is apparent that exposure to the target-item orientation task did enhance S8's performance, insofar as there were fewer failed trials, initially, and longer retention duration, overall. However, the same results are not so clear when making comparisons with the other experimental participant (S10). This participant did not show benefits of exposure to the task when compared to the other control participants. We speculate that because this participant (S10) scored lower on the MMSE compared to the control participants, S10 was not able to benefit from exposure to the target-item orientation task, as predicted. It seems likely that the target-item orientation task may be most effective within a particular range of MMSE scores. Further research to clarify the boundary conditions for the beneficial effects of the target-item orientation task seems warranted.

In short, modest effects of exposure to the target-item orientation task can be seen when making broad comparisons
between the control group (Table 11A) and the experimental group (Table 11B). Benefits of exposure to the task are more evident when comparisons are made between the experimental group at re-test versus their original scores. Benefits are also more apparent when each experimental participant is compared to their matched control participant. For example, both of the experimental participants, S7-R and S9-R, had fewer failed recall trials and longer retention duration, overall, compared to their matched control participants. It seems warranted for future research to examine ways to pin-point those participants that would most benefit from exposure to the target-item orientation task.

Implicit Memory for the Trained Object

Tables 12A and 12B present the results of the category exemplar pretest and posttest, our measure of implicit retention of the trained object. Our results indicate that approximately one third of the time participants did show evidence of the contribution of implicit retention to spaced-retrieval, in that they generated the target word during posttest only, as predicted. It is interesting to note this percentage increases to fifty percent of the time for six of the participants during an increased period of training (6 days of training vs. 3). These data provide more substantial evidence of the contribution of implicit
Table 12A: **Implicit Memory Measures**

<table>
<thead>
<tr>
<th>Participants</th>
<th>S1</th>
<th>S1-R</th>
<th>S2</th>
<th>S3</th>
<th>S3-R</th>
<th>S4</th>
<th>S5</th>
<th>S5-R</th>
<th>S6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pre/post</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 3</td>
<td>0/0</td>
<td>0/1*</td>
<td>0/0</td>
<td>0/0</td>
<td>0/1*</td>
<td>0/1*</td>
<td>1/1</td>
<td>0/1*</td>
<td>0/0</td>
</tr>
<tr>
<td>Day 4</td>
<td>0/1*</td>
<td>1/1</td>
<td>0/1*</td>
<td>1/0</td>
<td>0/1*</td>
<td>0/1*</td>
<td>1/0</td>
<td>0/1*</td>
<td>0/1*</td>
</tr>
<tr>
<td>Day 5</td>
<td>0/0</td>
<td>0/1*</td>
<td>0/0</td>
<td>1/1</td>
<td>1/1</td>
<td>0/0</td>
<td>1/1</td>
<td>0/0</td>
<td>0/1*</td>
</tr>
<tr>
<td>Day 6</td>
<td>-/-</td>
<td>0/0</td>
<td>1/1</td>
<td>-/-</td>
<td>0/0</td>
<td>0/0</td>
<td>-/-</td>
<td>0/1*</td>
<td>1/1</td>
</tr>
<tr>
<td>Day 7</td>
<td>-/-</td>
<td>0/1*</td>
<td>0/1*</td>
<td>-/-</td>
<td>0/1*</td>
<td>0/1*</td>
<td>-/-</td>
<td>0/1*</td>
<td>0/1*</td>
</tr>
<tr>
<td>Day 8</td>
<td>-/-</td>
<td>0/1*</td>
<td>0/1*</td>
<td>-/-</td>
<td>1/1</td>
<td>0/0</td>
<td>-/-</td>
<td>1/0</td>
<td>0/1*</td>
</tr>
</tbody>
</table>

**Note.** Score of 0 indicates SS did not name target object, whereas, a score of 1 indicates SS did name the target object. A score of 0/1* indicates the presence of implicit memory for the target object.
Table 12B: **Implicit Memory Measures**

<table>
<thead>
<tr>
<th>Participants</th>
<th>S7</th>
<th>S7-R</th>
<th>S8</th>
<th>S9</th>
<th>S9-R</th>
<th>S10</th>
<th>S11</th>
</tr>
</thead>
<tbody>
<tr>
<td>pre/post</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>Day 3</td>
<td>1/0</td>
<td>0/0</td>
<td>0/1*</td>
<td>0/1*</td>
<td>0/0</td>
<td>0/0</td>
<td>1/1</td>
</tr>
<tr>
<td>Day 4</td>
<td>1/1</td>
<td>0/1*</td>
<td>0/1*</td>
<td>0/0</td>
<td>0/1*</td>
<td>0/0</td>
<td>0/1*</td>
</tr>
<tr>
<td>Day 5</td>
<td>1/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/1*</td>
<td>0/1*</td>
<td>0/1*</td>
<td>0/0</td>
</tr>
<tr>
<td>Day 6</td>
<td>--</td>
<td>0/1*</td>
<td>0/1*</td>
<td>--</td>
<td>0/0</td>
<td>0/1*</td>
<td>--</td>
</tr>
<tr>
<td>Day 7</td>
<td>--</td>
<td>0/1*</td>
<td>1/1</td>
<td>--</td>
<td>0/1*</td>
<td>0/1*</td>
<td>--</td>
</tr>
<tr>
<td>Day 8</td>
<td>--</td>
<td>0/0</td>
<td>0/1*</td>
<td>--</td>
<td>0/1*</td>
<td>0/1*</td>
<td>--</td>
</tr>
</tbody>
</table>

**Note.** Score of 0 indicates SS did not name target object, whereas, a score of 1 indicates SS did name the target object. A score of 0/1* indicates the presence of implicit memory for the trained objects.
retention to spaced-retrieval, in that each participant showed implicit memory of at least one item during three days of training and three out of six items during six days of training (see Table 12A and 12B). As well, it is important to note that these findings replicate the Experiment 1 results for implicit memory.

