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THE FULD OBJECT MEMORY EVALUATION: A STUDY OF VALIDITY, CLINICAL

UTILITY, AND THE EFFECTS OF EXTENDING THE DELAY

A Dissertation

Submitted to the School of Graduate Studies and Research

in Partial Fulfillment of the

Requirements for the Degree

Doctor of Psychology

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The Fuld Object Memory Evaluation (FOME) is a geriatric assessment of memory with several strengths but relatively scant data concerning its normative properties and clinical validity. This study investigated several aspects of the FOME, including its convergent and discriminant validity, the effects of extending the delay from 5-minutes to 60-minutes, and the effectiveness of its current normative information. In order to examine these factors, archival data was collected from an academic medical center to determine issues of validity and extending the delay. Data was additionally collected from healthy participants in senior centers to investigate the effects of extending the delay and effectiveness of current normative information. Data was analyzed using series of multiple regressions and Person's correlations. A number of exploratory analyses were also performed to further investigate aspects of the FOME in the data collected. At the conclusion of the data analysis, results demonstrated convergent validity between the FOME and other commonly used measures of immediate memory. Specifically, scores for Anna Thompson I (r=.455, $p<.01$) and Verbal Paired Associates I (r=.397, $p<.05$) demonstrated moderate positive correlations with FOME total recall scores. Results did not demonstrate discriminant validity between the FOME and other commonly used neuropsychological measures. Instead, FOME total recall scores had a strong positive correlation with the Boston Naming Test (r=.527, $p<.01$), a measure of confrontational naming, and a moderate positive correlation with Controlled Oral Words Association (r=.449, $p<.01$), a

measure of phonemic verbal fluency. Multiple regression analyses were very similar for both the FOME 5-minute delay and the 60-minute delay, suggesting that extending the 5-minute delay to 60-minutes does not add clinical utility to FOME delayed recall and retention scores. It was also found that the original normative data for the FOME was able to correctly distinguish between a group of healthy older adults and a clinical population. Data obtained from exploratory analysis, implications of these results, and limitations to the current study are discussed.

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

LITERATURE REVIEW

Introduction

Dementia, a term which has recently become known as Major Neurocognitive Disorder, is a significant healthcare issue in the United States. As the population becomes older, dementias, and Alzheimer's disease in particular, are becoming increasingly prevalent in the United States (Alzheimer's Disease and Facts and Figures, 2013). It is estimated that 1 in 3 seniors in the United States dies with a dementia and that there are about 5.4 million individuals in the United States who currently have dementia of the Alzheimer's type (DAT) (Herbert, Scherr, Bienias, Bennett, & Evans, 2003; Alzheimer's Disease and Facts and Figures, 2013). The Aging Demographics and Memory Study, a large-scale study in the Unites States, found the prevalence of dementia to be 13.9% among individuals aged 71 years and older in 2007, with 9.7% of those cases being DAT (Plassman et al., 2007). America's population of older adults is substantial and continuing to grow, suggesting that dementias will continue to be a growing problem in the future. In 2007, there were approximately 35 million Americans over the age of 65, a figure that is assumed will double by the year 2030 (Plassman et al., 2007).

Dementias are debilitating disorders that afflict many older adults. In fact, currently, Alzheimer's disease is the sixth leading cause of death (Alzheimer's Disease and Facts and Figures, 2013). They are characterized by a myriad of deficits in memory, language, visuoperceptual and visuospatial abilities, emotion, and cognition – with memory deficits being most prominent early in its course (Chamberlain, et al., 2011)). According to the Diagnostic and Statistical Manual of Mental Disorders (5th ed., American Psychiatric Association, 2013; DSM-5), someone diagnosed with dementia, specifically Alzheimer's Disease, experiences significant

memory impairment, and may lose the ability to learn new information or lose the ability to retain information learned in the past (American Psychiatric Association, 2013). Patients with dementia usually suffer from both impairments. Specifically, in the beginning stages of dementia, individuals may start to demonstrate an impaired ability to retain information by forgetting where they stored their wallet, keys, or other valuables. In the advanced stages dementia, individuals may start to forget their name, birthday, or family members.

Dementia is generally assessed in a clinical setting. Impairments usually show up on neuropsychological testing years before the diagnosis of dementia is necessary (Zahodne, Stern, & Manly, 2014). Accordingly, an early and comprehensive assessment that incorporates measures of learning and memory is ideal when dementia is suspected.

Memory is a key issue in neuropsychological assessments for dementia (Lezak et al., 2004). The DSM-IV-TR, which was the primary diagnostic system for several years, required evidence of memory impairment for the clinical diagnosis of dementia (American Psychiatric Association, 2000). In the most recent Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5; American Psychiatric Association, 2013), the current accepted nomenclature used by clinicians and researchers for the classification of mental disorders, the necessity for memory impairment in Major Neurocognitive Disorder was eliminated. Nevertheless, the importance of memory impairment is still emphasized in the current diagnostic criteria, particularly as it relates to the Neurocognitive Disorder specifier of Alzheimer's Disease[i] (American Psychiatric Association, 2013).

As important as the assessment of memory is for older adults, it is often confounded with a myriad of problems. For one, memory assessments can be easily confounded with sensory or psychological functioning. Also, memory complaints do not necessarily predict cognitive

functioning (Mol, Van Boxtel, Willems, & Jolles, 2006). Additionally, assessing memory in older adults is complex because there is a natural decline in cognitive functions with age (Albert, 2010). Abilities such as manipulating information in working memory, name retrieval, declarative memory, and information processing all decline with age (Martin, 2006). In order to properly assess for dementia in older adults, memory impairment needs to be distinguished from the normal aging process. Although decline in memory is an expected part of normal aging, the type of memory impairment observed in dementia is an exaggerated version of what is typically found or experienced (Sliwinski, Hofer, Hall, Buschke, & Lipton, 2003).

The Fuld Object Memory Evaluation

The Fuld Object Memory Evaluation (FOME), introduced by Dr. Paula Fuld in 1980, is an assessment measure specially designed to evaluate memory impairments in older adults. The FOME provides several advantages for use with the geriatric population. It was designed to circumvent sensory impairments that are common in older adults by using multiple sensory modalities to store learned information. It is also relatively quick to administer and is typically non-threatening for the test taker. Despite its brevity, the FOME provides detailed information related to learning and memory, making it a strong instrument to use for the assessment of dementia. In order to discuss the strengths of the FOME with greater detail, a current review of the literature concerning memory and how it is assessed clinically for the geriatric population is provided below.

Human Memory

Learning and memory are closely linked. Learning is the process of acquiring new information and memory is the system that preserves and stores the information that is learned (Squire, 1987). Memory is formed as a direct consequence of learning; specifically, in order for

learning to occur, a memory must be created and strengthened by repetition (Gazzaniga, Ivry, & Mangun, 2002; Squire, 1987).

The memory system is complex and dynamic. While there are many models that aim to explain memory, a common theme among them is that memory can be subdivided into three main components: encoding, storage, and retrieval (Scott & Shoenberg, 2011). Encoding refers to the process of converting new information into memories and has two separate steps: acquisition and consolidation. Acquisition refers to the analysis and recording of new information and consolidation refers to creating a stronger representation of the information over time. Storage, a result of acquisition and consolidation, creates and maintains a record of acquired information (Gazzaniga et al., 2002). Retention of information is achieved when information is stored and maintained in memory (Gilmore et al., 1989). Lastly, retrieval refers to the act of remembering acquired information at a later time; it is what allows humans to utilize stored information (Gazzaniga et al., 2002).

The ability to use a memory can fail at any of its three primary stages: encoding, storage, and/or retrieval (Gilmore et al., 1989). For example, the efficiency of the memory system is dependent on how easily and accurately information can be retrieved (Lezak et al., 2004); if a memory is stored but cannot be remembered when needed, the strength of the memory makes no difference. Retrieval of information can occur through free recall or recognition (Scott & Schoenberg, 2011). As a rule of thumb, recognition is almost always better than recall unless there are motivational factors involved. In order for the memory system to work efficiently, encoding, storage, and retrieval must function appropriately.

The salience of a memory is determined by a variety of components, including how it is initially encoded, how often it is rehearsed, and how significant the information is perceived to

be. The way that information is encoded determines to a large extent how well memories will be retrieved in the future (Gilmore et al., 1989). Specifically, when information is encoded in a deep and elaborate way, it results in stronger memories compared to information that is encoded in a limited and superficial fashion (Squire & Kandel, 1999). Information is processed deeply during the time of encoding when a relationship is identified between newly acquired information and past information already in memory (Gilmore et al., 1989). For example, Otten, Henson, and Rugg (2001) found a clear advantage for remembering items that were processed deeply in a study of incidental learning. In their study, participants were cued to make either a semantic decision (deep encoding task) or non-semantic decision (shallow encoding task) about words (Otten, Henson, & Rugg, 2001). Results of the study found that participants were able to remember words in the 'deep processing' task with greater accuracy than words that were in the 'shallow processing' task (Otten et al., 2001). Additionally, finding connections between new and old information, as well as finding information salient and interesting, makes it easier to remember (Gilmore et al., 1989). For example, when information is perceived as interesting, enjoyable, or familiar, it can be related to previously acquired information and can be recalled more freely when needed (Squire & Kandel, 1999; Breslin & Safer, 2011). This may be partly due to the amount of attention that is given to a task. Naveh-Benjamin, Craik, Gavrilescu and Anderson (2000) found that distraction of attention to a secondary task leads to shallower encoding of events processed in a primary task. In tandem, Craik and Byrd (1982) found that deeper analysis of information requires more attention. Rehearsal of information also affects how deeply it is encoded; therefore, the more that someone attends to a piece of information, the more likely they will deeply encode it and remember it later (Squire & Kandel, 1999). When data is processed deeply, it is thought to possess more distinctive encoding qualities that makes the

memory easier to discriminate during the time of recall (Gilmore et al., 1989). As a result, deep processing aids information to be remembered more vividly and readily.

A dynamic memory system means that some memories become strong while other memories become weak. Forgetting is an inevitable consequence of learning and memory; changes in memory sometimes leads to forgetting, defined as the inability to bring forth past memories (Squire, 1987). The act of forgetting is a normal and necessary component of learning and remembering. In order for the memory system to work efficiently, new memories are formed and older memories are erased. Sometimes, the accuracy of remembering information systematically decreases the longer information is retained, suggesting that forgetting is a function of time (White & Brown, 2011). Forgetting, however, does not always occur on a temporal gradient. For example, Unsworth, Heitz, and Parks (2008) asked subjects to remember three letters and then count backwards by three's before asking them to recall the three letters. They found that accuracy at a long-retention interval was greater than at a short-retention interval for some conditions, suggesting that length of time is not always indicative of forgetting (White & Brown, 2011).

Although forgetting is not entirely linked with time, the fact remains that some memories still become weaker with its passage. Classical interference theory postulates that forgetting is correlated with time but is due to the storage of new experiences (particularly highly similar experiences) that interfere with older memories (Anderson, 2003). For example, this theory would infer the reason that people don't remember every dinner they have is not because time has passed, but because they have had so many dinners over time that the memory system is ultimately 'cluttered' with many highly similar dinner events (Anderson, 2003). Thus, forgetting

is how the memory system reduces the 'clutter' in the brain. As a consequence, some memories invariably lose detail, while others become stronger.

The way information is learned impacts how it is stored in memory. In order to perceive the external environment, the human brain uses numerous sources of sensory information derived from different modalities (Ernst & Bülthoff, 2004). Initial information can be stored in different modalities, including touch, smell, taste, sound, or vision (Squire, 1987). For a short period of time after information is acquired, it is bound to the particular processing system that was used to encode the new information. For example, in a study by Kahneman (1968), subjects were shown a visual presentation of a letter and an unrelated stimulus immediately after. When the unrelated stimuli was visual, the subjects were unable to remember the original stimuli; conversely, when subjects were presented with stimuli in other modalities, it did not interfere with memory formation, suggesting that memory for the letter depended on visual storage, at least in the beginning stages of memory formation (Squire, 1987). The same type of phenomena has been replicated in other modalities, suggesting that newly obtained information is stored in a way that preserves the modality of the original stimulus (Squire, 1987). Kolers (1979) asked college students to read text that was inverted, mirror reversed, or otherwise transformed. He then asked subjects to read the same text or a different text that was presented in either the same manner as the initial exposure or in a different transformation. Kolers found that the college students were able to read familiar text more rapidly than unfamiliar text. Furthermore, he found that the college students performed best when the text reappeared in the same format as it was during initial exposure. Altogether, these studies suggest that storing new information is partly tied to the specific modality in which the information was initially processed and that the same

processing systems that analyze information contribute to and influence the ability to remember that information at a later time (Squire, 1987).

Recently, more sophisticated evidence corroborates that memory retrieval is dependent on how it is encoded. For example, an imaging study conducted by Nyberg, Habib, McIntosh, and Tulving (2000) demonstrated that remembering a visual word paired with a sound during encoding activates regions in the auditory responsive cortex during both the encoding and retrieval periods, suggesting that retrieval of specific event information is associated with reactivation of regions that were involved during the encoding period. In a separate study, Goldberg, Perfetti, and Schneider (2006) found a direct relationship between perceptual knowledge and sensory brain mechanisms by activating brain regions associated with touch, taste, audition, and vision, suggesting that the retrieval of perceptual knowledge relies on a widely distributed network of regions necessary for encoding specific sensory experience. Overall, results indicate a broad modality-specific relationship between sensory brain regions and perceptual knowledge retrieval (Goldberg, Perfetti, & Schneider, 2006).

Sensory Memory, Long-Term Memory, and Short-Term Memory

Memory has been divided into three primary stages that complement each other in the process of acquiring and learning new information: sensory memory, short-term memory (STM) and long-term memory (LTM) (Scott and Schoenberg, 2011). Sensory memory, which is the first stage of memory, refers to the point of time that any sensory information (auditory, visual, gustatory, tactile, or olfactory) enters consciousness. Sensory information has a short shelf life, typically decaying in a few seconds if sensory information is not further attended to. In order for information to be transferred over to STM, it must be attended to.

STM, which is often referred to as working memory, can be conceptualized as a temporary holder for recent information that is perceived by the senses (Scott & Schoenberg, 2011). In STM, information that is attended to can be manipulated and maintained. STM is limited in range; the average capacity of STM in humans is approximately seven items (± two). This capacity can be increased, however, by superimposing organization such as chunking. Information that is held in STM can be lost due to time, interference, or displacement by new materials (Gilmore et al., 1989). In fact, without imposing some process such as organizing or rehearsal, information in STM is quickly forgotten (Scott & Schoenberg, 2011). If information in STM is given enough attention, it will make its way into LTM.

LTM is information that is relatively permanent and can be retrieved volitionally (Scott & Schoenberg, 2011). Ideally, storage of information in LTM provides an opportunity to use and access the information at a later time. Several factors affect the level of consolidation of information. Rehearsal, emotional strength of material (positive or negative), state and environment, and elaboration of information being learned facilitates transfer and consolidation of information into LTM. For example, individuals are able to remember words that describe themselves more easily than words that simply have a positive or negative characteristic that they are asked to remember (Scott & Schoenberg, 2011). In general, the level of consolidation of information affects the strength of the memory (the stronger the consolidation the stronger the memory).

