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By

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This thesis has been examined and approved by the following members of the thesis committee.

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Memory problems are a hallmark symptom of dementia. Although memory problems can take various forms, anomia is a common type of cognitive deficit that involves difficulty recalling names of people or objects. The purpose of the current study was to test the effectiveness of two interventions designed to improve the ability to recall the names of objects. Two elderly individuals with memory impairment participated in this study. Baseline involved identifying low and high probability images, with low-probability (low-p) items serving as the target images during the intervention phases. Two interventions were compared using an alternating treatments design. The first intervention, Recognition-to-Recall, involved a series of high-p recognition tasks followed by one low-p recall task. The second intervention, Recall-to-Recall, involved a series of high-p recall tasks followed by one low-p recall task. Results indicated that the two interventions greatly improved recall for the names of low-p target objects, although the Recall-to-Recall intervention appeared to be somewhat more effective for both participants. Results indicate that this intervention shows promise as a means for improving recall for names of objects in persons with mild to moderate cognitive impairment.

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CHAPTER 1

INTRODUCTION

As the American population experiences a steady increase in life expectancy, more elderly individuals are suffering from cognitive impairment. Deficits in cognitive functioning can occur on a spectrum from mild to severe and can be caused by a variety of conditions. For instance, normal aging can be accompanied by changes in cognitive abilities such as speed of cognitive processing and working memory (Luo & Craik, 2008). "Cognitive impairment without dementia" is a term used to describe deficits in memory that are more severe than those seen in normal aging, but less severe than those observed in dementia. Cognitive impairment without dementia can be caused by numerous factors such as medical conditions, sensory impairment, vascular disease or past alcohol abuse (Plassman et al., 2008). It is estimated that approximately 5.4 million elderly individuals display cognitive impairment without dementia (Plassman et al., 2007; Plassman et al., 2008).

Some causes of cognitive impairment without dementia may be precursors to more severe cognitive disorders such as dementia. For example, a condition called Mild Cognitive Impairment (MCI) is characterized by similar, yet less severe, cognitive deficits as those found in elderly persons diagnosed with dementia (Dudas, Clague, Thompson, Graham, & Hodges, 2005). MCI requires that the individual show impairment in one area of cognitive functioning without associated deficits in daily functioning (Gauthier et al., 2006). Dudas and colleagues (2005) found deficits in person

naming, item recognition, and recall of item location for participants with MCI and those with Alzheimer's disease. Individuals with MCI have also displayed deficits in language performance (Taler & Phillips, 2008); visual motion and visuo-spatial processing (Mapstone, Steffenella, & Duffy, 2003), and divided attention (Okonkwo, Wadley, Ball, Vance, & Crowe, 2008). MCI is associated with decreases in quality of life as well as increases in pathological symptoms and levels of disability (Lyketos et al., 2002; Troyer, Murphy, Anderson, Moscovitch, & Craik, 2002). Individuals with MCI are more likely to develop Alzheimer's disease and have higher mortality rates than cognitively intact elderly adults (Plassman et al, 2008). Research has suggested that up to 48% of individuals with MCI will meet criteria for dementia within three years (Geda, Negash, & Petersen, 2009).

On the more severe end of the spectrum of cognitive impairment is dementia, which can be caused by numerous conditions. The most common cause of dementia is Alzheimer's Disease (AD), which accounts for approximately 60 – 80% of cases of dementia and affects an estimated 5.3 million people in the United States (Alzheimer's Association, 2011). Dementia of the Alzheimer's type is characterized in the Diagnostic and Statistical Manual of Mental Disorders (4th ed., text rev.; DSM-IV-TR; American Psychiatric Association, 2000), as involving impairments in memory impairment and at least one other cognitive domain that interferes with daily functioning. Impairments in memory associated with AD usually involve deficits in short-term memory and new learning. Disturbances must also occur in at least one other cognitive domain such as: aphasia (e.g., language disturbance), apraxia (e.g., inability to carry out motor activities

despite intact motor functioning), agnosia (e.g., difficulty recognizing items), or in executive functioning (e.g., planning, organizing, sequencing, abstracting, etc.).

Cognitive impairment in older adulthood affects millions of individuals, can be caused by numerous conditions, and can occur along a spectrum of severity. Although cognitive deficits can occur in several different cognitive domains, disturbances in memory are often the most noticeable and disruptive to older individuals. There are different types of memory and some are more susceptible to the effects of both normal aging and conditions that cause more severe cognitive disturbances. For example, one common form of memory impairment relates to the inability to recall previously learned information and/or the inability to learn new information (American Psychiatric Association, 2000).

Recall memory involves retrieving previously learned information without presentation of answer choices (Erber, 2010). A recall task could be remembering a person's name after being introduced (e.g., "Do you remember what my name is?"). Cued recall involves providing an individual with a prompt or hint in order to better guide recall (Erber, 2010). For example, a person could be shown a picture and later given a categorical cue about the picture (e.g., "What animals did you see?"). Recognition differs from recall in that the correct answer is embedded within the answer choices, there is more environmental support, and less self-initiated processing (Erber, 2010; Reed, 2010). For instance, "Is his name Bob, Tom, George, or Sam?" Recognition and recall memory differentially decline in both normal aging as well as dementia. Recall memory diminishes before recognition memory, which is why the current study

targets the improvement of recall in persons suffering from mild to moderate cognitive impairment (Cushman et al., 1988; Zec, 1993).

Individuals suffering from memory loss experience an array of negative emotions that are associated with forgetting. Anxiety, depression, anticipation, distress, frustration, and dependence may be correlated with cognitive impairments (Sherman, 1999). Persons with dementia may realize someone is coming to visit, yet may not remember the person's name or time of arrival. This deficit in recall memory is associated with dementia and may also relate to humiliation, anxiety, and dependence on a caregiver for information (Sherman, 1999). Dependence on caregivers may lead to strain on relationships. Non-pharmacological interventions that could slow the progression of memory loss and maintain autonomy in individuals with impaired functioning would be highly beneficial to the individual suffering as well as caregivers (Buchanan, Christenson, Houlihan, & Ostrom, 2011). Developing interventions to maximize the functioning of the estimated 115.4 million elderly individuals who will have dementia in 2050 is both necessary and humane (Alzheimer's Disease International, 2010).

Memory Enhancement Procedures

Due to the negative, personal impact of cognitive impairment and the continued increase in elderly persons who will suffer from impaired functioning, researchers have been studying the effect of non-pharmacological interventions on memory enhancement. These interventions have targeted individuals suffering from varying levels of cognitive impairment. Previous research indicates that individuals with MCI or dementia can benefit from memory training and enhancement procedures.

Some researchers have used comprehensive memory training programs to improve cognitive functioning (Belleville et al., 2006; Kinsella et al., 2009; Rapp,

Brenes, & Marsh, 2002; Troyer et al., 2008) in individuals with MCI. Kinsella and colleagues (2009) used a memory-training program that involved education about memory loss, external memory aids, verbal categorization and elaboration, visual imagery, errorless learning, and space retrieval. Kinsella and colleagues (2009) incorporated family members into the training program, as these individuals usually become highly involved as caregivers. Caregiver awareness of memory strategies better generalized the use of memory enhancement procedures. Both participants and caregivers displayed an increase in memory strategy competence and participants displayed a decrease in everyday memory errors (Kinsella et al., 2009).

Rapp and colleagues (2002) included education about memory loss, relaxation training, memory skills training, and cognitive restructuring in a memory enhancement program. Upon comparison between the treatment and control group, individuals in the treatment group displayed greater ability to recall a word list at follow-up. Belleville and colleagues (2006) also implemented a cognitive training program that involved: information on memory loss, computer-assisted memory training, interactive imagery, method of loci, face-name association, and organization of text information. Similar to Rapp and colleagues (2002), participants displayed an increase in world list recall and furthermore, an increase in name-face association (Belleville et al., 2006).

