2006

Spaced-retrieval effects on memory for scenes in older adults with probable Alzheimer's disease

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SPACED-RETRIEVAL EFFECTS ON MEMORY FOR SCENES IN OLDER ADULTS WITH PROBABLE ALZHEIMER'S DISEASE

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in the partial fulfillment of the
requirements for the degree of
Master of Arts
in
The Department of Psychology

by
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B.A., Louisiana State University, 2003
August, 2006

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ABSTRACT

Previous studies have found the spaced-retrieval memory intervention technique to be successful in training people with probable Alzheimer's disease (AD) to learn new, simple associations. In the present study, we expanded on these previous findings by training eight participants with probable AD to learn the names and pictures of countries via spaced retrieval. We demonstrated the flexibility of the technique, gave insight as to the effects of distracters on the spaced-retrieval training performance, and demonstrated the memorial effects of adding pictorial support to the text.

INTRODUCTION

An unprecedented demographic trend is well underway. For the first time, older adults are the fastest growing segment of the population. The older adult population numbered 35.6 million in 2002, and the number is expected to more than double to 71.5 million by the year 2030 as the baby boom generation reaches age 65 (U.S. Bureau of the Census, 2002). This record demographic process commands grave concern because as the older adult population grows, the proportion of older adults who require care grows.

In 1997, roughly 54% of the older population reported having at least one form of physical or nonphysical disability (U.S. Bureau of the Census, 2002). Some of these disabilities require little attention, but over a third report having a disability that requires assistance to meet essential personal needs (U.S. Bureau of the Census, 2002). It is certainly preferred to keep older adults at home and independent as long as possible and services such as home health care are available for those in which this is an option (Mace & Rabins, 2001). For those who are unable to remain completely independent, adult day care, assisted living accommodations, and nursing homes are the most common options for older adults with severe disabilities (Mace & Rabins, 2001). However, the number of older adults utilizing outside services is staggering. About 1.6 million older adults are in nursing homes and about half are age 85 and older (U.S. Bureau of the Census, 2002). Assistance targeted at older adults is becoming increasingly more valuable and warrants awareness.

This paper is organized as follows. In the first section, the definition, history, types, and diagnosis of adult dementia is discussed. Next, an overview of Alzheimer's disease (AD) is presented. The third section addresses the characteristic behaviors and psychological problems associated with AD. Then the cognitive losses due to AD are discussed followed by various interventions designed to enhance cognitive function, with special attention directed to the spaced-retrieval method. Finally, specific aims of the present research are presented, followed by research methods, results, conclusions, and future directions.

Adult Dementia

Definition. Adult dementia is one of the most common disorders affecting older adults today. It is an umbrella term for a group of serious symptoms caused by changes in brain function that results in a loss in at least two areas of intellectual functioning, such as memory, language, reasoning, and movement (Turkington & Galvin, 2003). The problems are severe and interfere with a person's daily life. Dementia is not a disease, but can accompany disease and in that case is irreversible. In addition, there are treatable forms of dementia, as discussed in greater detail next.

Alzheimer's disease is the most common form of irreversible dementia and includes about half of all reported dementia cases (Turkington & Galvin, 2003). Alzheimer's disease involves a loss of nerve cells in the areas of the brain responsible for memory and other vital mental capabilities (Mayo Foundation for Medical Education and Research: MFMER, 2005). The second most common form of irreversible dementia is vascular dementia, or multi-infarct dementia, occurring when arteries entering the brain shrink or become blocked (MFMER, 2005). The dementia symptoms often occur immediately after a stroke. Other irreversible dementias include Lewy body dementia, Frontotemporal dementia, Huntington's disease, Parkinson's disease, and Creutzfeldt-

Jakob disease (Cherry & Plauche, 1996; Turkington & Galvin, 2003; MFMER, 2005). Table 1 presents a summary of common disorders resulting in dementia and their symptoms, adapted from Cherry and Plauche (1996) and Raskind and Peskind (1992). Several other conditions which cause dementia or dementia-like symptoms are reversible (Turkington & Galvin, 2003). These include reactions to medications, metabolic abnormalities, nutritional abnormalities, nutritional deficiencies, emotional problems, and infections (MFMER, 2005). Although dementia-like symptoms are easy to recognize, dementia is difficult to diagnose because there are numerous etiologically distinct conditions that produce dementia like behaviors in older adults (see Table 1).

Table 1: Common Disorders Resulting in Dementia

Type	Presenting symptoms
Alzheimer's disease	Slow onset and progressive deteriorating course. Loss of nerve cells associated with the development of abnormal plaques and tangles of protein the brain cells responsible for memory, etc. Characterized in early stages by difficulties in memory, repetition in conversation, disorientation.
Multi-infarct dementia	A vascular dementia, abrupt onset, stepwise deterioration, focal neurologic signs and symptoms.
Lewy body dementia	Lewy bodies develop in midbrain, underneath cerebral hemispheres. Symptoms similar to both Alzheimer's disease and Parkinson's disease.
. Frontotemporal dementia	Affects lobes of brain responsible for judgment and social function, results in socially improper behavior.
Huntington's disease	Begins in midlife, intellectual decline, irregular and involuntary movement of limbs/facial muscles. Personality change, memory declines, slurred speech, impaired judgment, psychiatric problems. Genetic marker identified on chromosome 4.

(table continued)

Parkinson's disease	Loss of motor ability, memory impairment, slowness of thinking, preserved language ability.
Cruetzfeldt-Jakob disease	Rare, fatal brain disorder likely due to a virus. Memory declines, loss of coordination, pronounced mental deterioration, involuntary muscle spasms, blindness, weakness in arms and legs, coma. Definitive diagnosis only after autopsy.

Alzheimer's Disease

Historical Perspective on AD. The history of Alzheimer's disease spans several centuries. The first known doctor to recognize what is known today as Alzheimer's disease was Aretaeus of Cappadocia in the 2nd Century AD (Reisburg, Ferris, deLeon, Crook, & Haynes, 1987). After centuries of revelations, by the early 1900's, doctors had organized the principle neurological characteristics of AD into three features. The three characteristics included: senile plaques as described by Emile Redlich in 1892, neurofibrillary tangles by Alois Alzheimer (a German physician whose name the disease honors) in 1907, and granulovacuolar degeneration by Simchowitz in 1910 (Reisburg et al., 1987). All neurological discoveries made today about AD are based upon these three key components of the illness.

AD is defined as a progressive, degenerative disease typified by the death of nerve cells in numerous areas of the brain (Turkington & Galvin, 2003). It is not a normal part of the aging process, although the specific symptoms vary greatly. AD impairs memory, thinking, and behavior and eventually results in death, typically due to secondary conditions such as pneumonia or congestive heart failure. The deterioration central to the disease can persist up to 20 years, although most people with AD die within three to five years of diagnosis (Turkington & Galvin, 2003).

The diagnosis of AD is difficult because the physical and behavioral symptoms vary greatly and can be so similar to other forms of dementia as mentioned previously. In addition, only a definite diagnosis can be given postmortem, as an autopsy must be performed to confirm the characteristic brain abnormalities central to the disease. The American Psychiatric Association in their fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM IV) lists criteria for dementia of the Alzheimer's type. An adapted version of the table is presented below in Table 2.

Table 2: Diagnostic Criteria for Dementia of the Alzheimer's Type

DSM IV Criteria

A. The development of multiple cognitive deficits, including both:
    1. Memory Impairment
    2. One or more of the following cognitive disturbances:
        a. aphasia (language problems)
        b. apraxia (impaired ability to move functionally)
        c. agnosia (failure to recognize or identify objects)
        d. disturbance in executive functioning

B. Cognitive deficits cause significant impairment in social or occupational functioning and represent a significant decline from a previous level of functioning.

C. The disease process is gradual onset and continuing cognitive decline.

D. Cognitive deficits are not due to any of the following:
    1. other central nervous system conditions that cause progressive deficits in memory and cognition
    2. systemic conditions that are known to cause dementia
    3. substance-induced conditions

E. The deficits do not occur exclusively during the course of a delirium.

F. The disturbance is not better accounted for by another Axis I disorder.

Biological Aspects of AD. The biological aspects of AD focus on two main irregular features: neurofibrillary tangles and amyloid plaques. Neurofubrillary tangles are bundles of tau protein that have become badly twisted (Gruetzner, 2001; Turkington

& Galvin, 2003). They occur naturally with age in all parts of the brain. However, in Alzheimer's patients, the tangles occur in areas of the brain responsible for memory such as the hippocampus and the amygdala in significantly larger numbers than in healthy older people (Gruetzner, 2001). Amyloid plaques are abnormal clusters of dead and dying nerve cells, other brain cells, and amyloid protein fragments. Whereas tangles are located within nerve cells, plaques are located between the brain's nerve cells (Peskind, 1996). Both tangles and plaques develop first in areas of the brain used for memory and other cognitive functions in large number and then spread to other parts of the brain as well (Turkington & Galvin, 2003). The progression of AD has seven stages corresponding to the progression of the underlying nerve cell degeneration (Alzheimer's Association, 2005; Reisburg, 1987). Table 3 presents the 7 stages of AD.

Table 3: Functional Assessment Stages in Normal Aging and Alzheimer's Disease

Global Deterioration Scale Stage	Clinical Diagnosis	Functional Assessment Stages Characteristics
1. No cognitive decline	Normal	No functional decrement.
2. Very mild cognitive decline	Normal for Age	Complains of forgetting location of objects.
3. Mild cognitive decline	Borderline impairment	Decrease in functioning in demanding work settings; difficulty in new locations.
4. Moderate cognitive decline	Mild AD	Decreased ability to perform complex tasks.

(table continued)

5. Moderately severe cognitive decline	Moderate AD	Requires assistance in clothing; may require coaxing to bathe.
6. Severe cognitive decline	Moderately severe AD	Requires total assistance in dressing, bathing, and toileting.
7. Very severe cognitive decline	Severe AD	Limited ability to speak, loss of ambulatory ability, loss of ability to sit up, smile, hold head up; total care needed.

Genetics are also an important biological aspect of AD. Apolipoprotein E is a protein whose main function is to transport cholesterol. The gene for this protein is located on chromosome 19 and is referred to as the Apoliopoprotein E gene. The Apolipoprotein E gene (apoE) has been researched and found that it may help to diagnose Alzheimer's (Gruetzner, 2001). There are three variations of the apoE gene that have been identified: apoE-2, apoE-3, and apoE-4. ApoE-4 is thought to be an inherited risk factor for AD (Turkington & Galvin, 2003). Those without a copy of the apoE-4 gene are considered not to have a high risk of developing AD; for those with one copy of the gene, the risk is between 25 and 60 percent of the gene; and in those with two copies of the gene, the expected risk of developing AD ranges from 50 to 90 percent (Turkington & Galvin, 2003).

