2014

Memory Self-Efficacy and Beliefs about Memory Controllability in Late Life

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MEMORY SELF-EFFICACY AND BELIEFS ABOUT MEMORY CONTROLLABILITY IN LATE LIFE

A Thesis

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

by
Bethany A. Lyon
B. A., Augustana College, 2012
August 2014

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ABSTRACT

The Selective Optimization with Compensation (SOC) model for lifespan development (Baltes & Baltes, 1990) holds that as we age, our goals change from growth to maintenance. When people face difficulties, they work to minimize losses in order to maintain skills they already have physically, mentally, and socially. Thus, we compensate when possible in order to maintain the life we have established. In the case of memory people assume that there is little they can do when memory starts to fail and forgetfulness becomes more prominent. In the present research, we examine memory self-appraisals to provide new evidence on memory self-efficacy in later life. Additionally, we address memory aging knowledge and memory controllability as individual difference variables that contribute to subjective beliefs about one's own memory. An intervention to improve beliefs held about memory was also carried out to examine differences in memory self-efficacy in the post-intervention stages through the use of the Memory Functioning Questionnaire, Memory Control Inventory, and the Knowledge of Memory and Aging Questionnaire. We found that memory self-efficacy levels in the oldest-old were the same as their younger counterparts, implying that subjective memory appraisals remain relatively stable in later life. Contrary to our expectations, high levels of memory knowledge and controllability were not significant predictors for memory self-efficacy. An intervention carried out with the oldest-old yielded no differences in meta-memory appraisals, and findings show their memory self-efficacy beliefs and control beliefs were already at high levels.

INTRODUCTION

Successful aging has become a popular topic in the social gerontological literature. According to the Gerontological Society of America, successful aging is more about “adding life to years, not just years to life” (Baltes & Baltes, 1990). This quotation stresses the importance of quality of life over quantity of years. The sheer number of years lived does not make one successful. Several attempts have been made to operationally define successful aging. Rowe and Kahn (1997, 1998) classified successful aging as having few chronic health conditions, maintaining functional physical ability, and having an active engagement with life, both interpersonally and in a productive capacity. The vast majority of older adults would not qualify as successfully aging under these criteria; for example of those aged 65 and older, 77% have multiple chronic health conditions (Machlin, Cohen & Beauregard, 2008). However, even without meeting Rowe and Kahn’s criterion, older adults still rate themselves as aging successfully (Strawbridge, Willhagen & Cohen, 2002). The discrepancy between objective versus subjective perceptions of successful aging suggests that older people may apply their own subjective criteria to evaluate whether or not they are aging successfully. Understanding how older adults evaluate their functional abilities has implications for quality of life and is therefore an important topic for cognitive aging research.

The study of successful aging becomes increasingly important when demographic trends are considered. In particular, the number of older adults in our society has increased dramatically over the past century. Elderly adults comprise the most rapidly growing group in our population. Due to improved efforts to maintain health as well as advances in medicine, the death rates of those aged 65 and over have greatly reduced (Rowe & Kahn, 1998). In addition to the maintenance of health and physical function, a pressing issue among older adults today concerns the retention of cognitive functionality in later life. Complaints of memory problems are common in later life. Older adults may worry that everyday forgetfulness may be signaling the onset of dementia, although not everyone will develop a dementing disorder in late adulthood (of those aged 71 and older, 13.9% have dementia; Plassman, Langa, Fisher, Heeringa, Weir, Ofstedal et al., 2007). Numerous studies in the cognitive aging literature have shown that aging comes with deficits in episodic memory, defined as memory for personally experienced events bound in unique spatial and temporal contexts (see Bäckman, Small, Wahlin & Larsson, 2000). Because episodic memory is sensitive to context, episodic memory performance varies with factors both external (test type, test pacing, instructions, etc.) and internal (motivations, verbal ability, interests, etc.). The more factors aiding the older participant, the less differences will be seen in their performance compared to a younger person (Bäckman, Mäntylä & Herlitz, 1990). For example, while free recall testing shows age differences, recognition tests show much smaller, or sometimes no differences with age (Bäckman et al., 1990). Performance on memory tasks can be improved for older adults by keeping the encoding and retrieval conditions similar. Older adults that perform at higher levels typically have a higher level of verbal skills, or task relevant pre-existing knowledge (Bäckman et al., 1990; Craik, 2000; Craik, 1986; Craik, Byrd & Swanson, 1987).

However, for the oldest-old, typically defined as over the age of 90, no form of memory is resistant to aging effects. However, the degree of deficit varies greatly (Bäckman et al., 2000). The largest age-related memory deficits appear in episodic and working memory tasks (see Elliott, Cherry, Silva Brown, Smitherman, Jazwinski, Yu, & Volaufova, 2011; Bäckman et al., 2000). Memory intervention magnitude is smallest for the oldest-old adults (Bäckman et al., 2000). While there are plenty of studies that look into memory interventions (for review see Reijnders, van Huegten & van Boxtel, 2013), the literature is sparse in attempts to explore memory interventions targeting nonagenarians. Further research involving very old adults is needed to clarify what is known about cognitive abilities in the oldest-old.

The structure of this paper is as follows. The first section will address successful aging and cognition, including two relevant theories of cognitive adaptation in later life (Baltes & Baltes, 1990; Baltes, Staudinger & Lindenberger, 1999; Heckhausen & Schultz, 1995). The second section addresses memory self-efficacy and aging. The third section covers individual differences. The fourth section will address interventions to improve self-efficacy and control beliefs. The fifth section provides an overview of the focus of the present research. Results and their significance follow.

Successful Aging and Cognition

Successful Aging. Rowe and Kahn (1997, 1998) established a three-pronged definition of successful aging that encompasses several aspects; one must be free of disease and disability, perform at high levels of cognitive and physical function, and have a social engagement with life. Rowe and Kahn state that in order to succeed, one must work for it. The authors note risk factors that increase with age (body mass index, cholesterol levels, blood pressure, etc.) as well as lifestyle choices (physical activity, dietary factors, etc.) that could lead to disease or disability in the later years. The importance of maximizing cognitive and physical health is also stressed, with education as the strongest predictor of maintaining high cognitive functioning. Longevity is linked to belonging to a social network as well as participating in productive activities. These provide an older person with emotional support and ward off isolation and feelings of loneliness. Having high levels of self-efficacy and control were found to be predictive of participation in productive activities in later life. The authors note a slowing of processing speed and reduced capabilities in explicit memory (intention to remember, recalling a particular name, number place or demand) as cognitive declines that accompany aging (Rowe & Kahn, 1998). The slowing might be due to a decrease in the number of neurons in the brain (Aldwin & Fox Gilmer, 2013; DiGiovanna, 1994, 2000). Reductions are especially pronounced in areas responsible for voluntary movement, vision and hearing. The basal ganglion loses volume as well as areas that produce acetylcholine used for short-term memory functioning and norepinephrine to regulate sleeping (Digiovanna, 1994, 2000). The aging brain contains neurofibrillary tangles that may reduce the amount of neurotransmitters released at the synapses, as well as amyloid plaques (Digiovanna, 1994, 2000). Changes in the blood-brain barrier also occur with aging, and this lessens the protective function the barrier once held, and puts neurons at a higher risk for exposure to toxins (Aldwin & Fox Gilmer, 2013). These biological changes in the aging brain are reflected in the age-determined changes experienced in later life. These changes do not indicate disease (at normal levels), merely the aging process.

Rowe and Kahn's model of successful aging reflects a medical perspective, stressing the absence of disease (Aldwin & Fox Gilmer, 2013; Siegler, Bosworth & Poon, 2003). Many scholars have redefined successful aging so that people are able to qualify as successful even if they have a chronic disease. Operationalizing successful aging must account for many factors. Jeste and his associates establish their definition of successful aging to also include positive psychology traits like resilience (Jeste, Salva, Thompson, Vahia, Glorioso, Martin, et al., 2013). The results indicate that older adults hold higher self-ratings of successful aging even though the older participants showed poorer physical health and cognitive functioning. Margrett, Mast, Isales, Poon and Cohen-Mansfield (2011) look at successful aging as a matter of *cognitive vitality*, defined as having a level of cognitive capability that allows one to function in an everyday environment. To have vitality one must have a combination of mediating factors (social support, personality, mental and physical health, and nutrition) working in a balance. With this definition of cognitive vitality, it is possible for someone suffering from dementia to be considered successful, as vitality is not measured solely on cognitive health. The Shifting Baseline Theory (Cohen-Mansfield, 2011) states there are multiple levels of well-being, and individuals have a baseline of well-being they maintain. Even as their baseline of functioning is reduced they are able to return to their well-being status. A different aging theory (Martin, Despande-Kamat, Poon & Johnson, 2011) looks at events that have occurred throughout life as predictive of ones' well-being. An adaptation model incorporates influences in life that occurred both distally and proximally in time to the present as mediated through resources to effect well-being (a developmental outcome; Martin et al., 2011). Still others argue that they (Rowe and Kahn) have left out some key elements such as spirituality (see Cherry, Marks, Benedetto, Sullivan & Barker, 2013b) and subjective ratings of success (see Pruchno, Wilson-Genderson & Cartwright, 2010a; Pruchno, Wilson-Genderson, Rose & Cartwright, 2010b; Strawbridge et al., 2002). One's perceived success in aging is inferred based on subjective ratings of well-being (Strawbridge et al., 2002), the ability to adapt to changes in the environment, and managing their lives in such a way to reduce negatives while highlighting positives (Freund & Baltes, 1998).

When put to a test, subjective views of well-being play a role in successful aging. Strawbridge and colleagues (2002) addressed Rowe and Kahn's definition of successful aging in relation to participants' own perception of whether they were aging successfully or not. They asked participants to state how much they agreed with a statement saying they were aging successfully on a Likert rating scale, and only ranked those marking strongly agree as aging successfully. They followed the successful aging definition established by Rowe and Kahn in absence of disease, maintenance of functioning (physical and mental), and actively engaging with life as a social aspect. They then compared which participants qualified as successful by their subjective rating and those that qualified under Rowe and Kahn's standards on measures of well-being. These measures include ratings of happiness, energy levels compared to others, enjoyment from spare time, lack of depression, mental/emotional health, feeling loved, feeling satisfied with relationships, optimism/pessimism, perceived control, affect balance, and having a low amount of cynical distrust. Of their 867 participants, only 18.8% passed the Rowe and Kahn criterion as aging successfully while 50.3% of participants rated themselves as aging successfully. Of those 163 participants who Rowe and Kahn would count as successful, 36.8% did not agree- and subjectively rated themselves as not successful. Of the participants that did not meet Rowe and Kahn's criterion, 47.3% still rated themselves as successful. These large discrepancies suggest Rowe and Kahn's definition of successful aging is not the same definition held by most people when they evaluate their own aging. It is also important to know what factors, if any, can change one's perception of their success.