Research has demonstrated the efficacy of external memory aids, or cognitive prosthetics, in combination with memory training to enhance cognitive functioning in individuals with cognitive impairment (Burgeois et al., 2003). Cognitive prosthetics may include: labels on kitchen drawers and cabinets, grocery lists, calendars, lists of important phone numbers, or pictures of family members with their name below the photograph

(Buchanan et al., 2011). Cognitive prosthetics are items that serve as reminder cues for individuals with memory loss (Buchanan et al., 2011). Troyer and colleagues (2008) used memory books, which are a conglomeration of cognitive prosthetics, to facilitate memory-related behavior change in participants with MCI. Participants were taught ways to use the reminder cues in their memory books to help them remember future events and to incorporate the use of the memory books during daily living (Troyer et al., 2008).

A yearlong cognitive-motor intervention in addition to social support maintained cognitive functioning in persons with MCI (Olazaran et al., 2004). The cognitive-motor intervention included: cognitive enhancement strategies, psychomotor activities, and social activities. After six months of only receiving social support, individuals in the control condition showed further decline in cognitive functioning, whereas individuals in the treatment condition maintained or improved their scores on a multitude of cognitive assessments (Olazaran et al., 2004).

Other memory enhancement techniques have also produced positive results in persons with more severe impairment. Personal information presented on index cards served to moderately improve the number of correct responses given by patients diagnosed with dementia (McEvoy & Patterson, 1986). Participants were presented with their name, address, and phone number on the index card and then asked to recall the information after one week for 20 consecutive weeks.

Repetition of pictures increased delayed and free recall in elderly patients diagnosed with dementia (Heun, Burkhard, & Benkert, 1997). Pictures were presented on different fixed schedules to measure the effects of different repetition procedures.

Pictures were presented for 10-sec or 20-sec at a time, a set of pictures were cycled through once or twice, and cycles were repeated either immediately or four days later. Prolonged presentation time and within-list repetition of items did not improve recall more than shorter item presentation or single list repetition, although general improvement was displayed (Heun et al., 1977).

Also, a case report using repetition of word lists and a picture dictionary improved anomia in an individual diagnosed with semantic dementia (Graham, Patterson, Pratt, & Hodges, 1999). The participant used a notebook to categorize names of objects he could no longer identify. The participant used repetitious presentation of the words in his notebook to attempt to facilitate memory. A picture dictionary was also utilized in a similar manner, yet the participant would use the visual presentation of the object, instead of the object's name, to facilitate recall. By using these tools the participant was able to improve on both naming tests over a 15-month period (Graham et al., 1999).

Karlsson and colleagues (1989) prompted individuals with mild, moderate, and severe cognitive impairment to demonstrate the use of an object before being required to name the object. Using an object prior to naming is referred to as a subject-performed task. Free and delayed recall was targeted and all participants displayed improvement in ability to recall the names of objects. Patients with severe impairment performed almost as well as cognitive intact elderly controls when provided with a cue (Karlsson et al., 1989).

Cueing is a popular method used to improve all types of memory and has specifically been used to enhance recall and recognition in persons with dementia (Arkin, 1992, 2001; Clare, Wilson, Breen, & Hodges, 1999; Clare et al., 2000; Cushman, Como,

Booth, & Caine, 1988). Cushman and colleagues (1988) found that cues helped impaired individuals recall information at five times the rate of recall during baseline. Patients with dementia displayed greater improvement in recognition rather than recall tasks (Cushman et al., 1988). Cueing after use of audiotapes increased probability of correct responses in elderly patients with dementia (Arkin, 1992, 2000). Participants listened to an audiotape of relevant personal history and were then asked questions pertaining to the material. Clare and colleagues (1999, 2000) used vanishing cues for face-name associations. Participants were provided with a picture of a person with their name located below with one letter removed. Upon each instance of a correct response, another letter was removed. Clare and colleagues (1999, 2000) then implemented space retrieval procedures, which helped maintain correct responses.

Space Retrieval is another procedure for improving recall in persons with mild to moderate dementia that has a greater amount of empirical support compared with the previously discussed procedures (Camp & Schaller, 1989; Camp & Stevens, 1990; McKitrick & Camp, 1993). Camp and Schaller (1989) identified that participants with cognitive impairments could remember information over longer periods of time during space retrieval. Intervals between asking the participant to recall information were determined by the participant's performance. When the participant answered incorrectly the interval was decreased and when the participant answered correctly the interval was increased. Camp and colleagues (1983; 1990; 1993) demonstrated the efficacy of space retrieval to improve recall of names of family members, caregivers, and objects.

Purpose of the Study

The current study aimed to improve recall of the names of common objects in individuals with mild to moderate cognitive impairment. Two novel high-p low-p

procedures were implemented and their effectiveness was compared using an alternating treatments design. Both interventions were based on the concept that individuals with memory impairment may perform better on difficult memory tasks (i.e., naming common objects in the current study) when they first build success by completing easier memory tasks. The "high-p" (high-probability) memory tasks are those that the individual performs well on while the "low-p" (low-probability) memory tasks are those the individual can answer only infrequently.

The high-p low-p procedures implemented in the current study were based on research using similar techniques applied to different target populations and problem behaviors. For instance, research based on the theory of behavioral momentum has demonstrated interpretations of the high-p low-p procedure to be effective for increasing desired behavior in students with and without disabilities (Belfiore, Pulley-Basile, & Lee, 2007; Carr, Newsom, & Binkoff, 1976; Ducharme & Worling, 1994; Lee et al., 2004; Lee et al., 2006), adults with disabilities (Mace et al., 1988) and toddlers (McComas, Wacker, & Cooper, 1998). These studies increase compliance with less desirable commands (e.g., low-p commands) by first presenting a series of highly desirable commands (high-p commands) and then reinforcing compliance**.**

Hypotheses

The study sought to demonstrate the effectiveness of implementing high-p low-p procedures to improve recall memory in elderly individuals with cognitive impairment. Secondly, the study sought to identify a magnitude of difference between two interventions for improving recall of the names of objects. The two interventions were Recognition-to-Recall and Recall-to-Recall and the effectiveness of the interventions was compared using an alternating treatments design. Both interventions incorporated high-p

tasks (e.g., recognition or recall) to build success. High-p items were easier tasks that participants could identify with 80% or higher accuracy during baseline. After correct identification of three high-p recognition or recall items, the participant was presented with a low-p recall task. This low-p recall task involved presenting the participant with a low-p recall item (e.g., an item the participant can identify correctly 33% or less of the time) and then asking the individual to identify the name of the object in the picture.

It was hypothesized that recall memory would improve within treatment sessions (i.e., recall would improve during a given treatment session) and across treatment sessions (i.e., recall would eventually be demonstrated from one treatment session to the next) for both interventions when compared to baseline.

It was also hypothesized that the Recall-to-Recall procedure would be the more effective of the two interventions. This hypothesis was posed for at least two reasons. First, in the Recall-to-Recall procedure, memory tasks remain within the same response class, as high-p recall tasks are first presented followed by low-p recall tasks. Due to the continuity of the type of memory task (i.e., both high and low-p tasks are recall tasks), the participants may be able to make an easier cognitive leap between high-p and low-p items. During the Recognition-to-Recall intervention, high-p recognition items are first presented followed by low-p recall items. Changing the response class involved during the procedures may contribute the participant's difficulty identifying low-p recall items.