Behavioral and Psychological Problems in AD Patients

With the progression of AD come distinctive behavioral and psychological problems. In the early stages, people with AD may experience personality changes such as irritability, anxiety or depression (Mace & Rabins, 2001). In addition, tasks such as shopping and using transportation (instrumental activities of daily living or IADLs) are difficult for people in the early stages of AD (Greutzner, 2001). As the disease progresses, other symptoms may appear, including sleep disturbances, delusions, hallucinations, wandering, stubbornness/uncooperativeness, combativeness, apathy or anger, and socially inappropriate behaviors (Alzheimer's Association, 2005; Mace & Rabins, 2001). The most distressing symptoms that occur in the later stages of the disease are problems with activities of daily life (ADLs) (Gruetzner, 2001). Abilities such as dressing, bathing and eating refer to activities of daily living and become impossible activities for people with AD to perform without assistance in the late stages of the disease.

Cognitive Losses. In addition to behavioral and psychological impairments, people with AD also battle major cognitive deficits. As mentioned previously, AD is a progressive disease that results in progressive intellectual decline. Memory loss is evidently the most distinctive cognitive deficit for Alzheimer's patients, but in addition, deficits in intellectual ability, thinking, and judgment; speech and language; spatial orientation, physical movement, and recognition worsen as the disease advances (Gruetzner, 2001). Early in the illness, people with Alzheimer's may not be reasonable and may be unable to judge situations or abstract problems correctly. By the late stages of the disease, intellectual abilities are nearly entirely impaired.

Speech and language impairment is a unique characteristic of people with AD. Those with AD have difficulty in both expressing themselves and understanding what others are trying to express to them (Brush & Camp, 1998). Aphasia is the most common speech/language problem people with dementia encounter (Brush & Camp, 1998). Aphasia is the loss of the capacity to speak or understand spoken or written language as a result of damage to the nervous center in the brain and is very common in those with AD (Turkington & Galvin, 2003). Usually the aphasia is gradual and begins with problems in word finding, or anomia: a form of aphasia (Gruetzner, 2001). People with Alzheimer's typically have problems verbalizing the names of people, objects, or places. Eventually, Alzheimer's patients may loose their ability to make coherent speech at all and complete mutism may occur in the final stages of the disease.

Impaired memory is the defining cognitive deficiency of AD. In the early stages of the disease, patients may have difficulty remembering recent episodes- such as forgetting a conversation with someone or losing something (Gruetzner, 2001). Alzheimer's patients also have trouble learning new information or procedures. For example, someone with early AD would be expected to have difficulty learning how to cook something in a different way. These concepts refer to short-term memory (or primary memory), which is the ability to retain information for a very brief period of time such as 30 seconds. Short-term memory is severely impaired in people with AD and becomes increasingly impaired with the progression of the illness (Cherry & Plauche, 1996). In general, if a memory is rehearsed and retained, it can be transferred from short- term memory into a long-term memory. For people with early AD, long-term memory begins to decline. However, in the early stages, Alzheimer's patients' remote memory, or memory for personally experienced events that occurred in the distant past may remain intact (Cherry & Plauche, 1996). For instance, a person with early Alzheimer’s may not remember what he or she ate for breakfast that morning, but can remember the details of a high school prom sixty years ago. Episodic memory is a basic term meaning memory for events in a person’s life and includes short-term, long-term, and remote memory events. As the disease advances to the later stages, all of the temporal types of memory become increasingly severely impaired (Cherry & Plauche, 1996).

Interventions

In order to alleviate some of the devastating effects of brain deterioration that result from Alzheimer’s disease, many types of memory interventions have been developed. Pharmacological interventions in particular are commonly used to help treat cognitive problems. There are five medications that have been currently approved by the FDA for treating cognitive problems common in mild to moderate AD (see Table 4). Four of the five pharmacological agents operate by interfering with the breakdown of acetylcholine, a neurotransmitter that appears in abnormally low levels in people with AD (Cherry & Plauche, 1996; Turkington & Galvin, 2003). Acetylcholine is a neurotransmitter that is vital to memory, thought, and judgment. Enzymes including acetylcholinesterase break down acetylcholine in order to recycle it. Some drugs that treat AD are cholinesterase inhibitors, which means they stop acetylcholinesterase and allow acetylcholine to stay active in cell communication (Gruetzner, 2001). The four drugs are called Tacrine (or Cognex), Donepezil (or Aricept), Rivastigmine (or Exelon), and Galantamine (or Reminyl) and all work by increasing the brain’s supply of acetycholine (Turkington & Galvin, 2003). These drugs can help slow the progression of AD by either stabilizing or delaying the worsening of memory problems. The fifth drug, Memantine (or Namenda) works by regulating glutamate, a chemical which in excess leads to cell death in the brain (Alzheimer's Association, 2005). It allows patients with moderate to severe AD to maintain daily functions such as using the bathroom independently longer (Alzheimer's Association, 2005). The drugs are somewhat effective in alleviating symptoms of AD, but cannot cure the disease.

Table 4: FDA Approved Medications for AD Patients

Proper Name	**Marketed Name**	**How it works**
Tactrine	Cognex	Prevents breakdown of acetylcholine; Not as safe as other drugs; increases cognition in a third of all mild to moderate AD patients
Donepezil	Aricept	Boosts levels of acetylcholine; helps some mild to moderate AD patients by improving thinking, general functioning, and behavior
Rivastigmine	Exelon	Blocks enzymes that break down acetylcholine; improves memory, ADLs, and overall functioning for mild to moderate AD patients
Galantamine	Razadyne	Interferes with an enzyme that breaks down acetylcholine and stimulates brain to release more acetylcholine; improves overall functioning and cognition for mild to moderate AD patients
Memantine	Namenda	Regulates glutamate; allows patients to maintain daily functions longer; helpful for moderate to severe AD

Individuals providing care for people with dementia such as therapists, nursing staff, social workers, family members, and volunteers can also use non-pharmacological interventions to help manage the problems they encounter while providing care. Most techniques of interventions have been adapted from memory interventions used for healthy adult populations. It has been found that the most effective interventions have been ones with minimal cognitive demands that target the preserved cognitive capability in Alzheimer's patients (Cherry & Plauche, 1996). These interventions allow people with AD to learn new information, a task normally extremely difficult to perform in all stages of the disease.

Various types of non-pharmacological memory interventions have been found to be helpful for Alzheimer's patients. The use of external memory aids such as memory diaries, reality orientation panels and signposts have been supportive in assisting people with dementia to recall personal information and orientation information (Butter, Soety & Becker, 1997). A form of reality orientation called Question-Asking Reading (QAR), involves a group of Alzheimer's patients answering direct questions about a story that is read and has been found to improve retention of the story (Camp & Mattern, 1999). The Montesorri technique has also been another type of intervention used to improve the functioning of people with AD. This technique is based on Maria Montessori's original, comprehensive approach to educating children and includes use of external cueing, focus on productive, meaningful activity, lots of feedback, and adaptive environments (Camp, Cohen-Mansfield, & Capezuti, 2002). One intervention in particular termed the spaced-retrievaltechnique has received plenty of positive response.

Spaced Retrieval

Spaced retrieval is an alternate memory intervention that uses an expanding schedule of successful retrievals from memory to enhance recall. Spaced retrieval is based on the concept of expanding retrieval practice. Landauer and Bjork (1978) created an experimental paradigm that would eventually lead to the present day spaced retrieval memory intervention. Specifically, they tested the effects of spaced versus massed practice on memory using a sample of college students. The students were told to study names in various practice patterns. In the first study pattern, the students practiced the names by learning them in a set uniform pattern. The second study pattern expanded the time intervals of study. The third practice was an expanding pattern test-type rehearsal in which the names were learned, then tested, and if successfully recalled, then tested again after a longer interval. The expanding pattern test-type rehearsal produced the best final recall of the names. Landauer and Bjork's (1978) results are the first support for the recall benefits of spaced-retrieval. Many studies have been done consequently to test the effectiveness of expanding retrieval practice for use as a mnemonic aid. For instance, Schacter, Rich, and Stampp (1985) applied the spaced-retrieval method to help the memories of those suffering from memory disorders due to aneurysms and amnesia from encephalitis. Schacter et al. found that new information could be learned by those with memory disorders using the spaced-retrieval technique. Cull, Shaughnessy and Zechmeister (1996) conducted a series of experiments testing the expanding retrieval strategy with college students, seeking to stimulate more research in applying the mnemonic. Consequently, much research has been done to investigate the spaced-retrieval technique in other populations.

Other researchers have since explored the use of spaced retrieval as an aid for older people with memory problems. Camp (1989) was successful at applying spaced retrieval as a method for Alzheimer's patients to remember simple associations. Camp

(1989) modified the spaced-retrieval technique into a form easily used for dementia patients. He gradually increased the period of time between successful recalls of a target association, starting with an opening interval of 5 seconds, and afterwards 10, 20, 40, and 60 seconds, with extensions of 30 seconds if the initial interval is successful. If the patient fails to recall, he/she is given the correct answer, asked to repeat it, and then tested again at the interval in which the patient was last successful (Camp, 1989). In between intervals, the experimenter chats with the patient to ensure the patient is at ease, and the session is socially enjoyable. The ultimate goal of the intervention is long-term retention of new learned information.

The theoretical basis of spaced retrieval draws from various theories of learning. Due to the spaced intervals of recall, spaced retrieval can be thought of as effective due to the spacing effect. The spacing effect refers to the positive effects of information studied over separate trials on memory (Bahrick & Hall, 2005). It is one of the oldest and best documented phenomena in the history of memory research, its origins dating back to Ebbinghaus in 1855 when he found that recall performance improves when practice is distributed rather than massed (Donovan & Radosevich, 1999). A meta-analytic review of 63 studies on the spacing effect confirmed that individuals in spaced practice conditions performed significantly higher than those in massed practice conditions (Donovan & Radosevich, 1999). In addition, the spacing effect has been confirmed consistently in explicit memory tasks. However, the benefit from the spacing effect in the implicit memory literature is not as consistent. Green (1990) found spacing effects on three implicit memory measures: spelling of homophonic words, word-fragment completion and perceptual identification. Green did not find the spacing effect in perceptual identification when the information was studied incidentally or between lists when the spacing was controlled. Spaced retrieval is believed to work implicitly (Camp, Bird & Cherry, 2000) and so it is questionable whether the spacing effect alone is responsible for the memory gains in this intervention.