In response, Kahn (2002) agreed that the concept of successful aging should be operationalized. He said Strawbridge and colleagues made a fair effort to put measures to the definition established by himself and Dr. Rowe. Strawbridge and colleagues (2002) remarked that aging successfully according to the Rowe and Kahn standards would show little or no age-relate declines, while Kahn clearly points to their notion that aging successfully does not mean no aging at all. Kahn states that his model of successful aging is compatible and complementary to Baltes and Baltes' (1990) SOC model, as both state older people use what they have and work to make the best and most success of it. The SOC model will be discussed more fully later on.

According to Freund and Baltes (1998), people who are aging successfully maximize desired outcomes and minimize undesirable outcomes in their life. A person who is aging successfully would subjectively report that he or she is aging well (an evaluative measure), holding positive emotions (an affective measure), and seldom feeling lonely (a social measure). These three aspects are incorporated into the measures and scales used to define successful aging for Freund and Baltes. In order to maximize desired outcomes in their lives, people select things they are well suited for. And when people encounter losses they compensate for the loss, and make up for in in other ways. This follows the lifespan development theory known as the Selective Optimization with Compensation (SOC) model (Baltes & Baltes, 1990), which is the focus of the following section.

The SOC Model. The SOC model is based on adaptation to biological and lifestyle changes over time (Baltes & Baltes, 1990). This conceptual formation is based on several propositions. Baltes and Baltes propose that there are drastic differences between people who age normally, optimally, and pathologically. Normal aging occurs without pathology, both biologically and mentally, while pathological aging is typically classified with the development of dementia or Alzheimer's disease. Optimal aging therefore is someone in age-enhancing conditions, having aged gracefully. Optimal aging is synonymous with successful, with a less competitive connotation. Aldwin and Fox Glimer (2013) stress that optimal aging or aging well can be reached through any number of paths, and it is a process that each faces his or her own vulnerabilities and struggles. Aging introduces increased variability, or individual differences in the population. There is still a great deal of plasticity in function and the learning capacity of older adults is still present. Aldwin and Fox Glimer (2013) also state that knowledge and pragmatics can offset age related declines in cognitive mechanics. According to Baltes and Baltes, pragmatics refer to accumulated knowledge, similar to crystallized intelligence, while mechanics refer to basic information processing skills, similar to fluid intelligence. The assumption is that when fluid intelligence starts to fade in older age, knowledge and pragmatics set in to compensate. In support of this view, Baltes and Baltes refer to the classic Salthouse (1984) study where typists, both young and old, are measured on typing speed (a measure of mechanics) and the younger typists are faster. The older typists still display higher levels of performance, however, and this is due to their ability to read further ahead in the text (a show of knowledge and pragmatics making up for lost pace). With this background information in mind, the Baltes and Baltes SOC model states that people use the processes of selection, optimization, and compensation to manage the balance between gains and losses (though the balance is tipped more toward the losses in old age).

When a person is faced with losses, be that reduction in their mental capacities, deterioration of a particular function, or an altered environment, they must work to shape their new life capabilities and conditions into a condensed version of an altered yet effective life. The way to transform one's life when faced with losses is through the processes of selection, optimization, and compensation. One can select to partake in fewer but more meaningful activities when their stamina is shortened. Optimization refers to practicing skills already acquired for maintaining goals. Compensation allows one to make up for losses by finding other ways to complete goals (Baltes & Baltes, 1990). When we age it becomes exceedingly important to maintain what we have gained in the course of life and reduce losses. In this way, we shift resources more toward maintenance methods in the later years (Baltes et al., 1999).

The Lifespan Theory of Control. Heckhausen and Schultz (1995) have proposed a similar lifespan development theory that focuses on control. According to Heckhausen and Schultz (1995), people are motivated to gain control over their environment. They can do this via primary control (directly altering their environment) or secondary control (change one's self to be better fitted to the environment). Secondary control, which is very similar to the SOC processes, acts to minimize losses of one's primary control over the environment, and works to maintain and expand that control. A commonly used example of secondary control is taking medications to alter oneself, making themselves better adapted to their environment. Interestingly enough, losses of control are more easily spotted in other people rather than in oneself (Heckhausen & Schultz, 1995), implying that people have limited insight into their own aging. This ability to spot where others are falling short more accurately than in one's own attempts seems to showcase the subjective appraisal of our memory and the appraisals of perceived control on memory.

Memory Self-Efficacy and Aging

Memory self-efficacy, or the beliefs one holds about the capabilities of their memory, can incorporate a number of different cognitive behaviors. According to Rowe and Kahn (1998) those with a higher self-efficacy are better able to maintain sharp mental abilities than those with low self-efficacy. Meta-memory encompasses self-reports of memory beliefs, or control, as well as knowledge about how memory functions (Hertzog, Dixon & Hultsch, 1990). For example, Herzog et al. (1990) examined young and older adults' meta-memorial judgments and found no age differences in accuracy of memory predictions or in people's beliefs about their memory as it related to performance predictions, with both groups under estimating their abilities. A closer look is needed for both knowledge about memory and memory control beliefs, and their possible impacts on memory performance. Cavanaugh (1996) stated that no single measure of memory self-efficacy is adequate in isolation; therefore the use of several measurement instruments is ideal. Memory self-efficacy has been measured through the use of several instruments, which are described in turn next.

The MFQ. The Memory Functioning Questionnaire (MFQ; Gilewski, Zelinski, & Schaie, 1990) was developed as an enhancement of the Metamemory Questionnaire (Zelinski, Gilewski & Thompson, 1980). After a factor analysis on the Metamemory Questionnaire, 64 items loaded onto 4 factors, and the tool was renamed the MFQ. Of the 4 MFQ subscales, 33 items of the MFQ loaded onto their Frequency of Forgetting scale, which was later reduced to a 10-item Frequency of Forgetting scale that measures memory self-efficacy (Zelinski & Gilewski, 2004). The MFQ also contains a Seriousness of Forgetting Scale, which gauges how much gravity is associated with moments of forgetfulness (rating misplacing car keys as a very severe memory error or not). This instrument is comparable to the memory self-efficacy subscale that is part of the Memory in Adulthood Scale (MIA; Hertzog, Hultsch & Dixon, 1989). The MIA (Hertzog, Dixon, Schulenberg & Hultsch, 1987) incorporates knowledge of memory as well as beliefs about memory, with seven dimensions to the instrument. The MIA includes capacity (or one's view of their own ability), change (one's view of the stability of their memory), and locus (feelings of control over one's memory). The psychometric analysis of the MFQ found high internal consistency for all subscales (Cronbach's alpha levels > 0.83; Gilewski, Zelinski & Schaie, 1990).

For the purposes of the present research, both the Frequency of Forgetting (FoF) and the Seriousness of Forgetting (SoF) subscales of the MFQ were selected for inclusion as these reduced scales were deemed preferable to administer to nonagenarians. Both hold value when looking at memory self-assessments, as people would consider how often their memory in everyday life fails them as well of the gravity of the memory failure. Reese and Cherry (2006) utilized the full Seriousness of Forgetting scale in the MFQ, and found younger adults perceived small slip-ups in memory to be more serious than older adults did. However, Cherry, Brigman, Reese-Melancon, Burton-Chase, and Holland (2013a) found no differences between young and old participants on the FoF and SoF subscales, so further research is necessary.

Episodic Memory

Episodic memory was first coined by Endel Tulving (1972) as a distinct form of memory, separate from semantic memory. Episodic memory is classified as remembering an event that has occurred in a certain time and place. Tulving's episodic memory fits the Brewer and Pani (1983) definition of personal memory. A variety of laboratory tests measure aspects of episodic memory (recognizing previously studied material when new material is also present, free recall tests, etc.)(Roediger, Zaromb & Goode, 2008; Tulving, 1972). Experiments and interventions typically focus on episodic memory phenomena by increasing what participants know of how episodic memory functions, and using various training methods to improve cognitive performance. The age sensitivity of episodic memory ability is well documented. Numerous studies document age-related declines in healthy older adults (Craik, 1986; Craik, 2000; Kausler, 1994). In contrast, semantic memory remains strong in later life, though it is at a slower processing rate with increased age (Cherry & Smith, 1998).

With respect to the accuracy of subjective memory appraisals, it is widely recognized that older persons who are depressed tend to underestimate their memory capabilities, whereas an older person with cognitive impairment secondary to adult dementia, may overstate their memory performance (Gilewski & Zelinski, 1986). Other evidence indicates that objective memory performance is linked with subjective memory appraisals, yet still not in a predictable way how one might imagine. For example, Cook and Marsiske (2006) found that accuracy of subjective memory self-appraisals was greater from people with mild cognitive impairments compared with participant's ratings without mild cognitive impairments. Taken together, these studies indicate that individual differences in affective and cognitive status should be taken into account as both have been shown to influence older adults' perceptions of memory and objective memory performance. Other individual difference variables that influence adult cognition in general and episodic memory function in particular are discussed more fully next.

Individual Differences

Individual differences play a large role in cognitive aging research, as each person has been through countless experiences, each of which may play some role in their current well-being (Martin et al., 2011). Variation increases with age, and memory performance as we age varies significantly on a person to person basis (Cherry & Smith, 1998). These individual differences are typically explained by biological factors (Poon, 1985) as well as variations in personality and metamemory factors such as control beliefs or knowledge of memory processes (Lachman, Steinberg, & Trotter, 1987). Differences such as level of educational attainment and knowledge or expertise in a particular area can greatly influence performance and beliefs held. With more memory knowledge, it logically follows the individual would have more accurate views and predictions of their own memory abilities and performance.