Second, Recall-to-Recall procedures are consistent in how the images are presented (e.g., one image is presented during each recall task). The environmental structure changes during Recognition-to-Recall, as participants are presented with four images during recognition tasks and one image during the recall task. Recognition tasks

also involve less cognitive effort, as the participant is presented with four images and told that one of them is the correct object. Recognition is a forced choice intervention, whereas participants are not given the name of the object during Recall-to-Recall procedures. Change in response class and environmental structure coupled with the requirement of less cognitive effort are posited as reasons why the Recognition-to-Recall procedure may not be as effective as the Recall-to-Recall intervention.

CHAPTER 2

METHODS

Participants

All participants were recruited from a residential care facility in the Midwest. Residents were referred for participation by facility staff. Participants who were suffering from mild to moderate cognitive impairment were recruited for the study. A formal diagnosis of dementia, however, was not required for participation. Exclusion criteria included severe sight and verbal difficulties, as the procedures involved visual inspection of stimuli and communicating the names of common objects.

Given the time intensive nature of the study, the researchers aimed for two to three participants. Overall, five residents were approached and two completed the study (40%). Two elderly males were excluded from the study due to severe cognitive and sight impairment. A third woman, who had a diagnosis of dementia with intermittent agitation, discontinued participation after five days of baseline. Therefore, two individuals completed the study.

In order to determine severity of cognitive impairment, each participant was administered the Modified Mini Mental Status Exam (3MS; Teng & Chui, 1987). Scores on the 3MS range from 0 – 100 with 100, with a cut-off score of 77 or higher generally indicating intact cognitive functioning (Tombaugh, McDowell, Kristjansson, & Hubley, 1996). The cut-off score is not adjusted for age or education; however, normative data for different age groups and levels of education are available and were used to interpret the scores of the participants in this study. The 3MS targets object naming,

concentration, immediate and delayed recall, orientation, registration, language, executive functioning, and ability to follow commands. Because the 3MS is an expanded version of the commonly used Mini Mental Status Examination (MMSE), an MMSE score can also be derived from the 3MS.

The first participant, Mabel, was a 91-year-old Caucasian female who resided in the assisted living center within the facility. Mabel had a primary diagnosis of dementia and displayed anomia upon direct observation as indicated by an inability to identify common objects after being given the correct answer. Upon direct observation, Mabel also displayed aphasia, as she often referred to objects or key points in a story as "thing," "that," or "it." Mabel had difficultly with verbal expression, as she would repeat stories, pause for seconds at a time during a sentence, and forget which story she was speaking about midsentence. Mabel's score of 86 on the 3MS fell at the 37th percentile for her age and education. An MMSE score of 28 was derived from the 3MS assessment. Although these scores are above the mild to moderate cognitive impairment cut-off, Mabel's diagnosis and observed cognitive deficits deemed her appropriate for participation in the study.

The second participant, Sophia, was a 92-year-old Caucasian female living in the memory care unit within the facility. Sophia had a history of increased memory loss, yet did not have a proper diagnosis of dementia. Upon direct observation, Sophia demonstrated aphasia, anomia, and disturbances in executive functioning. Aphasia was displayed by the participant's difficulty with verbal expression. Sophia would struggle to find the words to finish a sentence or tell a story. Also, Sophia would repeat sentences and questions during a conversation. Disturbances in executive functioning were

indicated by difficulty finding similarities and differences between items on the 3MS and diminished ability to complete complex motor tasks in everyday life. Anomia was indicated by the participant's inability to identify common objects after being given the correct answer. Sophia had a 3MS score of 47, which placed her well below the second percentile for her age and education level. Using the results from the 3MS, Sophia had an MMSE score of 14. This placed her within the moderate cognitive impairment range. Mabel and Sophia completed all phases of the study.

Training

Research assistants were trained before assisting with data collection. Each assistant met with the primary data collector to review a task analysis, role-play, and ask questions regarding implementation of procedures. Research assistants functioned as data coders during sessions. The primary data collector facilitated each session while the secondary collector recorded participant answers, time between memory tasks, and session length. Utilizing trained assistants as data recorders enhanced the credibility of the implementation of procedures.

Procedures

Assessment.

During the assessment phase, the principal investigator and primary data collector met with residents to ensure appropriateness for participation in the study. During each meeting, participants were informally observed to determine their level of cognitive and functional impairment (e.g., how well could they carry on a conversation, did they repeat stories, did they have word finding difficulties during conversations?) The 3MS was administered to provide an objective measure of the severity of each resident's cognitive impairment. Additionally, collateral contacts with a legal guardian or staff member were made via phone and in person to identify participant characteristics and

relevant history. Meetings to assess the resident's level of functioning spanned 1 – 2 sessions, and lasted between 30 – 45 minutes.

Baseline. The purpose of baseline was to determine high-p recognition and recall items and low-p recall items. High-p items consisted of images the participant could correctly identify 80% of more of the time. Images the participant could identify 1 – 33% of the time were deemed low-p items. Items identified with 34% - 79% accuracy were not used as target items. Baseline spanned 16 sessions for Mabel and Sophia. All 94 items were asked a minimum of five times. On average, 28 items were presented during each session, which ranged from 7 min 44 sec – 24 min 52 sec (M = 15 min 18 sec). Items spanned six general categories: animals, clothing items, fruit, kitchen items, tools, and vegetables.

Initially, sessions incorporated recognition and recall tasks. Both memory tasks incorporated a categorical and visual cue. Recognition tasks included grouping four images of the same category together and asking the participant to identify the correct image out of the grouping of four items. For instance, the participant would be presented with an image of a cow, horse, deer, and dog (e.g., a visual cue). The research assistant would state, "This is a grouping of four types of animals," and would ask, "Can you tell me which picture is of a horse?" The categorical cue was the first statement during the task that signified which category the pictures were from for recognition (e.g., "This is a grouping of four types of animals"). Recall tasks included the participant viewing a single image (e.g., visual cue) and being asked to correctly identify the name of the common object. For example, if the item was a horse the research would state, "This is a type of animal," and then ask, "Can you tell me what type of animal it is?" The

categorical cue was the first statement during the recall task (e.g., "This is a type of animal"). The visual cue involved in the recall task may easily be confused with visual prompts used during tests of recognition memory. However, the use of visual cues to illicit recall memory is an established procedure in memory literature that secures greater levels of recall than auditory cues (see Brandimonte, Schooler, & Gabbino, 1997; Dorado & Saywitz, 2001; Geis & Lange, 1976; Marshall, Karow, Freed, & Babock, 2002; McDermott & Knight, 2004; Page & Fragar, 2001; Spitzer, 1976; William, Healy, & Ellis, 1999).

The participants were provided with feedback after each task and praise when items were identified correctly. Based on the recall example used above, the researcher would say, "Correct, that is a horse. Great job!," if the participant answered correctly. The researcher would reply, "That is a horse," if the participant answered incorrectly. If the participant was unable to correctly identify the item during the first presentation of the images, the item would be asked a second time at the end of the session.

After three days of baseline with the first participant, it was determined that recognition tasks were easier than recall tasks. Recognition tasks were subsequently dropped from baseline procedures, as the goal was to stringently identify high- and low-p items. Also, the goal of the study was to improve recall because this tends to be more impaired than recognition. Accordingly, the more stringent procedure (i.e., recall) was continued through the remainder of baseline for Mabel and throughout the entire baseline for Sophia.

Research Design. An *alternating treatments design* was implemented to determine the effectiveness and magnitude of difference between two memory enhancement

interventions: Recognition-to-Recall and Recall-to-Recall. Low-p target items were manipulated through the use of recognition and recall tasks.