Camp, Foss, Stevens, Reichard, McKitrick, and O'Hanlon (1993) examined the memory intervention literature and formed the E-I-E-I-O model, which cites various memory interventions for a 2 x 2 matrix that includes external versus internal sites of initial storage of information, and explicit vs. implicit types of memory. They encourage using the E-I-E-I-O model to classify memory interventions and directing the design of new interventions for older adults.

When spaced retrieval was first tested with people with AD by Camp (1989), it was used to teach name-face associations of nurses. The results show that the patients retained the name-face associations for up to one week, when before they could not retain such associations for more than a few seconds (Camp & Schaller, 1989). Since then, name-face associations have been taught using spaced retrieval in many versions. Camp and McKitrick (1992) found the successful retention of name-face associations for up to 5 weeks in people who could not retain the information previously for more than a minute. Joltin, Camp and McMahon (2003) used spaced retrieval to train a woman with AD over the phone to recall the name of her grandchild looking at a photograph. The patient learned the grandson's name correctly for the four sessions and was able to recall his name even five days after the intervention ended. An errorless learning, spaced retrieval type of study was also demonstrated to train dementia patients to learn name-face associations and benefits were shown without follow-up training after six months (Clare, Wilson, Carter, Roth, & Hodges, 2002).

Recent research has proven spaced retrieval to be a valuable tool in teaching speech-language therapy in which learning names is essential (Brush & Camp, 1998). A name-face association trained using spaced retrieval was also found to transfer to a live person target by Hawley and Cherry (2004). They trained six participants with Alzheimer's using spaced retrieval to remember an unknown name-face association and transfer that knowledge to a live person target. The participants trained for two weeks (six times total). For each session, the participants selected a target photograph and stated the target name out of eight others at progressively longer time intervals. The training resulted in learning the names of the photographs and transferring that knowledge to a live person for three of six participants.

Spaced retrieval has also been used to train dementia patients to perform tasks. McKitrick, Camp, and Black (1992) found that dementia patients were able to complete a prospective memory task correctly using the spaced-retrieval technique. The patients were successful in selecting a colored coupon and giving it to the experimenter after one week. Camp et al. (1996) had success in teaching dementia patients with MMSE scores from 11–26 to use a daily calendar in 2-4 sessions using spaced-retrieval. Participants were asked to view the calendar to see which tasks they were assigned each day and then sign it. Participants at first were unable to remember the new information on the calendar for more than couples of minutes, but after training were successful at using the calendar for a least one week.

In addition to learning to do tasks, spaced retrieval has been used to train Alzheimer's patients to correct problematic behaviors. Alexopoulos (1994) used the method of spaced retrieval to stop a dementia patient's inappropriate sexual behavior. The experimenter gave the participant a written statement telling the participant to stop touching females. He was then asked to recall the rule and eventually, the patient stopped touching the female staff inappropriately (Alexopoulos, 1994). In another study, Bird, Alexopoulos, and Adamowicz (1995) used fading cues as well as spaced retrieval to teach patients where to use the restroom, not to wander into others' rooms or take others' belongings, and to wait to use the restroom. The participants performed the correct behaviors increasingly well using spaced retrieval and showed retention of the learned behavior up to a year later (Bird et al., 1995).

The spaced-retrieval technique has also been used to train people with Alzheimer's disease to learn names of objects. In Abrahams and Camp (1993), patients were trained to remember common objects. Patients were shown a target item and asked to say the name of the object. If they failed at naming, they were given the correct name and then told to repeat the name. After two weeks of training, the participants were able to identify the objects when at first they were failing repeatedly (Abrahams & Camp, 1993). In a similar study, McKitrick and Camp (1993) found spaced retrieval effective in teaching a woman with dementia the names of unfamiliar objects such as floppy disk. In another study, Cherry, Simmons, and Camp (1999) found spaced retrieval to be successful in producing the recall of everyday objects. Participants were trained to identify a target object out of a group of objects and hand it to the experimenter after hearing a beeper. After three sessions, the participants could name and hand the target item to the experimenter more easily and retain knowledge of the object much longer than at the start of training (Cherry et al., 1999).

The most recent spaced retrieval research is focused on comparing the spaced-retrieval training to other training schedules (Hochhalter, Gasper, Bakke, Holub, & Overmier, 2005; Hawley, Cherry, Olinde, & Jackson, 2005). For example, Hochhalter, Bakke, Holub and Overmier (2004) trained ten people with Alzheimer's disease or alcohol induced dementia to remember an association between a picture of a pill and its name. The participants were trained with either spaced retrieval or uniform retrieval training trials. Results show that most learned the association in the spaced retrieval condition, and none learned the association in the uniform retrieval training. In a subsequent study, Hochhalter et al. (2005) found that spaced retrieval did not produce long-term retention more often than other schedules of practice on either a pill naming or nonverbal sequence task**.** In contrast to Hochhalter et al.'s findings, Hawley et al. (2005) found that spaced-retrieval training resulted in better and longer retention of name-face associations than did fixed-interval training. Methodological differences between the two studies may be responsible for the discrepant outcomes. For example, in Hochhalter et al. (2005) in which spaced retrieval was no different than other non-expanding training schedules, participants were presented with only one to-be-remembered memory stimulus during training trials. In contrast, Hawley et al. (2005) presented the to-be-remembered target item in the presence of eight distracter items. Perhaps those in Hawley et al.'s study benefited from spaced retrieval more than fixed-interval training because they had a richer representation of the target item in memory as they learned to select this item from 8 similar distracters over multiple spaced trials. While it seems reasonable to assume that selecting a target item from an array of similar distracters had a positive effect on long-term memory for the target stimulus, further research is needed to clarify the role of the target to distracter ratio in spaced-retrieval training.

An important task parameter of spaced-retrieval training that has not been researched is the target to distracter ratio. In most studies in which spaced-retrieval training has been used to help people with dementia, one target has been used, and at most three targets (McKitrick et al., 1992; Camp et al., 2000). However, the optimal numbers of distracter items have not been established to date. A review of the literature reveals that eight distracter items and one target have been used several times in training people with dementia to learn associations (e.g., Cherry et al., 1999; Cherry et al., 2003; Hawley et al., 2004; Hawley et al., 2005). Conversely, several studies have neglected to use distracter items at all (e.g., Camp, 1989; Joltin et al., 2003; Hochhalter et al., 2004; Hochhalter et al, 2005). Table 5 presents a summary of the number of targets and distracters in key studies. In the present research, we varied the target to distracter ratio during spaced-retrieval training trials to provide direct evidence bearing in this issue.

Another issue that has not been addressed in the memory intervention literature to date concerns the optimal stimulus format for spaced-retrieval training to be effective. Countless previous studies have established that pictures are better remembered than words; a phenomenon termed the pictorial superiority effect (Paivio, 1971). It has not been established whether AD patients demonstrate the pictorial superiority effect, nor has the pictorial superiority effect been shown using the spaced-retrieval technique. This represents a serious gap in the research literature because the success of memory remediation attempts may depend importantly on the type of material or stimulus format

Table 5: Summary of Target to Distracter Ratios in Prior Spaced Retrieval Studies

Study	**Stimuli**	**Target Item(s)**	**Distracter Items(s)**
Camp et al. (1989)	nurses' names	unspecified (several)	0
McKitrick et al. (1992)	colored coupons	1	8
Abrahams et al. (1993)	common objects	1	0
McKitrick et al. (1993)	common objects, new unknown object	several	0
Alexopoulos et al. (1994)	written rule	1	0
Camp et al. (1996)	tasks on a calendar	1 each day	0
Brush et al. (1998)	name, piece of information, behavior	3	0
Cherry et al. (1999)	common household items	1	8
Cherry et al. (2003)	common household items	1	8
Hawley et al. (2004)	photographs of faces	1	8
Hochhalter et al. (2004)	pill names	1 each training session	0
Hawley et al. (2005)	photographs of faces	1	

of the to-be-remembered materials.

A review of the mainstream experimental literature reveals that healthy older adults show pictorial superiority effects of comparable magnitude as younger adults (see Smith and Park (1990) for review). For example, Smith, Park, Cherry and Berkovsky (1990) found that unimpaired older adults perform similarly to younger adults on memory tasks testing their memory for complex scenes. The authors propose the failure to find age differences with memories for complex real scenes may be due to the rich visuospatial detail and perceptual elements of the scenes (Smith et al., 1990). Older adults were also tested for their memory for pictures as opposed to words and found the pictorial superiority effect to be present (Park, Puglisi, & Sovacool, 1984). Winograd, Smith, and Simon (1982) examined the pictorial superiority effect for older adults in comparison to younger adults. For their first experiment, the pictorial superiority effect was only demonstrated in the younger adults and not the older adults for a recall task of pictures of common objects in comparison to a word list of the corresponding objects. In experiment 2, older adults demonstrated the pictorial superiority effect for recall of pictures of common objects over recall of the objects in word form with the aid of a semantic orienting task. A third experiment was conducted to resolve the conflict between the results of the first two studies. The results of the third study soundly confirm the pictorial superiority effect for both the younger and older adults because the participants significantly remembered the pictures better (Winograd et al., 1982). Rissenberg and Glanzer (1986) tested the pictorial superiority effect for younger versus older adults as in Winograd et al. (1982), but they added older adults with dementia as a third group. In their first experiment, only the younger adults (and neither of the older groups) demonstrated the pictorial superiority effect in a recall task of pictures and words. In a second experiment, Rissenberg et al. (1986) tested the pictorial superiority effect for the three groups in the same way, except in addition, the participants were asked to view the stimuli silently and then name the stimuli out loud. The experimenters expected all groups to perform better on the pictorial task when naming the pictures verbally as it was expected to increases activation of the stimulus. However, the pictorial superiority effect reduced with age and was not significant for the participants with dementia (Rissenberg et al., 1986). The authors suspect that overt verbalization did not provide enough activation and encoding of the stimulus, and thus would be the reason for not demonstrating the pictorial superiority effect for the older adult groups (Rissenberg et al., 1986). These studies encourage more research on whether the pictorial superiority effect occurs in people with cognitive impairment due to adult dementia. The present research is designed to provide new evidence on how pictorial support provides memorial benefits in AD patients using the spaced retrieval memory intervention.

SPECIFIC AIMS

Unfortunately, Alzheimer's patients face the undeniable progressive decline in cognitive functioning that corresponds to the death of neural cells and loss of cerebral tissue as the decrease progresses. Fortunately, there are memory interventions to support cognitive functioning that rely on the remaining cognitive capabilities of people with AD. In particular, the method of spaced retrieval has proven to be an effective memory intervention for Alzheimer's patients. Spaced retrieval has been shown to be successful in learning new information and retaining that information over significant periods of time. Spaced retrieval has been used to train people with probable Alzheimer's disease on name-face associations (i.e., Hawley & Cherry, 2004), everyday task learning (Camp & McKitrick, 1996), appropriate behaviors (Alexopoulos, 1994) and object-name associations (Abrahms & Camp, 1993; McKitrick & Camp, 1993). To date, previous studies have not attempted to train specific images representative of particular places. In the present investigation, we trained persons with probable Alzheimer's disease to remember the names of pictures of countries via spaced-retrieval, a more abstract task. We expected that the present study would further demonstrate the success of spaced-retrieval training and further attest to the adaptability of the technique as a valuable intervention for people with probable AD.