While many types of memory have been described, two predominant types of LTM have remained robust in the literature. LTM is divided into two separate systems: declarative and non-declarative memory (Scott & Schoenberg, 2011). Declarative memory refers to memories that can be brought to conscious recollection either verbally or visually, whereas non-declarative

memory refers to memories that are unconscious and are expressed in behaviors versus in communication. Declarative memory contains information that can be deliberately recalled. For example, remembering facts or specific knowledge would be considered part of declarative memory. Declarative memory is divided into episodic and semantic memory (Martin, 2006). Episodic memory refers to information that is personally meaningful and semantic memory refers to memories that are based on knowledge of events, places, or people (Martin, 2006). Compartmentalizing memories in this way enables psychologists to conceptualize and analyze the complicated process of memory. In neuropsychological assessments, declarative memory is the type of memory that is measured most of the time. In assessments of dementia, this becomes especially important because impairment tends to manifest primarily in semantic memory.

Memory Structures

A general understanding of the structural aspect of memory facilitates the overall conceptualization of memory and provides a deeper understanding of dementia. Memory and learning, however, are probably the most difficult human functions to localize in the brain because memory is a process and not a single entity (Martin, 2006). Much of the early knowledge of where memory "lives" in the brain was obtained by studying the amnestic patient Henry Molaison (H.M.), who experienced a traumatic brain injury when he was nine years old that led to him suffering from severely debilitating epilepsy by the age of 27 (Squire & Kandel, 1999). In order to treat the epilepsy, H.M. underwent a lobectomy of the inner surface of the temporal lobes; while the procedure cured H.M. of his seizures, it left him with severe anterograde amnesia. From the time of his surgery until later in life, H.M. became unable to convert ST memories into permanent LT memories. Through the careful observation and study of H.M., the structural nature of memory was learned in greater detail. The case study of H.M.

established the importance of the temporal lobes and hippocampus in learning and forming new memories, and demonstrated there was a structural separation in the brain between immediate memory, learning, and long-term memory.

The current literature suggests that memory functioning requires the involvement and integration of multiple cognitive functions and brain regions (Scott & Schoenberg, 2011). For example, attentional capacity is vital to memory functioning. Arousal, sensory, motor, and perceptual integrity is additionally necessary for forming, consolidating memories, and recalling memories. Structurally, several areas of the human brain are directly involved in memory functioning, including the medial temporal lobes, entorhinal cortex, hippocampus, amygdala, cingulated cortex, basal forebrain, and diencephalic structures (Scott & Schoenberg, 2011; Liu et al., 2008; Vann, 2013).

The temporal lobes, which have many functions and distinct neuroanatomical pathways, are an important structure for memory (Schoenberg, Marsh, & Lerner, 2011). Accordingly, one of the primary neurological symptoms associated with temporal lobe lesion is impairment in declarative memory. The mesial temporal lobe structures are involved in declarative memory, particularly for memories that are time and person specific (episodic memory) for objects, spatial information, and verbal auditory memory. The memory/mesial temporal pathway is a distinct neuroanatomical pathway located within the temporal lobes that is important for memory. Somatosensory information, such as auditory and visual information, is projected to the parahippocampal gyrus where information is then 'directed' to the perirhinal cortex and then to the entorhinal cortex along the hippocampal formation and/or the amygdala. A popular view in the literature is that efferent projections (which carry nerve impulses away from central nervous system) from the hippocampus form the perforant pathway, which are important for memory and

form what is known as the Papez circuit (Granziera, Hadjokhanni, Arzy, Seeck, Meuli, & Krueger, 2012). The Papez circuit is believed to underlie memory functioning and is particularly involved in declarative memory and the formation of new autobiographical memories (Scott & Schoenberg, 2011).

The Papez circuit is a functional loop that involves the basal forebrain, thalamic nuclei, fonix, mammilary body, parahippocampal gyrus, hippocampus, temporal lobe, entorhinal cortex, perirhinal cortex, amygdala, and the uncinate fasciculus (Shah, Sukhdeep, Jhawar, & Goel, 2012). The mammillary bodies have had long standing implications as being required for memory formation due to their role in relaying projections from the hippocampus formation (Aggleton et al., 2005). More recently, however, Seralynne Vann (2013) found that blocking projections from Gudden's ventral tegmental nucleus to the mamillary bodies had a greater impact in memory formation than blocking projections sent from the hippocampal formation, suggesting that these midbrain inputs may be more important for the formation of memory than the hippocampus formation.

Via the affective/emotional process and movement control/frontal lobe pathway, the temporal lobes are involved in short-term memory and in emotional processing (Schoenberg, Marsh, & Lerner, 2011). This pathway has connections with the amygdala. The amygdala "tags" emotional information to visual and auditory stimuli, which increases the encoding of information (learning) and provides a neuroanatomic pathway for state-dependent learning. The amygdala, a group of more than 10 nuclei located in the midtemporal lobe with extensive intra-nuclear and inter-nuclear connections, is part of a second well-described memory circuit related to the formation of long-term declarative memory as well as classical fear conditioning (Sah, Faber, Armentia, & Power, 2003). The amygdaloid circuit includes the amygdala, thalamic

nuclei, orbitofrontal cortex, olfactory piriform, insula, hypothalamus, limbic striatum and nucleus basalis of Mynert. Neuroimaging research also implicates the medial temporal lobes, including the peripirhinal cortex, parahippocampal cortex, and the hippocampus in different roles of remembering episodic memory (Diana, Yonelinas, & Ranganath, 2010). Additionally, Cabeza and Nyberg (2000) demonstrated that encoding of episodic memory is associated with activation in regions including prefrontal and medial-temporal cortex and the cerebellum.

Normal Aging and Memory Impairment

Memory assessment is integral for determining neuropsychological strengths and weaknesses. According to Lezak et al. (2004), memory is one of the major dimensions generally assessed in a standard neuropsychological evaluation because it is what gives individuals the ability to retain and use information for adaptive purposes. Memory is also especially sensitive to brain dysfunction because it requires the intact functioning of many brain regions and can be compromised by psychiatric conditions (Lezak et al., 2004). Therefore, despite its importance, many factors complicate the accurate assessment of memory. For one, memory impairment can be difficult to discern from the natural aging process. Second, many older adults suffer from sensory impairments, making it difficult to use traditional memory measures. Lastly, factors such as attitude towards testing, performance anxiety, and individual characteristics can complicate the assessment of memory.

The distinction between "normal" aging and memory impairment is complex. In general, there is a natural decline in overall memory functioning with age. Both short-term and long-term memory experiences a slight natural decline with age (Nyberg et al., 2012). Healthy older adults generally have difficulty retrieving names and putting names to famous faces (Martin, 2006). Source memory also tends to decline in healthy older adults; therefore, older adults tend to have

difficulty remembering where, when, or how an event occurred, although they may remember the event itself. Prospective memory (i.e., remembering to perform an event in the future) as well as metamemory (i.e., knowing about knowing) are areas that also demonstrate a natural decline with age. Additively, factors such as sensory impairments and reduced processing speed, which also occur naturally with age, have an impact in the ability for older adults to form, process, and recall memories, as well as perform activities of daily living and instrumental activities of daily living (Lezak et al., 2004; Wood, Edwards, Clay, Wadley, Roenker, & Ball, 2005).

In contrast, some memory functions remain stable throughout the lifespan. Semantic memory (i.e.,-remembering facts/knowledge about the world), procedural memory (i.e.,-remembering how to do things), and skill learning tend to remain relatively intact throughout the lifespan (Nyberg, et al., 2003; Nyberg, Lovden, Riklund, Lindenberger, & Backman, 2012). Recognition memory also tends to remain unchanged with normal aging (Nyberg et al., 2012).

In addition to normal aging, there is also a distinction between mild cognitive impairment (MCI) and dementia. MCI refers to cognitive functioning that is poorer than expected with normal aging (approximately 1-2 standard deviations below the mean) but is not as severely impaired as what is expected with dementia. Specifically, while the definition of MCI is somewhat varied in the literature, general criteria includes a) subjective or informant reported memory difficulties; b) preserved abilities in basic activities of daily living; c) objective cognitive impairment; d) absence of dementia (Luck, Luppa, Briel, Riedel-Heller, 2010). Notably, MCI is most similar to what has recently been termed as Minor Neurocognitive Impairment in the DSM-5 (American Psychiatric Association, 2013). DSM-5 criteria for Minor Neurocognitive Disorder requires a) evidence of significant cognitive decline from a previous level of performance in one or more cognitive domains (complex attention, executive functions,

learning and memory, language, perceptual-motor, or social cognition); b) the absence of delirium; c) lack of interference with independence in everyday activities; d) deficits are not better explained by another mental disorder.

MCI is an important category because it is thought to be a precursor to dementia in many cases (Jessen et al., 2012). For example, Peterson (2004) defines MCI as a transitional cognitive state between normal aging and the early stages of dementia. In general, about 12-15 percent of amnestic MCI patients develop AD annually, a rate five times greater than what is observed in healthy older adults; as a result, individuals with MCI are thought to be at high risk for developing dementia (Yaffe, Petersen, Lindquist, Kramer, & Miller, 2006; Luck et al., 2010). In a longitudinal study, Jessen and colleagues (2012) found an increased risk of AD dementia in an ordered fashion for participants in different stages of cognitive decline, with highest risk in Late MCI (defined as performance in delayed verbal recall more below 1.5 SD of the norm) followed by Early MCI (defined as performance in delayed verbal recall more between 1.0 and 1.5 SD of the norm) and subjective memory impairment only (with delayed verbal recall scores within the norm).

The distinction between healthy aging, MCI, and dementia is partly determined by assessment scores. In neuropsychological assessments, when an individual takes an assessment measure, the scores they produce are compared to others of a similar age and level of education. Ideally, this comparison allows clinicians to assess for the degree of impairment in an individual's performance by comparing their scores to the average level of performance. Individuals with mild cognitive impairment produce scores at a level that is between 1 and 2 standard deviations (SD) from the mean when compared to the normative data (Jessen et al., 2012). Therefore, individuals with MCI demonstrate impairment in performance when compared

to the average population, but not to the degree expected for someone who has dementia. In contrast, individuals with dementia score at a level that is at least 2 SD below the mean, suggesting that their overall level of functioning is lower than 98 percent of their peers (Jessen et al., 2012).

Current research dictates that DAT is associated with structural changes in the human brain. DAT has two core neuropathological features: senile plaques and neurofibrillary tangles (Schellenberg & Montine, 2012). In-vivo imaging and postmortem examination of brains find that plaques, which are deposits of protein fragment called beta-amyloid that build up in the spaces between nerve cells, and tangles, which are twisted fibers of the protein tau, are overrepresented in the brains of individuals that have Alzheimer's Disease (Braskie et al., 2011). Although there is controversy whether plaques and tangles are a causative factors or a consequence of having DAT, they are nonetheless thought to be a good indicator of disease processes since they have been found to be abundant in brains that have developed DAT. Additionally, Braskie et al. (2011) found that cognitive performance was significantly correlated with the presence of plaques and tangles in right frontal and parietal regions in normal cognitive aging, suggesting that they may be associated with subtle cognitive decline.

In addition to the presence of tangles and plaques, brain changes that are characteristic of DAT include cerebral amyloid angiopathy, brain atrophy and neuronal loss, and glial activation (Schellenberg & Montine, 2012). Regarding brain atrophy, the average brain weight of individuals with DAT versus normal controls is significantly lesser, regardless of age (Dickson and Weller, 2011). In terms of regional differences, it was found that brains of individuals with DAT exhibit a decrease in weight of 41% for the temporal lobe, 30% for the parietal lobe, and

14% for the frontal lobe. The medial temporal lobe structures (including the temporal pole, amygdala, hippocampus, and fusiform gyrus) are the most severely reduced in volume.

While the specific manifestation of DAT varies per individual, the structural impact of DAT can be observed in its disease course. For example, one of the first symptoms observed in DAT is the inability to store new information into memory. For example, patients afflicted with DAT and their caregivers report incidents of misplacing personal possessions (MacDuffie, Atkins, Flegal, Clark, & Reuter-Lorenz, 2012). These symptoms indicate impairment in episodic memory, implicating atrophy of the medial temporal lobes during the beginning stages of the disorder. However, as DAT progresses in severity, a temporal gradient retrograde amnesia is observed, suggesting that while brain atrophy starts at a specific location, it spreads throughout the entire brain. This is congruent with what is observed in neuroimaging studies of individuals with DAT – a general deterioration in the brain (Knobloch & Mansuy, 2008).

To summarize, memory impairment is a prominent sign of dementia; however, a decline in memory functioning occurs in the natural aging process as well (Grady & Craik, 2000). Healthy older adults naturally experience a decline in declarative memory, efficiency for processing information, and verbal LTM (Martin, 2006). In DAT, memory is impaired in the same areas as healthy older adults but with much greater severity. Differentiation between normal change and DAT becomes tremendously important in neuropsychological assessments of dementia.

As can be inferred from this section, memory impairment occurs over a continuum, which makes the assessment of DAT complicated. The following section will focus on the current problems encountered in a typical neuropsychological assessment of DAT.

Neuropsychological Assessment of Dementia of the Alzheimer's Type

Neuropsychological assessments are integral to the diagnosis of dementia. The diagnosis of dementia is multifaceted – personal characteristics such as age, education, and family history are factors that have to be accounted for in a formal diagnosis. Memory complaints are usually extensive and tend to be the first signs of dementia, particularly for DAT. Evidence suggests, however, that subjective complaints are not necessarily related to objective memory deficits (Jungwirth et al., 2004). Jungwirth and colleagues looked at the relationship between subjective memory complaints and objective memory functioning. Participants were given two measures of subjective memory complaints and an altered version of the FOME. In this altered version, participants were told that they would be taking a memory test before initiating the first learning trial. Results found no correlation between subjective complaints and objective memory performance. Instead, several participants with memory complaints had no measurable memory deficits and only one out of 16 patients that had objective memory deficits complained of poor memory. These results indicate that clinicians cannot rely on the subjective observations of their patients; instead, a clinician should rely on objective assessment measures with proven efficacy to determine memory impairment, making neuropsychological assessments integral to dementia evaluations. For example, some objective measures have been demonstrated to predict the presence of dementia in older adults. Marcopulos and colleagues (1999) found that the best predictors of a dementia diagnosis were the FOME delayed memory and the Mattis Dementia Rating Scale (MDRS) for psychiatric patients. Similarly, Marcopulos and McLain (2003) found that low scores in delayed recall for tests of memory, including the FOME, MDRS, and Mini Mental Status Examination (MMSE) were among the best predictors of cognitive decline in a comprehensive neuropsychological assessment (Marcopulos & McLain, 2003).

Despite its importance, the assessment of memory in older adults is complicated by several mediating factors. For one, older adults are more likely than other age groups to have visual or hearing impairments. According to the Center for Disease Control and Prevention, sensory deficits in adults over the age of 70 are prevalent: one out of six experience impaired vision and one out of four have impaired hearing (Dillon, Gu, Hoffman, & Ko, 2010). Additionally, the incidence of vision and hearing impairments increase with age; for example, it is estimated that the prevalence of sensory impairments double in persons aged 80 years and over compared with persons aged 70-79 (Dillon et al., 2010). Sensory impairments complicate the assessment of memory because many of the common tests that are used rely heavily on the ability to process visual or auditory information, making it difficult to properly assess memory functioning in older adults who have sensory impairments. For example, Logical Memory (LM) is a subtest in the Wechsler's Memory Scale (WMS) Battery - one of the most researched and used batteries for memory assessment (Lezak et al., 2004). A common criticism of the subtest is that it relies heavily on the examiner's word pronunciation and rate of speech, suggesting the test is heavily influenced by a person's ability to hear clearly (Lezak et al., 2004). It has additionally been argued that LM requires a large amount of information that may exceed the demands of WM (Loewenstein, Acevedo, Ownby, et al., 2006).