The Recognition-to-Recall and Recall-to-Recall intervention sessions were systematically randomized over 12 sessions to guard against carry over effects. One intervention was implemented during each session. The interventions were identical with the exception of the type of memory task that was implemented. One low-p recall item and 10 high-p items were targeted during each session. Each low-p recall item (N = 4) was asked five times per session over three sessions, thereby being asked a total of 15 times. Each session consisted of five cycles of memory tasks followed by one to two-minute breaks between cycles. The participant and researchers would have a general conversation about the weather, food served during supper, and visits from family members during breaks. Sessions were held at approximately the same time of day for both participants (e.g., directly before or after supper) to enhance internal validity.

Each cycle of memory tasks included a series of at least three high-p memory tasks followed immediately by a low-p recall task. During the Recognition-to-Recall intervention, the participant was required to consecutively and correctly identify three high-p recognition items before the low-p recall task was introduced. The low-p recall task involved giving the participant a categorical cue (e.g., “This is a type of fruit.”) and then asking her to identify the item. Recognition-to-Recall sessions lasted 16 min 51 sec, on average, and ranged from 13 min 17 sec to 24 min 40 sec.

The Recall-to-Recall intervention was similarly structured, yet only incorporated recall tasks. The participant was required to consecutively and correctly identify three high-p recall items before being asked to recall the name of a low-p target item. Stated in

a different way, the participant would be shown a single picture at a time. The participant would be asked to identify the name of the common object seen in each picture after being provided with a categorical cue. After three successful identifications of high-p recall items, the participant was presented with a low-p recall item. On average, Recall-to-Recall sessions lasted 11 min 10 sec and ranged from 8 min 33 sec to 13 min 41 sec.

The low-p recall, or target, item was always conceptually similar to the last high-p memory task. For instance, if the last grouping of images during the high-p recognition task were pictures of tools the low-p target item would be a tool. The researchers attempted to make items as conceptually similar as possible by grouping items within categories. For example, if the last high-p target item was a green vegetable (e.g., a cucumber), the low-p target item was also a green vegetable (e.g., asparagus). Conceptually similar items relate to encoding specificity. This principle states that better learning can occur when the processes of encoding and retrieval are similar to each other (Reed, 2010). In the green vegetable example, cucumber is a high-p item that is already encoded into the participant's repertoire and asparagus can more readily be retrieved when highly related to the stimulus that precedes it.

Optimal treatment. The most effective and efficient procedure was implemented during the optimal treatment phase. A higher rate of accurate responses occurred during the Recall-to-Recall procedure for both participants. Additionally, the Recall-to-Recall procedure was less time intensive than the Recognition-to-Recall procedure, as there were fewer cards to sort during the session. Recall-to-Recall procedures from the alternating treatments phase were replicated during this phase with the exception of using different low-p recall target items. The two low-p items targeted during the Recognition-

to-Recall procedure were subsequently targeted using the Recall-to-Recall procedure during this phase.

Maintenance. A maintenance procedure closely related to Cameron Camp's Spaced Retrieval (SR) procedure was used to strengthen and maintain treatment gains (see Camp & Schaller, 1989; Camp & Stevens, 1990; McKitrick & Camp, 1993). At the start of SR sessions, each low-p target item was probed to assess treatment gains. Probes involved using a recall procedure (e.g., "This is a type of fruit. Can you tell me what type of fruit it is?") without providing feedback. Thereafter, the Recall-to-Recall procedure was implemented on set intervals. Intervals began at two minutes, doubled when the participant correctly identified a low-p target item, and decreased by half when the target item was incorrectly named.

The goal during the maintenance phase was to increase intervals from two minutes to overnight (i.e., the participant could demonstrate recall over the span of at least 24 hours) to secure within- and between-session recall of low-p target items. One low-p item was targeted during a SR session, but all low-p items were probed at the beginning of each maintenance session. A low-p item was considered "mastered" once the participant could successfully name the common object without feedback after one session of Space Retrieval. Once an item was mastered, the next low-p item was targeted until all four items were mastered.

Follow-Up. After two months, all four low-p target items were probed using the same procedures from Space Retrieval sessions. The participant was given a categorical cue (e.g., "This is a type of clothing") and then asked to identify the image (Can you tell

me what type of clothing item it is?"). Participants were not given feedback during follow-up.

CHAPTER 3

RESULTS

Tables 1 and 2 illustrate the percentage of correct responses for each target item across each treatment phase for both participants. Baseline data is an average of correct responses from the amount of instances (M = 7.5, range 5 – 12) the participants were asked to identify each item during baseline. Each value from intervention phases, noted as "Alt Tx," for alternating treatments, and "Optimal Tx," for optimal treatment, in the tables, is comprised of an average of five participant responses, as each item was asked five times during each intervention session. The SR data point is an average of the participants' ability to correctly identify items while the items were probed prior to space retrieval procedures. Follow-up values are either 0 (e.g., for an incorrect response) or 100 (e.g., signifies a correct response).

Tables 3 and 4 display within session responses across the alternating treatments, optimal treatment, and space retrieval phases for both participants. Responses were recorded as either 0 (e.g., incorrect response) or 100 (e.g., correct response). Increased within-session accuracy is defined as an inability to correctly identify an object at the beginning of a session, yet correctly identifying the same object later in the session. Additionally, the majority of responses must be correct (e.g., at least three out of five) to qualify as increased within-session accuracy. Sessions with perfect accuracy (e.g., five correct responses) were excluded from the analysis.

Mabel

Mabel's progression through the study can be seen in the aggregated data provided in Figure 1. During baseline, Mabel correctly identified the two low-p items used during the Recall-Recall intervention, avocado and zucchini, an average of 22% of the time. The two low-p items targeted during the Recognition-to-Recall intervention, broccoli and squash, were recalled with an average of 28% accuracy. Taken separately, the four target items still fell within the low-p range: avocado (33%), zucchini (10%), broccoli, (33%), and squash (22%).

Following baseline, the alternating treatments phase was implemented in which the effectiveness of the two interventions was compared. Upon implementation of the Recall-to-Recall intervention, Mabel identified avocado and zucchini with 83% accuracy. An overall increase in with-in session accuracy was found during the Recall-to-Recall intervention in four out of six sessions (66%). Broccoli and squash were identified with 63% accuracy during the Recognition-to-Recall intervention. An overall increase in within-session accuracy was found during the Recognition-to-Recall intervention in 4 out of 5 sessions (80%).

The two items targeted during the Recognition-to-Recall intervention were then targeted using the Recall-to-Recall intervention during the optimal treatment phase. This was done to examine if the participant's ability to recall the names of objects would improve once the Recall-to-Recall intervention was implemented, as this intervention was deemed more effective during the alternating treatments phase. Mabel was able to correctly identify broccoli 93% of the time and squash 73% of the time. Optimal treatment sessions alternately targeted broccoli and squash using sequential randomization.

Figure 1 also highlights Mabel's ability to recall the names of all target items while probing during the space retrieval (SR), or maintenance, phase. The aggregated data point in each graph illustrates the percentage of correct responses from participants while identifying target items without providing feedback. Mabel was able to identify the target items with 56% accuracy. Over eight days of maintenance for Mabel, two objects became moderate-probability items (e.g., answered with 34% - 79% accuracy): zucchini (67%) and squash (60%). Two items became high-p (e.g., answered with 80% or higher accuracy) during the space retrieval procedure: avocado (100%) and broccoli (100%). Mabel was able to successfully recall the name of all target items over the span of 8-min (the initial time interval was 2-min) during the first day of SR.