To summarize, the present research is designed to address two issues with respect to the study of memory interventions for cognitively impaired older adults suffering from probable AD. The first issue under investigation in this study concerns the role of the target to distracter ratio in spaced retrieval. We suspected that the target to distracter item ratio would be important in spaced-retrieval training, but prior research has not addressed this issue to date. We manipulated the number of distracter items, using the traditional eight distracters (Hawley et al., 2004) for half of the participants and no distracter items for the other half, as in the procedures used by Camp and his colleagues (see also Hochhalter et al., 2004; 2005). We expected to replicate the positive effects of spaced-retrieval training on recall and retention of countries for all participants. Further, we expected that the participants would perform better on spaced-retrieval training when they studied the target item in the presence of eight distracter items compared to when the target item is presented in isolation (i.e., no distracter items). The presumption is that the distracters used in training would result in better performance on learning the target item in spaced-retrieval training. The hypothesized benefit of studying the target item in the presence of distracters should also be evident in the three explicit memory measures, which are described more fully later on.

The second issue under investigation in the present study concerns the facilitative role of pictorial illustrations on spaced retrieval performance in participants with probable AD. We used an adapted version of the Hawley et al. (2004) methods and procedures. Instead of training the Alzheimer's patients on name-face associations, we trained the Alzheimer's patients to learn pictures of countries and the corresponding word names of countries to retain knowledge of a target country. We then compared the participants' performance on spaced retrieval for pictures of the countries versus words of the country names. We expected to demonstrate that the pictures provided positive memorial benefits based on the results of Winograd et al. (1982) and Rissenberg et al. (1986). In both studies, the normal younger and older adults exhibited the pictorial superiority effect. However, in Rissenberg et al. (1986), the participants with dementia did not display the pictorial superiority effect and the researchers suspected it to be due to a lack of intense activation of the stimulus. Because spaced-retrieval training is an intensive memory intervention, we expected that the AD patient participants would exhibit recall benefits of learning the target countries with the addition of pictures over recalling the target countries as text only.

METHOD
Participants

A total of eight people with probable AD were recruited from a local adult day care center. In order to participate in the study, the potential participants must have had a chart diagnosis of adult dementia, the DSM IV criteria for dementia of the Alzheimer's type, and no history of neurological impairment such as stroke. The participants, as well as their caregivers were given a consent form along with information about the study. Informed consent was obtained by participants' legal guardian first, and after by the participant.

Initially, each participant was given several individual difference measures including the Mini-Mental State Exam (MMSE), the Geriatric Depression Scale (GDS), the short-form of the WAIS vocabulary test, the Forward and Backward Digit Span tasks from the WAIS-R (Wechsler, 1987), and a succession of subject- performance tasks (Cherry et al., 1999). The MMSE was administered first and a score between 12 and 24 was the inclusion criterion (Folstein, Folstein, & McHugh, 1975). Previous research has suggested that participants scoring lower than 12 on the MMSE did not benefit as well from spaced-retrieval training. For the current sample, scores ranged from 13 to 23, indicating cognitive impairment (see Table 6). Participants were in the fourth or fifth Stage of dementia according to the Global Deterioration Scale, which is representative of mild to moderate AD (Reisberg, Ferris, deLeon, Crook, & Hayes, 1987). The participants were given the GDS as a measure of affective status (Sheikh & Yesavage, 1986). Scores between 6 and 10 on the GDS represent mild depression. The scores from the current sample ranged from 0 to 3, indicating no participants exhibited depressive symptoms at the time of testing. In addition, the short -form of the WAIS vocabulary test

(Jastak & Jastak, 1965) was used as a measure of general intellectual functioning and verbal capability. Forty is the maximum number of points possible on the vocabulary subtest. Research has established that lower education adults score a mean verbal score of 16.1 on the WAIS and higher education adults score a mean verbal score of 29.7 (Cherry & Park, 1993). Participant scores from this sample ranged from 5 to 30. Participant 5 was the only participant to score exceptionally well on the vocabulary test. Overall, the participants' scores indicate an overall deficiency in general intellectual functioning and verbal ability.

The Forward Digit Span and the Backward Digit Span from the WAIS-R (Wechsler, 1987) were used as measures of short-term memory.   The highest possible score is 9.0 on the FDS and 8.0 on the BDS. On the FDS, the current sample scores were between 4.0 and 5.5, suggesting deficits in short-term memory. Scores on the BDS were between 2.5 and 4.5, suggesting memory impairment (see Table 6).

Finally, participants were given a series of subject-performed tasks adapted from Cherry et al. (1999) as a measure of secondary memory ability. In this task 10 items were shown to the participants and then they were asked to perform a specific action with each item. For example, the experimenter handed the participant a toothpick and said, "Here's a toothpick, I want you to break the toothpick." Participants were later asked to free recall the object and what they did with the object. For items that the participants could not recall, the object was brought out as a cue and participants were asked to describe what they did with the object.

The task was scored based on a strict (i.e., verbatim) and lenient (i.e., semantically parallel) criteria for free recall and cued recall of the items and the actions.

In general, free recall of the objects and actions was low, for both strict and lenient criteria (see Table 6). These results confirm research that demonstrates people with probable AD exhibit gross deficits on measures of secondary memory (Cherry & Plauche, 1996). Memory for the object and action improved when the participants were able to view the items as cues in the cued recall task, but overall recall remained low. These results indicate large deficits in secondary memory for the current sample.

Table 6: Summary of Individual Difference Measures									
Participants									
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**Mean**
Age:	86	78	81	82	79	76	71	80	79.12
MMSE[a]:	19	18	21	15	23	13	22	20	18.89
GDS[b:]	0	1	0	1	0	0	0	3	0.63
Vocab[c]:	30	16	15	20	11	5	7	12	14.5
FDS[d]:	5	5.5	4	4.5	5.5	5.5	5.5	5.5	5.06
BDS:	3.5	2.5	3.0	3.0	4.5	2.5	3.0	2.5	3.05
Subject Performed Task[e]									
Free Recall:									
Correct (S)	2	2	0	1	3	0	2	2	1.5
Correct (L)	0	0	0	0	0	0	0	0	0
Cued Recall:									

(table continued)

Correct (S)	0	4	2	4	2	1	2	6	2.63
Correct (L)	0	0	1	1	3	2	2	1	1.25

[a]Mini-Mental State Exam (MMSE, Folstein, Folstein, & McHugh, 1975).
[b]Geriatric Depression Scale (GDS, Sheikh & Yesavage, 1986).
[c]Vocabulary Score, Short-Form of the WAIS Vocabulary test (Jastak & Jastak, 1965).
[d]Forward Digit Span (FDS) and Backward Digit Span (BDS) from the Wechsler Adult Intelligence Scale (Wechsler, 1955).
[e]Subject-performed tasks (SPT) (Cherry and Simmons-D'Gerolamo, 2000).

Materials

Color photographs of countries around the world and text of the country names were used as stimuli for this research. All photographs included a structure characteristic of the country it represented (e.g. the Eiffel Tower, France). The photographs were deemed representative after going through a norming process in which 46 volunteer Louisiana State University students viewed 30 pictures of countries and guessed which country the picture represented. Eighteen of the 30 most representative pictures were chosen to be used as daily stimuli and twelve other representative pictures were used for the final country picture recognition task. England and India were chosen as the two target pictures to be used because respectively 61 percent and 65 percent of the students correctly recognized their pictures. For all pictures, the names of the country were printed in size 28 font and used as the word stimuli. One of the photographs and the corresponding word name of the country were chosen as the target item and the other eight photos and words were used as distracter items for half of the participants. For the other half of the participants, one of the photographs and the corresponding word name of the country were chosen as the target item and no distracters were used. The pictures and words were laminated and placed on a 6-x 6-cm piece of foam board in order for them to be moved around easily. The photos and words were placed on a flat wooden board (29- x 29-cm) with engraved lines to represent a 3 x 3 matrix. For half of the participants, the photos and words were presented separately with nine presented at once with one photo/word each in all of the locations on the matrix. The other half of the participants were presented with one photo/word alone on the matrix with no distracters.

Procedure

Each training session was given in a quiet area at a local adult day care center. A total of six spaced-retrieval training sessions were accomplished with each participant. The sessions were held on Mondays, Wednesdays, and Fridays for two weeks. Each session was conducted for no shorter than thirty minutes and no longer than one hour, unless the participant wished to stop.

Baseline Measures of Memory: *Prospective Nametag Task***.** Two measures of baseline memory- the prospective nametag task and the shirt color naming task were given to the participants on each training day in addition to spaced-retrieval training. The prospective nametag task was given in order to provide a baseline measure of memory for a simple verbal cue/motor response association without the benefit of spaced-retrieval training. The experimenter and the participants were given nametags to wear during the session, and participants were asked to return their nametags at the end of the session when the experimenter said, “We are finished for the day.” Participants were then asked to repeat the instructions to ensure they understand the task. Four points were given to the participants who returned their nametags upon hearing the key phrase for the first time. If the participant turned in their nametag after hearing, “We are finished for the day" twice, 3 points were given. If the participant returned their nametag after the experimenter touched their own nametag as a cue and repeated the cue phrase three times, 2 points were awarded. If the participant turned in their nametag after the experimenter first touched their own nametag, stated the cue phrase four times, and took off their own nametag, 1 point was given. If the participant failed to remember to turn in their nametag after all of the above cues were given, no points were awarded. The experimenter requested the participant to return their nametag and asked if they remembered what they were supposed to do when they heard, "We are finished for the day." Each day the participant's responses and actions were recorded and scored. The overall task was scored for each participant by totaling the nametag scores across all six testing sessions.

The results for the prospective nametag task appear in Table 7. For each participant, a total score was calculated by summing the nametag task score from each of the 8 sessions. The highest possible score was 32 points. The results for each participant are as follows: S1 = 0 points, S2 = 5 points, S3 = 1 point, S4 = 4 points, S5 = 19 points, S6 = 2 points, S7 = 4 points, and S8 = 10 points. All but one participant did not initially remember to turn in their nametags when cued to do so (see Days 1 and 2). More participants remembered to turn in their nametags as the days progressed. However, in general, most did not remember to turn in their nametags until several cues had been given. S5 was the exception as the participant remembered to turn in the nametag on Days 6-8 with few cues offered. Overall, there is only slight improvement in scores for most participants. The results of the prospective nametag task provide evidence that repetition by itself is insufficient to produce considerable memorial benefit for memory in impaired older adults.