The KMAQ. The Knowledge of Memory and Aging Questionnaire (Cherry, West, Reese, Santa Maria & Yassuda, 2000) was developed to gauge participants' knowledge of both normal memory aging and pathological memory aging. This distinction is particularly relevant for the early diagnoses in deteriorating cognitive functioning. The questionnaire is a 28-item true/false measure, with half of the items geared either towards normal memory aging or pathological memory aging. The psychometric qualities of the KMAQ are established and include convergent and discriminant validity (Cherry et al., 2000), content validity (Jackson, Cherry, Smitherman & Hawley, 2008), and adequate internal consistency reliability (Cherry, Allen, Jackson, Hawley & Brigman, 2010). An option to mark an item as "don't know" was added to reducing guessing and make the measure more sensitive (Cherry, Brigman, Hawley & Reese, 2003).

The KMAQ has two subscales, one measures normal memory aging knowledge and the other measures pathological memory aging knowledge. There is conceptual overlap between the scales, confirmed by a small but significant correlation (r = 0.29; Cherry et al., 2013a). For the purposes of the current investigation, only the scores for the normal memory aging subscale will be used. Our rationale for this design decision is based on the fact that if participants are making self-assessments of their own memory abilities, only the knowledge of normal memory aging should impact their responses. Further, participants in the present research were screened for cognitive status using the Mini- Mental State Exam, a standardized cognitive assessment (MMSE; Folstein, Folstein & McHugh, 1975). Thus, participants' own memory capabilities were deemed to be within a range considered normal and healthy. Consequently, pathological memory aging was not considered an important consideration in the proposed study.

Prior research using the KMAQ has included different groups of students and laypersons from the community, such as undergraduate students, mental health professionals, caregivers and senior service providers, community-dwelling people, police officers, social workers (both professionals and students), older adults, and very old adults (Mol, de Groot, Willems & Jolles, 2006; Jackson et al., 2008; Cherry et al., 2010; Cherry, Allen, Boudreaux, Robichaux & Hawley, 2009; Cherry et al., 2003; Reese, Cherry & Copeland, 2000; Hawley, Garrity & Cherry, 2005; Hawley, Cherry, Su, Chui & Jazwinski, 2006). Typical performance indicates persons have a higher level of knowledge regarding pathological memory aging than normal memory aging.

Previous work has shown that the KMAQ is sensitive to instructional manipulations and increases in participants' knowledge of cognitive aging and memory performance are found post-manipulation (Cherry et al., 2003; Jackson et al., 2008; Brigman & Cherry, 2010). One might suspect that level of knowledge one has about normal memory aging as opposed to pathological memory aging would help increase accuracy of views for a memory self-appraisal task.

Cherry and colleagues (2013a) tested the hypothesis that the higher the level of knowledge about memory, the higher the memory self-efficacy should be. They compared young adults (mean age = 20.3 years) to older adults (mean age = 71.4 years). They found that participants responded more accurately to the pathological memory aging questions on the KMAQ, and older participants performed better on both KMAQ scales than their younger counterparts. The MFQ was used to gauge memory self-efficacy. The authors controlled for age, education level, and verbal ability in their analyses of partial correlations between KMAQ and MFQ scales. Their findings did not show significant correlations between the KMAQ scales and the subscales of the MFQ. This study also looked at ageist stereotypes through a subset of questions on the KMAQ and found those with higher levels of knowledge about memory aging were better adept at dismissing ageist views of adult cognition. The authors note it is possible that those holding a higher memory self-efficacy view may notice their memory successes and drive memory knowledge by making less biased assumptions about memory performance. From this point of view, greater knowledge is linked to more positive views of memory self-appraisal, by reducing biased ageist responses. Alternatively, people who perceive that memory functioning can be modified through the use of memory strategies despite age-related declines in later life may have more positive self- appraisals of their own memory. The notion of memory controllability and how it is measured is discussed more fully next.

The MCI. The Memory Controllability Inventory was designed as an individual differences measure, to capture differences in how much a person gauges their memory performance to be in their control. The MCI measures memory control and self-perceived memory ability with 12 items that tap beliefs regarding the present ability of one's memory, their view of potential memory improvement, effort utility (putting in effort to control memory), and inevitable decrement in memory (Lachman, Bandura, Weaver & Elliott, 1995). The subscales comprising the MCI were found to be acceptably reliable (coefficient alpha values equal to .58 or greater) and comparisons with the Personality in Intellectual Contexts control scales and Rosenbaum's Self Control Scale displayed good convergent validity (Lachman, et al., 1995). Controllability beliefs in general decrease with an increase in age (Lachman, 2006). High control beliefs are associated with successful aging attributes like wisdom and good health (Lachman, 2006, pg. 283; Lachman & Firth, 2004). A person with a stronger sense of control would be better at coping with impossible situations by utilizing secondary control to change their own ways rather than trying to change the environment they are in (primary control). Lachman (2006) inferred that persons with low sense of memory control will likely have more memory problems because they are not trying to use compensatory methods to maintain current levels of performance. Further Lachman, Neupert, and Agrigoroaei (2011) have shown that people want to have more gains than losses in matters of perceived control. Typically, young and old people alike hold the view that memory aging is past the point of controlling for deterioration (Lachman, 2000). Windsor and Anstey (2008) found evidence showing that control beliefs are linked to performance. As the level of perceived control increased, performance on memory tests also improved. People that believed their memory losses were inevitable also showed poorer memory performance (Lachman et al., 1987). Lachman (2000) notes that when constructing a memory training program that one must hone in on the participants' beliefs about memory self-efficacy. Generally speaking, memory self-efficacy perceptions relate to remembering people, events, and activities, which are expressions of episodic memory, as discussed next

Interventions to Improve Memory Self-Efficacy

There is a small but growing literature on cognitive interventions to improve memory knowledge and memory self-appraisals. Ideally, these programs would provide tools people can use to optimize their memory performance while simultaneously increase their knowledge base which may allow for compensation of memory loss. Fairchild and Scogin (2010) designed a memory training program that was tailored for older adults. The majority of the time spent in the intervention was educating the participants in the workings of memory and how it changes over time. Their participants showed major changes in their beliefs about memory as well as some improvements to their objective memory performance in a names and faces task. The authors were well aware of conflicting evidence found by other research groups citing improvements to objective memory performance does not lead to improvements regarding subjective memory beliefs. The present research will utilize intervention methods to attempt to elicit changes in participants' beliefs about memory.

Turner and Pinkston (1993) set up a memory and aging workshop. They found positive changes in attitudes and beliefs about aging and memory, with most of the realizations stemming from a renewed sense of control over our memory, and that it is not just deteriorating with increased age. They tested the idea that negative beliefs about memory lead to poorer memory performance in participants (mean age = 72.6 years) and found that increasing participants' knowledge of memory through their two-day intervention, the participants' showed positive changes in their perceptions of memory self-efficacy. A follow-up study was carried out using a young comparison group (mean age = 23.8 years), and their analyses revealed the young did not show significant differences after participating in the two-day intervention program, showing no change in perceived memory control (Turner & Pinkston, 1993). This lends itself to the SOC theory in that when one does not try to compensate for cognitive decline he or she more or less accepts that as a loss. However, if individuals are shown how to compensate for the loss, they may have a fresh perspective on the control they may possess over memory.

Rasmusson, Rebok, Bylsma and Brandt (1999) tested several methods of memory intervention programs including a seminar, listening to audiotapes, and completing a memory program on a computer. Of these methods, the seminar and the computer program were found to improve objective memory scores. The people that improved on the tasks were additionally found to be in better health, suggesting that physical health is strongly related to cognitive health. In fact, those with poorer health ratings were found to have worse performance on cognitive measures (Zelinski, Crimmins, Reynolds & Seeman, 1998). Another intervention program (Schmidt, Zwart, Berg & Deelman, 1999) selected an intervention method that aimed to reduce negative beliefs and worries about memory functioning (Age M= 62, SD= 8.87). The intervention decreased worries about memory failures (which holds relevance to the Seriousness of Forgetting subscale of the MFQ), and also increased participants' knowledge of memory functioning. While the subjective appraisals improved, no differences were found on the studies' objective measures of memory performance.

Brigman and Cherry (2010) examined young-old adults' knowledge of memory aging assessed with the KMAQ and their subjective appraisals of fictitious characters' memory with the use of vignettes featuring forgetful young and old people. The MFQ was completed to measure their subjective view of their memory ability. With an informative intervention seminar that discussed normal memory aging- participants showed significant improvements on their KMAQ scores. The perceptions that participants had of the forgetful older characters in the vignettes did not change, indicating that while memory knowledge is sensitive to instruction, the opinions and attributions assigned to forgetful characters may be less malleable.

Focus of the Present Research

In the present research we address three goals with respect to the study of memory self-appraisal in late life. The first goal focuses on subjective memory perceptions in the oldest-old, defined as persons aged 90 years and older. Based on prior research (Hertzog et al., 1990; Lane & Zelinski, 2003), we expected that self-rated memory of the oldest-old participants would be lower than that of their younger counterparts. To test the hypothesis that self-reported memory ratings are lower among nonagenarians than their younger counterparts, we compared the oldest-old participants' MFQ scores to young-old (60-74 years of age) and old-old (75-89 years of age) comparison groups. The inclusion of two younger comparison groups provided us with a wider scope to examine differences between age groups in memory self-efficacy well into late adulthood. Finding a significant age difference favoring the young-old adults would replicate prior research, and extend the literature to document age sensitivity in memory self-appraisal in nonagenarians who were not included in much of the previous research.

The second goal of the present research was to examine the influence of individual difference variables (especially memory knowledge and memory control beliefs) on subjective memory appraisal. We suspect that knowledge of memory aging influences self-reported memory ability, although prior studies have yielded conflicting outcomes (see Cherry et al., 2013a, for discussion). We also suspect that people's beliefs about the controllability of memory influence their self-reported memory abilities. We examined age-related differences in memory knowledge and memory control beliefs by comparing responses on the KMAQ and MCI, respectively, across three age groups (60-74 year olds, 75-89 year olds, and 90+ year olds). Based on prior research (Hawley et al., 2006), we expected that the nonagenarians would be less knowledgeable about memory aging than their younger counterparts. We also anticipated that MCI scores would be lower for the nonagenarians than those in the young-old and old-old age groups. Of greater interest are the hypothesized associations between memory aging knowledge and memory control beliefs, and subjective memory appraisal. We hypothesized that higher levels of knowledge about memory and a greater sense of control over memory aging will be associated with more positive appraisals of one's own memory, perhaps independently of age.