Overall, Mabel was able to name a target object with perfect accuracy in 10 out of 24 total sessions (42%). At a two-month follow-up, Mabel was able to correctly identify all target items: broccoli, avocado, squash, and zucchini

Sophia

Figure 2 illustrates Sophia's accuracy in identification of low-p target items across phases. During baseline, Sophia was able to recall the two items later used during the Recall-to-Recall intervention, llama and asparagus, with 17% accuracy. The two items later targeted for Recognition-to-Recall, blender and dates, were accurately identified 18% of the time. Taken separately, Sophia recalled the names of the four target items within the specified low-p range: blender (17%), dates (20%), llama (14%), and asparagus (20%).

Following baseline, the alternating treatments phase was implemented in which the effectiveness of the two interventions was compared. During the alternating treatments phase, Sophia recalled llama and asparagus with 87% accuracy during the

Recall-to-Recall intervention. Llama was specifically recalled with 87% accuracy across three sessions, as was asparagus. Within-session accuracy improved during Recall-to-Recall in three out of six session (50%). Blender and dates were recalled 83% of the time during the implementation of the Recognition-to-Recall intervention. Blender was specifically recalled 75% of the time across four sessions, while the second target item for the Recognition-to-Recall intervention, dates, was recalled with 93% accuracy across three sessions. Within-in session accuracy improved during the Recognition-to-Recall intervention in three out of four sessions (75%).

Blender and dates were then targeted using the Recall-to-Recall intervention during the optimal treatment phase. Sophia was able to recall blender with 87% accuracy across three sessions and dates with 100% accuracy across three sessions. Optimal treatment sessions alternately targeted blender and dates using sequential randomization.

Sophia was able to correctly identify target items 85% of the time during probes, which occurred during each maintenance session before SR training. Over five days of maintenance for Sophia, all objects became high-p items during the space retrieval procedure: blender (80%), dates (100%), llama (80%) and asparagus (80%). Sophia's intervals increased from 2-min to 8-min during the first day of SR across three items with the exception of intervals for dates, which increased to 16-min. Additionally, all target items were mastered after one day of SR for Sophia.

Overall, Sophia was able to name a target object with perfect accuracy in 10 out of 24 total sessions (42%). At follow-up, Sophia was able to identify three of the four target items: asparagus, dates, and llama. Sophia referred to "blender" as "juicer" during the follow-up session.

CHAPTER 4

DISCUSSION

The results of the study demonstrate that the high-p low-p procedure can be used to facilitate improvement in recall memory while using categorical cues and stimuli. Both participants' ability to recall the names of common objects increased when implementing the Recall-to-Recall and Recognition-to-Recall interventions. The data support the primary hypothesis that the Recall-to-Recall intervention would be the most efficient and effective intervention. The Recall-to-Recall intervention was less time intensive and produced the larger percentage of accurate responses.

Marked improvement in recall across sessions was most noticeable from baseline to intervention phases and at follow-up. However, the average number of correct responses per session varied across treatment days and phases. For instance, during the Recognition-to-Recall intervention, Mabel was able to correctly identify squash with 60% accuracy on the first day, 20% on the second day, and 80% on the third day. Variability in accurate participant responses was seen more often in the Recognition-to-Recall procedure than the Recall-to-Recall intervention. Once again, the data suggest the Recall-to-Recall procedure to be the more dependable intervention.

Another secondary hypothesis was that improvement in recall of low-p items would occur within treatment sessions and this was supported by the data. During the majority of intervention sessions, the participants were able to either recall the names of common objects with perfect accuracy or make improvements in their ability to identify

an object within session. Cognitive functioning in individuals with cognitive impairment tends to fluctuate (sometimes dramatically) on a day-to-day basis. Participants may have had greater difficulty remembering the names of common objects on these "off" days. Future research needs to be conducted regarding a possible relationship between variability in correct responses and daily functioning.

Within-session recall always improved during SR sessions. The participants may have not been able to correctly identify the target item at the beginning of the session, yet a marked increase was seen in every SR session. Both participants were also able to master target items after one day of SR. Introducing the target item on an interval schedule that was based on the participants' ability may have contributed to the success of the maintenance procedure. This finding is consistent with findings in previous research studies using SR (Camp & Stevens, 1990; McKitrick & Camp, 1993; Stevens, O'Hanlon, & Camp, 1994).

Besides improvements observed in object naming, anecdotal observations made throughout the study indicate that participants may have benefited in other ways. For example, the intervention involved social contact with the researchers. Before the researchers arrived, the participants would sit alone in their rooms after supper and only receive attention from staff when necessary (e.g., assistance with changing clothes, being placed in bed, medication administration, etc.). Sessions provided participants with an extra 20 – 30 minutes of socialization each day. Between each of the five cycles of memory tasks in a session, the participant and researchers would have a conversation. After each session had ended, the researchers would spend a few minutes conversing with

the participant. The social component of the intervention may be partially responsible for the improvements in object naming observed in this study.

The participants also may have gained confidence during the memory enhancement procedures, as the majority of tasks incorporated high-p items. The participants were provided with feedback and praise when correctly identifying items, which may have led to the participants feeling more secure in their ability to correctly identify the low-p target item. Stated differently, this confidence may have contributed to the participants' willingness to guess the name of low-p objects because they had achieved success during the correct identification of high-p items. Additionally, each time the participants were provided praise, (e.g., "You're correct! Great work!") they would both smile and Sophia would giggle. Thus, positive affect resulted from praise. Mabel and Sophia also demonstrated positive affect upon seeing the researchers, which could indicate their enjoyment of increased socialization, attention, and praise. Although these are unintended benefits, they may be important from a quality of life standpoint and future research should attempt to quantify these effects across a larger sample of participants.

Strengths

The current study has several strengths that are worth highlighting. First, an attempt was made to isolate the specific mechanism of change responsible for observed improvements. Feedback and praise were given to participants during baseline and intervention. Therefore, feedback and praise cannot be solely responsible for the observed improvements, as they were consistently provided across phases (with the exception of probes and follow-up). Feedback allows an opportunity for learning to occur. Because participants continued to misidentify or were unable to name common

objects after receiving feedback during baseline, the results suggest that Recognition-to-Recall and Recall-to-Recall interventions were responsible for change as opposed to feedback and praise.

Both memory enhancement procedures are cost effective and time efficient. On average, the current interventions take less than 20 min to implement and require 1 – 2 facilitators. The optimal treatment method, Recall-to-Recall, only requires one facilitator, as there are less cards to sort during the procedure. The facilitator can allocate more time to administering the tasks in a timely manner and recording information on the data sheet without the help of another research assistant. A colored printer, 4x6 note cards, and laminated sheets were used to create the items. Ease of implementation and efficiency are additional strengths of the current interventions.

As mentioned above, a secondary gain for the participants was an increase in socialization. Not only did the participants experience the physical presence of the researchers, but also the social nature of the interventions. There was ample opportunity for the participants to converse with the researchers between cycles of the memory tasks and after sessions. The social component may have made the procedures more desirable to the participants, which may have contributed to treatment gains. Stated differently, the participants may have been more invested in the procedures because they found the social nature of the interventions pleasurable.

Limitations and Future Research

The interventions utilized in the current study are novel and are loosely based on the principle of behavioral momentum. The rationale for this study was that elderly individuals with cognitive impairment would learn more effectively if they first engage in memory tasks that are relatively easy. Support for this hypothesis was generated in this

study. However, the theoretical foundation behind the mechanisms of change of the current procedures is unknown. In other words, it appears as if the intervention works, but it is unclear what psychological principles can account for why it works. The interventions may be effective due to simple rehearsal or may be the effect of a complex system involving rehearsal, feedback, and sequencing of low- and high-p target items. Another possible explanation based on behavioral principles, is that momentum was gathered from building mass and velocity (e.g., consecutive, correct identification of items followed by positive feedback and praise) during the high-p tasks, which influenced the participants' ability to correctly identify low-p items.