Older individuals are also prone to experience anxiety during a neuropsychological evaluation (Lezak et al., 2004). As noted beforehand, the advanced stages of dementia can be extremely debilitating for an individual. Therefore, an older adult who is being evaluated for suspected dementia may become anxious if they perceive they are performing poorly; if their anxiety is high enough, it may interfere with their performance and confound their memory assessment. Additionally, today's population of older adults is diverse; they have different

educational, cultural, and racial backgrounds. For example, given that educational opportunities were different in the past, it is common to encounter older individuals with relatively few years of education. The 2009 US Census Bureau found that 23.5 percent of the US adults 65 years and older did not have a high school diploma, a percentage that is higher than for other age groups (Ryan & Siebens, 2012). This type of diversity can be problematic when using many assessments measures because performance is often confounded with race, culture, and education. For example, a measure that is confounded by education may not be appropriate to use with someone who has an eight-grade education because poor performance may be attributed to low education instead of true memory impairment. While education corrected normative data is available for some measures, they are not always available. Taken as a whole, these factors make the assessment of memory in older adults complicated. In choosing assessment instruments, it is imperative for the clinician to choose assessments measures that will provide a true reflection of the individual's capabilities.

To summarize, the assessment of memory for older adults is important but has some inherent complications associated with it. Memory impairments in older adults are difficult to distinguish from normal aging, MCI, or from depression. Older adults are also more likely to experience sensory deficits, test performance anxiety, and may have individual characteristics that make it particularly difficult to obtain an accurate assessment. Another important test aspect concerns its relevance. Although face validity does not affect a test's psychometric properties, a test's apparent relevance may influence the test takers' motivation to response in a serious and honest manner (Furr & Bacharach, 2008).

Merits of the Fuld Object Memory Evaluation

The FOME is an assessment measure that attempts to circumvent many difficulties encountered in testing memory in older adults, making it a valuable assessment to use with the geriatric population. The FOME guarantees deep stimulus processing by having the patient identify objects to be recalled via touch and then sight. Additionally, the objects used are those that many individuals might encounter in daily life, making the task more inherently meaningful than standard measures of memory.

The FOME uses a selective reminding technique designed to simultaneously measure the ability to store, retain, and retrieve information, to assess for memory and learning (Fuld, 1980). As delineated by Buschke and Fuld in 1974, in this type of task, the test taker is selectively reminded of items they did not recall after a free recall trial; accordingly, the only items repeated are those they did not recollect during free recall. This process allows the test taker to demonstrate learning by spontaneous recall of information without further presentation, making the method useful for analyzing disorders of memory and learning (Buschke & Fuld, 1974). Initial storage is demonstrated if the test taker can recall the stimulus spontaneously without a second presentation (Buschke & Fuld, 1974). Selective reminding also distinguishes between retrieval from STM and LTM. When the test taker demonstrates spontaneous retrieval of a stimulus without further presentation, it demonstrates retrieval from LTM; if, on the other hand, retrieval occurs after a reminder, it is considered retrieval from STM (Buschke & Fuld, 1974). Moreover, selective reminding likely increases learning by forcing the subject to attend to the words that were not recalled (Buschke & Fuld, 1974). Overall, selective reminding provides enough presentation for maximal learning and may direct attention to items not yet learned (Buschke & Fuld, 1974).

The directions for the FOME are relatively simple and non-threatening. The test taker is not initially told the FOME is a test of memory; instead, they are told that they will be tested on the recognition of objects by touch (Fuld, 1980). Ten common household items are placed inside a bag and the test taker is asked to reach into the bag and feel around for an object. Before they pull the item out of the bag they are asked to identify the item by touch (stereognosis). Once they identify the object, the person is asked to pull the item out to see if they are correct; any mistakes made are verbally corrected by the examiner. If the person is not able to identify an object by touch, he/she is asked to pull the item out and name it after visualization; if the person cannot name the object after they see it, the examiner verbalizes the name of the object. After the test-taker is asked to attend to all the objects in the bag by touch, vision, and by verbal naming, it can be inferred that the person adequately processed all 10 objects. Thus, any failure to recall the objects in subsequent trials should not be attributed to inattention or processing deficit.

Once all ten items are identified via touch and then sight, they are placed back inside the bag and a distracter task consisting of a rapid semantic retrieval is administered (Fuld, 1980). After the distracter task, the test taker is asked to recall all of the items that were in inside the bag within a 60-second time limit. After the first recall trial, he/she is informed that he/she will be reminded of the items that they forgot in order to determine how well they are able to learn a list, thus making the examinee aware they are performing a test of memory. Then they are selectively reminded of the items they did not name and a second distracter task ensues. The next portion of the test alternates between a retrieval trial and a distracter trial for five separate trials. Uniquely, the FOME varies from other list-learning tasks because it uses distracter trials in conjunction with its learning trials, which is thought to interfere with the initial acquisition of to-be-remembered information (Loewenstein, Acevedo, Ownby, et al., 2006). Because there is a

distracter trial in between each recall trial, recall is thought to occur from LTM rather than STM. For the first rapid semantic retrieval trial, the test taker has 60 seconds to complete the distraction task in order to negate the prominent impact touch has over memory; therefore, maximizing the probability that subsequent recall results from long-term storage rather than from STM (Fuld, 1980). For the remaining four rapid semantic trials, the test taker has 30 seconds to complete the distraction task. After the five recall trials are completed, the examiner moves on to an unrelated task. After five minutes, the test taker is unexpectedly asked one more time to name the objects that were in the bag. For any items that are not recalled, the person is given a 3-item recognition task.

The FOME produces several scores related to learning and memory. Recall refers to the number of items recalled for each separate trial and is the basis for the rest of the memory scores obtained by the FOME (Fuld, 1980). Additionally, there are three separate component scores, including Storage Estimate, Repeated Retrieval, and Ineffective Reminders that were derived to obtain specific information about the process of storage and retrieval. Storage is the number of different items recalled at any point during the five trials; it demonstrates the number of items for which there is evidence of storage by the end of the task. Repeated Retrieval measures retrieval efficiency and is estimated by the total number of items recalled on successive trials without any reminders. Ineffective Reminders, or recall failure, is estimated by words not recalled after a reminder was given; it suggests a failure to modify behavior in response to feedback. Overall, these component scores provide a comprehensive look at the variability and relationships that occur between storage, recall, and retrieval. Delayed recall and recognition scores are also obtained after a five-minute delay. Importantly, the FOME was designed to be a relatively pure test of LTM because the distracter task is thought to greatly reduce recall from STM (La Rue,

D'Elia, Clark, Spar, & Jarvik, 1986). Given that severe impairment in LTM is a key characteristic of DAT, the FOME may be considered a valuable measure in the diagnosis of dementia (La Rue et al., 1986).

Although the FOME is a good measure of memory for the geriatric population, its clinical usefulness is restricted by its limited psychometric properties. For one, it has scarce normative data that includes few participants not representative of the majority of the population. Specifically, it was normed on 54 Caucasian subjects between the ages of 68 and 93 who were part of an outstanding senior citizen's center servicing a specific neighborhood and ethnic group (Fuld, 1980). Additionally, it has few studies that support its clinical validity, making it difficult for clinicians to use the assessment with confidence. Although the lack of adequate normative data and validity studies will be discussed in more detail later in this document, it is important to note this may be the reason why, despite its positive characteristics, the FOME is not widely popular. In a study that surveyed the assessment practices of clinical neuropsychologists in the United States and Canada, the FOME was not listed among the top 40 neuropsychological memory assessment instruments used, although non-verbal memory was assessed 87.8 percent of the time and verbal memory was assessed 96.1 percent of the time (Rabin, Barr, & Burton, 2005). In contrast, one of the most widely used assessments for memory is the Wechsler Memory Scales (WMS; Rabin et al., 2005), which is reported to have both excellent reliability and extensive evidence of validity for several groups in its manual (Groth-Marnat, 2009).

Evaluation of Fuld Object Memory Evaluation

According to Gary Groth-Marnat (2009), clinicians should evaluate psychological tests in accordance to five key points, including theoretical orientation (how the test measures its intended construct), practical considerations (real-world usefulness), standardization (adequacy

of norms), reliability, and validity. These five key points should be considered anytime a clinician is contemplating using a measure for assessment purposes (Groth-Marnat, 2009). Using those five key points to evaluate the FOME, several strengths and weaknesses surface. Overall, the theoretical orientation, practical considerations, and reliability of the FOME can be considered strengths, whereas its validity and standardization are significant weaknesses.

Theoretical evaluation refers to the construct the test is supposed to measure and how the test approaches this construct. For example, when contemplating a measure's theoretical orientation, clinicians might ask themselves: 'is there a clear construct the test is measuring?' or 'do the test items make sense for the construct that is being measured' in order to evaluate the theoretical orientation of the test (Groth-Marnat, 2009). The FOME has a clear theoretical orientation. In its test manual, Fuld (1980) clearly states that LTM is the primary construct the FOME intends to measure. Accordingly, the type of tasks the test taker performs and the scores provided by the FOME are all (at least on the surface) related to LTM.

The FOME is a practical assessment measure. It is relatively easy to administer and understand, making it very functional for 'real-world' usage. Additionally, the FOME is a test that can be administered to a variety of patients, regardless of their cultural backgrounds or education attainment. For example, several studies have found that education and race do not affect overall performance on the FOME, making it applicable to use with most populations, including those of diverse and underrepresented backgrounds. Marcupolus, McLain and Giuliano (1997) looked at the effects of education and race on commonly administered neuropsychological assessments for older adults and concluded that the FOME represents a relatively culture fair test of memory for older adults that is uniquely resistant to the effects of education. Education and race were not significant predictors of performance for Storage,

Repeated Retrieval, Ineffective Reminders, and Delayed Recall scores (Marcopulos, McLain, & Giuliano, 1997). Age, on the other hand, was found to be a significant predictor for those same scores. Recall scores were affected by age and education but not by race (Marcopulos et al., 1997). Chung and Ho (2009) also concluded that the FOME is an appropriate test to use with older adults who have low levels of education. Chung and Ho examined the influence of age, educational level, and visual functioning on FOME performance of Chinese nursing home residents. They found that age, educational attainment, and visual impairment did not influence performance on the FOME, making it an appropriate test to use with older adults who have low education levels or visual impairments. This is particularly important given the statistics cited previously regarding sensory deficits in older individuals. In a separate study, Chung (2009) concluded that performance on the FOME was not influenced by level of education, regardless of the subject's level of cognitive functioning, suggesting the FOME is a clinically useful tool for diagnosis of dementia among older adults with little education. Similarly, Ganguli and colleagues (2010) concluded that FOME scores were not affected by level of education.

The FOME is a reliable measure. The reliability of a test refers to its degree of stability, consistency, predictability, and accuracy (Groth-Marnat, 2009). The FOME has two different forms available. According to Fuld (1980), the FOME has good parallel form reliability (r=.71). More recently, Chung and Ho (2009) examined the psychometric properties and discriminative power of the FOME in a sample of Chinese nursing home residents. They found that the FOME is a reliable instrument for detecting probable dementia among older Chinese nursing home residence. Additionally, they found high test-retest reliability and parallel-form reliability coefficients, suggesting that the FOME is stable across occasions and that its two versions have a similar level of difficulty.

The normative data for the FOME is scant and represents a major weakness of its use as an assessment measure. As discussed above, normative data consists of 54 subjects of a specific neighborhood and ethnic group (Fuld, 1980). Most subjects that make up the normative data had Jewish backgrounds and prior occupations of clerical sales, craftsman-foreman, and operative categories (Fuld, 1980). In comparison, the WMS – 4th Edition, one of the most popular memory assessments used, has a normative sample that is representative of the U.S. population of adult aged 16-90 years (according to the national census) that is stratified based on age, sex, race and ethnicity, educational level, and geographic location (Wechsler, 2009). The normative sample for this test included 1,400 examinees, including100 individuals in each in each age band.

Additional normative data has emerged since the 1980's. In 1999, La Rue, Romero, Ortiz, Liang, and Lindeman developed normative data for two age groups (65-75 & 75-97 years) and four education groups (7-9, 10-12, & 12+ years of education) of Hispanic adults. Their sample consisted of 194 men and 165 women (total sample size of 359). Similarly, Ganguli and colleagues (2010) used a sample size (n) of 1,404 to provide normative data for healthy older adults for the following age ranges: 65-74 (n=539), 75-84 (n=655), and 84 + (n=210). Additionally, using a sample size of 104, Marcopulos, Gripshover, Broshek, McLain, and McLain, (1999) proposed cut-off scores derived for psychogeriatric patients.

Fuld, Masur, Blau, Crystal and Aronson (1990) developed new normative data for the 75-85 year old age group for a modified 2-trial FOME test with 475 cognitively healthy adults. Participants, however, were not representative of the US population: they were 90% Caucasian, had a modal education of 7-9 years, and were slightly above average in intelligence. Half of the subjects were native born and the rest were predominantly of eastern European origin.

Validity of Fuld Object Memory Evaluation

Test validity is the most fundamental issue in test construction because it determines if the test actually measures its intended construct (Groth-Marnat, 2009). According to the American Educational Research Association, American Psychological Association and National Council on Measurement in Education (1999), validity refers to "the degree to which evidence and theory support the interpretation of test scores entailed by the proposed uses" (as cited in Furr & Bacharach, 2008). Thus, validity should be a deciding factor for test users when choosing what tests they administer.

The FOME underwent two separate validation studies during its construction. In the first study, Fuld (1980) demonstrated the FOME could differentiate between mentally impaired and mentally intact nursing home residents. Fuld administered the FOME to 21 mentally intact and 21 moderately impaired nursing home residents and found that mentally impaired subjects retrieved fewer different items over trials and obtained overall lower retrieval scores on each trial compared to unimpaired subjects. Impaired individuals did not demonstrate as much improvement as unimpaired individuals across trials (Fuld, 1980). In the second validation study, Fuld demonstrated that storage and retrieval scores represent different components of learning and memory in nursing home residents. Comparisons of mental status, recall across five trials, storage, repeated retrieval, ineffective reminders, retrieval after three weeks, and retention were obtained (Fuld, 1980). For this study, 18 subjects were administered the FOME and then were unexpectedly asked to recall the items in the bag three weeks later (Fuld, 1980). Mental status was found to have the highest correlation with retention (.70) and the lowest correlation with the three-week retrieval score (Fuld, 1980). Overall, storage and retrieval estimates were found to be relatively independent of one another (Fuld, 1980). Participants of both validation studies were

from a nursing home located in a middle class, Jewish neighborhood in New York City (Fuld, 1980).

Although the original validation studies support the usefulness of the FOME, they have several limiting factors. Few subjects were used in each study. Additionally, subjects used were not representative of the nation, making it difficult to generalize the validity of the FOME beyond individuals that were part of the Jewish neighborhood in New York City. Despite the modest nature of original validity studies, several studies since that time have supported the FOME's validity (Chung & Ho, 2009; Chung, 2009; Fuld et. al., 1990; Marcopulos, Gripshover, Broshek, McLain & McLain, 1999; Kraybill et al., 2005; Bäckman, Hassing, Forsell, & Viitanen, 1996; La Rue et al., 1986; Loewenstein, Acevedo, Owbny, et al., 2006; Luis et al., 2004; Loewenstein, Acevedo, Agron, et al., 2006; Loewenstein, Argüelles, Barker, & Duara, 1993; Diniz et al., 2008; La Rue, Romero, Ortiz, Liang, & Lindeman, 1999; Marcopulos & McLain, 2003; Hill, Neely, & Backman, 1997).