Explicit Memory for the Trained Object

**Immediate Recall/Recognition.** At the end of each training session, participants were asked to free-recall (or recognize) the target object they had just been trained on. As can be seen in Tables 13A and 13B, half of the participants were unable to free-recall the trained objects. The other half (S1-R, S5-R, S6, S7-R, S8, and S9-R) were more successful at free-recall of the trained object. It is interesting to note that most of the participants that performed quite well on the free recall task were participants that have had prior exposure to the spaced-retrieval training, and three of those participants (S7-R, S8, S9-R) had exposure to the target-item orientation task.

In regards to the recognition task, when the array of objects was re-presented the other participants (that were not able to free recall any of the trained objects) were consistently able to recognize all target objects, further
Table 13A: **Summary of Explicit Memory for the Trained Object**

<table>
<thead>
<tr>
<th></th>
<th>Immediate Recall/Recognition</th>
<th>Delayed Recall</th>
<th>Final Delayed Recall/Recognition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S1</strong></td>
<td>2/1</td>
<td>1</td>
<td>2/1</td>
</tr>
<tr>
<td><strong>S1-R</strong></td>
<td>6/0</td>
<td>2</td>
<td>0/3</td>
</tr>
<tr>
<td><strong>S2</strong></td>
<td>2/4</td>
<td>0</td>
<td>0/3</td>
</tr>
<tr>
<td><strong>S3</strong></td>
<td>0/3</td>
<td>0</td>
<td>0/3</td>
</tr>
<tr>
<td><strong>S3-R</strong></td>
<td>0/6</td>
<td>0</td>
<td>0/3</td>
</tr>
<tr>
<td><strong>S4</strong></td>
<td>1/5</td>
<td>1</td>
<td>1/2</td>
</tr>
<tr>
<td><strong>S5</strong></td>
<td>3/0</td>
<td>3</td>
<td>2/1</td>
</tr>
<tr>
<td><strong>S5-R</strong></td>
<td>6/0</td>
<td>3</td>
<td>2/1</td>
</tr>
<tr>
<td><strong>S6</strong></td>
<td>6/0</td>
<td>3</td>
<td>1/2</td>
</tr>
</tbody>
</table>

**Note.** Scores of 0 indicate the participant was not able to recall the object, and a score of 0/1 or more indicates the participant could recognize the object but not name the object. Scores for **S1**, **S3**, and **S5** are out of a total of 3 days of training. For **S1-R**, **S2**, **S3-R**, **S4**, **S5-R**, and **S6** there were a total of 6 days of training and two separate days of final recall/recognition (on days 6 and 9).
Table 13B: **Summary of Explicit Memory for the Trained Object**

<table>
<thead>
<tr>
<th></th>
<th>Immediate Recall/Recognition</th>
<th>Delayed Recall</th>
<th>Final Delayed Recall/Recognition</th>
</tr>
</thead>
<tbody>
<tr>
<td>S7*</td>
<td>2/1</td>
<td>1</td>
<td>1/2</td>
</tr>
<tr>
<td>S7-R</td>
<td>5/1</td>
<td>5</td>
<td>2/1</td>
</tr>
<tr>
<td>S8</td>
<td>6/0</td>
<td>2</td>
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<tr>
<td>S9*</td>
<td>1/2</td>
<td>0</td>
<td>0/3</td>
</tr>
<tr>
<td>S9-R</td>
<td>4/2</td>
<td>2</td>
<td>1/2</td>
</tr>
<tr>
<td>S10</td>
<td>3/3</td>
<td>2</td>
<td>0/3</td>
</tr>
<tr>
<td>S11*</td>
<td>2/1</td>
<td>0</td>
<td>0/3</td>
</tr>
</tbody>
</table>

**Note.** Scores of 0 indicate the participant was not able to recall the object, and a score of 0/1 or more indicates the participant could recognize the object but not name the object. Scores for S7*, S9*, and S11* are out of a total of 3 days of training. For S7-R, S8, S9-R, and S10 there were a total of 6 days of training and two separate days of final recall/recognition (on days 6 and 9).
suggesting that they had knowledge of the target objects, but may have been unable to access this knowledge during free-recall. Therefore, the actual re-presentation of the stimulus item was adequate for prompting their successful recognition of that item. Overall, these results compliment the results from Experiment 1 where free recall performance was poorer, overall, than that of cued recall with the trained object. However, these results provide modest evidence that prior exposure to spaced-retrieval training and exposure to the target-item orientation task may enhance performance on free-recall of the trained object.

**Delayed Recall.** Tables 13A and 13B show participants' performance on the delayed recall task. As seen, only one participant (S7-R) was able to free recall more than half of the target objects when prompted to do so during the next training session. It is significant to note that this participant not only had prior exposure to spaced-retrieval training but also had exposure to the target-item orientation task. These results suggest prior exposure may in fact play an important role in the delayed recall of the trained object. Other participants were not as successful at free recall of the trained object, although their performance is more consistent with the results of Experiment 1, overall, in that they are having difficulty
when only permitted to use free-recall as an expression of memory.

**Final Recall/Recognition.** As seen in Tables 13A and 13B, nine of the participants were able to free-recall at least one or more of the target objects. Other participants that were not able to free recall any of the trained objects were all able to recognize the objects from among the others displayed on the table. Of those participants that were re-tested, all but one of their performances improved at re-test, indicating that expansion of the training sessions was beneficial.

These results differ from the results from Experiment 1, in that participants in this experiment are better able to free-recall the trained target objects. It is also evident that additional training sessions (4-6) improve free-recall during the last day of testing. Overall, these results provide new information regarding the benefits of additional sessions and possible benefits of exposure to the target-item orientation task regarding explicit memory for the trained objects.