Enhancement of recall memory could have also been the result of altering an establishing operation. The participants could have had a deficit in social feedback, which intensified the participant's inability to identify the names of target items. This uncertainty or self-doubt was alleviated once the participant was given feedback. At this point, accuracy of responses began increasing alongside the participant receiving praise for correct answers. Feedback and praise may have added to the reinforcing effectiveness and increase in frequency of correct responses. In other words, the participants are no longer deprived of social feedback and may enjoy receiving praise, which influences their ability to correctly identify the names of common objects.

The present study has sound internal validity, whereas external validity is limited. Given the small number of participants, it is difficult to generalize the results of the present study to the majority of individuals with mild to moderate cognitive impairment. Replication is essential in determining the effectiveness of either intervention to improve recall memory. Replication could involve a more diverse demographic (e.g., ethnicity,

age, sex, level of impairment) or the use of autobiographical information (e.g., names and faces of family members). Using autobiographical information would strengthen the personal relevance of the intervention and may result greater motivation to engage in intervention sessions.

The sample size of the present study was not only small, but also heterogeneous in terms of cognitive impairment. One participant displayed a high level of cognitive functioning on the 3MS, yet had a formal diagnosis of dementia. This participant lived in assisted living rather than the memory care unit. The other participant resided on the memory care unit and displayed moderate cognitive impairment on the 3MS, yet did not have a formal diagnosis of dementia. There were evident inconsistencies between residential placement, cognitive assessment per a standardized measure, and diagnoses. However, collateral contacts and observed cognitive deficits were incorporated into the assessment protocol to determine a resident's appropriateness for participation in the study. Future research could aim to target a homogenous and larger sample of participants. More stringent criteria regarding level of cognitive impairment may be used in the future to secure a homogenous pool of participants.

In addition to level of cognitive impairment, future research studies could screen participants for co-morbid agitated behaviors, breadth of their social repertoire, and level of education. A formal diagnosis of dementia may not be sufficient inclusion criteria, as some participants may have co-morbid agitation. Individuals who are easily agitated may be less interested in social interaction. This correlation appeared to be present in the woman who discontinued participation in the study after five days of baseline. The participant had a diagnosis of dementia with intermittent agitation and was highly

educated. Identifying the names of common objects may frustrate highly educated individuals who may perceive the procedures as belittling. In future research studies, baseline could serve as an assessment opportunity to examine how an individual with cognitive impairment with co-morbid agitated behaviors, a diminished social repertoire, or a high level of education may function during the procedures. These variables may need to become exclusion criteria if functioning is impaired during baseline. This may help better determine for whom the high-p low-p procedure is most effective.

Determining for whom the high-p low-p procedures are most effective also applies to expanding outcome measures in order to examine generalization of treatment gains. Improvement in each participant's ability to recall the names of four common objects was the only outcome measure. Improvement in overall quality of life and general improvement in recall memory were not assessed. Future research could include pre- and post- quality of life and general assessments of memory. Additionally, secondary gains noted above, socialization, confidence, and positive affect, were not quantified during the study. Future research could measure the amount and variety of words, expressions of positive affect, and expressions of self-doubt a participant emits during a session. Future studies could also measure the amount of time the participant spends socializing or seeking reassurance outside of sessions.

Future research could include images from the same source, as the present study used computerized images from various websites. All images were based on common objects seen in Oxford's Picture Dictionary (Adelson-Goldstein & Shapiro, 2008). The images in the picture dictionary were helpful in identifying objects, yet were too small to

include in the present study. Future researchers could attempt to better standardize the images.

Frequency of sessions served as both a strength and weakness of the current study. Sessions occurred once daily, although it may have been more beneficial to alternate between interventions twice daily. During some afternoons, the participants were ill, sleeping, or gone with family. These occurrences further separated the time between intervention sessions. For instance, if asparagus was targeted on Monday, the participant was sleeping on Tuesday, blender was targeted on Wednesday, and asparagus on Thursday, the participant would have gone three days before being asked to identify asparagus after the initial session. Despite these lapses between sessions, both participants' ability to recall the names of common objects greatly increased. Future research studies could incorporate a more stringent schedule of sessions, which may further enhance recall memory. Overall, the appropriate amount of training needed to maximize intervention benefits is yet to be determined.

In the future, training could simultaneously target all four low-p recall items during each SR session to further strengthen and maintain treatment gains. For instance, zucchini was not targeted until the last two days of SR for Mabel. Zucchini was identified with 12.5% accuracy when the item was probed across eight days of SR. Mabel's treatment gain of recalling zucchini diminished until targeted during SR training. Similarly, the session after mastering squash, Mabel identified it as a radish. In other words, mastery of an item was not consistently maintained when SR training targeted other items. Mabel may have performed better during probing if zucchini, squash, avocado, and broccoli were simultaneously targeted.

Aside from changing methodology within procedures, future research could examine two other permutations of the high-p low-p procedure. An intervention involving high-p recognition tasks and low-p recognition target items could be implemented to examine if treatment gains differ when tasks remain in the same response class and all memory tasks involve recognition. Another permutation could involve high-p recall tasks and low-p recognition target items. Results for the Recall-to-Recognition intervention may be similar to the Recognition-to-Recall procedure, as response class and environmental structure change during the procedures. Overall, four permutations of the high-p – low-p procedure could be implemented to determine differences in level of effectiveness of each intervention to improve recall or recognition memory.

Future research should also investigate how easily intervention procedures can be taught to other individuals such as: family members, or individuals in long-term care facilities such as nursing or activities staff, other residents, or volunteers. Conducting these procedures could also result in benefits for those implementing the interventions. For example, cognitively intact residents of long-term care facilities could find a great deal of meaning and pleasure in being able to assist other, more impaired residents. Using a broader set of facilitators should be empirically tested before procedures are disseminated to caregivers. However, these interventions could serve as pragmatic means to improve recall memory. Family, staff, volunteers, and residents without cognitive impairment could actively contribute to enhancements in the patient's memory and quality of life. Interventions such as these may provide patients and caregivers with a simple, yet effective tool for combating some of the effects of age-related cognitive decline.

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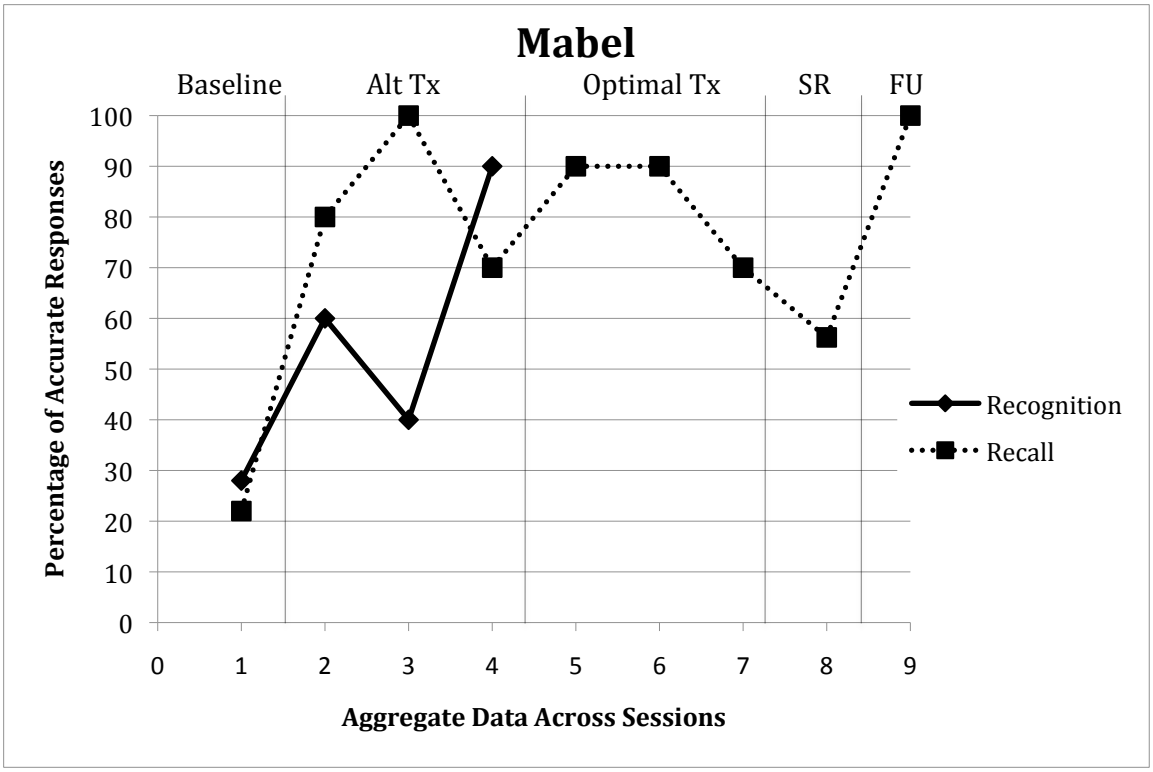