Dementia and Fuld Object Memory Evaluation

Numerous studies have evaluated the clinical efficacy of the FOME and have demonstrated its ability to discriminate between patients who have dementia and those who do not. Fuld and colleagues (1990) investigated the preclinical detection of dementia in elderly individuals with normal mental status by administering the FOME and following them over time. They found the FOME was able to predict the development of dementia over one year before clinical changes occurred. Fuld et al. used an abbreviated version of the FOME; administration followed the directions in the test manual except that only two trials for recall and learning were given, with the second trial including a multiple choice recognition component for any items the subjects had not recalled during the trial. They used three separate FOME scores: recall for trial

one, recall for trial two, and a recall plus recognition component. Fuld et al. examined the discriminative validity of the FOME by looking at the ability of the test to distinguish between cognitively healthy older adults and from those with dementia at the time of diagnosis. Recall for trial one demonstrated a sensitivity of .86 and a specificity of .82 for distinguishing cognitively normal older adults from individuals with beginning dementia at the time of diagnosis, indicating that one trial of recall on the FOME is capable of discriminating between normal functioning and very early dementia in better than 8 out of 10 cases (Fuld, Masur, Blau, Crystal, & Aronson, 1990). The FOME also demonstrated some ability to predict the onset of dementia. Recall for trial one had the highest sensitivity at .57 as a predictor of dementia, suggesting the FOME has moderate sensitivity for detecting incipient dementia (Fuld et al., 1990). The specificity was high for all three measures, ranging from .84 for recall in trial one to 1.00 for the recognition plus recall score (Fuld et al., 1990). The positive predictive value for the FOME ranged from .30 to 1.00, a number much higher than the base rate for dementia and suggests the FOME could make a substantial contribution to the accuracy of diagnosis of the base rate for dementia alone (Fuld et al., 1990). Fuld and colleagues concluded the FOME has the predictive power to anticipate dementia one year before its clinical onset. Furthermore, recall for trial one was the best to use for predictive purposes and was the most important in distinguishing between patients with dementia and normal controls.

Marcopulos and colleagues (1999) found that the FOME could differentiate between demented, psychiatric, and normal populations. Additionally, Chung and Ho (2009) found that the FOME validly detected probable dementia in Chinese nursing home residents. They also found the FOME possesses good convergent validity with two established screening measures for dementia: the Mini Mental Status Exam (MMSE) and both the memory subscale and the

initiation/perseverations subscale of the Mattis Dementia Rating Scale (MDRS). Chung and Ho concluded the FOME was a valid instrument to screen for dementia in older community dwelling Chinese adults with the sensitivity of identifying older adults with age-related memory impairments.

The FOME may also help differentiate between different types of dementia, a task that tends to be challenging in a clinical setting. In a study that used autopsy-confirmed cases from a community-based sample of dementia, patients with DAT performed worse than patients with Lewy-Body pathology for the FOME delayed recall and LM Delayed Recall (Kraybill et al., 2005).

Pseudodementia and Fuld Object Memory Evaluation

The FOME has demonstrated the ability to distinguish between patients with Major Depression (MD) and dementia. The differential diagnosis of MD and early dementia is often difficult because they manifest similarly in older adults. Bäckman, Hassing, Forsell, and Viitanen (1996) examined the interaction of DAT and MD in assessment measures of episodic memory. This study used subjects between the ages of 90-100 years of age, and divided them into the following four diagnostic groups: MD, DAT, a dual diagnosis of MD and DAT, and a control group of normal older adults. Bäckman et al. used the FOME to measure object recognition as part of a larger neuropsychological battery. Four separate FOME scores were used, including total recall (all objects correctly recalled across five trials), long-term retrieval (total objects correctly recalled on at least two consecutive trials without reminding), list learning (total objects consistently recalled throughout four trials without reminding), and short-term retrieval (all objects recalled from the previous trials with reminding). One alteration of the original FOME administration was noted. The study gave participants 120 seconds for each recall trial versus the

standard 60-second allowance; no explanation was given for this alteration on the FOME. Bäckman et al. found that FOME total recall, long-term retrieval, and list learning scores distinguished between the different diagnostic groups. They also found that no group differences were achieved in the FOME short-term retrieval measure. Overall, normal controls and the MD group outperformed DAT subjects and the group that had a dual diagnosis (Bäckman et al., 1996).

In another study, La Rue and colleagues (1986) compared elderly individuals diagnosed as having either primary degenerative dementia, MD, or no significant mental health or medical disorder in their performance of three tests: the FOME, Benton Visual Retention Test (VRT), and Inglis Paired Associate Learning Test. On the FOME, healthy elderly participants performed much better than subjects who were diagnosed with dementia on all measures of learning and recall (La Rue et al., 1986). On retrieval, repeated retrieval, and category retrieval, the depressed group performed worse than the healthy group but better than the group with dementia. On storage and recall failure, performance of the depressed group was equal to that of the normal participants, and superior to that of the dementia patients. Of the three tests, the FOME was most useful for differentiation among dementia, depression, and healthy aging (La Rue et al., 1986). With that said, La Rue et al. also found that although the FOME was sensitive to memory impairment, it lacked specificity. They concluded that persons with true dementia are highly likely to score poorly on the FOME, but individuals with MD and without dementia are only likely to obtain better scores about 70% of the time. Therefore, the FOME should just be used in extended evaluations where questionable scores were obtained on screening instruments (La Rue et al., 1986).

Mild Cognitive Impairment and Fuld Object Memory Evaluation

In addition to its ability to detect dementia, the FOME has been found useful for detecting MCI. Loewenstein, Acevedo, Ownby, et al., (2006) examined the efficacy of different memory indices in distinguishing between clinically diagnosed patients with MCI-DAT and cognitively normal community dwelling elders. The FOME was able to correctly identify a majority of cognitively impaired patients with a MCI-DAT diagnosis when a 1.5 standard deviation cutoff score was used. For this study, twenty-three subjects previously diagnosed with MCI-DAT and eighty cognitively normal community dwelling elderly subjects were given a neuropsychological battery that consisted of four memory measures: the FOME, the Semantic Interference Test (SIT), LM for Passages from the WMS- 3rd Edition (WMS-3), and Visual Reproduction (VR) from the WMS-Revised (WMS-R) (Loewenstein, Acevedo, Ownby, et al., 2006). Loewenstein, Acevedo, Ownby, et al. used a modified three trial version of the FOME. The FOME correctly identified 78% of cognitively impaired patients with a MCI-DAT diagnosis when a 1.5 standard deviation cutoff score was used (Loewenstein, Acevedo, Ownby, et al., 2006). In comparison, the SIT, LM Immediate Recall, and Delayed VR were able to correctly identify 70% of MCI-DAT patients as impaired (Loewenstein, Acevedo, Ownby, et al., 2006). The savings score for LM and Immediate VR correctly identified 44% of patients with MCI-DAT, which was significantly less than the FOME and made the LM savings score for passages inferior to the FOME in overall classification of subjects (Loewenstein, Acevedo, Ownby, et al., 2006). Loewenstein and colleagues concluded that the three trial FOME was as effective in classification of MCI-DAT as other traditional memory measures when a 1.5 SD cutoff is used.

Luis and colleagues (2004) also found the FOME to be capable of identifying patients with MCI. This retrospective study aimed to determine the conversion rates to dementia in

patients diagnosed with MCI thought to be caused by either early stages of DAT or Vascular Dementia as diagnosed by history, neurological, cognitive, and neuroimaging findings. This study surveyed a group of 134 individuals who had been previously evaluated as having MCI of the Alzheimer's or Vascular Type (VAS) (Luis et al., 2004). Performance on several neuropsychological measures was compared, including the FOME (a modified three trial version), WMS-R LM I & II, WMS-R VR I & II, Boston Naming Test (BNT), Controlled Oral Word Association Test (COWAT), Wechsler's Adult Intelligence Scale-Revised (WAIS-R) Similarities, WAIS-R Vocabulary, WAIS-R Block Design (BD), WAIS-R Digit Span (DS), and Trails A & B (Luis et al., 2004). They found that the neuropsychological test that best differentiated converters from non-converters was the FOME. The FOME 3-trial, FOME recall, and WMS-R LM Delay were the only neuropsychological measures that were found to differentiate between subjects with a diagnosis of MCI who developed dementia and those who did not (Luis et al., 2004). Additionally, the FOME 3-trial total score was the only measure that differentiated converters from non-converters in each of the MCI-DAT and MCI-VAS groups (Luis et al., 2004). Average FOME trial total score for converters was 13.9 (SD 3.1) out of a possible score of 30. Non-converter scores was an average of 18.1 (SD 4.3) (Luis et al., 2004). Overall, the FOME was able to differentiate individuals with MCI who would eventually develop dementia from those who would not.

Low Sensitivity of Fuld Object Memory Evaluation in Distinguishing Between Mild Cognitive Impairment and Unimpaired

Sensitivity and specificity summarize a test's ability to correctly categorize its test takers (Furr & Bacharach, 2008). A test intended to diagnose the presence or absence of a specific disorder can have four outcomes: a true positive (a person has the disorder and the test says the

person has the disorder), a true negative (the person does not have a disorder and the test says the person does not have the disorder), a false positive (the person does not have the disorder but the test says that the person has the disorder), or a false negative (the person has the disorder but the test does not recognize it). Sensitivity reflects the probability that someone who has the disorder will be identified correctly by the test (true positive), whereas specificity reflects the probability that someone who does not have the disorder will be identified correctly by the test (true negative) (Furr & Bacharach, 2008). Although in theory, a perfect test would be 100% sensitive and 100% specific, no test is perfect and without error. In reality, there tends to be a tradeoff between how sensitive and specific a measure is. A clinically useful assessment measure will achieve a proper balance between sensitivity and specificity.

Despite its high specificity for detecting dementia, the FOME has low sensitivity for MCI. Although the FOME may be able to discriminate between individuals with MCI and dementia, it may not be sensitive enough to discriminate between individuals with MCI and healthy controls. Diniz and colleagues (2008) looked at the performance in neuropsychological testing for patients diagnosed with MCI, DAT, and healthy controls. There were significant differences in performance for FOME scores between subjects diagnosed with DAT and healthy controls (Diniz et al., 2008). Subjects who had a diagnosis of MCI, on the other hand, demonstrated nearly intact performance, suggesting that even if the FOME is able to discriminate between patients with and without DAT, it may not be sensitive enough to capture individuals who have MCI.

Similarly, Loewenstein, Acevedo, Agron, et al. (2006) found that the FOME is not sensitive enough to categorize patients with MCI. Their research study examined differences in cognitive profiles of four separate groups: non-demented patients with MCI-DAT, MCI-VAS,

mildly demented patients diagnosed with DAT (mild-DAT), and healthy elderly controls. They administered the FOME (a modified three trial version), WMS-3 Delayed Recall for LM, and WMS-R Delayed VR in either Spanish or English depending on the subject's native tongue. Overall, participants in this study demonstrated a large range of variability in FOME performance. MCI-AD patients had a median score of 2.5 SD below the mean, with a range of 2 SD above the mean to 6 SD below the mean (Loewenstein, Acevedo, Agron, et al., 2006). The MCI-VAS group was 1.5 SD below the average, with a range of 1.5 SD above the mean to 5 SD below the mean (Loewenstein, Acevedo, Agron, et al., 2006). No Mild DAT patient scored better than 3.0 SD below the mean on the FOME and there was a large degree of overlap in scores between the mild DAT and MCI-DAT (Loewenstein, Acevedo, Agron, et al., 2006). Additionally, about one third of MCI – VAS subjects and one fifth of MCI-AD subjects scored in the normal range. These scores suggest the FOME does not provide sufficient separation between the MCI –AD and MCI-VAS subtypes to make a useful clinical diagnosis and is not sensitive enough for clinical utility in diagnosing MCI.

Additional Aspects of Fuld Object Memory Evaluation

The assessment of dementia includes several more functions in addition to memory. According to the Diagnostic and Statistical Manual of Mental Disorders (5th ed., American Psychiatric Association, 2013), individuals who are afflicted with DAT experience a myriad of symptoms, including amnesia, aphasia, agnosia, frontal lobe disinhibition, and apraxia. Therefore, a neuropsychological assessment for someone suspected to have a diagnosis of dementia must account for memory, language skills, motor skills, frontal lobe functions, and object recognition. In addition to memory, the FOME measures a variety of symptoms that are typically common in dementia (Fuld, 1980).

The FOME provides several scores in addition to those that assess for memory. Verbal fluency tends to be impaired in individuals who have a diagnosis of dementia. The distracter tasks that are part of the FOME call for rapid semantic retrieval of Names, Food, and Vegetables. Scores for these rapid semantic trials can be compared to normative data and provide information about semantic language fluency. Additionally, the FOME has an experimental technique that is intended to screen for depression embedded in its distracter trials; a depression screen is useful in dementia evaluations, given that depression and dementia manifest in a similar fashion in older adults (Fuld, 1980). Two of the rapid semantic trials are "things that make you happy" and "things that make you sad". Given Beck's Theory of Depression (1973), which states that the majority of depressed patients report a loss of satisfaction and gratification from activities, the assumption is that symptoms of depression should manifest in a semantic retrieval task with a specific time constraint (Fuld, 1980). According to the test makers, if a patient retrieves more "sad" words than "happy" words, depression should be considered a possible clinical diagnosis (Fuld, 1980). Despite its inclusion in the FOME, there is no current evidence to suggest that the two rapid semantic trials provide any information concerning a possible mood disorder. Additionally, the FOME provides information about stereognosis, object naming, left-right orientation, possible depression, and semantic fluency – all common aspects of evaluation for dementia (Fuld, 1980). Given these different characteristics, the FOME is an ideal assessment instrument for geriatric neuropsychological assessments.

An additional strength of the FOME is that many studies have found it to be a relatively culture fair test. Lezak et al. (2004) states that a patient's cultural background should be considered when planning and interpreting their neuropsychological assessment. Understanding of cross cultural influences and bias become essential for the assessment of people who come

from cultural backgrounds other than those of a test's developers and original standardization population (Lezak et al., 2004). According to the U.S. Census Bureau, 63.4 percent of the US population was considered White, non-Hispanic in 2011 (United States Census Bureau, June 2012). Thus, 36.6 percent were considered to be part of a minority group.

Loewenstein, Argüelles, Barker, and Duara (1993) were interested in the presence of cultural bias in commonly administered neuropsychological assessments for the elderly. Subjects in this study were Spanish and English speaking female patients diagnosed with DAT who were matched according to degree impairment as assessed by the FOME (Loewenstein et al., 1993). The Spanish and English speaking subjects did not differ in regard to their FOME retrieval scores (Loewenstein et al., 1993). Overall, results of this study suggest that the FOME, along with the BNT and WAIS-R Similarities subtest, produced similar scores for English and Spanish Speaking DAT subjects (Loewenstein et al., 1993). On the other hand, assessment measures such as WAIS-R Comprehension, WAIS-R DS, and COWAT produced dissimilar scores in the two groups of subjects and may be inherently culturally biased (Loewenstein et al., 1993). In a separate study, La Rue, Romero, Ortiz, Liang, and Lindeman (1999) researched differences in performance on a brief battery of neuropsychological tests for Hispanic and non-Hispanic adults. Education, language preference, language used during test, and ethnicity did not impact FOME scores significantly for Hispanic versus non-Hispanic participants (La Rue et al., 1999). Although relatively low, gender differences were significant for retrieval, delayed recall, and verbal fluency scores on the FOME, with women performing better than men (La Rue et al., 1999). Overall, age was the predominant factor affecting performance on the FOME (La Rue et al., 1999). Marcopulos and McLain (2003) conducted a longitudinal study of a biracial sample of rural elders with low education to assess for test predictors of cognitive decline. Race and

education were not factors that affected performance on the FOME, leading Marcopulos and McLain to conclude the FOME demonstrated good sensitivity and clinical utility for measuring memory performance in their sample of biracial elders with low education.