**Summary of Experiment 2A and 2B**

Experiment 2A and 2B offered several findings of interest worth noting. First, we found evidence to confirm that prior exposure to spaced-retrieval does impact future performance, regarding savings-in-relearning, particularly
when follow-up training is accomplished one year or less after original training. On the other hand, we take into consideration that there was not a clear difference in performance between participants tested six months ago versus one year ago. The long-term effectiveness of spaced-retrieval could therefore be re-examined in future research to determine more specific time frames which could suggest when prior exposure remains most effective. This knowledge could also help determine appropriate time frames for necessary booster sessions when spaced-retrieval is used in more applied settings.

Second, there was some evidence that prior exposure to the target-item orientation task improves performance more so than only prior exposure to spaced-retrieval, as predicted. Future research may include larger sample sizes to help determine the effectiveness of prior exposure to the target-item orientation task. As well, future research may address the issue of the appropriate range of MMSE scores where the target-item orientation task is most effective.

Although this study indicates only a modest advantage for those participants who were exposed to the target-item orientation task, this study confirms spaced-retrieval training can be made more effective by the addition of task-relevant orienting activities prior to training (see Cherry & Simmons-D’Gerolamo, in press). One direction for future
research would be to determine how beneficial the target-item orientation task could be when adapted for use by service providers, or even caregivers in order to address the real-world, practical memory problems faced by older adults with probable AD.

Third, we found additional evidence that implicit memory does contribute to spaced-retrieval effects, and was more evident with additional training sessions, as predicted. These results not only confirm similar findings from Cherry et. al. (in press), but replicate the findings from Experiment 1. We also found that explicit memory for the trained object was observed when prior exposure to spaced-retrieval training had occurred. This finding suggests that performance on all measures of explicit memory were enhanced due to additional training sessions, as well as, prior exposure to the spaced-retrieval training task. Future research could examine ways to provide additional training sessions of the spaced-retrieval training task, as well as booster sessions, as ways to make optimal use of spaced-retrieval training in more applied settings.

In general, these findings are noteworthy in that they shed new light on ways to enhance performance of spaced-retrieval training, provide direction for future research regarding the long-term benefits of spaced-retrieval as a memory intervention, and provide new information regarding
optimal time frames for the applied use of spaced-retrieval training as a method of intervention for cognitively-impaired older adults suffering from AD.
OVERVIEW OF EXPERIMENTS 3A AND 3B

In Experiments 3A and 3B, we examined the real world application of spaced-retrieval in an adult day care setting to determine whether the spaced-retrieval technique could be used as a method to decrease the frequency of typical problem behaviors in the day care setting. We speculated that the spaced-retrieval technique may be useful in real world settings, such as adult day care facilities, to decrease problem behaviors typical of those persons with AD. These experiments provide information on the functional use of the spaced-retrieval technique to possibly lessen the occurrence of those difficult behaviors seen in adult day care settings.

Experiment 3A

The purpose of Experiment 3A was to gather information on typical problem behaviors in real world settings by surveying the staff at a local adult day care facility (St. Francis House). To increase the ecological validity of our procedure, we asked the staff to identify those problem behaviors that could be targeted in our training program.

Participants

The staff at St. Francis House included two Licensed Practical Nurses, a social worker, an activity therapist, a horticulturist, and several assistants. The survey
requested that staff identify and rate the importance of improving various difficult behaviors typical in their adult day care setting (see Appendix B).

**Procedure**

We asked the staff to rate the importance of improving five difficult behaviors through a behavioral intervention program for clients at St. Francis House (see Appendix B). On the questionnaire, the five difficult behaviors included: asking the same questions all day; asking where the restroom is located; asking what time it is; asking when they will be picked up; being confused about where they are. To allow the staff an opportunity to describe other difficult behaviors that may not have been included in the first question, we asked them to further identify specific, difficult behaviors that they would like to see improved through an intervention program.

**Summary of Experiment 3A**

Based on our questionnaire and informal conversations with staff, we found that the difficult behavior identified as the most important to modify through behavioral intervention was the problem with clients that continue throughout the day to ask when their ride is coming to pick them up. Therefore, we constructed our training program in accordance with our results from the questionnaire.

**Experiment 3B**

Based on the results of the staff survey in Experiment 3A, we selected repetitive questions asked by the clients
about when their ride is coming to pick them up as the most difficult behavior. We then used an adapted version of the spaced-retrieval technique to decrease the frequency of the identified difficult behavior. We used an experimental format during the first three spaced-retrieval training sessions (days 3-5) to familiarize the participants with the target object. We then used an applied format during the next 3 training sessions (days 6-8) to establish real world significance of the training procedures.

Participants

A total of four persons with probable AD were recruited from St. Francis House (see Experiment 1, General Method section, for stipulations for participation). All participants were identified by staff as displaying signs of the identified difficult behavior.

Procedure

Initial training sessions were conducted individually at the adult day care facility. Prior to participating in the training sessions, informed consent was obtained from each participants' family member or legal guardian. For two of the four participants, we gathered initial baseline information for a two week period to determine the frequency of the identified difficult behavior during a regular scheduled day. This baseline information allowed us to measure any reduction of the difficult behavior.

For the other two participants, we gathered initial baseline information for only a portion of the two week
period. For example, the third participant, S3, was unable to answer any of the questions on the MMSE measure and was unable to be redirected by staff with continued daily increase in confusion and anxiety. Ultimately, due to this unmanageable behavior, S3 was transitioned to a nursing home for a safer environment. Therefore, we were only able to gather some of the initial baseline data for this participant. The fourth participant, S4, was also monitored for baseline data, but did not meet criteria for the problem behavior, as S4 was unable to ambulate independently, and did not exhibit any of the nonverbal behaviors to indicate the problem behavior.

Days 1 and 2: On the first day, we obtained informed consent from the participants. We administered 3 of the individual difference measure (FDS, MMSE, GDS, see Table 4). The two baseline measures of secondary memory were also given (on days 1-8): the prospective name-tag task (administered at the beginning and end of a session), and shirt-color task (administered at the end of one session and the beginning of the next), as described previously. On the second day, we administered 3 more individual difference measures (BDS, SPT, Vocabulary test, see Table 4). Again, the two baseline measures of secondary memory were given (the prospective name-tag task and the shirt-color task), just as on day one. For a detailed description of the Individual Difference Measures and the Baseline Measures
of Memory, see the General Method section of Experiment 1 (p. 39).