Our third goal addressed the malleability of self-reported memory and control beliefs through the use of a memory intervention based on the SOC model (Baltes & Baltes, 1990). A subset of individuals who participated in the subjective memory assessment was recruited for the follow-up memory intervention. This intervention was designed to test the hypothesis that memory self-efficacy and memory controllability ratings could be improved by providing objective information about memory aging. Prior research has shown that interventions targeting control beliefs, as well as those focused on increasing memory aging knowledge improve subjective memory self-appraisals (Fairchild & Scogin, 2010; Turner & Pinkston, 1993). Lachman, Andreoletti, and Pearman (2006) used an intervention to improve subjective control beliefs about memory with participants ranging from age 21 to 83 years old. Their findings yielded improvements in the subjective memory appraisals; however, the differences were much smaller than the objective memory performance improvements that they found when participants completed the episodic memory task post-intervention. Other researchers have attempted interventions, some of which manipulate the level of knowledge imparted to participants during the intervention (see Fairchild & Scogin, 2010). Based on prior findings, we expected to observe higher ratings on the MFQ and MCI after the intervention relative to baseline. If the oldest-old adults have poorer memory self-efficacy and memory control perceptions at baseline relative to the other groups as we suspect, then it seems reasonable to assume that the benefits of the intervention may be more pronounced for the oldest-old adults. This added benefit for the oldest-old adults would also reflect the findings of Cherry et al. (2008) in the pictorial superiority effect. The support of additional information given in the pictures assists the oldest-old more than their younger counterparts. Thus added information provided in an intervention format could help the oldest-old catch-up to the younger group.

METHOD

Participants

All participants in the subjective memory assessment and intervention were enrolled in the Louisiana Healthy Aging Study (LHAS) which is a multidisciplinary study looking at the causal factors of longevity. A collaboration of researchers from Louisiana State University, The LSU Health Sciences Center in New Orleans, Tulane University School of Medicine, the Pennington Biomedical Research Center, The University of Pittsburgh, and the University of Alabama at Birmingham all worked together to collect these LHAS data from a population living within a 40-mile radius of the Pennington Biomedical Research Center in Baton Rouge, LA. Participants were randomly sampled from the Voter Registration 2000 files for those between the ages of 20 and 64 years. Participants aged 65 or older, who live within the greater Baton Rouge community, were sampled from the Medicare Beneficiary Enrollment Data file of the Center for Medicare and Medicaid Services. The final LHAS central database comprises 869 participants, with 275 participants being over the age of 90. Of this larger sample, a total of 364 individuals participated in the cognitive assessment (Project 5) that examined cognitive functioning in late life (see Cherry, Hawley, Jackson, Volaufova, Su & Jazwinski, 2008; Cherry, Silva Brown, Jackson Walker, Smitherman, Boudreaux, Volaufova, et al., 2012). A subset of these participants (N=101) completed the subjective memory assessment, yielding data that addressed the first two goals of the present investigation. Average ages of the Young-Old, Old-Old, and Oldest-Old groups were 66.48, 82.70, and 91.00 years, respectively. An intervention phase was carried out to examine hypothesized changes in memory beliefs and memory control after providing objective information about memory aging and memory exercises to improve memory awareness in daily life. The intervention participants (n=80) were a subset of the participants who completed the subjective memory assessment. Half of the participants were nonagenarians and the other half were ages 65 to 89 years old.

Sociodemographic information on the participants in the subjective memory assessment included age, educational attainment, vocabulary (as a proxy for verbal intelligence), and affective status indexed by the General Depression Scale (GDS; Sheikh & Yesavage, 1986). Cognitive status and knowledge of memory aging were assessed using the MMSE (Folstein et al., 1975) and the KMAQ (Cherry et al., 2003), respectively. Subjective health assessments were taken at this time as well. Demographic information can be seen in Table 1 and Table 2.

Table 1: Cognitive, Demographic, and Health Characteristics

	Young-old (n = 21)	Old-old (n = 30)	Oldest-old (n = 50)		
		M (SD)		*F*	*p*
Age	66.48 (4.50)	82.70 (4.56)	91.00 (1.08)	409.30	<.001
Vocabulary[a]	22.62 (8.57)	25.03 (6.58)	23.76 (7.10)	0.698	0.500
Cognitive status[b]	28.81 (1.40)	28.37 (1.47)	27.30 (1.97)	6.999	0.001
FDS[c]	5.86 (1.09)	5.82 (1.12)	5.67 (1.08)	0.290	0.749
BDS	4.38 (0.88)	4.63 (0.96)	4.07 (1.15)	2.816	0.065
SJS[d]	4.50 (0.87)	3.97 (0.51)	3.68 (0.67)	11.033	<.001
GDS[e]	0.71 (0.96)	1.47 (1.93)	1.58 (1.69)	2.121	0.125

Notes. [a]Vocabulary scores are based on a short-form of the Wechsler Adult Intelligence Scale Vocabulary subtest (Jastak & Jastak, 1965). [b]Cognitive status entries reflect scores on the Mini-Mental State Exam (Folstein, Folstein, & McHugh, 1975). [c]Forward Digit Span (FDS) and Backward Digit Span (BDS) from the Wechsler Adult Intelligence Scale-Revised (WAIS-R; Wechsler, 1981). [d]Size Judgment Span (SJS; Cherry, Elliott & Reese, 2007). [e]Geriatric Depression Scale (Sheikh & Yesavage, 1986).

Table 2: Demographics and Health Characteristics

	Young-Old (n = 21)	Old-Old (n = 30)	Oldest-Old (n = 50)		
		N (%)		χ^2	*P*
Gender				0.009	0.996
Male	9 (42.9)	13 (43.3)	22 (44.0)		
Female	12 (57.1)	17 (56.7)	28 (56.0)		
Marital status				27.40	<0.001
Single	1 (4.8)	2 (6.7)	1 (2.0)		
Married	16 (76.2)	10 (33.3)	11 (22.0)		
Divorced	1 (4.8)	4 (13.3)	1 (2.0)		
Widowed	3 (14.2)	14 (46.7)	37 (74.0)		
Education				5.604	0.469
High school or less	9 (42.9)	5 (16.7)	15 (30)		
Some college / specialized training	5 (23.8)	10 (33.3)	14 (28)		
College degree	6 (28.6)	11 (36.7)	13 (26)		
Graduate degree	1 (4.8)	4 (13.3)	8 (16)		
Self-perceived health				1.142	0.565
Excellent / good	17 (81.0)	23 (76.7)	43 (86.0)		
Fair / poor	4 (19.0)	7 (23.3)	7 (14.0)		
Health troubles stand in the way				5.625	0.229
Not at all	12 (57.1)	10 (33.3)	22 (44)		
A little / some	8 (38.1)	12 (40.0)	21 (42)		
A great deal	1 (4.8)	8 (26.7)	7 (14)		
Health compared to others				8.721	.068
Better	14 (66.7)	25 (83.3)	43 (87.8)		
Same	7 (33.3)	5 (16.7)	4 (8.2)		
Worse	0 (0.0)	0 (0.0)	2 (4.1)		

Informed consent was obtained for all participants according to protocols approved by the respective Institutional Review Boards. All participants included in this study scored at least a

25 or higher (Max. = 30) on the Mini-Mental State Exam (MMSE; Folstein et al., 1975) on intake interview and were free of known neurologic impairment due to stroke or adult dementia at the time of testing. Analyses of the demographic information collected revealed an age group effect difference in cognitive status (MMSE), $F(2,98) = 6.999$, $p = 0.001$ (see Table 1), although mean cognitive status falls within the normal range for all three age groups.

Materials and Procedure

Subjective Memory Assessment. For the subjective memory assessment, participants (N=101) completed an adapted version of the Practical Memory Concerns survey (PMC; Reese & Cherry, 2004), which is not included in the present research, and an adapted version of the original 64-item MFQ (Gilewski et al., 1990) which contains the reduced Frequency of Forgetting subscale (FoF-10, see Zelinski & Gilewski, 2004) and reduced Seriousness of Forgetting subscale (SoF-Revised; see Cherry et al., 2013a), along with the original MFQ Retrospective Memory and Mnemonics Usage subscales. Internal consistency reliabilities of the FoF and SoF subscales for the MFQ were previously found to be 0.94 and 0.94, respectively (Gilewski et al., 1990). Participants also completed the Memory Controllability Inventory (MCI; Lachman et al., 1995).

Statistical Considerations and Data Analyses Plan. To address the first goal of the present investigation, which concerned age effects in memory self-appraisal, we compared participants across three different age groups (65-74 year olds, n=21; 30 75-89 year olds, n=30; and 90 years old and older n=50) on two MFQ subscales, the Frequency of Forgetting subscale (FoF-Revised) which is interpreted as a measure of memory self-efficacy, and the Seriousness of Forgetting subscale (SoF-Revised; see Cherry et al., 2013a). We ran an ANOVA with three age groups (young-old, old-old, and oldest-old). We predicted that the oldest-old would have a significantly lower FoF- Revised (indicative of more memory problems) as well as lower SoF-Revised scores (indicative of greater perceived seriousness of memory failures) than either of the younger age groups. Reese and Cherry (2006) found younger adults to have higher scores on the SoF, but this finding was not replicated in other studies (see Cherry et al., 2013a).

To address the second goal of the present research, which concerned individual differences in memory aging knowledge and memory controllability and their relationship to self-reported memory ability, we also looked at several key factors. First, we compared participants' scores on the KMAQ to access their level of memory knowledge in a one-way ANOVA, while controlling for potentially confounding factors such as educational attainment, MMSE scores, affective status, and verbal ability. We also looked for a main effect of age group on MCI scores on a one-way ANOVA, controlling for the same possible confounds. We hypothesized that those with higher scores on the KMAQ normal memory aging subscale (indicative of more knowledge of normal memory aging) and better beliefs about the controllability of their memory (higher MCI scores), would have higher (more positive) responses on both the MFQ subscales. Regression analyses were carried out on the KMAQ subscale scores and MCI (pretest scores, N=101) scores as predictors of MFQ ratings. Recall that the scores on the KMAQ show knowledge of normal memory aging as well as pathological memory aging, however we only considered the normal memory aging subscale of the KMAQ.