The effects of educational factors in neuropsychological assessments are especially important to understand when working with populations that are at particular risk for producing false positives. Marcopulos, Gripshover, Broshek, McLain, and McLain (1999) investigated the ability of the FOME to identify dementia in a hospitalized psychogeriatric sample whose clinical state was complicated by both low education and major mental illness. In general, these patients tend to perform poorly on cognitive measures, which makes it difficult to discern the effects of suspected dementia and makes this population susceptible to obtaining an incorrect diagnosis of dementia (Marcopulos, Gripshover, Broshek, McLain, & McLain, 1999). There are two variables that complicate assessment further. Not only is low education in itself considered a risk factor for dementia, but an existing mental illness makes a diagnosis of dementia even more complicated because mental illness can manifest similarly to a dementia (Marcopulos et al., 1999). Participants used were 55 years and older and had 10 or fewer years of education (Marcopulos et al., 1999). They were divided into three groups: Demented Psychogeriatric patients (DEM), Non-Demented Psychogeriatric patients (Psych), and Normal controls (NORM) (Marcopulos et al., 1999). The researchers administered a neuropsychological battery consisting of the following tests: FOME, MDRS, Clock, Cube and Cross Drawing, and the Geriatric Depression Scale (Marcopulos et al., 1999). Findings indicated that age and education were not significantly correlated with most FOME memory scores, including: Retrieval, Storage, Ineffective Reminders, and Delayed Recall (Marcopulos et al., 1999). Age and education did correlate with the Rapid Semantic Retrieval distracter task score for Names, Foods, and Vegetables

(Marcopulos et al., 1999). Overall, the DEM group performed consistently worse on all FOME indices than the PSYCH group (Marcopulos et al., 1999). The PSYCH group differed from the NORM group on Retrieval, Repeated Retrieval, and Delayed Retrieval (Marcopulos et al., 1999). All three groups were significantly different on performance for Names, Foods, and Vegetables (Marcopulos et al., 1999). All other assessment measures, including the: MMSE, Cross, Cube, and Clock series were affected by a combination of education and age (Marcopulos et al., 1999). Additionally, education did not impact FOME scores (Marcopulos et al., 1999). Overall, results suggest that the FOME is less affected by demographic variables than other memory tests.

While memory composite scores for the FOME do not appear to be influenced by education, recall scores appear to be more vulnerable to the effects of educational attainment. In very healthy older adults, FOME recall scores correlate with education and performance IQ to some extent. Hill, Neely, and Backman (1997) studied the effectiveness of the FOME as a tool for assessing age-related stability and change in a two-year longitudinal study of a population based sample of healthy older adults 74 years of age or older who were free of health problems that could potentially interfere with cognitive performance. Subjects in this study were re-assessed at yearly intervals for the course of three years: at baseline, and two years thereafter (Hill, Neely, & Backman, 1997). Results suggest that in this group of optimally healthy very old adults, changes in episodic memory were likely due to an inability to benefit from strategic cues designed to facilitate the transition of information from temporary to permanent memory (Hill et al., 1997). Performance IQ was found to be a significant predictor in forming memories, suggesting the storage of information into LTM seems less likely to occur in older adults with lower IQ levels (Hill et al., 1997). Education, and to some extent gender, also played a predictive role in the FOME scores (Hill et al., 1997). Overall, subjects with more education and those who

were female had increased abilities for storing information in long-term memory (Hill et al., 1997). In tandem, Marcopulos and colleagues (1997) also found that recall scores were affected by level of education.

To summarize, several studies have supported the FOME's clinical usefulness. For example, the FOME has been found to predict preclinical dementia one year before clinical changes occur. Additionally, the FOME can likely differentiate between patients who have dementia, depression, psychiatric problems, and healthy older adults. The FOME can also differentiate individuals with MCI who would eventually develop dementia from those who would not, as well as classify individuals who have developed MCI. However, although the FOME is likely able to differentiate between MCI and dementia, it is not sensitive enough to differentiate between MCI and healthy controls. Despite the data that supports the clinical usefulness of the FOME, the following section will discuss the current problems with using the FOME as an assessment measure.

The Problem

The FOME has several strengths as an assessment instrument to use with a geriatric population. For one, the FOME allows the examiner to evaluate memory and learning under conditions that virtually guarantee attention and minimize anxiety (Fuld, 1980). The FOME was developed while testing hundreds of elderly individuals and is designed to circumvent several sensory deficits that make neuropsychological assessments with the geriatric population difficult, including visual and hearing impairments (Fuld, 1980). Additionally, the FOME provides the ability to encode information using different modalities (touch and sight), allowing older adults with visual impairments, who may have difficulty performing other assessment measures, to perform at optimal levels (Chung, 2009). The FOME is also unique compared to widely used

measures of verbal and visual memory because it uses objects that are commonly encountered in everyday life. Therefore, the FOME can be said to have ecological validity.

No assessment instrument is perfect. Despite its strengths, the FOME has several weaknesses. For one, the research for the FOME is still lacking. Its normative data are limited and the research concerning its validity is scant. With that said, studies concerning the FOME support its clinical efficacy for testing memory impairments in older adults, specifically for those who are suspected of dementia. Although other measures, including word lists, are available and well validated for the assessment of memory, they are unable to replace the value that the FOME can provide neuropsychological assessments. Specifically, the FOME is a measure that is well suited for older adults with sensory impairments, and as such can be a valuable tool for many geriatric assessments.

Validity refers to the degree to which empirical evidence and theoretical rationales support each other, and is one of the most important factors to consider when evaluating an instrument's efficacy in measuring specific constructs (Leong & Austin, 2006). According to the Standards of Educational and Psychological Testing, validity is defined as "the degree to which evidence and theory support interpretation of test scores entailed by the proposed uses" (AERA, APA, & NCME, 1999, p.9, as cited in Furr & Bacharach, 2008). Therefore, a measure in itself is neither valid nor invalid; instead, validity concerns the interpretation and uses of assessment outcomes. Although it oversimplifies the concept, validity can generally be classified into three central components: content validity, criterion validity, and construct validity (Leong & Austin, 2006). Content validity refers to the extent to which an instrument properly measures the defined domain of interest. Criterion validity refers to how the outcome of a measure can be predicted bases on the scores obtained on the measure. Construct validity, which is presently viewed as the

essential concept of validity, refers to the degree to which test scores can be interpreted as reflecting a particular psychological construct (Furr & Bacharach, 2008). Two important components of construct validity include convergent validity and discriminant validity (Leong & Austin, 2006). A measure that has convergent validity correlates significantly and positively with other instruments designed to measure the same construct. Discriminant validity, on the other hand, measures the extent to which a test does not correlate with tests that theory suggests it should not.

As mentioned earlier, a few studies to date have looked at the convergent and discriminant validity of the FOME with other neuropsychological measures. Chung (2009) compared the FOME to measures used to screen for dementia. According to Chung, the FOME possesses excellent parallel form reliability between its two forms (intraclass correlation coefficients ranged from 0.91-0.96) and good convergent validity with two established screening measures for dementia: the MMSE (r=0.69 – 0.74) and both the memory subscale and the initiation/perseveration subscale of the MDRS (r=0.63-0.74) (Chung, 2009).

Wall, Deshpande, MacNeill, and Lichtenberg (1998) also looked at the convergent and discriminant validity of the FOME. They found that the FOME was significantly correlated with the MDRS memory scale (r-.65, p< .001), the WMS-R LM Immediate (r=.46, p<.001) and Delayed (r=.50, p<.001) Recall scores, and the Total MDRS Score (r=.50, p<.001). Additionally, as expected, the FOME was not correlated with a reading test from the Wide Range Achievement Reading Test (WRAT) (r=.08, p=ns). On the other hand, the WRAT was significantly correlated with the MDRS memory scale (r=.37, p<.001) and both Immediate (r=.37, p<.001) and Delayed (r=.34, p<.001) scores for LM, suggesting these tests are influenced by reading levels and the FOME is not. The results obtained by Wall and colleagues support that

the FOME possesses good convergent validity with other established measures of verbal memory, as well as good discriminant validity. However, studies have yet to look at how the FOME compares to more recent assessment of verbal and non-verbal memory.

Current Study

Despite the evidence that exists in support of the FOME's convergent and discriminant validity, further research defining the construct it measures is indicated (Wall, Deshpande, MacNeill, & Lichtenberg, 1998). From a face validity perspective, the FOME is expected to correlate with measures of memory more than with other neuropsychological tasks. However, as was previously mentioned, the FOME is able to circumvent several issues that affect the assessment of memory in older adults and should not correlate too highly with tests that depend on intact visual or hearing capabilities. Therefore, the FOME will most likely correlate with other tests of memory, including those that are both verbal and nonverbal in nature, but will assess true memory abilities more clearly.

Because the FOME is less influenced by factors that tend to affect the assessment of memory in older adults, such as anxiety, visual and hearing impairments, and lack of real world relevance, the FOME is probably less likely to diagnose someone as experiencing memory impairment if they are afflicted by extraneous factors that negatively impact their assessment results but do not suffer from memory impairment. In other words, the FOME should be more specific than other tests in detecting the absence of true memory deficits in older adults, particularly if they suffer from sensory impairments, language-processing deficits, or have minimal education. Additionally, it has great potential for assessing memory in individuals for whom English is a second language. The degree to which the FOME is likely to correlate with other measures of verbal memory is confounded by the fact that typically, if an individual is

unable to hear adequately, they do not become part of standardization samples. In other words, it is expected that the FOME will be a more reliable measure of memory for older individuals who might experience deficits in hearing or language processing. Such individuals would normally be excluded from research studies examining issues of reliability and validity in such measures as the WMS. However, in clinical practice, one cannot exclude such individuals and typically neuropsychologists do the best job that they can in trying to assess individuals who might have reductions in hearing or language processing. Thus, while it is expected that there will be a high correlation between the FOME and such measures as the WMS, the true utility of this measure may not be adequately captured because individuals whose hearing or language processing is judged to be inadequate will not be administered the WMS or other tasks.

As previously mentioned, the FOME would benefit from being more sensitive to the diagnosis of dementia. Delayed memory scores are important because they are highly correlated with memory impairment (Lezak et al., 2004). Currently, the FOME has a 5-minute delay. There are no normative data on delayed memory to make it clinically useful with the exception of one note in the FOME manual stating that 14 out of 15 community residents 70-79 years olds tested recalled 7 or more items and that 13 out of 15 80-89 year olds recalled 6 or more items. Popular neuropsychological assessments tend to use a longer delay period. For example, the WMS-IV Battery has a 25-35 minute delay between its immediate and delayed subtests (Wechsler, 2009). If the five-minute delay for the FOME were extended, it may be more clinically useful. This study examined the relationship between an extended recall on the FOME and recall for other tests of memory, and postulated that by altering the current 5-minute delay on the FOME to a 60-minute delay, the FOME would become more sensitive to diagnosing dementia. A sixty-minute delay, while longer than delays used in other commonly used memory tasks, was selected

because the FOME provides a higher level of processing than other measures of delayed memory. Specifically, it allows test takers to process information using visual and tactile modalities.

The FOME also has a recognition component. The recognition component is administered after the 5-minute delay. Again, there are no normative data associated with the recognition component with the exception of the manual stating that subjects (age groups 70-79 & 80-89) recognized all of the remaining items with the exception of one subject who appeared distracted. The recognition component may be more useful if there was a longer time separating it from immediate recall. As such, the relationship between an extended 60-minute delayed recognition component on the FOME and recognition for other tests of memory was assessed.

The lack of normative data is a weakness of the FOME that needs to be addressed. As already mentioned, Fuld (1980) provides scant normative data for the FOME. Since then, a few other studies have also provided additional data (LaRue et al., 1999; Marcopulos et al., 1999; Ganguli et. al, 2010; Fuld et al., 1990). Examining how it classifies healthy older adults can best assess the utility of the current normative data. The current study obtained data from healthy community dwelling adults in order to compare those results with the current normative data available for the FOME.

<div align="center">**Research Hypotheses**</div>

In order to address the various aspects of the FOME discussed above, the following formal research hypotheses were examined in the current study.

Hypothesis 1

It was predicted that the FOME total raw recall score across five trials (TR), a measure of learning over 5 separate trials that requires the immediate recall of objects, would be

significantly correlated with the following measures of learning over trials and/or immediate recall: Verbal Paired Associates I (VPA I) scaled score, the "Anna Thompson" passage for the WMS (initial presentation) raw score, Hopkins Verbal List Test -Revised (HVLT-R) Form 1 total recall raw score, and the Brief Visual Memory Test- Revised (BVMT-R) Form 1 total recall raw score.

Hypothesis 2

 It was hypothesized that performance on the FOME would be relatively unrelated to other neuropsychological domains. Specifically, the FOME TR, which measures learning across five separate trials, was not expected to correlate with a measure of visual discrimination, confrontational naming, or semantic fluency. In order to assess this hypothesis, the current study predicted that the FOME TR raw score would not be significantly correlated with the Benton Visual Form Discrimination (BVFD) Form 1 total correct raw score, Boston Naming Test total correct raw score, or the Controlled Oral Word Association Test total words raw score.

Hypothesis 3

 It was hypothesized that the FOME 60-minute delay total recall score, a score that measures long-term memory, would correlate with other measures of long-term memory. Therefore, this study predicted that the FOME 60-minute delay total free recall raw score would be significantly correlated with VPA II scaled score, Anna Thompson story total retention (Anna Thompson story LM II total raw score/ Anna Thomson story LM I total raw score), HVLT-R Form 1 Delayed Recall raw score, and the BVMT-R Form 1 Total Delayed Recall Total Recall raw score.

Hypothesis 4

Similarly, this study hypothesized that the 60-minute total retention score for the FOME, which is the addition of the delayed recall and recognition, would be correlated with other measures that assess for delayed recognition. It was predicted that the FOME 60-minute total recognition and retention estimate (Total Recalled + Total Recognized) raw score would be significantly correlated with VPA II Total Recognition raw score, Anna Thompson II Recognition raw score, the HVLT-R Form 1 Discrimination Index raw score, and the BVMT-R Form 1 Discrimination Index raw score.

Hypothesis 5

This study hypothesized that a 5-minute delay on the FOME total recall raw score was not a long enough delay to measure long-term memory, and will therefore not correlate with other measures of long-term memory highly. Thus, it was predicted that the FOME 5-minute delay total recall raw score would not be significantly correlated with VPA II scaled score, Anna Thompson story total retention, BMVT-R Form 1 Delayed total recall raw score, or the HVLT-R Form 1 Delayed total recall raw score.

Hypothesis 6

Similarly, it was predicted that a 5-Minute delay on the FOME total retention raw score was not a long enough delay to measure long-term memory recognition, and would therefore not correlate with other measures of long-term memory highly. It was predicted that the FOME 5-minute total recognition and retention estimate score would not be significantly correlated with Anna Thompson II Total Recognition raw score, VPA II Total Recognition raw score, HVLT-R Form 1 Discrimination Index raw score, or the BVMT-R Form 1 Recognition Discrimination Index raw score.