**Days 3-5:** We used the same spaced-retrieval training procedures from Experiment 1 (see p. 46). Revisions in the original spaced-retrieval program included different objects used for training. We used an audible-clock as the target item in order to apply the training procedures to real-world problem behavior. The distracter objects included items one would find on a desk-top (i.e., in addition to the audible-clock, we included a calculator, remote control, stapler, white out, tape, hole punch, ruler, and a large paper clip).

On each day of training, the “audible-clock” was designated as the “correct” item; the experimental task was for the participant to select the correct item and present it to the experimenter on cue. For example, “When I say, what time is your ride coming, you are to pick up the clock and tell me.” (The audible-clock was set for the correct time for each of the participants.) The trained target response consisted of a visual cue associated with a correct motor response. Both had to be demonstrated within a trial in order to be considered a success. All responses were recorded on prepared sheets.

**Days 6-8:** On each day of training, during the applied training trials, the “audible-clock” was designated as the “correct” item; the task was now for the participant to take the “audible-clock” out of a black waist-pouch placed around their waist, and present it to the experimenter on
cue. For example, "When I say, what time is your ride coming, you are to take out your clock from the pouch and tell me." The trained target response consisted of a visual cue associated with a correct motor response. Both had to be demonstrated within a trial in order to be considered a success. We used the same procedures from Experiment 1, although the object was placed in a leather waist-pouch that the participant wore around their waist, rather than placed on a board, in order to adapt the spaced-retrieval training program to applied format. All responses were recorded on set sheets.

**Days 9-14:** We gathered post-training data to measure the reduction in frequency of the difficult behavior. We observed the participants for a two week period before and after training, while they were participating in regular group activities at St. Francis House. During the post-training observation period, we monitored participants' general behaviors. In addition, we asked the participants when their ride was coming to pick them up. Participants were asked this question once in the morning (i.e., between 8:00 am and 12:00 noon) and once in the afternoon (i.e., between 12:00 noon and 4:00 pm) on each day of post-training observation. We made note of how many times the participant was able to spontaneously locate their audible-clock in their waist-pouch and verbally tell us/show us what time their ride was coming.
The purpose of this task (i.e., questioning the participant about when their ride is coming) was to ensure that all participants remembered the trained response of retrieving the audible clock from their waist pouch. Thus, this task essentially served as a post experimental manipulation check. A response was scored as correct if the participant mentioned their waist pouch/clock or retrieved the audible clock from the waist pouch to show the experimenter. We compared the frequency of the difficult behavior before the training began and after training was complete. All responses were recorded on prepared sheets.
RESULTS AND DISCUSSION FOR EXPERIMENT 3B

Individual Difference Measures

Results of the individual difference measures appear in Table 14. The MMSE was administered (total score of 30). As can be seen in Table 14, the MMSE scores were 10 (S1) and 11 (S2), respectively, indicating the presence of substantial cognitive impairment. Participants’ scores on the GDS were 09 and 10, respectively, indicating mild depression for each participant.

On a short-form of the WAIS Vocabulary Subtest, both participants scores were 07, which is suggestive of a deficiency in verbal ability as well as intellectual functioning. Participants also completed the FDS and BDS. Scores were 3.5 for the FDS and 1.0 for the BDS for both participants, consistent with the typical pattern of higher scores on the FDS compared to the BDS. It is also worth noting that these two participants’ scores are much lower on all measures of cognitive function compared to the participants’ scores in Experiments 1 and 2.

Participants were also given the SPT Measure. As can be seen in Table 14, both participants scored 0 points in the free-recall category, but performed somewhat better on the recognition portion of the measure. However, performance was quite poor overall, compared to participants in Experiments 1 and 2. The changes in performance seen may
Table 14: Summary of Individual Difference Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Participants</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SI</td>
<td>S2</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>80</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>Mini-Mental State</td>
<td>10</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Geriatric Depression Scale</td>
<td>09</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>WAIS Vocabulary</td>
<td>07</td>
<td>07</td>
<td></td>
</tr>
<tr>
<td>Forward Digit Span</td>
<td>3.5</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>Backward Digit Span*</td>
<td>1.0</td>
<td>1.0</td>
<td></td>
</tr>
</tbody>
</table>

Subject Performed Tasks

Free Recall
- correct (s): 0
- correct (l): 0
- guesses: 0

Cued Recall
- correct (s): 5
- correct (l): 0
- guesses: 5

Note. Free recall and cued recall were scored according to a strict (s) and lenient (l) criteria. *BDS score of 1.0 indicates that participant was correct on only one trial of a two-digit sequence.
be attributed to a more advanced level of dementia as suggested by the low MMSE scores for these two participants. Overall, these results confirm the presence of gross secondary memory impairment in the present sample.

**Baseline Measures of Memory**

**Prospective Name-Tag Task.** For each participant, the name-tag task scores were summed for a total score from all 9 days (max. total score=36 points). The results were zero for both S1 and S2. Both were unable to remember to turn in their name-tag on cue and there was no improvement over nine days of training. These are interesting results, as they highlight the idea that repetition alone is not enough to produce a memorial benefit for memory-impaired older adults. It seems that spaced-retrieval, on the other hand, is necessary in order to observe memorial benefits, confirming results found from previous Experiments 1 and 2.

**Shirt-Color Naming Task.** As can be seen, neither participant was able to name the color of shirt when cued to do so. Even after 9 days of training, participants were still unable to recall the color of shirt from the previous training session. This result is consistent with the deficits on the other secondary memory measures given here (i.e., SPT task, see Table 14). Overall, the findings from the shirt color task were quite similar to that of the name-tag task. Together, these results point to the notion that spaced-retrieval training is necessary to provide memorial
benefits in memory impaired older adults where repetition alone will not.