Memory Aging Intervention. In all, 80 participants (40 young-old, ages 60-89, which combines the young-old and old groups previously used, and 40 oldest-old, aged 90 and older), all of whom completed the subjective memory assessment, took part in the memory intervention. Participants were tested in one of three groups: a wait-list control group (n=20; no further contact until 4-week posttest), a diary control group (n=20; personal memory diary kept over a 4-week period), or an experimental group (n=40; received objective information about memory aging, two sets of memory exercises, and kept the memory diary over a 4-week period). For each of the three groups, half of the participants were between 60-89 years of age and the other half were age 90 and older, ensuring an equal distribution of ages across groups. After checking for no differences between the two control groups on the MFQ and MCI pretest and posttest scores, we collapsed across groups and compared the 40 controls to the 40 participants in the experimental group.

We included two control groups (a memory diary only group, and a no intervening activity or contact with Project 5 personnel group) to account for the possibility that the practice of keeping a memory diary might raise awareness of memory functioning in daily life or encourage memory self-reflection in a manner that might influence posttest performance, independently of the objective information that only those in the experimental group received (described later). Any differences between the control group receiving the diary and the control group receiving nothing for the intervention can be interpreted as memory diary influences on self-reported memory at posttest. However, we assume that the practice of keeping a memory diary alone will not influence posttest performance, as the critical part of the intervention is not the keeping of the diary; it is stressing memory adaptability and helping participants notice that their memory has undergone changes as they age, and that they have found ways to compensate for those changes into late adulthood. Thus, the two control groups' responses to the MFQ and MCI should be the same at posttest and pretest. Initial analyses (separate t-tests) were conducted to test for this possibility. Assuming that the two control groups do not differ at pre and posttest, and verifying this assumption statistically, we combined these two groups for the purpose of data analyses and overall evaluation of the efficacy of the intervention.

The experimental group received a memory diary, as well as feedback on their diary at a private follow-up meeting one week later. The intervention took place at the follow-up meeting, which lasted approximately 90 minutes. Participants were given feedback about their diary entries from the past week, and instructed to continue using their diary for the next 3 weeks. Objective information about the nature of memory aging and adaptation to cognitive change in late adulthood was given. Specifically, participants in this experimental intervention group were told that *successful aging is not the absence of change, but adaptation to cognitive* change, after the Baltes and Baltes (1990) SOC model (see Cherry & Smith, 1998). They received a refrigerator magnet to remind them of this intervention meeting which emphasized successful aging is adapting to cognitive changes. These participants also completed memory exercises (free recall of everyday activities) and were given the opportunity to ask questions and discuss their performance on this task and their memory diaries. The inclusion of discussion and feedback on the memory diaries, as well as presentation and discussion of objective information about memory aging was considered vitally important to the success of the intervention. That is, previous research has documented that memory training exercises alone have little effect on peoples' beliefs about memory aging (Floyd & Scogin, 1997). Rather, memory training coupled with cognitive restructuring to improve adaptive beliefs about memory aging appears to be the most effective for older persons (Lachman, Weaver, Bandura, Elliott & Lewkowicz, 1992).

The subjective memory measures were re-administered at 4-weeks post-test to detect changes in self-reported memory abilities, including self-efficacy (indexed by the FoF-Revised and SoF-Revised) and memory control (MCI). The memory diaries were also collected at this time. Separate analyses were conducted to examine the narrative contents of the diaries, as well as frequency of entries for both memory successes and memory failures (Cherry et al., 2014).

We anticipated that the intervention would influence older adults (60 to 89 years) differently than the oldest-old adults (90+ years), showing a greater increase in memory self-efficacy ratings for the oldest-old, for continuity with results found by Cherry et al. (2008). Our intervention placed emphasis on memory adaptability, and we hypothesized that the oldest-old (having started at a lower self-efficacy and controllability score) would adopt this thinking about their successful memory more readily. All groups received a debriefing of the research and its objectives as part of the experimental protocol. Separate 2 (age group) x 2 (pretest/posttest) x 2 (intervention group: control or experimental) mixed analyses of variance (ANOVAs) were carried out to test for significant main effects and interactions for both the MCI and the MFQ. Education levels, vocabulary scores, MMSE scores, and affective state were entered in as covariates.

Expected results included a significant main effect for time of test, with the results of the post-test showing more positive subjective appraisals after the intervention. A main effect of age group would show the oldest-old adults having lower overall scores of their memory self-efficacy which matches the first goal of the present research. A main effect of intervention group would provide evidence that the intervention was strong enough to elicit a response change in the experimental group. A significant three-way interaction would reveal the intervention improved memory self-appraisals unequally between the age groups, which would suggest a greater advantage post-intervention for the oldest-old as their initial self-appraisals were significantly lower than the younger aged group.

RESULTS

Goal 1: Age Group Differences in MFQ

Table 3 presents mean ratings on the two MFQ scales by age group. To address the first goal of the study, we conducted two ANOVAs for the 2 MFQ scales, Frequency of Forgetting (FoF) and Seriousness of Forgetting (SoF), controlling for potential confounding variables (education, vocabulary, cognitive status through the MMSE, and affective status through the GDS). These covariates were selected based on prior research showing that education and vocabulary (a proxy for verbal intelligence) influence scores on the MFQ (Reese & Cherry, 2006). Other evidence has shown that educational attainment and depressive symptoms are strongly correlated with self-reported memory (Small, Chen, Komo, Ercoli, Miller, Siddarth, et al., 2001; Zelinski, Burnight, & Lane, 2001). We also included MMSE as a covariate, given the significant age group differences observed (see Table 1). Univariate analyses yielded non-significant age effects for both the FoF and the SoF subscales (see Table 3). Three of the four covariates were non-significant, however, the GDS effect was marginally significant ($F(1, 94) = 4.573$, $p = 0.035$ for FoF and $F(1,94) = 4.038$, $p = 0.047$ for the SoF). This finding is consistent with previous research where depressive symptoms have been shown to negatively influence MFQ ratings (see Small et al., 2001). Consequently, we control for GDS in the hierarchical regression analyses that address Goal 2 of the present research.

To summarize, our hypothesis that MFQ scores would show age group differences was not supported. The results presented so far indicate that nonagenarians' self-reports of memory abilities do not differ appreciably from their younger counterparts. This result parallels previous findings looking at younger and older participants' scores on the FoF and SoF subscales (Cherry et al.; 2013a). One explanation for this null result concerns low power, which hinders our ability to detect any differences among the age groups (effect sizes (partial η^2) and power values are reported in Table 4).

Table 3: Memory Aging Knowledge and Self-Rated Memory (Goals 1 and 2)

	Young-old (n = 21)	Old-old (n = 30)	Oldest-old (n = 50)		
		M (SD)		*F*	*P*
MFQ[a]					
Frequency of forgetting	5.03 (0.70)	4.71 (0.70)	4.79 (0.86)	0.45	0.639
Seriousness of forgetting	5.01 (0.93)	4.58 (1.33)	4.79 (1.27)	0.78	0.461
KMAQ[b]					
Normal	0.65 (0.16)	0.64 (0.17)	0.58 (0.20)	1.64	0.200
Pathological	0.76 (0.16)	0.73 (0.15)	0.65 (0.21)	4.121	0.019
MCI[c]					
Present ability	5.60 (0.75)	4.79 (1.14)	5.13 (1.31)	2.21	0.116
Improvement	3.52 (0.58)	3.98 (0.87)	3.75 (0.92)	1.41	0.250
Effort utility	5.59 (1.02)	5.28 (0.96)	5.18 (1.06)	1.16	0.320
Inevitable decrement	3.22 (1.21)	3.78 (1.24)	3.79 (1.38)	0.90	0.409

Notes. [a]Memory Functioning Questionnaire (Gilewski et al., 1990) with revised frequency and seriousness scales (Cherry et al., 2013). [b]Knowledge of Memory Aging Questionnaire (Cherry et al, 2003). [c]Memory Controllability Inventory (Lachman et al., 1995). GDS, MMSE, Education level, and vocabulary scores were all entered as covariates.

Goal 2: Individual Differences in Memory Aging Knowledge and Memory Controllability

To address the second goal of the research, which concerned individual differences in memory aging knowledge and perceptions of memory controllability and their relationship to self-reported memory, we first examined age group differences in the KMAQ proportion correct scores and MCI ratings. Means appear in Table 3. A univariate analysis was carried out on the KMAQ normal scores with age group (young-old, old-old, oldest-old) as a between group factor,

Table 4: Effect Sizes and Power Values (Goal 1)

	Partial η^2	1-β
MFQ		
Frequency of Forgetting	0.009	0.121
Seriousness of Forgetting	0.016	0.180
Retrospective Memory	0.045	0.445
Mnemonics	0.015	0.166
MCI		
Present Ability	0.045	0.440
Potential Improvement	0.029	0.295
Effort Utility	0.024	0.248
Inevitable Decrement	0.019	0.202

Notes: Values are all after controlling for Education Level, Affective status (GDS), Cognitive Ability (MMSE), and Verbal Intelligence (vocabulary score).

and education level, vocabulary score, affective status (through the GDS) and cognitive status (through the MMSE) were entered as covariates. This analysis yielded a non-significant main effect of age, $F(2, 98) = 1.638$, $p = 0.200$ (see Table 3). This pattern of outcomes, where the oldest-old adults' mean is numerically lower than their younger counterparts, replicates earlier work with very old adults defined as 85 years of age and older (see Hawley et al., 2006).

Next we tested for age group differences in MCI subscale scores, while controlling for possible confounds (MMSE, education level, GDS, and vocabulary). Univariate analyses yielded non-significant age effects for Present Ability, $F(2, 98) = 2.206$, $p = 0.116$, Potential for Improvement, $F(2, 98) = 1.406$, $p = 0.250$, Effort Utility, $F(2, 98) = 1.155$, $p = 0.320$, and Inevitable Decrement, $F(2, 98) = 0.902$, $p = 0.409$. Two of the four covariates were significant (Vocabulary, $F(1,94) = 4.700$, $p = 0.033$; GDS, $F(1,94) = 4.384$, $p = 0.039$). Thus, there is no evidence to support the hypothesis that memory controllability ratings decline with age, after taking education, vocabulary, MMSE, and GDS into account.