Table 7: Summary of Nametag Task Performance									
Participants									
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**Mean**
Day 1	0	0	0	0	1	0	0	0	0.13
Day 2	0	0	0	0	1	0	0	0	0.13
Day 3	0	0	1	1	1	0	0	2	0.63
Day 4	0	0	0	0	2	0	0	0	0.25
Day 5	0	0	0	0	2	0	1	2	0.63
Day 6	0	1	0	0	4	0	0	2	0.88
Day 7	0	1	0	0	4	0	1	2	1.00
Day 8	0	3	0	3	4	2	2	2	2.00
Total	0	5	1	4	19	2	4	10	5.63
Note. Score is based on a possible total of 32 points.									

Shirt Color Naming Task. The shirt color-naming task was given as a baseline measure of delayed recall of single-item information without the benefit of spaced-retrieval training. At the end of each training session, the participants were asked to remember the color of shirt that the experimenter wore that day (a plain, solid-colored shirt). The experimenter named the shirt color and then asked the participants to repeat the color as soon as they saw the experimenter the next day of training. On the next day of training, if the participant did not immediately recall the shirt color, a prompt was given. If the participants were still unable to recall the color, they were asked to name the color of the experimenter's shirt from the last session. The task was scored as pass or fail.

Results of the shirt color naming task are in Table 8. Participants received a score of zero if they could not remember the color of shirt the experimenter was wearing in the previous session and a score of one was awarded if the participant correctly remembered the shirt color. The participants' scores were totaled across sessions with a maximum score of 7. The scores are as follows: S1= 2, S2 = 1, S3 = 1, S4 =0, S5 =5, S6 = 0, S7 = 0, and S8 = 1. Five out of the eight participants remembered the correct shirt color of the experimenter from the previous session on at least one day. However, only two participants out of eight remembered the correct shirt color from the previous day on more than one day. Overall, participants performed very poorly on this task, despite seven days of repeated exposure. Again, results of the shirt color task provide additional evidence that repetition alone is insufficient to provide memorial benefits with memory impaired older adults.

Table 8 : Summary of Shirt Color Task Performance

	Participants								
Days	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**Mean**
Day 2	0	0	0	0	0	0	0	0	0
Day 3	1	0	0	0	1	0	0	0	0.25
Day 4	1	0	1	0	1	0	0	0	0.38

(table continued)									
Day 5	0	0	0	0	1	0	0	0	0.13
Day 6	0	1	0	0	1	0	0	0	0.25
Day 7	0	0	0	0	0	0	0	0	0
Day 8	0	0	0	0	1	0	0	1	0.25
Total	2	1	1	0	5	0	0	1	1.25
Note. Score is based on a possible total of 7 points.									

Summary of Spaced-Retrieval Training Program

Practice Trials. At the start of the first session, all participants performed practice trials at the 5-second interval until the participant met the criterion of one correct trial (which means the participant selected the correct picture and stated the correct country name). Hawley and Cherry (2004) discovered it was necessary for each participant to train to criteria instead of setting a predetermined number of practice trials, because archival data revealed many participants performed multiple trials to achieve success on the task. Practice trials were done in order to ensure that all participants had a clear understanding of the task requirements.

Training Sessions. Following is a summary of the spaced-retrieval training procedure. First, the experimenter talked informally with the participant at the start of each training session to establish rapport. Then, for half of the participants, the experimenter placed the 3 x 3 matrix on the table in front of the participant and presented either the country photographs or the words individually, naming each one and placing all nine stimuli on the board in their positions on the matrix. For the other half of the participants, the experimenter placed the 3 x 3 matrix on the table in front of the participant, and presented and named either the target country photograph or the target country word by itself, and placed it on the matrix. The participants then listened to the sound of the beeper and the experimenter made sure all of the participants were able to hear the beeping sound so that they were trained to respond to the sound during the sessions. The participants were asked to select the target picture/word and give it to the experimenter on cue. For example, “When you hear the beeper, I want you to hand me the picture of England and tell me the picture is of England.” In order for the participant to perform the task correctly, the participant had to select the correct stimuli, hand it to the experimenter, and verbally state what the stimulus was. Selecting the correct picture/word is a visual response, handing it to the experimenter is a motor response, and saying the target’s name is a verbal response. As a result, an association was made between the visual cue and the motor and verbal response. All three responses must have occurred within a trial if the trial was to be considered successful. After each recall trial, the position of the target item on the matrix was shifted to ensure that participants learned the country picture with its name, and not only the specific location of the stimulus. The time limit for the trials was set at between 30 minutes to an hour, with an upper limit of a twelve minute time interval, or until the participant wished to stop. Half of the participants studied country pictures for the first three days of spaced-retrieval training and then studied words for the last three days of spaced-retrieval training. The other four participants studied words of the countries for the first three spaced retrieval days and pictures of the countries for the last three spaced-retrieval training days. In addition, half of the participants were shown no distracter pictures/words and the other half was shown eight distracter picture/words.

The spaced-retrieval method was used to teach the target response. A stopwatch was used to control the time of the trials using the following retention interval schedule: the first retention interval was five seconds. If successful, the following intervals were 10, 20, 40, and 60 seconds. After a successful 60-second retention interval was achieved, retention intervals were increased by 30 seconds if following a successful recall. After a 180 second (or 3 minute) retention was established, the intervals were expanded by 60 seconds following each successful recall. After a 360 second (or 6 minute) retention was achieved, the intervals were expanded by 120 seconds.

Explicit Memory for the Target Object

Three different measures of explicit memory were given to measure the participants' retention of the country picture/word association trained by the spaced-retrieval technique. The three measures included immediate recall and recognition of the trained country picture/word association (within session explicit control task), delayed recall of the trained country picture/word association (from one training session to the next training session), and final recall and recognition of the country picture/word association across the training sessions (recall of the association across sessions).

Immediate Recall and Recognition. Immediate recall and recognition occurred at the end of each spaced-retrieval training session. Participants were asked to recall the name of the target country that they had just been trained on. If the participant was not able to recall the name of the country, the experimenter then placed nine stimuli on the table in front of the participant. The participant was then asked to point out which stimulus they had been working with that day. All responses were recorded.

Delayed Recall. Delayed recall occurred at the beginning of a session following a spaced-retrieval training session. The goal of delayed recall was to determine whether the participants could remember the target country from the previous session. Participants were asked to recall the stimulus they had worked with in the previous session. The longevity of spaced-retrieval training benefits were demonstrated if the participants are able to recall the target. Scores for the task are as follows: a score of 1was given if the participant successfully recalls the target, and a score of 0 was given if the participant was unable to recall the target. All responses were recorded.

Final Delayed Recall. Final delayed recall occurred on the session after each completed week of spaced-retrieval training (sessions 3 and 6). The goal of this task was to determine whether or not participants were able to recall or recognize the target country used during the previous week of training. If participants were unable to recall the target country, then the experimenter placed nine stimuli on the table in front of the participant. Participants were then asked to point out the country they had been trained on the previous week. All responses were recorded.

Final Country Recognition Task. On the final day of the experiment, participants were asked to identify all pictures/words that were used as stimuli in the spaced-retrieval training sessions. The goal of the final country picture/word recognition task was to determine whether participants remembered only the country pictures/words they were exposed to during the spaced-retrieval training. For half of the participants, all nine pictures/words from the training sessions, in addition to nine new photographs/words the participants had not seen before, were placed on the table. For the other half of the participants, the one picture/word used in the training sessions in addition to nine new photographs/words were placed on the table. Participants were informed that some of the pictures/words they had seen before, and some they had not seen before. The participants were asked to hand the experimenter the country pictures/words they had seen before in previous sessions. All responses were recorded.

Detailed procedure for each training day. Each training session was given in a private room at a local adult day care center. A total of six spaced-retrieval training sessions were completed with each participant. The sessions were held on Mondays, Wednesdays, and Fridays for two weeks. Each session was conducted for no shorter than thirty minutes and no longer than one hour, unless the participant wished to stop.

*Day 1***:** Informed consent was obtained from the participant on the starting day. Three individual differences measures were administered: the FDS, MMSE, and the GDS. Also, two baseline measures of secondary memory: the nametag task and shirt-color task were given.

Day 2: On day two, the shirt-color task was given first. The prospective memory instructions were then given and the nametags were handed out. Three additional individual difference measures were administered; the BDS, SPT, DQOL and a Vocabulary test. Finally, the posttest nametag task was given.

Day 3: The prospective shirt color task and nametag task were given at the beginning of the session. The instructions for the spaced–retrieval training were given and the training trials were administered. The posttest nametag task was administered. All responses were recorded.

Day 4: The prospective shirt color task, nametag task, and delayed recall task were given at the beginning of the session. The instructions for the spaced–retrieval training were given, and the training trials were administered. The posttest nametag task was administered. All responses were recorded.

Day 5: The prospective shirt color task and the nametag task were given. The final delayed recall task was administered for the target picture/word. Spaced retrieval trials then began for the same target picture/word. Immediate recall/recognition was given. The final country picture/word recognition task was given. Responses were recorded on a prepared sheet. The posttest nametag task was administered.

Day 6-7: The prospective shirt color task, nametag task, and delayed recall task were given at the beginning of the session. The instructions for the spaced–retrieval training were given and the training trials were administered. The posttest nametag task was administered. All responses were recorded.

Day 8: The prospective shirt color task and the nametag task were given. The final delayed recall task was administered for the target picture/word. Spaced retrieval trials then began for the same target picture/word. Immediate recall/recognition was given. The final country picture/word recognition task was given. Responses were recorded on a prepared sheet. Participants then responded to a demographic questionnaire. The posttest nametag task was administered. At the conclusion of the session, a certificate of appreciation was handed out to every participant to express gratefulness for the participant’s involvement. A shortened summary of the procedure for each day is listed below (see Table 9).