In addition to the formal hypothesis listed, several characteristics of the FOME were examined via exploratory analysis. They will be discussed in further detail below.

[1] The standard classification system used by mental health professionals in the United States updated to a 5th edition in May 2013 (Diagnostic and Statistical Manual of Mental Health Disorders (DSM)-5, American Psychiatric Association, 2013). As a result of that revision, significant differences were made to cognitive disorders, both in the terminology used and in the diagnostic criteria.

In the previous version, the term 'Dementia' was part of a group of cognitive disorders that was characterized by the development of multiple cognitive deficits (DSM-IV, American Psychiatric Association, 2000). As of May 2013, the terminology that is being used in the new version of the DSM is 'Minor Neurocognitive Disorder' and 'Major Neurocognitive Disorder' (DSM-5, American Psychiatric Association, 2013). Also, what was formerly known as dementia of the Alzheimer's Type in the DSM-IV is now referred to as the specifier Alzheimer's Disease.

As a result of an updated DSM, dementia is a term that is in the beginning stages of being phased out in psychology. Given that the majority of research and statistical knowledge is about dementias and not neurocognitive disorder, this study will continue to use the word dementia and dementia of the Alzheimer's Type (DAT) to describe those particular phenomena. However, it is cognizant that the terminology is in the process of changing.

CHAPTER II

METHODS AND PROCEDURES

Participants

Archival data were analyzed from Allegheny General Hospital, a 661-bed academic

medical center in southwest Pennsylvania serving Pittsburgh and the surrounding five-state area.

Patient data were included if they were administered the FOME between March 2012 and

August 2013 and they were 50 years or older. On the whole, data for 41 subjects were collected

from Allegheny General Hospital.

A group of healthy, non-demented community dwelling adults from a predominantly

rural Western Pennsylvania county was recruited from senior centers. Seniors were recruited on

site from the Aging Services Inc. Daytime Centers in Indiana County (Indiana Social Center,

Chestnut Hills Social Center, Mahoning Hills Social Center, Saltsburg Social Center, Two Lick

Valley Social Center). The stipulations of the consent form, including the objectives and steps of

the study, as well as the voluntary status of participants were verbally explained to everyone

willing to participate in the study. Subjects were excluded from the study if, during the initial

screening interview, they reported the presence of chronic or severe psychiatric disorders,

extensive psychotropic drug use, long-term substance abuse history, history of neurological

diseases, or a history of head injury with loss of consciousness. Subjects were also excluded if

they were not between the ages of 69-90. For the purposes of this study, subjects were

considered healthy if they were living independently, were considered cognitively unimpaired by

staff at the senior center, and obtained a minimum score of 25 on the Mini Mental Status Exam.

At the conclusion of this study, 23 participants were recruited, including 14 participants between

the ages of 69-79 and 9 participants between the ages of 80-90.

Instruments

In order to address both formal research hypotheses and exploratory analysis, including convergent and discriminant validity of the FOME, along with the impact of extending the delay and issues related to the normative data, several instruments were used in the current study. The following section provides information about the instruments used in this study.

Fuld Object Memory Evaluation

Please refer to the narrative on pages 21-25 for a full description of the FOME. The FOME is an assessment designed to measure several aspects of learning and memory in older adults and provides additional information about tactile recognition, right-left discrimination, and verbal fluency. Several memory scores can be derived for the FOME, including a Total Recall across five separate trials (TR), Storage, Repeated Retrieval, and Ineffective Reminders. Additionally, the FOME has a five-minute recall and retention component. For the purposes of this study, an additional 60-minute delayed recall and retention component was appended to the test. Each participant from both senior centers and Allegheny General Hospital were administered both the 5-minute and 60 minute delays during the administration of the FOME.

Mini Mental Status Examination

The MMSE is the most widely used brief screening instrument for dementia and is routinely used to assess cognitive abilities in dementia treatment trials and epidemiological studies (Lezak et al., 2004). The MMSE consists of 11 items assessing orientation to time and place, immediate and delayed recall, attention and calculation, comprehension and language, and constructional abilities (Folstein, Folstein, & McHugh, 1975). Administration takes about 10-15 minutes. The possible range of score is 0-30, with a score of 25 or more considered indicative of being cognitively intact.

Wechsler Memory Scale: Anna Thompson Story

Logical Memory (LM) is one of the subtests that makes up the verbal memory index of the WMS (Wechsler, 2009). LM is considered to be sensitive to dementia for the Wechsler Memory Scale (WMS)– 3rd edition (Lezak et al., 2004). The Anna Thompson story is one of the two stories that comprise the LM subtest of the WMS, and has remained unchanged from the original WMS to the current fourth edition. For the WMS (4th edition), this story remains the same for both the adult and older adult battery.

The Anna Thompson story was selected as a variable of interest to facilitate the inclusion of study participants that were administered different versions of the WMS. Participants obtained from Allegheny General Hospital were administered different versions of the WMS, including the third and fourth edition, as well as the adult battery and the older adult battery. While the Logical Memory subtest varies significantly between the four versions, the Anna Thompson story remains unchanged in both content and administration rules. Thus, the Anna Thompson story was used as a way to include the Logical Memory subtest despite the significant differences between its distinctive versions.

The Anna Thompson story is read by the examiner and contains 25 important details that the patient is responsible for remembering. It measures memory for contextual information of a story presented in an auditory fashion. There are several scores associated with this assessment: the Anna Thompson story in LM I measures immediate recall and the Anna Thompson story in LM II measures delayed recall, memory retention, and recognition after 20-30 minutes. The possible range of score for the free recall portion of both LM I and II is 0-25. Total retention for the task is calculated by dividing the total raw score of the Anna Thompson story in LM II over the Anna Thompson story in LM I. Recognition includes 15-items.

Wechsler Memory Scale: Verbal Paired Associates

VPA assesses verbal memory for associated word pairs (Wechsler, 2009). There are two components to this task: VPA I assesses immediate recall and VPA II examines delayed recall. For this subtest, the patient is initially read a list of word pairs. Immediately after the examiner reads the first word of each pair, the test taker is asked to provide the corresponding word. VPA uses a selective reminding technique – when the patient does not remember one word, they are reminded of the corresponding word pair. This is done across four separate trials. VPA II is administered after a 20-30 minute delay. During VPA II, the patient is read the first word of the word pair and asked to provide the corresponding word; no feedback is provided during this portion of the test. Recognition is examined immediately after the free recall portion of VPA II.

VPA, which is slightly different in the two most recent versions of the WMS, is one of the subtests that make up the auditory verbal memory index of the WMS III and the WMS IV (Wechsler, 2009). The WMS-IV version of VPA features an increased number of word pairs for the Adult battery and added easy items (items where examinees would automatically provide the association 30% of the time). Additionally, recognition items include more difficult word pairs. VPA for the WMS IV-Adult Battery has 14 word pairs. VPA II, the delay for this task, is administered 20-30 minutes after VPA I. The recognition component consists of 40 items. VPA for the WMS-IV Older Adult Battery has 10 pairs. Recognition consist of 30 items. The word pairs are the same for both batteries of the WMS IV, except that four of the "harder" word pairs are not included in the Older Adult Battery. The easy items that were included in VPA for the WMS IV adult battery is thought to improve the floor by adding more items relative to the WMS III. VPA of the WMS III has 8 word pairs. VPA II is administered 25-35 minutes after VPA I. The recognition component consists of 24 items.

Brief Visual Memory Test-Revised

The BVMT-R is a test of visuospatial memory (Benedict, 1997). For this test, patients are asked to look at a stimulus sheet containing six uncommon designs for 10 seconds and are then asked to reproduce the designs immediately afterward. This is done for three separate trials. A delayed recall is administered after 25 minutes, along with a recognition component. Scores include one for each learning trial, a total recall score (the sum of recall across the three trials), a delayed free recall, and delayed recognition discrimination index. In a validation study that looked at patients with DAT, vascular dementia, and normal controls, the BVMT-R was found to discriminate between subjects that have dementia and normal controls (Benedict, 1997).

Hopkins Verbal Learning Test-Revised

The HVLT-R is a word list-learning task in which 12 words are presented for three learning trials (Brandt, 1991). In addition, a delayed recall trial is administered after a 20-25 minute delay, plus a subsequent 24-word recognition trial. Scores include one for each learning trial, a total recall score (the sum of recall across the three trials), a delayed free recall, and a recognition discrimination index. Patients with DAT as well as those with vascular dementia show a learning deficit on the HVLT-R (Lezak et al., 2004).

Benton Visual Form Discrimination

The BVFD is a 16-item, multiple-choice test of visual recognition (Benton, Sivan, Hamsher, Varney, & Spreen, 1994). For this test, the patient is presented a stimulus item that consists of geometric figures and four stimulus sets below the target, one of which is an exact match. The other three targets contain small variations of displacement, rotation, or distortion. Patients with DAT perform poorly on this test, as they tend to commit many peripheral errors. There is a total correct raw score for this test, with a possible range from 0-32.

Boston Naming Test

The BNT is a test of confrontational naming (Kaplan, Goodglass, & Weintraub, 1983). This test consists of 60 large ink drawings of items ranging in familiarity from very common (such as bed) to less common items (such as abacus). If the person is unable to recognize what the object is (e.g., sees a cup instead of a mask), they are provided with first a semantic cue, and if they are still not able to name the drawing, a phonemic cue. The BNT is a measure that is widely used in dementia assessments because it is a sensitive indicator of both the presence and the degree of deterioration (Lezak et al., 2004). The possible range for the raw score is 0-60.

Consent Procedures

IRB approval was obtained from the Indiana University of Pennsylvania and Allegheny General Hospital. For the participants recruited from senior centers, the study objectives and procedures were explained to the participants involved prior to beginning the study. They were additionally asked to sign consent forms in order to participate in the study.

CHAPTER III

RESULTS

Statistical Analysis

The current study had several aims. First, this study investigated convergent validity of

FOME immediate recall, delayed, and recognition scores with other commonly used measures of

immediate, delayed, and recognition memory. Second, this study examined the discriminant

validity of the FOME with assessment instruments purported to measure cognitive domains other

than memory, such as visual form discrimination, confrontational naming, and language fluency.

A power analysis was conducted in order to determine an appropriate sample size. In order to

obtain a small effect size of 0.34 (α= 0.05, 1-β=0.8), this study required a sample size of 40

subjects. Participants used for these analyses were obtained from Allegheny General Hospital.

Missing data were handled by using a means substitution method **(**Schlomer, Bauman, & Card,

2010**)**.

Hypothesis 1

The first hypothesis is that scores on the FOME total recall, which is the summation of

free recall scores for trials 1 through 5, would demonstrate convergent validity with other

measures of immediate memory. In order to investigate this hypothesis, a multiple regression

analysis was conducted to see if scores on commonly used measures of immediate memory

predict scores obtained on FOME total recall. Raw scores from the Anna Thompson story (WMS

LM I), VPA I, BVMT-R total, and HVLT total were used as predictors for this analysis. The

variables of interest were found to significantly predict FOME total recall scores. The results of

the regression analysis indicated that the 4 predictors explained about 21.3% of the variance in

the FOME total recall scores, adjusted R^2=0.213, F(4,36)=3.704, p=.013, α=.05. This finding

supports the hypothesis that the FOME total recall score has convergent validity with other

commonly used measures of immediate memory.

Independent Pearson's correlations were computed to examine correlations between

FOME total recall scores and the predictors used in the regression analysis discussed above.

Results revealed a significant correlation between the FOME total recall score and two

predictors: Anna Thompson I total recall score (r=.455, p<.01) and VPA I total recall score

(r=.397, p<.05). These results are found in Table 1. When the Anna Thompson story and Verbal

Paired Associates I were the only variables considered, they significantly predicted scores for

FOME total recall at a high degree (R^2=0.207, F(2,38)=6.231, p=.005, α=.05.)

Table 1

Pearson's Correlations (R) Between FOME Total Recall and Anna Thompson I Total Recall, Verbal Paired Associates I Total Recall, Hopkins Verbal Learning Test Total Recall, and Brief Visual Memory Test Total Recall

	FOME Total Recall	Anna Thompson 1	Verbal Paired Association I	Hopkins Verbal List Test Total Recall	Brief Visual Memory Test Recall
FOME Total Recall	1	.455(p=.005)	.397(p=.027)	.080(p=.761)	.343(p=.128)
N	41	37	31	17	21

Hypothesis 2

The second hypothesis was based on the assumption that the FOME total recall score

would demonstrate discriminant validity with measures that are not purported to measure the

cognitive domain of memory. In order to investigate this hypothesis, a multiple regression

analysis was conducted to examine if scores from measures of verbal fluency, visual

discrimination, and confrontation naming correlate with FOME total recall scores. Predictor

variables for this analysis included total raw scores from the COWAT, BVFD, and BNT.

Contrary to predictions, the predictor variables were found to significantly predict FOME total

recall raw scores. The results of the regression analysis indicated the 3 predictors explained

26.9% of the variance in the FOME Total Recall scores adjusted R^2=0.269, F(3,37)=5.902,

p=.002, α=.05. This was a completely unexpected finding and certainly did not support the

hypothesis. Examination of Pearson's correlations revealed that FOME total recall scores were

significantly correlate with BNT total (r=.527, p<.01) and COWAT total (r=.449, p<.01). Only

the BVFD failed to correlate with the FOME. (Correlations are illustrated in Table 2.)

Table 2

Pearson's Correlations (R) Between FOME Total Recall and Benton's Visual Form Discrimination Total, Boston Naming Test Total, and Controlled Oral Word Association Test Total

	FOME Total Recall	Brief Visual Form Discrimination	Boston Naming Test	Controlled Oral Word Association Test
FOME Total Recall	1	.143(p=.434)	.527(p=.003)	.449(p=.004)
N	41	32	30	40

Hypothesis 3 and 4

The third and fourth hypotheses postulated that the FOME 60-minute delay total recall

and retention (free delayed recall + recognition) scores would correlate with other commonly

used measures of delayed memory recall and retention, respectively. Multiple regression

analyses were again conducted using the delayed recall and recognition scores of VPA II,

BVMT-R, the Anna Thompson Story, and HVLT as predictors. The third hypothesis was not

supported by the results. Specifically, the variables in question did not significantly predict

FOME 60-minute delay total free recall scores. The 4 predictors explained 11.2% of the variance

in the FOME 60-minute delay total recall scores adjusted R^2=0.112, F(4,35)=2.230, p=.086,

α=.05. A series of Pearson's correlations for delayed recall scores demonstrated that FOME 60-minute delayed free recall scores were significantly correlated with scores for Anna Thompson retention (r=.462, *p*<.01, Table 3).

In the fourth hypothesis, the variables of interest did not significantly predict scores for FOME 60- minute delay total retention. The 4 variables explained about 6% of the variance in the FOME 60-minute total retention scores and did not reach significance (adjusted R^2=0.060, F(4,35)=1.624, p=.190, α=.05). However, when individual Pearson's correlations were calculated, the Anna Thompson Recognition score was significantly correlated with the FOME 60 minute retention score (r=.386, *p*<.05; Table 4).