Hierarchical Regression Analyses. Given the non-significant age effects observed in the KMAQ and MCI analyses just reported, we collapsed over the age group variable, treating chronological age as a continuous variable in the analyses that follow. Pearson's correlation coefficients appear in Table 5. The FoF and SoF subscales of the MFQ were found to be significantly correlated with each other, $r(99) = 0.455$, $p < 0.01$.

Table 5: Correlations Among Demographic Characteristics, Cognitive Variables, and Memory Self-Appraisals (Goal 2)

Variables	*M (SD)*	Correlations with MFQ scales: Frequency of forgetting	Seriousness of forgetting
Demographic characteristics			
Age	83.4 (10.0)	- 0.12	- 0 .02
Education	5.10 (1.35)	- 0 .03	0.17
Vocabulary[a]	23.9 (7.3)	0.06	0.11
GDS[b]	1.37 (1.67)	- 0.24 *	- 0.25 *
Cognitive variables			
Cognitive status[c]	27.9 (1.83)	0.07	0.03
KMAQ			
Normal	0.62 (0.18)	0.009	- 0.01
Pathological	0.70 (0.19)	0.010	0.08
MCI			
Present ability	5.13 (1.19)	0.54 **	0.27 **
Improvement	3.77 (0.85)	- 0.27 **	- 0.30 **
Effort utility	5.29 (1.02)	0.36 **	0.09
Inevitable decrement	3.67 (1.31)	- 0.35 **	- 0.16

Notes. * $p < 0.05$ ** $p < 0.01$ KMAQ = Knowledge of Memory Aging Questionnaire (Cherry et al., 2003). MCI = Memory Controllability Inventory (Lachman et al., 1995). [a]Vocabulary scores are based on a short-form of the Wechsler Adult Intelligence Scale Vocabulary subtest (Jastak & Jastak, 1965). [b]Geriatric Depression Scale (Sheikh & Yesavage, 1986). [c]Cognitive status entries reflect scores on the Mini-Mental State Exam (Folstein, Folstein, & McHugh, 1975).

We entered our set of demographic variables (GDS, vocabulary, and education level) and cognitive status measure (MMSE) as a block in the first step of the regressions (see Table 6), to control for the potentially confounding influence of these factors. In the second step, the normal memory aging subscale of the KMAQ was added. In the third step, the subscales of the MCI were added predictors for performance on the MFQ. Table 6 presents the results of hierarchical regression analyses on the Frequency of Forgetting scale of the MFQ.

Table 6: Hierarchical Regressions (Goal 2)

Variables	R^2	Incre R^2	β	*t*	*p*
Frequency of forgetting (MFQ)					
Step 1 (demographics)	0.069				
GDS[b] *			-0.243	-2.395	0.019
Education			-0.132	-1.080	0.283
Vocabulary[a]			0.088	0.700	0.486
MMSE[c]			0.023	0.222	0.825
Step 2 (KMAQ)	0.069	0.00			
Normal			0.002	0.019	0.985
Step 3 (MCI)	0.371	.302			
Present ability **			0.371	3.583	0.001
Improvement			-0.171	-1.685	0.093
Effort utility *			0.255	2.300	0.024
Inevitable decrement			-0.023	-0.214	0.831

* $p < 0.05$ ** $p < 0.01$ MFQ = Memory Functioning Questionnaire (Gilewski et al., 1990) with revised frequency and seriousness scales (cf. Cherry et al., 2013). KMAQ = Knowledge of Memory Aging Questionnaire (Cherry et al., 2003) MCI = Memory Controllability Inventory (Lachman et al., 1995) Notes. [a]Vocabulary scores are based on a short-form of the Wechsler Adult Intelligence Scale Vocabulary subtest (Jastak & Jastak, 1965). [b]Geriatric Depression Scale (Sheikh & Yesavage, 1986). [c]Cognitive status entries reflect scores on the Mini-Mental State Exam (Folstein, Folstein, & McHugh, 1975).

As can be seen in Table 6 (Step 1), demographic variables accounted for only 6.9% of the variance in the FoF scores, with only GDS making a significant contribution. However, the overall model was non-significant, $F(4, 96) = 1.767$, p = 0.142. In the next step we added the KMAQ normal memory aging items, after statistically controlling for the influence of the 4 demographic factors. KMAQ normal items did not make a significant contribution to the model. The overall model was also non-significant, $F(5, 95) = 1.399$, p = 0.232. Thus, the hypothesis that knowledge of memory aging would influence memory self-efficacy perceptions was not supported. In the third step, we added the four MCI scales. Inspection of Table 6 indicates that both Present Ability and Effort Utility made significant contributions to the full model, which accounted for 37.1% of the variance in FoF scores. The overall model was significant, $F(9, 91) = 5.977$, p < 0.001. However, GDS lost its significance in this model.

We conducted the same hierarchical regression analyses on the MFQ Seriousness of Forgetting scale (see Table 7). In step 1, demographic variables alone accounted for only 7.8% of the variance in the SoF scores, with only GDS making a significant contribution. However, the overall model was non-significant, $F(4, 96) = 2.019$, p = 0.098. In step 2, the KMAQ normal scores were added to the model. As in the preceding analysis, the KMAQ normal scores did not make a significant contribution. The overall model was also not significant, $F(5, 95) = 1.634$, p = 0.158, so these data indicate that knowledge of memory aging does not appear to influence seriousness of forgetting perceptions either. In the third step, we added the four MCI scales. Only the Potential for Improvement variable made a significant contribution. The full model was also significant, $F(9, 91) = 2.362$, p

Table 7: Hierarchical Regressions (Goal 2)

Variables	R^2	Incre R^2	β	*t*	*p*
Seriousness of forgetting (MFQ)					
Step 1 (demographic variables)	0.078				
GDS[b] *			- 0.230	- 2.277	0.025
Education			0.122	0.999	0.320
Vocabulary[a]			0.014	0.111	0.912
MMSE[c]			- 0.047	- 0.444	0.658
Step 2 (KMAQ)	0.079	0.001			
Normal			- 0.042	- 0.407	0.685
Step 3 (MCI)	0.189	.110			
Present ability			0.150	1.275	0.205
Improvement *			- 0.245	- 2.139	0.035
Effort utility			0.023	0.182	0.856
Inevitable decrement			- 0.040	- 0.332	0.741

Notes. * $p < 0.05$ ** $p < 0.01$ MFQ = Memory Functioning Questionnaire (Gilewski et al., 1990) with revised frequency and seriousness scales (cf. Cherry et al., 2013). KMAQ = Knowledge of Memory Aging Questionnaire (Cherry et al., 2003) MCI = Memory Controllability Inventory (Lachman et al., 1995)
[a]Vocabulary scores are based on a short-form of the Wechsler Adult Intelligence Scale Vocabulary subtest (Jastak & Jastak, 1965).
[b]Geriatric Depression Scale (Sheikh & Yesavage, 1986). [c]Cognitive status entries reflect scores on the Mini-Mental State Exam (Folstein, Folstein, & McHugh, 1975).

= 0.019, accounting for 18.9% of the variance in SoF scores. Taken together, the results of the regression analyses offer partial support of the Goal 2 hypothesis. That is, the notion that memory aging knowledge would contribute to self-reported memory assessed with the MFQ was not supported. However, the significant contributions of Present Ability and Effort Utility (see Table 6) to FoF scores, coupled with the significant contribution of Potential for Improvement to SoF scores (see Table 7), confirms that these aspects of memory controllability predict memory self-appraisals, in support of our hypothesis.

Goal 3: Memory Aging Intervention

Both the waitlist control and diary control groups for the intervention were compared using t-tests to ensure that the groups were not significantly different on any subscales (means

Table 8: Self-Rated Memory by Intervention Group MFQ (Goal 3)

	Control group 1 (Wait-list, n = 20)		Control group 2 (Diary Control, n = 20)		Experimental group (Diary + Exercises, n = 40)	
	Older	Oldest-Old	Older	Oldest-Old	Older	Oldest-Old
MFQ[a]						
FOF[b]						
Pretest	4.93 (0.87)	4.25 (0.86)	4.76 (0.74)	4.91 (1.05)	4.87 (0.63)	4.75 (0.82)
Posttest	4.87 (0.67)	4.65 (0.69)	4.71 (0.65)	4.71 (0.61)	4.75 (0.55)	4.77 (0.76)
SOF[c]						
Pretest	5.20 (1.10)	4.10 (1.29)	5.26 (0.91)	4.88 (0.88)	4.32 (1.18)	4.83 (1.38)
Posttest	4.92 (1.29)	4.24 (1.36)	4.82 (1.22)	5.14 (1.19)	4.65 (1.17)	4.48 (1.16)
RETRO[d]						
Pretest	3.44 (0.54)	3.24 (1.03)	3.72 (1.01)	3.48 (1.19)	3.04 (0.65)	3.51 (0.84)
Posttest	3.26 (0.83)	3.22 (0.75)	3.54 (0.57)	3.42 (0.72)	3.28 (0.70)	3.46 (0.74)
MNEM[e]						
Pretest	3.30 (0.81)	3.01 (0.77)	3.69 (0.88)	3.89 (1.21)	3.04 (1.05)	3.33 (1.38)
Posttest	3.16 (1.09)	3.29 (1.15)	3.68 (1.14)	3.93 (1.12)	2.93 (1.20)	3.28 (1.12)

Notes. [a]Memory Functioning Questionnaire (Gilewski et al., 1990) with revised frequency and seriousness scales (cf. Cherry et al., 2013). [b]Frequency of Forgetting, [c]Seriousness of Forgetting, [d]Retrospective Functioning, [e]Mnemonics Usage.

for each group in the intervention are reported in Tables 8 and 9). The groups were not different and control groups were collapsed for all further analyses (see Table 10). Thus, having a diary did not in itself alter participants' memory self-appraisals differently compared to those in a waitlist group.