Figure 1. Aggregated Data: Mabel

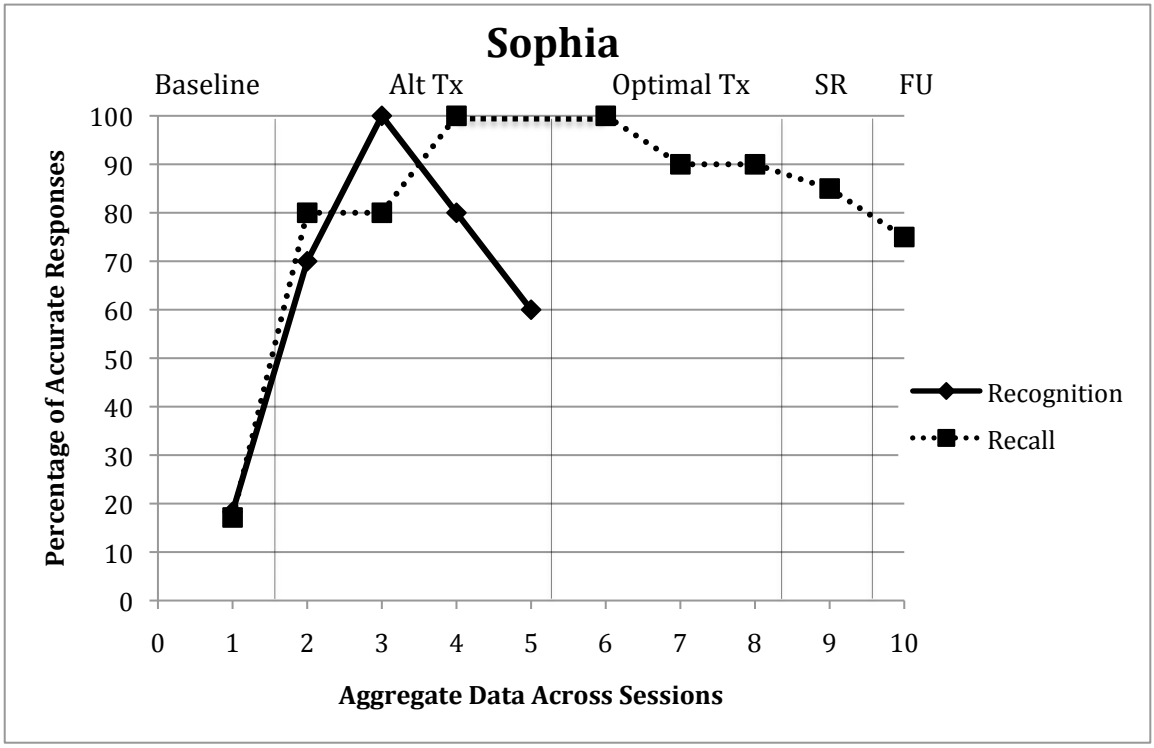

Figure 2. Aggregated Data: Sophia

Table 1

Mabel: Percentage of Correct Responses by Target Item and Phase

	Low-P Target Items			
Phases	Broccoli	Squash	Avocado	Zucchini
Baseline	33	22	33	10
Alt Tx				
Day One	60	60	100	60
Day Two	60	20	100	100
Day Three	100	80	100	60
Optimal Tx				
Day One	100	80	-	-
Day Two	80	60	-	-
Day Three	100	80	-	-
SR-Probe	88	50	75	13
Follow-Up	100	100	100	100

Table 2

Sophia: Percentage of Correct Responses by Target Item and Phase

	Low-P Target Items			
Phases	Blender	Dates	Llama	Asparagus
Baseline	17	20	14	20
Alt Tx				
Day One	60	80	80	80
Day Two	100	100	80	80
Day Three	80	100	100	100
Day Four	60	-	-	-
Optimal Tx				
Day One	100	100	-	-
Day Two	80	100	-	-
Day Three	80	100	-	-
SR-Probe	80	100	80	80
Follow-Up	0	100	100	100

Table 3

Mabel: Within-Session Responses by Target Item and Phase

	Low-P Target Items			
Phases	Broccoli	Squash	Avocado	Zucchini
Alt Tx	Recognition-to-Recall		Recall-to-Recall	
Day One	0	0	100	0
	0	0	100	0
	100	100	100	100
	100	100	100	100
	100	100	100	100
Day Two	0	0	100	100
	0	100	100	100
	100	0	100	100
	100	0	100	100
	100	0	100	100
Day Three	100	0	100	0
	100	100	100	100
	100	100	100	0
	100	100	100	0
	100	100	100	100
Optimal Tx	Recall-to-Recall			
Day One	100	100		
	100	0		
	100	100		
	100	100		
	100	100		
Day Two	0	100		
	100	100		
	100	100		
	100	0		
	100	0		
Day Three	100	0		
	100	100		
	100	100		
	100	100		
Space Retrieval	100	0	100	0
	100	0	100	0
	100	100	100	100
	100	100	100	100
		100		100
				100

Table 4

Sophia: Within-Session Responses by Target Item and Phase

	Low-P Target Items			
	Blender	Dates	Llama	Asparagus
Phases				
	Recognition-to-Recall		Recall-to-Recall	
Day One	0	0	100	0
	0	100	100	100
	100	100	100	100
	100	100	100	100
	100	100	0	100
Day Two	100	100	0	100
	100	100	100	100
	100	100	100	100
	100	100	100	0
	100	100	100	100
Day Three	0	100	100	0
	100	100	100	100
	100	100	100	0
	100	100	100	0
	100	100	100	100
Day Four	0			
	100			
	100			
	100			
	0			
Optimal Tx	Recall-to-Recall			
Day One	100	100		
	100	100		
	100	100		
	100	100		
	100	100		
Day Two	100	100		
	100	100		
	100	100		
	0	100		
	100	100		
Day Three	100	100		
	100	100		
	0	100		
	100	100		
	100	100		
Space Retrieval	0	100	0	0
	100	100	100	100
	100	100	100	100
	100	100	100	100
	100	100	100	100

Appendix A1

Baseline Order Data Collection Sheet

Participant:
Researchers:

Baseline Tally Sheet

Day:
Date:

#	Item	Task	#	Item	Task
1		Recog Recall	31		Recog Recall
2		Recog Recall	32		Recog Recall
3		Recog Recall	33		Recog Recall
4		Recog Recall	34		Recog Recall
5		Recog Recall	35		Recog Recall
6		Recog Recall	36		Recog Recall
7		Recog Recall	37		Recog Recall
8		Recog Recall	38		Recog Recall
9		Recog Recall	39		Recog Recall
10		Recog Recall	40		Recog Recall
11		Recog Recall	41		Recog Recall
12		Recog Recall	42		Recog Recall
13		Recog Recall	43		Recog Recall
14		Recog Recall	44		Recog Recall
15		Recog Recall	45		Recog Recall
16		Recog Recall	46		Recog Recall
17		Recog Recall	47		Recog Recall
18		Recog Recall	48		Recog Recall
19		Recog Recall	49		Recog Recall
20		Recog Recall	50		Recog Recall
21		Recog Recall	51		Recog Recall
22		Recog Recall	52		Recog Recall
23		Recog Recall	53		Recog Recall
24		Recog Recall	54		Recog Recall
25		Recog Recall	55		Recog Recall
26		Recog Recall	56		Recog Recall
27		Recog Recall	57		Recog Recall
28		Recog Recall	58		Recog Recall
29		Recog Recall	59		Recog Recall
30		Recog Recall	60		Recog Recall

Appendix A2

Baseline Data Collection Sheet

Session: Morning / Afternoon
Participant ID: MJW
Session #:

Baseline Coding Sheet

C = Correct
I = Incorrect

Date:_____
Researchers:_____

Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		
Recog. / Recall	Item:_____	C I	Time:_____	C I	Time:_____		

Appendix A3

High-P Low-P Data Collection Sheet

Date: _____
Day: ___
Researchers: ___
Participant ID: ___

Phase __
High-P ____ and Low-P ____

C= Correct
I= Incorrect

		Tally:				
High-P Items 1					Low-P: 1.	
2						
3						
4						
5						
6						
7						
8						
9						
10						

Cycle 1:						
High- P	High- P	High- P	High- P	High- P	High- P	Low-P
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	C I
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9 10	7 8 9 10	7 8 9 10	7 8 9 10	7 8 9 10	7 8 9 10	
C I	C I	C I	C I	C I	C I	Time:_____
					Time:	

Cycle 2:						
High- P	High- P	High- P	High- P	High- P	High- P	Low-P
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	C I
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9 10	7 8 9 10	7 8 9 10	7 8 9 10	7 8 9 10	7 8 9 10	
C I	C I	C I	C I	C I	C I	Time:_____
					Time:	

Cycle 3:						
High- P	High- P	High- P	High- P	High- P	High- P	Low-P
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	C I
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9 10	7 8 9 10	7 8 9 10	7 8 9 10	7 8 9 10	7 8 9 10	
C I	C I	C I	C I	C I	C I	Time:_____
					Time:	

Cycle 4:						
High- P	High- P	High- P	High- P	High- P	High- P	Low-P
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	C I
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9 10	7 8 9 10	7 8 9 10	7 8 9 10	7 8 9 10	7 8 9 10	
C I	C I	C I	C I	C I	C I	Time:_____
					Time:	

Cycle 5:						
High- P	High- P	High- P	High- P	High- P	High- P	Low-P
1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	1 2 3	C I
4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	4 5 6	
7 8 9 10	7 8 9 10	7 8 9 10	7 8 9 10	7 8 9 10	7 8 9 10	
C I	C I	C I	C I	C I	C I	Time:_____

Notes:
Session Time: _____

Appendix A4

Space Retrieval Data Collection Sheet

Date: _____
Day: __
Researchers: ___
Participant ID: ___

High-P Low-P
Space Retrieval

C = Correct
I - Incorrect

High-P: 1				Low-P: 1.		
2						
3						
4						
5						
6						
7						
8						
9						
10						
	Item:	Item:	Item:	Item:		
Free Recall:	Blender	Dates	Llama	Asparagus	**No Feedback!**	
	C I	C I	C I	C I		
Cycle 1:						
High-P	High-P	High-P	High-P	High-P	High-P	Low-P
1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	C I
6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	
C I	C I	C I	C I	C I	C I	Time: _____
Cycle 2:						
High-P	High-P	High-P	High-P	High-P	High-P	Low-P
1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	C I
6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	
C I	C I	C I	C I	C I	C I	Time: _____
Cycle 3:						
High-P	High-P	High-P	High-P	High-P	High-P	Low-P
1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	C I
6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	
C I	C I	C I	C I	C I	C I	Time: _____
Cycle 4:						
High-P	High-P	High-P	High-P	High-P	High-P	Low-P
1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	C I
6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	
C I	C I	C I	C I	C I	C I	Time: _____
Cycle 5:						
High-P	High-P	High-P	High-P	High-P	High-P	Low-P
1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	C I
6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	
C I	C I	C I	C I	C I	C I	Time: _____

Appendix A5

Follow-Up Data Collection Sheet

Date: _____
Day: ___
Researchers: ___
Participant ID: ___

Follow-Up
Probe Session

C = Correct
I - Incorrect

	Item:	Item:	Item:	Item:	
Free Recall:					**No Feedback!**
	C I	C I	C I	C I	

Appendix B

Informed Consent for Participation in the Research Study
(Legal Guardian)

Purpose
I understand that the purpose of the research study is to compare the effects of two different types of memory enhancement procedures.

Participants
I understand that the person for whom I am a guardian has been asked to participate because they have been diagnosed with a condition that causes memory problems.

Procedure
I understand the experimenter will ask the individual several questions and present several pictures to assess the individual's memory.

During the first part of the study, the individual will be asked a specific number of questions to establish the individual's ability to recall information. The next part of the study consists of implementing 2 different memory enhancement procedures. Individuals will be asked to identify the correct picture out of a grouping of four and will then be asked a more difficult question. During the third stage, the researcher will continue with the procedure that is most effective for the individual. The last phase of research involves the individual recalling specific memory items at longer intervals. The intervals of time will increase when the individual correctly recalls information.

Throughout the study, each session with the individual will last approximately 20 minutes, although some might be slightly longer. The individual will have two sessions a day, one in the morning and another in the afternoon. Approximately 12-15 sessions will be completed during the study. Therefore, the total time commitment for the individual will be between 240-300 minutes (4-5 hours) spread out over the period of about 8 weeks.

Risks
I understand that there are minimal risks associated with participation in this study. It is possible that an individual may not enjoy identifying pictures, answering questions, or may become agitated by the presence of the researcher. If this occurs the sessions will be terminated immediately.

Benefits
I understand that individuals will not be compensated for their participation. The results of this study may yield useful information about how to improve or maintain memory functioning in persons with memory problems.

Confidentiality
I understand that the findings of this study will be completely confidential. Confidentiality will be protected in that no identifying information will be included on any records collected during this study. All information will be kept in a locked cabinet in University Square.

Right to Refuse or Withdraw
I understand that I may refuse to allow my family member to participate or withdraw them from the study at any time without penalty. Furthermore, withdrawal from the study may occur if the participant becomes agitated or fatigues during any part of the study.

Questions
I have been informed that if I have any questions, I am free to ask them. I understand that if I have any additional questions later, I may contact the office of the principal investigators, Dan Houlihan, Ph.D. at (507) 389-6308, and Jeffrey Buchanan, Ph.D. at (507) 389-5824 or the student investigator, Dawn Seefeldt at (712) 204-9633, or if you have questions or concerns about the treatment of human subjects, please contact IRB Administrator and Dean of Graduate Studies, Dr. Anne Blackhurst at (507) 389-2321.

Closing Statement
My signature below indicates that I have decided to allow my family member to participate in a research study and that I have read this form, understand it, and have received a copy of this consent form.

_____ _____
Signature of Legally Responsible Person Date

_____
Name of Participant

_____ _____
Signature of Investigator Date