Table 3

Pearson's Correlations (R) Between FOME 60-Minute Free Recall Score and Verbal Paired Associates II, Anna Thompson II Retention, Hopkins Verbal Learning Test Delay, and Brief Visual Memory Test Delay

	FOME 60 Minute Free Recall	Verbal Paired Associates II	Anna Thompson Retention	Hopkins Verbal Learning Test Delay	Brief Visual Memory Test Delay
FOME 60 Minute Free Recall	1	.279(p=.115)	.462(p=.005)	.120(p=.658)	.057(p=.817)
N	39	33	36	16	19

Table 4

Pearson's Correlations (R) Between FOME 60-Minute Retention Score and Verbal Paired Associates II Recognition, Anna Thompson II Recognition, Hopkins Verbal Learning Test Discrimination Index, and Brief Visual Memory Test Discrimination Index

	FOME 60 Minute Retention	Verbal Paired II Associates Recognition	Anna Thompson Recognition	Hopkins Verbal Learning Test Discrimination Index	Brief Visual Memory Test Discrimination Index
FOME 60 Minute Retention	1	.228(p=.201)	.386(p=.020)	.418(p=.107)	-.108(p=.679)
N	39	33	36	16	17

Hypothesis 5 and 6

In an attempt to investigate the current FOME memory delays in more depth, the fifth and sixth hypotheses proposed that the FOME 5-minute delay total recall and retention scores would not significantly correlate with other commonly used measures of delayed recall and retention. Multiple regression analyses were conducted using delayed recall and recognition scores of VPA II, BVMT-R, Anna Thompson, and HVLT as predictors.

Contrary to hypothesis 5, FOME 5-minute delayed scores were significantly correlated with other measures of memory recall as the 4 predictors explained about 15.3% of the variance in FOME 5-minute delay total free recall scores (adjusted R^2 =0.153, F(4,36)=2.812, p=.040, α=.05.) Examination of individual correlations revealed a significant correlation between FOME 5-minute delay scores and Anna Thompson retention scores (r=.503, *p*<.01; Table 5).

Table 5

Pearson's Correlation Analysis Between FOME 5-Minute Delay Free Recall Total, Anna Thompson Retention, Verbal Paired Associates II Free Recall, Hopkins Verbal Learning Test Delayed Recall, and Brief Visual Memory Test Delayed Recall

	FOME 5 Minute Recall	Anna Thompson Retention	Verbal Paired Association II	Hopkins Verbal Learning Test Delay	Brief Visual Memory Test Delay
FOME 5 Minute Recall	1	.503(p=.002)	.185(p=.303)	.316(p=.234)	.220(p=.365)
N	40	36	33	16	19

The sixth hypothesis was weakly supported by the results as the predictor variables came close, but did not significantly predict scores for FOME 5-minute delay total retention (R^2 =0.0126, F(4,36)=2.446, p=0.064, α=.05.). The four predictors explained 12.6% of the variance in the FOME 5-minute total retention scores. Notably, when individual Person's correlations were calculated, scores for FOME 5-minute total retention were significantly correlated with scores for Anna Thompson Recognition (r=.450, p=.006).

Post-Hoc, Exploratory Analyses

In addition to examining the 6 formal hypotheses stated above, this study also aimed to investigate several aspects of the FOME by means of exploratory analyses.

Senior Center Statistics

A community sample of healthy older adults was obtained from senior centers in a rural area of Western Pennsylvania. The descriptive analysis for the data obtained from the senior center sample can be seen in Table 6.

Table 6

Descriptive Analysis of FOME Performance in Senior Center Participants

	N	Minimum	Maximum	Mean	Standard Deviation
5 Minute Recall	23	6.00	10.00	8.3913	1.19617
5 Minute Retention	23	9.00	10.00	9.9130	.28810
60 Minute Recall	23	6.00	10.00	8.3478	1.22877
60 Minute Retention	23	9.00	10.00	9.9565	.20851
FOME Total Recall	23	27.00	49.00	38.6087	5.39140

Comparing performance on the 5-minute and 60-minute delayed recall and recognition for participants revealed no significant differences. The mean score for the 5 minute delayed recall was 8.39 (s.d.=1.2) and 8.34 (s.d.=1.23) after 60 minutes. In terms of delayed retention, the mean score was 9.91 (s.d.=.29) after a five minute delay and 9.96 (s.d.=.21) after 60 minutes. In the original normative data for the FOME, mean scores were not available for the delayed tasks. Instead, the authors noted on the manual that out of 15 community residents, only one person was unable to recognize information after a 5-minute delay (Fuld et al, 1979). As a result, a formal comparison between delayed recall and retention scores in the data obtained from senior centers and the original FOME sample cannot be ascertained.

The mean scores for FOME total recall were calculated and are in Table 7. By comparison, in the original sample used to norm the FOME, the mean scores for total recall were 38.73 (s.d.=4.53) for 70-79 year olds and 33.59 (s.d.=6.61) for 80-89 year olds. Notably, although an approximate two and three point difference emerged in the data sets for each age group, the mean scores for the senior center data still fell within the range expected given the

standard deviations. Welch's T tests were calculated and confirmed that means scores were not

significantly different (p=0.489 for age group 70-79 & p=.2115 for age group 80-89). A

comparison between the original norms and the data obtained by the senior centers are illustrated

in figure1.

Table 7

Senior Centers: Age Group Means

	Mean	Standard Deviation
70-79	40.1	5.84
80-89	36.2	3.73

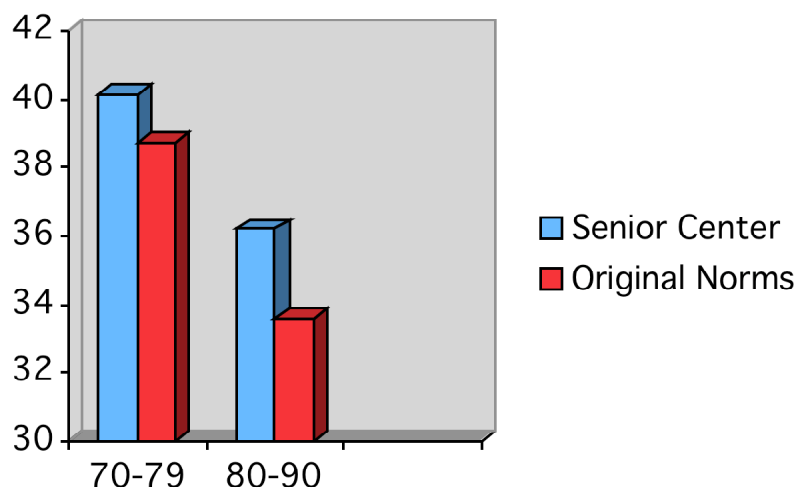*Figure 1.* Total recall score according to age for senior center vs original normative data.

Allegheny General Hospital vs. Senior Center Data

Differences between FOME performance in the clinical sample from Allegheny General

Hospital and subjects from Senior Centers were examined. The two samples were first compared

in terms of age and education level to ascertain any differences. The two groups differed

significantly in terms of age (p=.001, α=.05) but not in terms of education level (p= .066, α=.05). Table 8 illustrates the descriptive statistics for these two samples.

Table 8

Descriptive Analysis: Means and Standard Deviations for Groups

	Age	Education
Alleghany General Hospital	65.48(s.d.=1.71)	13.24(s.d.=2.66)
Senior Centers	79.26 (s.d.=1.35)	11.57(s.d.=1.99)

Differences between group performance on FOME scores, including total recall, 5-minute delay, 60-minute delay, 5-minute retention, and 60-minute retention, were analyzed. Given that there was a significant difference in age between groups, the effects of age were controlled in the statistical analysis by running a series of ANCOVA's. When controlling for age, individuals from senior centers performed significantly better on FOME total recall scores than participants from AGH (p<.0005). Senior center participants also performed better on the 60-minute delay and retention components of the FOME at a rate that approached significance (p=.070 & .063, respectively). No other significant differences between the data sets were found. Table 9 illustrates the means and standard deviations in both groups for the variables of interest.

Table 9

Means and Standard Deviations of Variables of Interest

	Allegheny General Hospital	Senior Centers	P Value
FOME Total Recall	35.15 (s.d.=2.27)	38.62(s.d.=5.40)	.000
Five-Minute Recall	7.75(s.d.=2.27)	8.39(s.d.=1.20)	.103
Five-Minute Retention	9.93(s.d.=0.35)	9.96(s.d.=0.21)	.201
Sixty-Minute Recall	7.10(s.d.=2.23)	8.35(s.d.=1.23)	.070
Sixty Minute Retention	9.76(s.d.=081)	9.95(s.d.=0.21)	.063

Depression Screening

The relationship between a diagnosis of depression and the performance on the FOME 'things that make you happy' and 'things that make you sad' categorical verbal fluency were examined. In the data set, 14 out of 38 subjects had a prior history of depression or dysthymia. However, out of those 38 subjects, only 7 subjects were able to name more things that made them sad than things that made them happy. Out of those 7 subjects, 4 of them had a documented history of depression or dysthymia. This did not support the assumption by Fuld (1980) that individuals that retrieved more "sad" words than "happy" were likely to be clinically depressed. Those results are illustrated in figure 2.
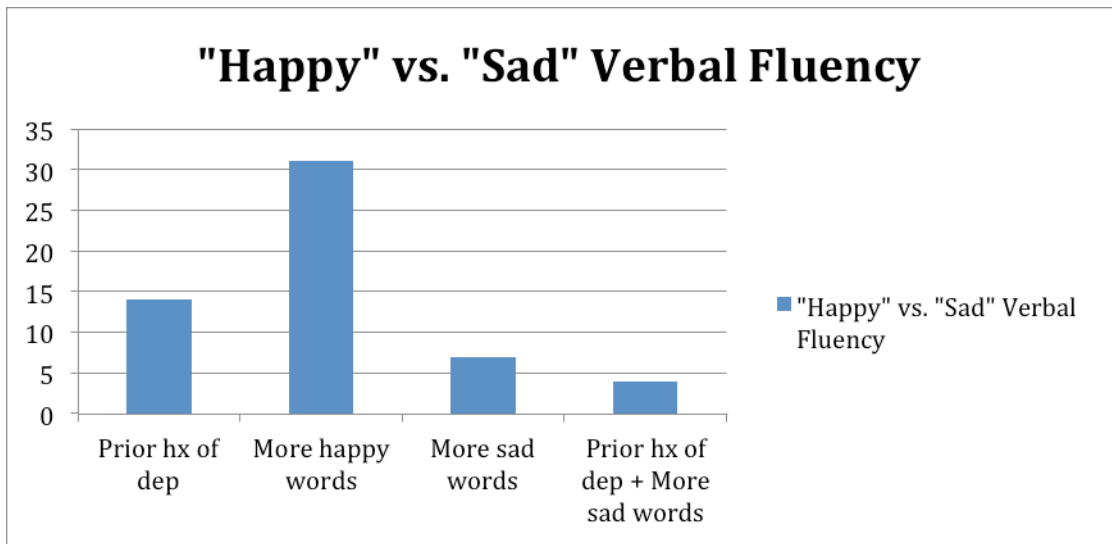
Figure 2. Happy words vs. Sad words verbal fluency.

CHAPTER IV

DISCUSSION

The Fuld Object Memory Evaluation is a geriatric assessment of memory that has several strengths but relatively scant data concerning its normative properties and clinical validity. This study investigated several aspects of the Fuld Object Memory Evaluation (FOME). Specifically, this study investigated convergent and discriminant validity of the FOME, and explored the effects of extending the original 5-minute delay to a 60-minute delay for recall and retention portions of the assessment. Six specific outcomes were predicted to result from the analysis: (a) the FOME total recall score would have convergent validity with other measures of immediate memory, (b) the FOME total recall score would have discriminant validity with measures of verbal fluency, confrontational naming, and visual form discrimination, (c) the FOME 60-minute delay recall score would correlate with other measures of delayed memory, (d) the FOME 60-minute total retention score would correlate with other measures of delayed recognition, (e) the FOME 5-minute free recall score would not correlate with other measures of delayed recall, and (f) the FOME 5-minute total retention score would not correlate with other measures of delayed recognition. For the purposes of this study, a correlation was considered weak when the correlation coefficient was between .10 to .30; moderate when the correlation coefficient was between .30 to .50; and strong when the correlation coefficient was .50 or larger. A secondary interest of this study was to examine a number of properties associated with the FOME using exploratory analysis.

At the conclusion of the data analysis, some hypotheses were supported while others were not. Hypothesis (a) was supported, as the results demonstrated that there is convergent validity between the FOME and other commonly used measures of immediate memory.

Specifically, scores for Anna Thompson I (r=.455, *p*<.01) and Verbal Paired Associates I (r=.397, *p*<.05), two measures of verbal memory, demonstrated moderate positive correlations with FOME total recall scores. The FOME total recall score did not have a significant correlation with the HVLT total score (r=.080), a measure of learning and memory, or with the BVMT-R total recall (r=.343), which is an assessment of immediate visual memory. These results suggest that the FOME has a strong verbal component, The results additionally suggest that despite the visual demands of the task, it does not tap similar constructs as the BVMT-R. In fact, the FOME total recall score demonstrated discriminant validity with the BVMT-R total recall score. This may be due to the fact that while the BVMT-R is considered a test of visual memory, it has little ecological validity, and has a strong visuospatial and visuoconstructional component. The FOME, on the other hand, may be measuring visual memory as it is observed in everyday functioning, and obtain more ecological validity in terms of visual memory. It is unclear and admittedly unexpected that the FOME total recall score would not correlate with the HVLT total score given its strong verbal component, both utilize a selective reminding procedure, and have a similar number of items to recall. However, it may be related to having a low power that is typically associated with a small sample size

Additionally, results did not demonstrate discriminant validity between the FOME and other commonly used neuropsychological measures. Instead, a strong positive correlation was found between the FOME total recall score and the Boston Naming Test (r=.527, *p*<.01), a measure of confrontational naming. A moderate positive correlation was also found between the FOME total recall score and Controlled Oral Words Association (r=.449, *p*<.01), a measure of phonemic verbal fluency. While these results were not expected, both the Boston Naming Test and Controlled Oral Word Association rely on the similar construct of language (Lezak et al.,

2004). Thus, similarly to what was observed in the first hypothesis, these results may be suggestive of a strong language component to FOME total recall scores. It may be that performance on the Fuld Object Memory Evaluation taps into a similar construct when people are asked to name the objects inside the bag. The correlation was particularly prominent between the Boston Naming Test and the FOME. In addition to being a measure of confrontational naming, the Boston Naming Test requires the examinee to recognize and recall the name of objects depicted in a picture, which is similar to the object recognition component of the FOME, where examinees are asked to recognize and recall names of objects inside of a bag. Thus, both tap lexical access. It is likely that the similarity in tasks is responsible for the correlation.

Multiple regression analyses were very similar for both the FOME 5-minute delay and the 60-minute delay. When independent Pearson's correlations were calculated, FOME 60-minute delayed recall and retention scores demonstrated significant moderate correlations with Anna Thomson recall (r=.462, $p<.01$) and recognition scores (r=.386, $p<.05$), respectively. Similarly, the 5-minute free recall score had significant strong positive correlation with the Anna Thompson retention score. Thus, unlike the original hypotheses, these results suggest that a 5-minute delay is slightly more correlated with commonly used measures of delayed memory than the proposed 60-minute.

The FOME 5-minute delay total retention score was predicted to not be significantly correlated with other measures of memory recognition. However, independent Person's correlations indicated that there was a significant moderate correlation between the scores for the FOME 5-minute retention and Anna Thompson Recognition. It is likely that the FOME total retention task did not correlate with many of the recognition tests because it is simply not challenging enough (ceiling effect). In the current study, 38 out of 40 subjects from AGH

obtained a score of 10 out of 10 for the 5-minute total retention score (total retention = delayed free recall + recognition). Similarly, 21 out of 23 subjects from senior centers obtained a score of 10 out of 10 for the 5-minute total retention score. In the original normative data derived for the FOME, 29 out of 30 subjects recognized all items after a 5-minute delay. The implication of these data is that most people are able to recognize all of the items after a five-minute delay, despite their performance on total recall scores. Given the ease of the task, the information it provides is limited.