Table 9: Self-Rated Memory by Intervention Group MCI (Goal 3)

	Control group 1 (Wait-list, n = 20)		Control group 2 (Diary Control, n = 20)		Experimental group (Diary + Exercises, n = 40)	
	Older	Oldest-Old	Older	Oldest-Old	Older	Oldest-Old
MCI[a]						
Present ability						
Pretest	5.20 (1.09)	4.70 (1.22)	5.37 (1.28)	4.93 (1.91)	5.00 (1.13)	5.22 (1.10)
Posttest	5.00 (1.11)	4.70 (1.23)	5.04 (1.59)	4.90 (1.26)	5.30 (1.00)	5.05 (1.13)
Improvement						
Pretest	3.90 (0.96)	4.10 (0.57)	4.00 (0.72)	3.57 (0.97)	3.68 (0.77)	3.77 (0.93)
Posttest	4.10 (1.08)	3.97 (0.78)	3.83 (0.65)	3.77 (0.77)	3.78 (0.72)	3.90 (0.77)
Effort utility						
Pretest	5.47 (1.00)	5.13 (1.66)	5.60 (1.10)	5.27 (1.15)	5.30 (1.03)	5.20 (0.71)
Posttest	5.00 (1.19)	5.03 (1.84)	5.53 (1.01)	5.20 (1.39)	5.50 (0.93)	5.02 (0.93)
Inevitable decrement						
Pretest	3.50 (1.52)	3.97 (1.33)	3.23 (1.44)	4.03 (1.54)	3.47 (1.16)	3.62 (1.15)
Posttest	3.67 (1.50)	3.77 (1.55)	3.13 (1.49)	3.87 (1.60)	3.03 (1.05)	3.35 (1.16)

Notes. [a]Memory Controllability Inventory (Lachman et al., 1995).

Table 10: Wait-list Control Group and Diary Control Group Comparisons

	Control Groups Older		**Control Groups Oldest-Old**	
PreTest	***t* (18)**	***p***	***t* (18)**	***p***
MFQ				
Frequency of Forgetting	0.47	0.64	-1.53	0.14
Seriousness of Forgetting	-0.13	0.90	-1.58	0.13
MCI				
Present Ability	-0.31	0.76	-0.33	0.75
Potential Improvement	-0.26	0.80	1.50	0.15
Effort Utility	-0.28	0.78	-0.21	0.84
Inevitable Decrement	0.40	0.69	-0.10	0.92
PostTest				
MFQ				
Frequency of Forgetting	0.54	0.59	-0.21	0.84
Seriousness of Forgetting	0.18	0.86	-1.58	0.13
MCI				
Present Ability	-0.06	0.95	-0.36	0.72
Potential Improvement	0.67	0.51	0.58	0.57

Effort Utility	-1.08	0.29	-0.23	0.82
Inevitable Decrement	0.78	0.45	-0.14	0.89

A 2(Age Group) x 2 (Intervention Group) x 2(Time of Testing) mixed ANOVA was conducted for the subscales of the MFQ. Analyses revealed no significant main effects for age group, intervention group, or time of testing (see Tables 11 and 12) all with *p*'s >0.05. The interactions did not yield significant differences, p's > 0.05.

Table 11: Frequency of Forgetting 2 x 2 x 2 ANOVA

Main Effects	*F* (1, 70)	*p*
Time of testing: Pretest, Posttest	2.18	0.15
Age Group: Older, Oldest-Old	0.16	0.70
Intervention Group: Control, Experimental	0.002	0.97
2 x 2 Interactions		
Time of Testing x Intervention Group	0.43	0.51
Time of Testing x Age Group	2.10	0.15
Age Group x Intervention Group	0.43	0.52
2 x 2 x 2 Interactions		
Time of Testing x Intervention Group x Age Group	0.01	0.94

Notes: controlled for MMSE, Education, Vocabulary, and GDS

Table 12: Seriousness of Forgetting 2 x 2 x 2 ANOVA

Main Effects	*F* (1, 72)	*p*
Time of testing: Pretest, Posttest	0.40	0.53
Age Group: Older, Oldest-Old	0.29	0.59
Intervention Group: Control, Experimental	1.93	0.17
2 x 2 Interactions		
Time of Testing x Intervention Group	0.28	0.60
Time of Testing x Age Group	0.50	0.48
Age Group x Intervention Group	1.64	0.20
2 x 2 x 2 Interactions		
Time of Testing x Intervention Group x Age Group	10.21	0.002*

Notes: controlled for MMSE, Education, Vocabulary, and GDS

The 3-way interaction was not significant for the FoF subscale. However, the 3-way interaction effect was significant for the SoF subscale, $F(1,73) = 10.21$, $p = 0.002$. The statistical significance of this effect is most likely attributable to a significant age group difference in the control condition at pre-test ($p = 0.035$). To be precise, the older and oldest-old adults differed at pre-test, with means of 5.23 and 4.49 in the control condition, respectively. There were no other significant pairwise differences observed between the two age groups (*p*'s > 0.217). Further, we note within age group differences in the direction of the pre- and post-test means for older adults across the control and experimental conditions. For older adults in the control group, the pre-test (*M* = 5.23) exceeded the post-test (*M* = 4.87), a marginally significant difference (*p* = 0.055), whereas in the experimental group, older adults' pre-test (*M* = 4.32) was somewhat lower than the post-test (*M* = 4.65), but not significantly so (*p* = 0.078). Because these pairwise differences in the analyses of SoF subscale scores likely reflect sampling error stemming from a small sample size, interpretative caution is warranted.

A 2(Age Group) x 2 (Intervention Group) x 2 (Time of Testing) ANOVA was carried out to examine differences in performance on the MCI subscales. Our findings revealed no significant main effects or interactions (see Tables 13-16). The hypothesis that memory self-efficacy and memory controllability beliefs would be changed through the present intervention method was not supported.

Table 13: Present Ability MCI 2 x 2 x 2 ANOVA

Main Effects	*F* (1, 71)	*p*
Time of testing: Pretest, Posttest	1.06	0.31
Age Group: Older, Oldest-Old	0.07	0.79
Intervention Group: Control, Experimental	<0.001	0.99
2 x 2 Interactions		
Time of Testing x Intervention Group	0.93	0.34
Time of Testing x Age Group	0.47	0.49
Age Group x Intervention Group	0.91	0.34
2 x 2 x 2 Interactions		
Time of Testing x Intervention Group x Age Group	2.40	0.13

Notes: controlled for MMSE, Education, Vocabulary, and GDS

Table 14: Potential Improvement MCI 2 x 2 x 2 ANOVA

Main Effects	*F* (1, 73)	*p*
Time of testing: Pretest, Posttest	1.94	0.17
Age Group: Older, Oldest-Old	1.97	0.17
Intervention Group: Control, Experimental	0.001	0.98
2 x 2 Interactions		
Time of Testing x Intervention Group	0.72	0.40
Time of Testing x Age Group	0.20	0.66
Age Group x Intervention Group	0.11	0.74

2 x 2 x 2 Interactions		
Time of Testing x Intervention Group x Age Group	0.01	0.92

Notes: controlled for MMSE, Education, Vocabulary, and GDS

Table 15: Effort Utility MCI 2 x 2 x 2 ANOVA

Main Effects	*F* (1, 72)	*p*
Time of testing: Pretest, Posttest	0.01	0.94
Age Group: Older, Oldest-Old	1.41	0.24
Intervention Group: Control, Experimental	0.26	0.61
2 x 2 Interactions		
Time of Testing x Intervention Group	0.38	0.54
Time of Testing x Age Group	0.19	0.66
Age Group x Intervention Group	0.003	0.96
2 x 2 x 2 Interactions		
Time of Testing x Intervention Group x Age Group	2.67	0.11

Notes: controlled for MMSE, Education, Vocabulary, and GDS

Table 16: Inevitable Decrement MCI 2 x 2 x 2 ANOVA

Main Effects	*F* (1, 71)	*p*
Time of testing: Pretest, Posttest	1.93	0.17
Age Group: Older, Oldest-Old	2.21	0.14
Intervention Group: Control, Experimental	0.13	0.72
2 x 2 Interactions		
Time of Testing x Intervention Group	0.12	0.73
Time of Testing x Age Group	0.49	0.49
Age Group x Intervention Group	0.59	0.45
2 x 2 x 2 Interactions		
Time of Testing x Intervention Group x Age Group	0.65	0.42

Notes: controlled for MMSE, Education, Vocabulary, and GDS

DISCUSSION

Our hypothesis that memory self-efficacy and memory controllability perceptions decline in late life was not supported. These findings extend Cherry et al. (2013a) to include the oldest-old in the subjective memory appraisal comparisons. Understanding how one thinks about their own memory capabilities will allow us to compare subjective memory assessments with standard objective memory tests, and better formulate intervention methods to maintain or improve memory self-efficacy. Studying the oldest-old adults' memory appraisals can provide insight into memory expectations and observations made by those who have lived longer than most others, an area of research where systematic study is currently lacking. Understanding how memory self-appraisals remain stable with increasing age can help to further establish what constitutes these appraisals and what can be done to strengthen those beliefs. Research on nonagenarians can provide valuable insight into how the oldest-old compensate for memory losses incurred with aging through compensatory mechanisms (Baltes & Baltes, 1990).

We used peoples' knowledge of memory aging assessed with the KMAQ to predict memory self-efficacy indexed by the MFQ. Based on previous research (Reese & Cherry, 2006; Cherry et al., 2013a), we expected that memory aging knowledge and memory controllability (KMAQ, MCI) would be related to self-efficacy of memory (MFQ). Our results only partially supported this hypothesis (Goal 2). Contrary to expectation, the KMAQ did not contribute to the variance in MFQ scores. However, two of the MCI subscales (Present ability and Effort Utility) contributed to the variance in Frequency of Forgetting, and one subscale of the MCI contributed to variance in Seriousness of Forgetting (Potential Improvement). When one has perceived control of his or her memory, he or she will recognize the importance of continued efforts towards improving their memory. Heckhausen and Schultz 's (1995) control theory is based on the notion that people attempt to control their environment, and when they cannot control their environment, attempts are made to change themselves (secondary control) to better fit their surroundings. If an individual has a failing memory, and if he or she holds high control beliefs, such an individual may be more likely to seek ways to retain control and maintain their memory abilities (instead of believing memory deficits are hopeless and beyond the ability to maintain or remedy).