Table 9: Summary of Experimental Procedure

Day 1:

(table continued)

Informed Consent obtained
Prospective Nametag Task
Forward Digit Span (FDS)
Mini-Mental State Exam (MMSE)
Geriatric Depression Scale (GDS)
Prospective Posttest Nametag Task

Day 2:

Shirt Color Naming Task
Prospective Nametag Task
Backward Digit Span (BDS)
Participant Performed Task (SPT)
Vocabulary Test
Country Recognition Pretest
Prospective Posttest Nametag Task

Days 3:

Shirt Color Naming Task
Prospective Nametag Task
Spaced Retrieval Training
- Matrix Presented
- Instructions Given
- Trials

Immediate Recall/Recognition
Prospective Posttest Nametag Task

Day 4:

Shirt Color Naming Task
Prospective Nametag Task
Delayed Recall
Spaced Retrieval Training
- Matrix Presented
- Instructions Given
- Trials

Immediate Recall/Recognition
Prospective Posttest Nametag Task

Day 5:

Shirt Color Naming Task
Prospective Nametag Task
Final Delayed Recall

(table continued)

Spaced Retrieval Training
    Matrix Presented
    Instructions Given
    Trials
Immediate Recall/Recognition
Final Picture/Word Recognition Task
Prospective Posttest Nametag Task

<u>Days 6-7:</u>

Shirt Color Naming Task
Prospective Nametag Task
Delayed Recall
Spaced Retrieval Training
    Matrix Presented
    Instructions Given
    Trials
Immediate Recall/Recognition
Prospective Posttest Nametag Task

<u>Day 8:</u>

Shirt Color Naming Task
Prospective Nametag Task
Final Delayed Recall
Spaced Retrieval Training
    Matrix Presented
    Instructions Given
    Trials
Immediate Recall/Recognition
Final Picture/Word Recognition Task
Demographic Questionnaire
Prospective Posttest Nametag Task
Certificate of Appreciation handed out

RESULTS

These data were analyzed according to the following plan. In the first section, we present overview of spaced-retrieval training outcomes based on visual analyses of participants' performance across groups (no distracters, 8 distracters present in the learning environment) and stimulus format (country names only, names with pictorial illustrations—see Table 10). Next, we focus on spaced-retrieval training performance separately by distracter group (Tables 11a and 11b) and by stimulus format (Tables 12a and 12b). In the second section we focus on the explicit memory measures, including immediate recall and recognition. Immediate recall and recognition were administered at the end of each spaced-retrieval training session in which participants were asked to recall the name of the target country that they had just been trained on. Performance is presented in Table 13. In the final section, we examine performance on the delayed and final recall/recognition measures in which participants are asked to recall or recognize the country they were trained on in the previous day's session. Performance appears in Table 14. Lastly, we examine performance on the final country recognition task in which participants were asked to identify all pictures/words that were used as stimuli in the spaced-retrieval training sessions. Performance is presented in Table 15.

Spaced-Retrieval Training Sessions Performance

General Impressions of Performance. Table 10 contains a summary of recall successes [i.e. number of correct trials (CT), proportion of correct trials (PC)], failures [i.e. failed trials (FT)], and longest time interval duration (LD) across trials, training sessions, and weeks of training for each participant. As can be seen in Table 10, the success of the spaced-retrieval technique in training the participants to remember the names and pictures of countries was evident across these dependent measures. For Week 1, the number of failed trials (FT) reduced from session 1 to session 3 for most participants (excluding S6 and S7). The same trend is apparent during Week 2. The number of correct trials did not prove to be the most illustrative evidence for the success of the spaced-retrieval technique as the number for some participants increased and for others the number decreased. Overall, the mean number of correct trials for the participants remained constant. The longest duration for retention provides better evidence of the success of the spaced-retrieval technique. Longest duration increased for every participant from Session 1 to 3 in Week 1. In other words, all participants were able to retain the correct country for longer retention intervals across the training sessions. As for Week 2, the longest duration either increased or remained constant for all participants, with S2, S3, S4, S5, S8 demonstrating the maximum length retention rate of 720 seconds by the last day of training, session 6.

Proportion correct is another variable to consider when evaluating the success of spaced-retrieval training (see Appendix for abbreviated data). The proportion scores were calculated by dividing the number of correct trials by the total number of trials. While performance fluctuated somewhat, most participants showed general increases in proportion correct across sessions during Weeks 1 and 2. When viewing the mean proportion correct scores for all participants for each day (see Table 10, last column), there is a constant slight increase during Weeks 1 and 2. For Week 1, the mean proportion correct scores start at 0.49 for session 1, to 0.67 for session 2, and finish with 0.71 in session 3. In Week 2, the mean proportion scores begin with 0.71 in session 4, which is a noteworthy finding in that all participants experienced a change in stimulus format in Week 2 relative to week 1 (i.e., those trained with pictures in week 1 were switched to words in week 2 and vice versa). This aspect of the data implies that most participants' gains in training across the first three sessions were maintained or at least not disrupted by a change in stimulus format (but see S5 and S8). In sessions 5 and 6, proportion correct scores were 0.80 and 0.83, respectively. To summarize, spaced-retrieval training appeared effective in that retention of the target was increased for all participants in the current sample across dependent measures.

Table 10: Summary of Spaced-Retrieval Task Performance

					Participants					
		S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	Mean
Week 1										
1	FT	15	4	5	11	0	12	4	8	7.38
	CT	18	16	16	19	15	14	20	20	17.25
	TT	36	25	21	36	15	36	36	36	30.13
	PC	0.50	0.64	0.76	0.53	1.00	0.38	0.56	0.56	0.49
	LD	40	120	300	60	720	20	90	90	180.00
2	FT	15	6	0	12	0	14	6	8	7.63
	CT	21	15	15	20	15	20	20	18	18.00
	TT	36	21	21	36	15	36	36	28	28.63
	PC	0.58	0.71	0.71	0.56	1.00	0.56	0.56	0.64	0.67
	LD	90	240	180	60	720	90	120	180	210.00

(table continued)										
3	FT	11	0	1	10	0	16	6	5	5.00
	CT	19	15	16	20	15	18	19	19	17.63
	TT	36	15	21	36	15	36	30	29	27.25
	PC	0.53	1.00	0.76	0.56	1.00	0.50	0.63	0.66	0.71
	LD	120	720	360	90	720	120	180	180	311.25
Week 2										
4	FT	14	0	2	9	1	15	4	9	6.75
	CT	19	15	17	18	14	19	16	18	17.00
	TT	36	15	21	30	16	36	21	30	25.63
	PC	0.53	1.00	0.81	0.60	0.88	0.53	0.76	0.60	0.71
	LD	60	720	720	180	720	90	300	120	363.75
5	FT	11	0	0	1	0	14	5	4	4.34
	CT	18	15	15	16	15	20	18	19	17.00
	TT	36	15	15	17	16	36	26	24	23.01
	PC	0.50	1.00	1.00	0.94	0.94	0.56	0.69	0.79	0.80
	LD	60	720	720	720	720	90	360	600	498.75
6	FT	3	0	0	0	0	15	5	4	3.34
	CT	20	15	15	15	15	19	19	19	17.13

(table continued)

	TT	36	15	15	15	15	36	26	23	22.63
	PC	0.56	1.00	1.00	1.00	1.00	0.53	0.73	0.83	0.83
	LD	90	720	720	720	720	120	480	720	536.25

Note. FT=Failed Trials, CT=Correct Trials, TT=Total Trials, PC=Proportion of Correct Trials (CT/TT), LD=Longest Duration in seconds.

The Role of Distracters on S-R Performance. Tables 11a and 11b provide a summary of the results of S-R performance for the no distracter group and the group with eight distracters (see Appendix for abbreviated data). Originally, we anticipated that distracters would help S-R performance by directing participants' attention to the to-be-remembered target. Contrary to expectation, it appears that there is little difference between the two groups' spaced retrieval performance, at least initially. That is, distracters appear to have very little effect on spaced retrieval performance in Week 1. Mean proportion correct scores for the three training sessions of Week 1 for the no distracter group are as follows: 0.61, 0.64, and 0.71. The mean proportion correct scores for the with distracters group for week 1 are 0.63, 0.69, and 0.70. The scores are very similar. Conversely, by Week 2, a difference between groups emerges where the no distracter group is outperforming the group with distracters. The no distracter group scored 0.74, 0.86, and 0.89 on their mean proportion correct scores for Week 2. For the group with distracters, their scores were lower for Week 2 with scores of 0.69, 0.75, and 0.77. Week 2, session 5 is the point in time in which it becomes apparent that distracters do have an effect on spaced retrieval performance.

The same pattern emerges overall for the other performance indicators such as failed trials and longest duration. Mean failed trials for the no distracter group for Week

1 are 8.75, 8.25, and 5.50. Overall, the numbers decrease in Week 2 to 6.25, 3.00, and 0.75. However, the trend is not apparent for the group with distracters for failed trials. The mean failed trials stay fairly constant for Weeks 1 and 2 with means of 6.00, 7.00, and 6.75 in the first week and 7.25, 5.75, and 6.00 in the second week. As for longest duration, the no distracter group dramatically increases over sessions as well as weeks. For Week 1, the mean longest durations include 121.00 s, 142.50 s, and 322.50 s. For Week 2, the mean longest durations continue to increase for the no distracter group and include 420.00 s, 555.00 s, and 562.50 s. As for the longest duration for the group with distracters, the show the same pattern of increase over sessions and weeks. For Week 1, the means of longest duration for the group with distracters are 230.00 s, 277.50 s, and 300.00 s. For Week 2, the means increase to 307.50 s, 442.50 s, and 510.00 s.

Table 11a: S-R Performance Without Distracters

		S1	**S2**	**S3**	**S4**	**Mean**
Week 1						
1	FT	15	4	5	11	8.75
	CT	18	16	16	19	17.25
	TT	36	25	21	36	29.50
	PC	0.50	0.64	0.76	0.53	0.61
	LD	40	120	300	60	121.00
2	FT	15	6	0	12	8.25
	CT	21	15	15	20	17.75

(table continued)

	TT	36	21	21	36	28.50
	PC	0.58	0.71	0.71	0.56	0.64
	LD	90	240	180	60	142.50
3	FT	11	0	1	10	5.50
	CT	19	15	16	20	17.50
	TT	36	15	21	36	27.00
	PC	0.53	1.00	0.76	0.56	0.71
	LD	120	720	360	90	322.50

Week 2						
4	FT	14	0	2	9	6.25
	CT	19	15	17	18	17.25
	TT	36	15	21	30	25.50
	PC	0.53	1.00	0.81	0.60	0.74
	LD	60	720	720	180	420.00
5	FT	11	0	0	1	3.00
	CT	18	15	15	16	16.00
	TT	36	15	15	17	20.75

(table continued)

	PC	0.50	1.00	1.00	0.94	0.86
	LD	60	720	720	720	555.00
6	FT	3	0	0	0	0.75
	CT	20	15	15	15	21.70
	TT	36	15	15	15	20.25
	PC	0.56	1.00	1.00	1.00	0.89
	LD	90	720	720	720	562.50

Note. FT=Failed Trials, CT=Correct Trials, TT=Total Trials, PC=Proportion of Correct Trials (CT/TT), LD=Longest Duration in seconds.