**Implicit and Explicit Memory for the Trained Object**

There was only modest evidence of implicit memory for the trained object, but for only one of the two participants (S2). It is interesting to note that both participants, in particular, S1, exhibited behaviors to indicate evidence of anomia, the loss of word finding ability. Their inability to perform on verbal measures of memory may have contributed to the decrease in implicit retention of the trained object. See Table 15 for results of the implicit measure of memory.

For the explicit measure of memory, both participants showed the ability to recognize the trained object during immediate recall/recognition and the final recall/recognition (see Table 16). However, S1 and S2 were both showing deficiencies in all areas of recall measures of memory, as expected. The results of the explicit memory task extend the findings from Experiments 1 and 2, and suggest that advanced levels of dementia seen in these participants may prevent adequate performance on a variety of measures of memory involving recall. Further discussion of this point will be delayed until the results of the spaced-retrieval training is reported.
Table 15: Implicit Memory Measures

<table>
<thead>
<tr>
<th>Participants</th>
<th>S1</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pre/post</td>
<td>pre/post</td>
</tr>
<tr>
<td>Day 3</td>
<td>0/0</td>
<td>0/0</td>
</tr>
<tr>
<td>Day 4</td>
<td>0/0</td>
<td>0/1*</td>
</tr>
<tr>
<td>Day 5</td>
<td>0/0</td>
<td>0/0</td>
</tr>
<tr>
<td>Day 6</td>
<td>0/0</td>
<td>0/1*</td>
</tr>
<tr>
<td>Day 7</td>
<td>0/0</td>
<td>1/1</td>
</tr>
<tr>
<td>Day 8</td>
<td>0/0</td>
<td>0/0</td>
</tr>
</tbody>
</table>

Note. Score of 0 indicates SS did not name target object, whereas, a score of 1 indicates SS did name the target object. A score of 0/1* indicates the presence of implicit memory for the trained objects.
Table 16: **Summary of Explicit Memory for the Trained Object**

<table>
<thead>
<tr>
<th>Participants</th>
<th>S1</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate Recall/Recognition</td>
<td>0/2</td>
<td>0/3</td>
</tr>
<tr>
<td>Delayed Recall</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Final Delayed Recall/Recognition</td>
<td>0/1*</td>
<td>0/1*</td>
</tr>
</tbody>
</table>

**Note.** Scores of 0 indicate the participant was not able to recall the object, and a score of 0/1 or more indicates the participant could recognize the object but not name the object. Scores for S1 and S2 are out of a total of 3 days of training. Scores of 0/1* are only based on the recall/recognition of one object.
Spaced Retrieval Training Trials for Experiment 3B

Results from Experiment 3B (see Table 17) provide new evidence on the usefulness of the spaced-retrieval technique when used in adapted form to improve recall in memory-impaired older adults with problem behaviors, such as asking repetitive questions throughout the day, which is a typical behavioral problem in the adult day care setting. These findings replicate the positive effects of spaced-retrieval training, and confirm previous findings in that there were fewer failures across sessions (experimental and applied sessions) and longer retention duration across trials. It is interesting to note that positive effects were found even though MMSE scores were much lower than other participants involved in Experiments 1 and 2. In other words, this data also provides suggestive evidence of the maintenance of spaced-retrieval training effects over time. Participants became more proficient on the training task over extended training, reflected by better performance in the third and sixth training sessions in spite of lower MMSE scores. Overall, these results confirm that spaced-retrieval training is efficacious for participants who are more advanced in the progression of dementia, therefore likely to be useful for adaptation in applied settings, as predicted.
Table 17: Summary of Spaced-Retrieval Training Trials

<table>
<thead>
<tr>
<th>Participants</th>
<th>S1</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Days 1–3:</strong> (Experimental Training Sessions)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Session 1</td>
<td>FT</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>TT</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>LD</td>
<td>120</td>
</tr>
<tr>
<td>Session 2</td>
<td>FT</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>TT</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>LD</td>
<td>180</td>
</tr>
<tr>
<td>Session 3</td>
<td>FT</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>TT</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>LD</td>
<td>360</td>
</tr>
<tr>
<td><strong>Days 4–6:</strong> (Applied Training Sessions)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Session 4</td>
<td>FT</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>TT</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>LD</td>
<td>240</td>
</tr>
<tr>
<td>Session 5</td>
<td>FT</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>TT</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>LD</td>
<td>300</td>
</tr>
<tr>
<td>Session 6</td>
<td>FT</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>TT</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>LD</td>
<td>480</td>
</tr>
</tbody>
</table>

**Note.** FT=number of failed recall trials; TT=total number of recall trials attempted; LD=longest retention duration successfully achieved within each session (in seconds).
Baseline Data Pre-Training

The baseline data was gathered during a two week period, prior to spaced-retrieval training, in order to determine the amount of time each participant displayed patterns of the problem behavior. To provide a broad description of participants' behavioral repertoire, we monitored them on the following non-verbal behaviors: wandering, sitting alone, staring outside, looking at their watch, looking out of the door/window, trying to get out of the door, pulling on the door knob, walking out of the front door, increased confusion and anxiety, unable to sit with the group. Verbal behaviors include: asking when their ride is coming, asking where their husband/wife is, asking if their husband/wife called. See Table 18 for baseline data results from pre-training and post-training.