Implications of Formal Hypotheses

Results from the various hypotheses provide clinically useful information to neuropsychologists about how the Fuld Object Memory Evaluation fits within an assessment battery. Convergent evidence reflects the degree to which test scores have the correct pattern of association with other variables (Furr & Bacharach, 2008). Namely, convergent validity refers to the notion that a measure of a particular construct should be strongly associated with other measures of the same constructs. The results found evidence for convergent validity. Additionally, the results found a correlation between the Fuld Object Memory Evaluation and measures of language, specifically verbal fluency and confrontational naming. Thus, the FOME is likely also measuring aspects of language and object recognition, making it uniquely positioned to help in assessments of Alzheimer's Disease, a disease whose symptomology is pronounced with impairments in memory and language in its inception (Albert et al., 2011). Given the high prevalence of dementia and particularly Alzheimer's Disease in the United States, it is important for health providers to have assessment tools that can help diagnostically (Alzheimer's Disease and Facts and Figures, 2013).

It is believed that the FOME is a valuable assessment tool for geriatric assessments. One of the appeals of the FOME is that it provides multifaceted neuropsychological information to the examiner in a relatively short administration time. In addition to assessing learning and memory, the FOME also provides information concerning object naming, inhibition, stereognosis, the ability to discriminate between left and right, and verbal fluency. Given that these cognitive domains are prominent areas assessed during a dementia evaluation, the information provided by the FOME renders it useful to serve as a brief, stand-alone, neuropsychological battery for older adults.

Notably, both the 60-minute and 5-minute delayed recall and total retention scores of the Fuld Object Memory Evaluation correlated with the equivalent scores from the Anna Thompson story (delayed recall and recognition, correspondingly). However, in contrast to what was originally hypothesized, the correlations with the Anna Thompson story were slightly stronger for the 5-minute delay than for the 60-minute delay. The implication of these data is that the FOME 5-minute delayed scores have similar convergent validity to the proposed 60-minute delay. This finding, while not expected, is an attractive characteristic of the Fuld Object Memory Evaluation. A 5-minute delay is significantly less than the typical 20-35 minute delays that are commonly used in other measures of memory. Thus, the fact that a 5-minute delay is more significantly correlated with a widely used measure of delayed memory than a 60-minute delay suggests the Fuld Object Memory Evaluation is a shorter and clinically useful test of learning and memory. Shorter neuropsychological assessments, when clinically valid, are desirable over longer tests for various reasons; shorter tests can increase optimal patient performance by decreasing tests anxiety and reducing fatigue; and practically, a shorter battery can reduce the overall time requirement for the evaluation and reduce work load for the neuropsychologist. The

shorter time requirement for the Fuld Object Memory Evaluation also makes it more attractive in certain assessment environments. Given the relatively quick administration of the measure, the Fuld Object Memory Evaluation may be an ideal assessment to use as a quick screen of memory functioning or as part of a bedside neuropsychological assessment battery.

Discussion of Exploratory Analysis

Several aspects of the Fuld Object Memory Evaluation were examined via exploratory analysis. The relationship between a diagnosis of depression and the performance on the FOME 'things that make you happy' and 'things that make you sad' categorical verbal fluency were examined. As reported in the results section, the data did not support the assumption proposed in the original Fuld Object Memory Evaluation manual that categorical fluency for "sad" words and "happy" words could be used as a screener for clinical depression. Given the data observed in this study, most individuals, regardless of clinical diagnosis of depression, are able to name more things that make them happy than sad. Also, individuals that demonstrate atypical performance and come up with more things that are "sad" than "happy," are not likely to have clinical depression.

One aspect of this study was to look at differences in FOME performance between a clinical sample from AGH and a healthy population from Senior Centers. Although the sample obtained from senior centers was not thoroughly screened to ensure a lack of cognitive impairments, they were considered a healthy sample for purposes of this study. In an effort to obtain a healthy sample, participants were only included if, after volunteering, they scored a minimum of 25 on the MMSE, were considered healthy by staff at senior centers, and reported living independently. Individuals who endorsed a presence of chronic or severe psychiatric

disorders, or a history of neurologic diseases, traumatic brain injuries, extensive psychotropic or other substance use were excluded from the study.

When the effect of age was controlled for in the two groups, participants from the senior centers performed significantly better on the FOME total recall score than participants from AGH. This is a completely expected finding as, by definition, those going to a hospital are doing so for a reason: illness. Senior centers participants also performed better on the FOME 60-minute delayed recall and retention. The latter two results approached significance. If more subjects would have been recruited for this study, senior centers participants would likely have performed significantly better on the FOME 60-minute recall and retention task than subjects from AGH.

No significant differences were found between clinical scores and senior center data for the FOME 5-minute delayed recall and retention. Delayed memory recall is considered to be one of the strongest predictors for developing Alzheimer's disease in the future (Gomar, Bobes-Bascaran, Conejero-Goldenberg, Davies, & Goldenberg, 2011). In the Fuld Object Memory Evaluation, the 60-minute delayed recall score could be measuring learning and memory over time. Although the number of participants obtained was too low make any definite conclusions, it is important to note the possibility that differences observed in the data may be due to differences in prevalence of Alzheimer's or other dementias in clinical and healthy populations.

Study Limitations

There are several limitations to this study. The fact that the results from the formal hypotheses are only correlational, interpretability is restricted due to the limitations of the design of this study. While the results supported a correlation between the Fuld Object Memory Evaluation and other measures of memory, a correlation between two measures is a somewhat ambiguous finding. For one, a correlation could be indicative that two measures share trait

variance, which suggests the constructs that they are intended to measure are similar (Furr &
Bacharach, 2008). However, a correlation could also be indicative that two measures share
method variance, meaning they are correlated mainly because they may be on the same method
of measurement (Furr & Bacharach, 2008). This is particularly important to keep in mind given
that the FOME lacked discriminant validity in this study. Thus, while correlation studies are
useful, by nature, they do not allow for definite conclusions to be made.

Missing data for the correlation analyses was addressed via means substitution. The use
of this method, in combination with the large amount of missing data for some of the correlation
analysis, is a limiting factor to this study. Particularly, for both the Brief Visual Memory Test
and the Hopkins Verbal Learning Test, approximately half of the data used in the correlation
analyses were substituted means of the few subjects for which data was available. Due to the
nature of the means substitution method, this likely impacted the findings of this study by
diminishing the observed correlation between those tests and the FOME total recall.

The type and number of participants obtained also limits this study. The senior center
data collected were obtained from a rural area of western Pennsylvania and is not representative
of the general population. That said, they are perhaps no less representative than Fuld's original
sample which was comprised of a Caucasian, mostly Jewish sample from New York. In this
community, senior centers are heavily used and are easily accessible by the community (they
provide transportation). Additionally, the use of senior center participants for the healthy
population sample is in itself a limiting factor to this study. Individuals who attend senior centers
on a regular basis are a selective subgroup and not representative of older adults. Also,
participants were not thoroughly screened to ensure they were cognitively intact. However, in
order to obtain a relatively healthy sample the participants were screened using the MMSE, by

conducting a clinical interview, and by using the report of staff members in the senior center locations. Exclusion criteria were obtaining an MMSE of less than 25 points, depending on someone for activities or daily living, being considered impaired by staff at senior centers, and by having a history of substance use, psychotropic medication use, neurologic disorders, or traumatic brain injury.

Similarly, the clinical data obtained at Allegheny General Hospital (AGH) may also limit the generalizability of the results. AGH is a large urban academic hospital. Older adults that have access to this hospital typically have personal insurance and a means of transportation. Thus, the population at AGH is also not considered to be representative of the older adult population at large. There were also a limited number of participants that further reduces the ability to generalize the results of this experiment. Collectively, the limitations of this study suggest interpretation should be made with caution.

Strengths of Study

Despite the limiting factors discussed above, this study has several strengths. As highlighted in previous sections, the FOME is a geriatric assessment that has many appeals for use with older adults. Importantly, this study adds to the existing knowledge regarding the FOME. It provides information concerning the FOME's convergent and discriminant validity, and examines the effects of extending the delay from five minutes to sixty minutes. The results found that the existing 5-minute delay has more convergent validity with other measures than the proposed 60-minute delay, suggesting that a primary strength of the FOME is the vast amount of information that can be obtained in a relatively brief amount of time. In fact, the FOME 5-minute delay demonstrated a strong correlation to a significantly longer task that is associated with a 25 to 35 minute delay.

The current study aimed to add credibility to the current normative data for the FOME. It obtained information about the FOME from both a clinical and healthy population. The data sets were compared to each other and to the original normative data for the FOME. Obtaining additional normative information is a valuable addition to the current knowledge given that participant data used to norm the FOME originally was limited in nature. Specifically, the sample size was small and relatively homogenous, making the generalizability of the normative data questionable. This added to the existing normative data by demonstrating it is comparable to the original normative information.

Future Research

Strengths associated with the FOME include its concurrent validity, relatively short administration, and its ability to circumvent sensory impairments. An additional and noteworthy strength of the FOME is the multifaceted amount of information the assessment is able to provide during as evaluation. The FOME provides information related to memory and learning over time, object naming, stereognosis, left right discrimination, the ability to inhibit behavior, and verbal fluency. As such, it is able to serve as a brief, fixed neuropsychological battery for older adults.

The significant amount of information provided by the FOME combined with its relative brevity makes its use as a neuropsychological battery appealing for geriatric assessments. Older adults tend to tire and become frustrated easily. Also, in outpatient settings, older adults tend to depend on others for transportation, which creates an additional barrier for long, comprehensive, neuropsychological batteries. As such, a battery such as the FOME, that is both comprehensive in the data it provides and has a short administration time is ideal for the assessment of older

adults. Further research that helps establish the FOME as a short, fixed battery for older adults is merited.

For this study, both the five and 60-minute delayed trials were administered to each individual subject. As such, the possibility of practice effects could not be eliminated from the interpretation of the results. Future studies would benefit from examining the differences between the five and 60-minute delayed trials by creating separate experimental groups in order to control for practice effects. Additionally, in order to eliminate other possible confounding variables, it may be beneficial to equate patients by neurological impairment or cognitive functioning at the time of test administration. For example, future studies may want to look at FOME delayed recall scores in a group of subjects diagnosed with Alzheimer's Disease. In order to equate for cognitive functioning, they may choose subjects with specific scores on the MMSE or similar performance for FOME total recall.

In order for neuropsychological assessments to be clinically useful, the examinee's performance must represent functioning outside of the testing situation (Burgess, Alderman, Evans, Emslie, & Wilson, 1998). Assessment measures should ideally contains strong ecological validity, and be indicative of the examinee's 'real-world' impairment (Shadish, Cook, & Campbell, 2002). For example, an isolated impairment in a test of memory would be clinical insignificance if test performance did not translate to 'real world' difficulties with memory. The FOME is hypothesized to possess strong ecological validity for the assessment of dementia, specifically DAT. Losing objects such as keys or wallets is an early symptom that arises with the onset of DAT, making the FOME, a measure that examines the recognition and recall of common household objects, likely to measure memory impairment associated with DAT (American Psychiatric Society, 2000). That said, there is no empirical evidence for the

ecological validity of the FOME. Future studies should focus on analyzing predictive validity associated with the FOME.

One of the problems identified by this study is the FOME's lack of discriminant validity. Thus, while this test may assess memory, it may also be assessing components of language. Future studies may want to consider how to best account for the FOME's correlation with the domain of language in the assessment's interpretation. Another weakness of the FOME is the small amount of normative data that is associated with it. Future studies should focus on improving the normative data associated with this test.

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Appendices

Appendix A: Allegheny General Hospital Data

Table A1: Allegheny General Hospital Descriptive Analysis

	Age	Education	FOME Total Recall	FOME 5-Minute Recall	FOME 5-Minute Retention	FOME 60-Minute Recall	FOME 60-Minute Retention
Mean	65.48	13.24	35.15	7.75	9.93	7.10	9.76
S.D.	1.17	2.66	2.27	2.27	0.35	2.23	0.81

Table A2: Person's correlations (R) between FOME total recall and Anna Thompson I total recall, Verbal Paired Associates I total recall, Hopkins Verbal Learning Test total recall, and Brief Visual Memory Test total recall

	FOME Total Recall	Anna Thompson 1	Verbal Paired Association I	Hopkins Verbal List Test Total Recall	Brief Visual Memory Test Recall
FOME Total Recall	1	.455(p=.005)	.397(p=.027)	.080(p=.761)	.343(p=.128)
N	41	37	31	17	21

Table A3. Pearson's correlations (R) between FOME total recall and Benton's Visual Form Discrimination total, Boston Naming Test total, and Controlled Oral Word Association Test total.

	FOME Total Recall	Brief Visual Form Discrimination	Boston Naming Test	Controlled Oral Word Association Test
FOME Total Recall	1	.143(p=.434)	.527(p=.003)	.449(p=.004)
N	41	32	30	40

Table A4: Person's correlations (R) between FOME 60 Minute Free Recall Score and Verbal Paired Associates II, Anna Thompson II Retention, Hopkins Verbal Learning Test Delay, and Brief Visual Memory Test Delay

	FOME 60 Minute Free Recall	Verbal Paired Associates II	Anna Thompson Retention	Hopkins Verbal Learning Test Delay	Brief Visual Memory Test Delay
FOME 60 Minute Free Recall	1	.279(p=.115)	.462(p=.005)	.120(p=.658)	.057(p=.817)
N	39	33	36	16	19

Table A5: Person's correlations (R) between FOME 60 Minute Retention Score and Verbal Paired Associates II Recognition, Anna Thompson II Recognition, Hopkins Verbal Learning Test Discrimination Index, and Brief Visual Memory Test Discrimination Index

	FOME 60 Minute Retention	Verbal Paired II Associates Recognition	Anna Thompson Recognition	Hopkins Verbal Learning Test Discrimination Index	Brief Visual Memory Test Discrimination Index
FOME 60 Minute Retention	1	.228(p=.201)	.386(p=.020)	.418(p=.107)	-.108(p=.679)
N	39	33	36	16	17

Table A6. Pearson's Correlation analysis between FOME 5-minute delay free recall total, Anna Thompson retention, Verbal Paired Associates II free recall, Hopkins Verbal Learning Test delayed recall, and Brief Visual Memory Test delayed recall.

	FOME 5 Minute Recall	Anna Thompson Retention	Verbal Paired Association II	Hopkins Verbal Learning Test Delay	Brief Visual Memory Test Delay
FOME 5 Minute Recall	1	.503(p=.002)	.185(p=.303)	.316(p=.234)	.220(p=.365)
N	40	36	33	16	19

Appendix B – Senior Center Data

Table B1. Senior Center Data Descriptive Analysis

	Age	Education	FOME Total Recall	5 Minute Recall	5 Minute Retention	60 Minute Recall	60 Minute Retention
Mean	79.26	11.57	38.62	8.39	9.96	8.35	9.95
S.D.	1.35	1.99	5.40	1.20	0.21	1.23	0.21
Minimum	69	8	27	6	9	6	9
Maximum	90	16	49	10	10	10	10
N	23						

Table B2: Senior Centers: Total Recall Age Group Means

	Mean	Standard Deviation
70-79	40.1	5.84
80-89	36.2	3.73