Table 11b: S-R Performance With Distracters						
		S5	**S6**	**S7**	**S8**	**Mean**
Week 1						
1	FT	0	12	4	8	6.00
	CT	15	14	20	20	17.25
	TT	15	36	36	36	30.75
	PC	1.00	0.38	0.56	0.56	0.63
	LD	720	20	90	90	230
2	FT	0	14	6	8	7.00
	CT	15	20	20	18	18.25
	TT	15	36	36	28	28.75
	PC	1.00	0.56	0.56	0.64	0.69
	LD	720	90	120	180	277.50
3	FT	0	16	6	5	6.75
	CT	15	18	19	19	17.75
	TT	15	36	30	29	27.50
	PC	1.00	0.50	0.63	0.66	0.70
	LD	720	120	180	180	300

	S5	**S6**	**S7**	**S8**	**Mean**

(table continued)						
Week 2						
4	FT	1	15	4	9	7.25
	CT	14	19	16	18	16.75
	TT	16	36	21	30	25.75
	PC	0.88	0.53	0.76	0.60	0.69
	LD	720	90	300	120	307.50
5	FT	0	14	5	4	5.75
	CT	15	20	18	19	18.00
	TT	16	36	26	24	25.50
	PC	0.94	0.56	0.69	0.79	0.75
	LD	720	90	360	600	442.50
6	FT	0	15	5	4	6.00
	CT	15	19	19	19	18.00
	TT	15	36	26	23	25.00
	PC	1.00	0.53	0.73	0.83	0.77
	LD	720	120	480	720	510.00

Note. FT=Failed Trials, CT=Correct Trials, TT=Total Trials, PC=Proportion of Correct Trials (CT/TT), LD=Longest Duration in seconds.

The Role of Pictorial Support on S-R Performance. Originally, we had expected pictorial support to enhance overall S-R performance across groups and training sessions. The pattern of outcomes obtained suggests that the benefits of pictorial illustrations on spaced retrieval performance may depend importantly on the presence of distracters in the learning environment and also prior experience with the training task. In this section, we first evaluate the mnemonic benefit of pictorial illustrations on spaced-retrieval training performance across participants. This comparison is important as it allows an examination of spaced retrieval performance within the same week of training, thus holding experience with the task constant. Next, we examine the benefit of pictorial support relative to text only within participants which may be a more powerful comparison but necessarily confounds stimulus format and training week.

Tables 12a (no distracters) and 12b (8 distracters) provide a summary of S-R performance in the text only and pictorial support conditions in Weeks 1 and 2 (see Appendix for abbreviated data). We had expected pictorial support to facilitate spaced retrieval performance overall, however, the present results imply that the mnemonic benefit of pictures may depend on task experience and the presence of distracters in the learning environment. Inspection of Table 12a (no distracters) indicates that there was no benefit of pictures in Week 1 in that S3 and S4 performed comparably to S1 and S2, with means of 0.65 and 0.66 respectively. In Week 2, those in the pictorial support condition (S3, S4) outperformed those in the text only condition (S1, S2). Means, in order, were 0.89 and 0.77. This aspect of the data implies that task experience may be necessary for people with probable AD to benefit from the presence of pictorial support when there are no other distracters present in the learning environment. The within-participant comparisons partially support this conclusion in that S3 and S4 showed a 0.24 gain in performance from Week 1 (text only) to Week 2 (pictorial support). In contrast, S1 and S2's performance across Weeks 1 and 2 did not show the same pictorial advantage. In fact, their Week 2 performance (text only) actually exceeded their week 1 performance (pictorial support) by 0.11, suggesting that task experience is a critical variable for enhancing spaced retrieval performance. The most conservative conclusion to be drawn based on these data is that the benefit of pictorial support appears to be evident given experience with the task (i.e., from text only in week 1 to text with pictorial support in week 2), although experience with the task may override the memorial value of pictorial support as S1 and S2's performance in Week 2 (text only) exceeded their performance in Week 1 (with pictorial support).

Inspection of Table 12b (8 distracters) reveals that pictorial support was useful in week 1 when distracters were present in the learning environment. That is, S5 and S6 (with pictorial support) outperformed S7 and S8 in Week 1, with means of 0.74 and 0.60, respectively. However, by Week 2, these four participants were performing comparably (means of 0.73 and 0.74). The within participant comparisons also yielded evidence of a mnemonic benefit of pictorial support in that S7 and S8 in week 1 (text only) showed a 0.13 improvement in week 2 (pictorial support), replicating the same Week 1 to Week 2 advantage as seen in S3 and S4 in the no distracter condition (see Table 12a). Interestingly, there was no evidence that prior task experience overrode the memorial benefit of pictures when 8 distracters were present in the learning environment. That is, S5 and S6, who received pictorial support in week 1 performed comparably in week 2 in the text only condition (means for both weeks were 0.74).

Table 12a: Without Distracters Text Only Versus Pictorial Support on S-R			
Week 1			
Text Only (S3, S4)		Pictorial Support (S1, S2)	
Session 1	0.65	Session 1	0.57
Session 2	0.64	Session 2	0.65
Session 3	0.66	Session 3	0.77
Mean	0.65	Mean	0.66
Week 2			
Text Only (S1, S2)		Pictorial Support (S3, S4)	
Session 4	0.77	Session 4	0.71
Session 5	0.75	Session 5	0.97
Session 6	0.78	Session 6	1.0
Mean	0.77	Mean	0.89

Table 12b: With Distracters Text Only Versus Pictorial Support on S-R			
Week 1			
Text Only (S7, S8)		Pictorial Support (S5, S6)	
Session 1	0.56	Session 1	0.69
Session 2	0.60	Session 2	0.78
Session 3	0.65	Session 3	0.75
Mean	0.60	Mean	0.74
Week 2			
Text Only (S5, S6)		Pictorial Support (S7, S8)	
Session 4	0.71	Session 4	0.68
Session 5	0.75	Session 5	0.74
Session 6	0.77	Session 6	0.78
Mean	0.74	Mean	0.73

Explicit Measures

Immediate Recall and Recognition. At the end of each training session, participants were asked to free recall, or recognize if they were unable to recall, the target country. Table 13 shows the results for each participant for each training session. Overall, performance improved for participants across sessions. During the first day of training, most participants were unable to free recall the target country. S5 was the only participant who could successfully free recall the target item at the end of session one. On the second day of training, three participants could free recall the target country. By the third and last day of Week 1 training, all but one participant, S6, could free recall the target country. In the second week of training, participants were trained on a new target country. Similar to Week 1, participants' performance increased over the three days and by the final day of testing, six of eight participants could free recall the target country. Although performance increased for free recall of the target across days, performance was not perfect for any participant, even though immediate recall was performed just moments after spaced-retrieval training which consisted of at least 30 minutes of exposure to the target. This finding is consistent with the literature in that older adults' with probable AD have secondary memory deficits.

When participants were unable to free recall the target, the target alone or the target with distracters were presented again for the recognition task. Usually when participants were unable to recall the target, they were able to recognize it. The re-presentation of the stimulus was adequate to prompt successful recognition of the target. By the end of the first week, the one participant that did not free recall the target was able to recognize it (S6). By the end of Week 2, out of the two participants that could not free recall the target (S1, S6), one of them could recognize it so seven of eight participants exhibited some memory for the target.

Immediate recall and recognition show a unique trend for memory of the target country when looking at the role of distracters. The performance in immediate recall and recognition appears to be similar for both the no distracter and distracter groups, but in fact, the group with distracters shows slightly higher recall and recognition performance totals overall than the group without distracters. The no distracter group totals 6 recalls for week 2 whereas the group with distracters totals 8 recalls. This finding is different from the spaced retrieval data which suggest distracters impair spaced retrieval performance (see Tables 11a and 11b). As for immediate recall and recognition in relation to the role of pictorial support, it appears that there is no significant difference on performance when comparing the names only groups with the pictorial support groups.

Table 13: Summary of Immediate Recall and Recognition Task

No distracters							With Distracters			
		Pictorial Support		Text Only			Pictorial Support		Text Only	
Measure		**S1**	**S2**	**S3**	**S4**		**S5**	**S6**	**S7**	**S8**
Free Recall / Recognition										
Week 1	Session 1	0/0	0/1	0/0	0/0		1/-	0/0	0/1	0/1
	Session 2	1/-	0/1	1/-	0/0		1/-	0/0	0/1	0/1
	Session 3	1/-	1/-	1/-	1/-		1/-	0/1	1/-	1/-
	Total	2/0	½	2/0	1/0		3/0	0/1	1/2	1/2
		Text Only		Pictorial Support			Text Only		Pictorial Support	
Week 2	Session 1	0/0	0/0	0/0	1/-		0/1	1/-	0/1	1/-
	Session 2	0/0	0/1	1/-	1/-		1/-	0/1	1/-	1/-

(table continued)										
	Session 3	0/0	1/-	1/-	1/-		1/-	0/1	1/-	1/-
	Total	0/0	1/1	2/0	3/0		2/1	1/2	2/0	3/0
Note. Scores of 0 indicate the Ss did recall or recognize the target person, whereas, a score of 1 indicates the Ss did recall or recognize the target person										

Delayed and Final Recall and Recognition. Each participant's performance on the delayed and final recall task can be found in Table 14. As can be seen, the target was successfully recalled only three times in the first week, on session 3, the final recall day by S1, S5, and S8. The other participants failed to successfully recall the target. In the second week, again the target was recalled successfully three times; by S3 during the first session, by S4 and S5 during session 6, the final recall day. Target recognition was better than recall performance for both Weeks 1 and 2. Three participants successfully recognized the target in week 1 which occurred in both session 2 (S2, S5, S8) and in session 3 (S2, S3, S7). For Week 2, session 4, only one participant recognized the target (S6), but in sessions 5 and 6, three participants successfully recognized the target (S2, S6, S7 and S2, S7, S8, respectively). Overall, more participants could successfully recognize the target than successfully recall the target.