Baseline Data Post-Training

After two weeks of spaced-retrieval training, participants were then monitored to observe for changes in their verbal and nonverbal behaviors regarding repetitive questions about when their ride is coming to pick them up. For the post-training observations, participants wore their waist/purse pouch (for S1) and waist pouch (for S2) throughout the day in order for us to determine if the training had any impact on their behavior. Participants were monitored while they participated in their daily routine at the day care facility. As a manipulation check,
<table>
<thead>
<tr>
<th>Activity</th>
<th>S1 pre</th>
<th>S1 post</th>
<th>S2 pre</th>
<th>S2 post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wandering</td>
<td>19</td>
<td>07</td>
<td>41</td>
<td>11</td>
</tr>
<tr>
<td>Sitting alone</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Sitting alone staring outside</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>06</td>
</tr>
<tr>
<td>Looking at watch</td>
<td>19</td>
<td>09</td>
<td>32</td>
<td>07</td>
</tr>
<tr>
<td>Looking out door/window</td>
<td>23</td>
<td>07</td>
<td>33</td>
<td>09</td>
</tr>
<tr>
<td>Trying to get out of door</td>
<td>03</td>
<td>01</td>
<td>04</td>
<td>02</td>
</tr>
<tr>
<td>Pulling on door knob</td>
<td>0</td>
<td>0</td>
<td>01</td>
<td>01</td>
</tr>
<tr>
<td>Walked outside</td>
<td>02</td>
<td>01</td>
<td>02</td>
<td>01</td>
</tr>
<tr>
<td>Increased confusion and anxiety</td>
<td>0</td>
<td>0</td>
<td>01</td>
<td>01</td>
</tr>
<tr>
<td>Asking when their ride is coming</td>
<td>06</td>
<td>05</td>
<td>03</td>
<td>04</td>
</tr>
<tr>
<td>Asking &quot;where is my wife/husband?&quot;</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>01</td>
</tr>
<tr>
<td>Asking &quot;did my wife/husband call?&quot;</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sitting with group</td>
<td>17</td>
<td>25</td>
<td>08</td>
<td>13</td>
</tr>
</tbody>
</table>

Note. S1's scores are from a total of 6 days of pre-training (04-14-99 through 04-23-99) and 6 days of post-training (05-10-99 through 05-21-99). S2's scores are from a total of 6 days of pre-training (04-05-99 through 04-16-99) and 5 days of post-training (05-03-99 through 05-14-99).
participants were asked when their ride was coming to pick them up a total of 12 times (twice a day for each of the 6 days of observations). Results appear in Table 19.

Summary of Experiment 3B

Experiment 3B revealed two interesting findings. First, results confirm that spaced-retrieval training can be used successfully to improve memory for a single object across experimental and applied formats. That is, we found evidence of transfer from the experimental spaced-retrieval training sessions (1-3) to the applied sessions (4-6). Both participants showed longer retention duration, initially, in the applied sessions, and the number of failures across trials declined sharply when compared to experimental sessions. Interestingly, these participants’ MMSE scores were much lower than any of the other participants involved in this study, but they still showed the characteristic pattern of fewer failures over trials and longer trial-to-trial retention duration (see Table 17). This result confirms that spaced-retrieval can be used to enhance retention, even for persons with more advanced AD.

Second, our results provide initial evidence that spaced-retrieval training works to reduce real-world problem behaviors as evidenced by the decrease in verbal and nonverbal problem behaviors from pre-training to post-training. We also found an increase in the participants’ ability to sit in group activities for longer periods of
Table 19: Post Experimental Manipulation Check

Participants

<table>
<thead>
<tr>
<th></th>
<th>S1</th>
<th>S2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WEEK 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:00-12:00</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>12:00-4:00</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Wednesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:00-12:00</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>12:00-4:00</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:00-12:00</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>12:00-4:00</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>WEEK 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:00-12:00</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>12:00-4:00</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Wednesday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:00-12:00</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>12:00-4:00</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Friday</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:00-12:00</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>12:00-4:00</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Note. Score of 1 indicates a correct response. Score of 0 indicates incorrect response or failure to respond at all.
time throughout their day. Overall, these findings suggest that spaced-retrieval training in an applied format may be effective in reducing some of the problem behaviors associated with AD persons that are focused on looking for their ride or waiting impatiently for their ride to show up.

Decrease in Problem Behaviors

Table 18 highlights non-verbal and verbal behaviors that were decreased during the two week post-training period. The most noticeable change for both participants was the sharp decline in their wandering behavior. As well, both participants were able to sit with the group for longer periods of time post-training. This data is especially noteworthy, because staff typically complain that when clients wander through the building rather than sitting with other clients during scheduled group activities, the staff has to leave their group to follow the client and spend time attempting to redirect him/her back to the group or to a safe area.

Prior to training, S2 spent most of his day either looking out the door/window or sitting in an area where he was able to see the parking lot. When approached, this client reported, "my wife is around here somewhere and I’m trying to find my car" or "I’m waiting for my wife, she was suppose to be here by now." When S2 was wearing his waist pouch, it was evident that he was less focused on looking
for his wife in the parking lot, and was able to spend time looking at his audible-clock in order to determine how much longer before his wife arrived. S2 was able to be more easily redirected during post-training, when he did begin to wander or continued to stare outside. He was then able, at times, to sit with the group, but typically did not participate in group discussions or activities.

During this 6-week period, S2 was able to begin staying longer in the afternoons in order to give his wife more time at home before she needed to pick him up. This attempt to extend his day had already begun prior to being involved in the study, but was continued throughout the study. This finding provides modest evidence that the training could be used in the future for other clients with similar problem behaviors in an attempt to increase the amount of time they are able to stay at the facility.

It is also important to mention that both participants did spend a great deal of time examining their pouch by zipping it closed and open, taking the clock in and out of the pouch, or showing it to other clients. This activity would typically occur when both participants were sitting with or near the group, therefore, spending less time wandering around the building.
Informal Observations

Because this experiment was the first to address applied issues, we describe some interesting observations that occurred during the course of the training program. One of the interesting observations was when S2 approached me one week after his post-training was complete, and asked me where his pouch was because he was not sure when his wife was coming to pick him up and wanted to know. He seemed as though he was frustrated with me because I did not bring his pouch that day.