Table 14: Summary of Delayed and Final Recall and Recognition Task				
Participants				
	No Distracters		With Distracters	
	Pictorial Support	Text Only	Pictorial Support	Text Only

(table continued)

Measure		S1	S2	S3	S4	S5	S6	S7	S8
Recall / Recognition Country									
Week 1	Session 2	0/0	0/1	0/0	0/0	0/1	0/0	0/0	0/1
Final	Session 3	1/-	0/1	0/1	0/0	1/-	0/0	0/1	1/-
	Total	1/-	0/2	0/1	0/0	1/-	0/0	0/1	1/1
		Text Only		Pictorial Support		Text Only		Pictorial Support	
Week 2	Session 1	0/0	0/0	1/-	0/0	0/0	0/1	0/0	0/0
	Session 2	0/0	0/1	0/0	0/0	0/0	0/1	0/1	0/0
Final	Session 3	0/0	0/1	0/0	1/-	1/-	0/0	0/1	0/1
	Total	0/0	0/2	1/0	1/0	1/0	0/1	0/2	0/1

Note. Scores of 0 indicate the Ss did recall or recognize the target person, whereas, a score of 1 indicates the Ss did recall or recognize the target person

Final Country Recognition Task. On the last day of each training week (Days 5 and 8), participants were presented with the target as well as a proportional number of distracter items. That is, those in the no distracter training condition were presented with the target item plus 8 distracter items. Those in the 8 distracter training condition saw the target item, the original 8 distracters, and 8 new distracters they had not previously seen. Participants were asked to identify the countries they had seen before. Table 15 contains the results of performance on this task. Overall, participants were able to correctly identify more stimuli countries (hits) than falsely identifying new items (false alarms). Participants also failed to identify old items (misses) fewer times than they correctly rejected new items (correct responses). All eight participants, with the exception of S6, were able to select the target country as an item they had seen before. These findings provide evidence that only exposure to the country(ies) during spaced-retrieval training is not sufficient for maintaining recall and recognition of the items. Spaced retrieval training on the item appears necessary for success in recalling or recognizing the item.

Table 15: Final Country Recognition Task								
Participants								
Week 1	0 Distracters				8 Distracters			
	Pictorial Support		Text Only		Pictorial Support		Text Only	
Old Items	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**
Hits	1	1	1	1	6	0	1	2
Misses	0	0	0	0	3	9	8	7
New Items								
False Alarms	0	0	0	0	0	0	0	0
Correct Responses	8	8	8	8	8	8	8	8
Week 2								
	Text Only		Pictorial Support		Text Only		Pictorial Support	
Old Items								
Hits	1	1	1	1	6	1	3	1
Misses	0	0	0	0	3	8	6	7
New Items								
False Alarms	2	7	1	0	0	0	1	0
Correct Responses	6	1	7	8	8	8	7	8

DISCUSSION

We expected that the present study would further demonstrate the success of spaced-retrieval training and further attest to the flexibility of the technique as a valuable intervention for people with probable AD. The results of the present study confirm that the spaced-retrieval technique is an effective tool for enhancing recall in older adults with probable AD.

The present research was designed to address two issues in regard to the study of memory interventions for cognitively impaired older adults suffering from probable AD. The first issue we addressed was the role of the target to distracter ratio in spaced-retrieval. We expected distracters to have an impact on spaced-retrieval training. We manipulated the number of distracter items, using the traditional eight distracters (Hawley et al., 2004) for half of the participants and no distracter items for the other half. We expected that the participants would perform better on spaced-retrieval training when they studied the target item in the presence of eight distracter items compared to when the target item is presented in isolation (i.e., no distracter items). We also expected benefits of studying the target item in the presence of distracters to be apparent in the three explicit memory measures, immediate, delayed, and final recall/recognition. Our results indicate some evidence of this and are discussed more fully below.

The second issue we addressed in the present study was whether pictorial support would be shown to provide memorial benefits in AD patient participants. We trained the Alzheimer's patients to learn pictures of countries and the corresponding word names of countries to retain knowledge of a target country. We then compared the participants' performance on spaced retrieval for pictures of the countries versus words of the country names. Our expectation was that the pictures would provide positive memorial benefits based on the results of Winograd et al. (1982) and Rissenberg et al. (1986). Because spaced-retrieval training is an intensive memory intervention, we expected that the AD patients would exhibit recall benefits of learning the target countries with the addition of pictures over recalling the target countries as text only. Our results provide some evidence that pictorial support enhances spaced retrieval performance. The findings are discussed in more detail below.

Spaced Retrieval Effects

The first goal of the present study was to determine the effects of distracters on spaced-retrieval training. We expected distracters to have an impact, which they did, but the impact observed was contrary to our expectations. We anticipated the distracters to help because we thought they would force the participants to pay closer attention to encoding the proper to-be-remembered items. By adding distracters to the learning environment during spaced-retrieval training, we thought we were adding difficulty as well. We thought that if participants were successful at learning the target among distracters, then they really were encoding the country as opposed to just randomly remembering the only choice available as in the no distracter group. However, our expectations were not fully supported in this study. To be precise, the distracters in this study appeared to have little effect on spaced retrieval performance initially and slightly impair spaced retrieval performance rather than helped it later in training. As evident in Tables 11a and 11b, the distracters had minimal effect on spaced retrieval performance in Week 1. The mean proportion scores were very similar for both the no distracter and the with distracter groups for week 1. By Week 2, participants in the no distracter group outperformed the distracter group, a pattern that was most evident in Week 2, session 5 when the no distracter group scored an average proportion correct score of 0.86 and the group with distracters scored an average of 0.75. For failed trials, a somewhat different trend emerged. That is, the number of failed recall trials stayed fairly constant for the group with distracters compared to the no distracter group whose failed trials declined over sessions. Further, the longest duration variable for the no distracter group clearly outperformed the group with distracters. The mean longest duration for the no distracter group was 562.50 s in week 2 versus a 510.00 s mean for the group with distracters.

Future research should extend the number of spaced retrieval sessions in order to help determine more clearly the role of distracters. However, it appears that overall distracters may impair the efficiency of spaced-retrieval training, perhaps due to the buildup of proactive interference, but more research is necessary. When applying the spaced-retrieval technique to aid people with probable AD, practitioners should limit the use of distracters. Spaced retrieval without distracters appears to be the most effective when dealing with older adults with probable AD at least for short term training gains.

The second goal was to determine whether pictorial support enhanced performance on spaced-retrieval training. We expected pictorial support to enhance spaced retrieval performance, but our results suggest that the benefits of pictorial support are complex and depend on the presence of distracters as well as previous experience with the task. Tables 12a (no distracters) and 12b (8 distracters) provide a summary of spaced retrieval in the text only and pictorial support conditions in Weeks 1 and 2. For Week 1 in the no distracter condition, it appears that there was no benefit of pictures initially. However, in Week 2, those in the pictorial support group outperformed those in the text only condition with no distracters. This finding suggests that task experience may be required for people with probable AD to gain from the addition of pictorial support when there are no distracters present in the learning environment. It may be that participants have to experience the task to understand firsthand that the pictorial support is additional help in encoding the target countries. Within participant comparisons also provide partial evidence for this conclusion. A possible confound to this conclusion though, is that experience in itself may be the factor that influenced spaced retrieval performance rather than pictorial support. Pictorial support coincides with experience with the task when making comparisons within participants, so interpretative caution is warranted.

In contrast, pictorial support in the presence of distracters appeared to be beneficial in Week 1. By Week 2, there appeared to be no difference in performance with pictorial support and without it. For the within-participant comparisons, the same effect of experience with the task was observed in that those with text only in Week 1 and pictorial support in Week 2 improved more than did those with pictorial support in Week 1 and text only in Week 2 who did not differ across weeks. Interestingly, it appears that prior task experience did not override the memorial benefit of pictures when distracters were present for these participants. In summation, pictorial support has complex effects on spaced retrieval performance in that our data imply that whether pictures are helpful or not depends on the characteristics of the learning environment.

Explicit Measures Effects

Immediate, delayed, and final recall/recognition tasks as well as final country recognition tasks display the participants' explicit memory for the target countries as well as the distracter items. Overall participants did not perform as well on these tasks as they did on spaced-retrieval, indicating the necessity of specific memory training over simple repetition for memorial benefits.

For the immediate recall/recognition task, Table 13 indicates that overall, performance improved for the participants across training sessions. Even though performance increased for free recall of the target across days, performance is not perfect for any participant. Immediate recall was done just seconds after spaced-retrieval training which means that simple repetition is not the most beneficial technique to use in training people with probable AD to learn new information. Interestingly, when participants were unable to recall the target, they were usually able to recognize it. By the end of Week 2, out of the two participants that could not free recall the target, one of them could recognize it, so seven of eight participants demonstrated some memory for the target. This data implies that participants do have knowledge of the target stored, but how it is accessed is important.

Performance on the delayed and final recall tasks was similar to immediate recall. Overall, performance improved over time for participants and recognition was attained when recall wasn't. Target recognition was better than recall performance for both Weeks 1 and 2.

As for the final country recognition task, in general, participants were better at identifying more stimuli countries (hits) than falsely identifying new items (false alarms). Also, participants failed to identify old items (misses) less than they correctly rejected new items (correct responses). Again, these results indicate the importance of utilizing the spaced-retrieval technique when training people with probable AD to learn new information. Mere exposure to the country(ies) during spaced-retrieval training was not enough to maintaining recall and recognition of the items.

In closing, the results of the present investigation provide new evidence concerning the role of distracters in spaced-retrieval training. Our findings also inform the use of pictorial illustrations as an aid to enhancing spaced retrieval performance. Nonetheless, there are several limitations of the present study. First, Alzheimer's patients are not all the same. Our participants were at varying progressions of the disease at the time of testing and thus control over the groups was difficult. In particular, S5 was a higher functioning participant and performed considerably higher than the others on most tasks. Another concern of the present study, the effect of previous experience with the spaced-retrieval training, was addressed previously. This factor may have impacted Week 2 performances of the participants. Nevertheless, future research to explore the reliability and generality of the present findings seems warranted.

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APPENDIX: ABBREVIATED DATA

Mean Proportion Correct for All Participants
Week 1
Session 1: 0.49
Session 2: 0.67
Session 3: 0.71

Week 2
Session 4: 0.71
Session 5: 0.80
Session 6: 0.83

Mean Proportion Correct Without Distracters
Week 1
Session 1: 0.61
Session 2: 0.64
Session 3: 0.71

Week 2
Session 1: 0.74
Session 2: 0.86
Session 3: 0.89

Mean Proportion Correct With Distracters
Week 1
Session 1: 0.63
Session 2: 0.69
Session 3: 0.70

Week 2
Session 1: 0.69
Session 2: 0.75
Session 3: 0.77

Mean Proportion Correct Without Distracters

Week 1	Week 2
Text Only (S3, S4) = 0.65	Text Only (S1, S2) = 0.77
Pictorial Support (S1, S2) = 0.66	Pictorial Support (S3, S4) = 0.89

Mean Proportion Correct With Distracters

Week 1	Week 2
Text Only (S7, S8) = 0.60	Text Only (S5, S6) = 0.74
Pictorial Support (S5, S6) = 0.74	Pictorial Support (S7, S8) = 0.73

VITA

Emily Olinde recently completed the requirements to complete her Master of Arts degree in psychology. She will continue her studies at Louisiana State University in the doctoral program of psychology. Her research interests include the cognition of older adults and interventions to help people with probable Alzheimer's disease.