Another interesting observation is that S1, a female participant, was not interested in wearing the waist pouch because it did not match her clothes. We found a purse-style pouch for her to wear and she was much more willing to give it a try. She was somewhat resistant to keeping the purse-pouch on while she sat and moved about the day care facility. She preferred to place the purse-pouch on the side of her chair when she sat, and wanted to leave the purse at her seat when she walked around the facility. I think she eventually agreed to keep it with her because I convinced her that I did not want her purse-pouch to get lost. She occasionally agreed to keep it with her without reminders, but only because she considered me a "worry wart", and called me that throughout the two week post-training period.
Future Directions for Research

One direction for future research would be to include additional experimental and applied training sessions, in order to extend the overall retention duration. As well, booster spaced-retrieval training sessions would be beneficial at the beginning of the second week of post-training observations to maintain a higher level of benefit from training during the second week of observations. Future research could also determine optimal time frames for booster sessions in order to provide data regarding the long-term benefits and limitations of the training if used in day care facilities for a longer time interval. Those with typical problem behaviors may need more time during training sessions, booster sessions during the monitoring phase, and longer intervals to wear the pouch/audible-clock to gain maximum benefit.

Through informal conversations with staff, they suggested that future studies could identify problem behaviors during admission to the day care facility, so that the intervention can be used as soon as the problem is identified. The staff wondered if immediate intervention would increase the chance that an AD person with typical problem behaviors would have a better chance to adjust to the program rather than being transitioned to a higher level of care. Family members typically use the day care facility as the last attempt to keep AD persons at home before they begin to require 24 hour care at home, or even nursing home
placement. Through informal conversations with family members, they see the AD persons quality of life improve while attending the day care program, and hope to continue until the AD person is unable to benefit from the program. If initial interventions could increase chances for those having difficulty making adjustments to the program, and could extend the amount of time they are able to participate in day care program, the better the quality of life for the AD person as well as his/her family members.
GENERAL DISCUSSION

The present results provide new evidence regarding the efficacy of the spaced-retrieval technique in improving recall in memory-impaired persons. Our findings confirm the positive effects of spaced-retrieval training on retention in memory-impaired older adults. Results also provide new evidence for the effectiveness of the technique across a wide-range of participants with varied scores on the MMSE (range of 10-22). In general, the spaced-retrieval training technique has proven to be not only beneficial with a varied group of memory-impaired older adults, but also has a six month to one year long-term range effectiveness, and appears to be useful in applied settings. These findings are discussed in greater detail in the sections that follow.

Long-term Effectiveness of Spaced-Retrieval

First, we provided new evidence regarding the long-term effectiveness of spaced-retrieval, in accordance with the first aim of the present research. It is essential that gerontological researchers demonstrate the long range effects of spaced-retrieval in order to expand the use of the technique in real world settings. By comparing subjects tested at various time intervals (one year vs. six months), we are now better equipped to draw conclusions regarding the benefits and temporal limitations of the spaced-retrieval technique. Overall, our findings suggest that performance...
was enhanced six months and one year after original training (Experiment 2A) but was not enhanced two years later (Experiment 1). This is valuable information in that it gives researchers more specific time frames in which to utilize the spaced-retrieval technique. This information can also be utilized to determine specific time frames in which booster sessions would enhance continued effects of the spaced-retrieval technique.

**Target-Item Orientation Task**

Second, we found that the target-item orientation task is useful for enhancement of the overall effectiveness of spaced-retrieval, in accordance with our second aim. Results provide modest evidence which demonstrates that participants who were given the target-item orientation task performed better (i.e., fewer failed trials, longer trial-to-trial retention intervals), overall, on the spaced-retrieval training trials when compared to those who were not given this task. Future research studies could determine those participants (according to MMSE scores, etc.) that would receive maximum benefit from the target-item orientation task. It would also be beneficial for future research to examine effectiveness of the target-item orientation task in applied settings, to enhance familiarity with trained objects, such as the audible-clock used in Experiment 3B.
Contribution of Implicit Memory to Spaced-Retrieval Effects

Third, these data provide more supportive evidence of the contribution of implicit retention to spaced-retrieval, as predicted. Data from Experiments 1 and 2 confirm and extend findings from previous studies (see Cherry et. al., in press). By including three additional training sessions, the evidence of implicit memory for the trained objects became more pronounced. Therefore, it is recommended that future studies include at least three additional spaced-retrieval training sessions in order to observe benefits of implicit memory for the trained objects. Overall, implicit memory was observed for participants in Experiments 1 and 2, but participants in Experiment 3B had difficulty with the implicit measure of memory. Future research could examine ways to expose implicit memory in those persons with lower MMSE scores and determine limitations of the contribution of implicit memory to spaced-retrieval.

Application of Spaced-Retrieval to Real-World Problems

Fourth, by using the spaced-retrieval task in an applied setting, we were able to provide new evidence regarding the potential applicability of the technique for real world problem behaviors. Our findings suggest that the spaced-retrieval technique worked to promote memory for the audible clock, and for the target response of checking the clock when questions about the participants' ride came up. We have suggested that the present results are largely due to the spaced-retrieval training program. Another
possibility is that participants were responding positively to social attention. Future research that includes a no-training control group who receives equivalent amounts of individual attention in a one on one format would be necessary to rule out a social desirability interpretation of the present findings.

Nonetheless, our findings suggest new possibilities for relative benefits of the technique for future use by staff members at adult day care facilities, and even caregivers for use at home with AD persons. Our ultimate goal was to make use of the spaced-retrieval technique in very applied situations. Staff at adult day care facilities typically find themselves dealing with characteristic problem behaviors that can possibly lead to frustration on the job and lead to disappointment when interacting with the clients. We now have initial evidence suggesting that the spaced-retrieval technique may be used to decrease the frequency of problem behaviors. We expect that this evidence may provide not only relief for the AD persons attending adult day care programs but also relief for the health care workers who may experience less frustration on the job. In return, this cycle may ultimately increase the quality of care given to cognitively-impaired older persons with AD. Future research could begin to extend our findings by including a social attention only control group and a larger experimental group for further clarity on the effectiveness of spaced-retrieval in applied format.
We expected that spaced-retrieval training would provide effortless learning on the part of the participants, which is an important aspect of successful memory intervention. Our findings confirm the benefit of spaced-retrieval, even for those participants with low MMSE scores. Further, a solid advantage of spaced-retrieval in applied format is that the technique can be incorporated into the activities that take place at the adult day care facility, which highlights the real-world application and benefits of spaced-retrieval.

Conclusions and Future Directions

The results of the present studies have several implications that deserve brief mention. First, we expected to provide evidence of the long-term effectiveness of the spaced-retrieval training, particularly once the training trials were extended from three training sessions to six. Cherry et al. (in press) concluded that the third day of training was crucial to observe the improvements in spaced-retrieval effects over time. That is, the savings in relearning was not revealed for two of the participants until the third day of training. Whether further improvements in performance would occur if more than three training sessions were included was addressed in the present research. We found evidence of improvement in performance
after extended training in all experiments reported here, particularly after the third day of training.

Second, the spaced-retrieval technique, in an applied format, appears to be well-suited for future use as a method to enhance new learning in cognitively-impaired persons, particularly for typical behavioral problems found in real world settings such as adult day care facilities. It is important to note the limitations of the applied form of the technique due to the small number of participants in Experiment 3B. Further, it may be desirable to include control participants who receive an equivalent amount of social attention, without spaced-retrieval training, to determine whether the improvement in problem behaviors is related to participants' desire to please the experimenter, independent of memory training. While our initial results appear promising, follow-up studies are needed to confirm the effectiveness of the technique in applied format. Ideally, with further confirmation of our findings, the technique could eventually be put into the hands of caregivers for use at home, as this may have implications for the quality of the lives of elderly adults with memory loss associated with AD.

In conclusion, the present research has provided new evidence on the long-term effectiveness of spaced-retrieval, and has identified ways to enhance the overall effectiveness
of the spaced-retrieval technique. As well, the present research has provided new preliminary information regarding the application of spaced-retrieval in real world settings which may, in fact, one day change the way adult day care facilities provide care for those AD persons with problem behaviors. It would be of enormous benefit to offer health care workers and caregivers an effective way to handle difficult behaviors typical of AD persons.
REFERENCES


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Cherry, K.E., Simmons S.S., & Camp, C.J., in press. Spaced-Retrieval Enhances Memory in Older Adults with Probable Alzheimer’s Disease.

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### APPENDIX A: TAXONOMIC CATEGORIES

<table>
<thead>
<tr>
<th>Taxonomic categories</th>
<th>Exemplar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clothing</td>
<td>Jacket</td>
</tr>
<tr>
<td>Furniture</td>
<td>Chair</td>
</tr>
<tr>
<td>Vegetables</td>
<td>Carrot</td>
</tr>
<tr>
<td>Personal care</td>
<td>Razor</td>
</tr>
<tr>
<td>Game pieces</td>
<td>Dice</td>
</tr>
<tr>
<td>Jewelry</td>
<td>Bracelet</td>
</tr>
<tr>
<td>Christmas decorations</td>
<td>Wreath</td>
</tr>
<tr>
<td>Money</td>
<td>Quarter</td>
</tr>
<tr>
<td>Farm animals</td>
<td>Cow</td>
</tr>
<tr>
<td>Sea life</td>
<td>Shark</td>
</tr>
<tr>
<td>Art supplies</td>
<td>Bottle of Paint</td>
</tr>
</tbody>
</table>

Note. More detailed information about these objects can be found in Cherry & Park (1993).
APPENDIX B: QUESTIONNAIRE

Date__________
Ss#__________

SAINT FRANCIS HOUSE ADULT DAY CARE CENTER QUESTIONNAIRE

We are conducting a survey in order to pinpoint problem behaviors that could be improved through training at Saint Francis House (SFH). Please fill in the information below. Your participation is voluntary. The results of the survey will be used for future research projects and program development. Questions regarding this survey should be directed to Mrs. Diane Kelly at 765-5273, Shannon Simmons-D'Gerolamo or Dr. Katie Cherry at 388-8745.

1. Please rate the importance of improving the difficult behaviors listed below through a behavioral intervention program for clients at St. Francis House. Rate on a scale of 1 to 5 (1= less important, 5= more important).

- Asking same questions all day. 1 2 3 4 5
- Asking where the restroom is located. 1 2 3 4 5
- Asking what time it is. 1 2 3 4 5
- Asking when they will be picked up. 1 2 3 4 5
- Being confused about where they are. 1 2 3 4 5
- Other____________________________. 1 2 3 4 5
- Other____________________________. 1 2 3 4 5
2. Please list and describe the specific, difficult behaviors that you would like to see improved through an intervention program for the clients that attend St. Francis House.

1. 

2. 

3. 

4. 

5. 

6. Other ideas or suggestions...
VITA

Shannon Susan Simmons-D'Gerolamo was born June 13, 1971, in Lake Charles, Louisiana. She is the only daughter of Charles and Susan Simmons, of Moss Bluff, Louisiana. She is the granddaughter of the late Dean and Myrtle Fuller, of Westlake, Louisiana, and Clyde and Margy Simmons of Des Moines, Iowa. Shannon is the wife of Chad Andre' D'Gerolamo, of Baton Rouge, Louisiana.

In 1993, Shannon graduated from Louisiana State University, earning a bachelor of science degree in psychology. In 1997, Shannon earned a master of arts in developmental psychology, from Louisiana State University, and in 1998, a master of arts in education with a concentration in agency counseling, from Louisiana State University.

Shannon has been employed for over five years by Our Lady of the Lake Regional Medical Center, Mental and Behavioral Health Division, of Baton Rouge, Louisiana. Shannon will receive the degree of Doctor of Philosophy in the Department of Psychology in August of 1999, from Louisiana State University.
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Major Field: Psychology

Title of Dissertation: An Examination of the Spaced-Retrieval Technique: A Method to Improve Memory in Older Adults with Probable Alzheimer's Disease

Approved:

[Signatures]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination:

June 10, 1999