The intervention addressed the malleability of MFQ self-efficacy perceptions indexed by the MFQ, with the goal of improving self-efficacy. Our attempt to show an increase in memory self-efficacy and perceived control of memory did not yield significant differences across intervention groups. The findings imply that beliefs about memory are stable, and remain strong past the age of 90. These findings suggest that nonagenarians think about their memory functioning the same way 60, 70, and 80 year olds do. Without being able to control our memory, or work at compensating for declines, the aging mind would be very bleak. Our participants appear to be flourishing in their memory self-appraisals, which gives us a glimpse of a lifelong model of continued learning and adaptability, compensating for losses as they arise.

Our intervention did not demonstrate improvements in self-appraisal, which could be due to a sample selection bias in the direction of vitality. Participants in the Louisiana Healthy Aging Study are exemplars of excellent health and pillars of longevity. Our sample of individuals rated their health as better than others their same age (see Table 2). It is highly likely that individuals who did not feel like they were aging successfully to begin with would have opted out of our study, even though they would have had the most to gain by participating. Future research should aim to find participants that have poorer memory self-appraisals and work towards creating interventions that would bolster marked improvements in self-efficacy and control beliefs.

The eventual goal of any memory training intervention program is transfer to real world situations, to help in everyday situations when memory fails us (Hawley & Cherry, 2004). McDaniel and Bugg (2012) address the issue that transfer from laboratory tasks is generally minimal, even for younger adults. In everyday situations like remembering a grocery list, even a former world memory champion still writes down what he wants from the store. This suggests using the everyday strategy for remembering utilizes external memory cues in order to carry out prospective memory tasks (tasks that must be carried out at some future time or place). McDaniel and Bugg suggest training programs and strategies should target memory contexts where older adults struggle and want to improve. This changes the general focus of the strategies from encoding (method of loci, etc.) to retrieval processes. One method that focuses on retrieval processes is the *Cognitive Interview* (Dornberg & McDaniel, 2006; McCauley & Fisher, 1995; Mello & Fisher, 1996). This technique involves instructing a participant to visualize the environment in which the information was learned, and recall the information from a variety of perspectives, forcing participants to attempt recall several times. This interviewing technique has been found to increase correct recall even after a 3-week delay (Dornberg & McDaniel, 2006) and provided older adults with more benefit than the younger adults (Mello & Fisher, 1996). Prospective memory training can involve external devices or a spaced retrieval technique. To improve transfer of training, McDaniel and Bugg suggest studies incorporate the transferring in the lab in examples of how techniques could be used, requiring homework and feedback from participants about how they used their new memory methods, and increasing participants' knowledge of how memory works so they can see the uses and structuring of the targeted training. Other research has documented that memory training exercises alone have little effect on peoples' beliefs about memory aging (Floyd & Scogin, 1997). Rather, memory training coupled with cognitive restructuring to improve adaptive beliefs about memory aging appears to be the most effective for older persons (Lachman et al., 1992). These studies suggest that either our sample did not need restructuring in their beliefs about memory, or that our experimental manipulation was not strong enough to elicit a change.

Future research ought to continue efforts to improve memory self-efficacy and memory controllability as the connections to objective memory performance have not been fully explored. Logically, if one holds the belief that they are in control of their memory, and they are equipped with knowledge of how memory works, they will seek out ways to maintain their level of current memory performance and utilize methods to improve their memory capabilities. Methods to improve objective memory performance reliably would be of high importance for those that feel their capabilities slipping with age. With more memory knowledge, it logically follows the individual would have more accurate views and predictions of their own memory abilities and performance. Future research could be conducted using the LHAS data that looks more closely at the connections between knowledge of memory aging, memory self-efficacy, and objective memory measures like Forward and Backward Digit Spans and the Size Judgment Span.

Research about the lifespan SOC model has led developmental researchers in the neuroscience realm into looking at biological changes that occur with aging, and they have found compensatory mechanisms exist at the neuronal level. Future directions as well as application for the SOC theory at this microscopic level would indicate an unconscious effort by the body to compensate for losses (Phillips & Andres, 2010). Park and McDonough (2013) found neuronal differences between their younger and older participants, with higher levels of activity in the older adults, suggestive of additional recruitment and compensation. Biological directions such as these further the depth and breadth of the SOC model as it applies to developmental science.

Further exploration of individual differences, especially those of personality measures would be a worthwhile venture. Metamemory has been found to interact with personality traits (see Cavanaugh, 1996), and personality traits might influence aspects of memory self-appraisals (Perri-Chiello, Perrig & Stähelin, 2000). Our study design was cross-sectional, which eliminates the possibility to make claims of changes as we age. Longitudinal research is critical in order to make the most accurate claims about age related changes. Infurna, Gerstorf, Ram, Schupp and Wagner (2011) conducted a longitudinal study looking at perceived control beliefs. They found that perceived control was predicted by having higher levels of self-rated health, and that age interacted with life satisfaction. This suggests that control beliefs could stem from well-being.

Expanding the age range of participants to age groups below 65 would add to the literature, and help to determine if memory self-efficacy and memory control beliefs are stable across the lifespan, or if the stability noted in the current research is reserved for older adults. Perhaps memory self-efficacy is more rigid than previously thought, or perhaps the strength of the current intervention was too weak to elicit an increase in perceptions. Future research should test stronger intervention methods.

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APPENDIX A- KNOWLEDGE OF MEMORY AND AGING QUESTIONNAIRE

Knowledge of Memory Aging Questionnaire©

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LOUISIANA STATE UNIVERSITY MEMORY AGING QUESTIONNAIRE

INSTRUCTIONS. Below you will find a series of statements about memory in adulthood. Think of "younger people" as those in their 20's and 30's, and "older people" as those over age 60. Some of the statements are true and some are false. For each item, indicate in the blank space whether you think the statement is true (T) or false (F). If you are uncertain, then feel free to write "DK" (Don't Know) in the blank space so that you have an answer for every item below.

1. ____ "A picture is worth a thousand words" in that it is easier for both younger and older people to remember pictures than to remember words.

2. ____ Older people tend to have more trouble concentrating than younger people. That is, older people are more likely to be distracted by background noises and other happenings around them.

3. ____ Regardless of how memory is tested, younger adults will remember far more material than older adults.

4. ____ Confusion and memory lapses in older people can sometimes be due to physical conditions that doctors can treat so that these symptoms go away over time.

5. ____ Becoming disoriented (such as getting lost or losing track of what day it is) happens to persons with Alzheimer's Disease, but only in the later stages of the disease.

6. ____ Older people remember to do future planned activities (such as returning a book to the library) better than they remember past actions that they have already completed.

7. ____ Medications that are prescribed by doctors for heart and circulation problems do not affect memory in older adults.

8. ____ Sometimes the effects of intense grief over the loss of a loved one may be mistaken for early Alzheimer's Disease in older adults.

9. ____ A complete physical exam by a doctor is routinely recommended, if a diagnosis of Alzheimer's Disease is suspected.

10. ____ Older people tend to remember specific past events in their daily life better than they remember the meanings of words (vocabulary) and general facts (such as the capital of the United States).

11. ____ Frequent complaining about memory problems is an early sign of Alzheimer's Disease.

12. ____ The only way to tell for sure if an individual has Alzheimer's Disease is to do an autopsy after that person has died.

13. ____ If an older adult is unable to recall a specific fact (e.g., remembering a person's name), then providing a cue to prompt or jog the memory is unlikely to help.

14. ____ When older people are trying to memorize new information, the way they study it does not affect how much they will remember later.

15. ____ If one has lived to be 85 years old and shows no signs of Alzheimer's Disease, then the chances are very high that this person will live out the rest of his or her life without developing the disease.

16. ____ For older adults, the ability to remember something is unrelated to the number of other thoughts or issues on their mind when trying to recall this information.

17. ____ Memory for how to do well-learned things, such as reading a map or riding a bike, does not change very much, if at all, in later adulthood.

18. ____ Signs and symptoms of Alzheimer's Disease show up gradually and become more noticeable to family members and close friends over time.

19. ____ When an older adult comes in for a checkup, doctors and psychologists can now clearly tell the difference between the symptoms of mental health problems and the symptoms of physical illness.

20. ____ Immediate memory (such as repeating a telephone number) is about the same for younger and older people, but an older person's memory for things that happened days, weeks, or months ago is typically worse than that of a younger person.

21. ____ If an older person has gone into another room and cannot remember what he or she had intended to do there, going back to the place where the thought first came to mind will often help one recall what he or she had intended to do.

22. ____ Alzheimer's Disease is the only illness that leads to confusion and memory problems in older adults.

23. ____ For older people, education, occupation, and verbal skills tend to have little influence on their memory.

24. ____ Modern day memory improvement methods that are based on organization (e.g., grouping similar items together) and association (e.g., linking new information to what is already known) can actually be traced back to the ancient Greek scholars, such as Aristotle and Plato.

25. ____ Healthy older adults have trouble remembering how to use familiar gadgets (like a key chain) and appliances (like a can opener).

26. ____ Dramatic changes in personality and relationships with others may be seen in persons who have Alzheimer's Disease.

27. ____ Memory training programs are not helpful for older persons, because the memory problems that occur in old age cannot be improved by educational methods.

28. ____ Lifelong alcoholism may result in severe memory problems in old age.

APPENDIX B- MEMORY FUNCTIONING QUESTIONNAIRE: MFQ

HEF ID# __________ LSU ID# _______

Memory Functioning Questionnaire-Revised

INSTRUCTIONS. This is a questionnaire about how you remember information. There are no right or wrong answers. Circle a number between 1 and 7 that best reflects your judgment about your memory. Think carefully about your responses, and try to be as realistic as possible when you make them. Please answer all questions.

General Frequency of Forgetting

How would you rate your memory in terms of the kinds of problems that you have?

major problems			some minor problems			no problems
1	2	3	4	5	6	7

How often do these present a problem for you?

	always			sometimes			never
a. names	1	2	3	4	5	6	7
b. faces	1	2	3	4	5	6	7
c. where you put things (e.g., keys)	1	2	3	4	5	6	7
d. directions to places	1	2	3	4	5	6	7
e. beginning to do something and forgetting what you were doing	1	2	3	4	5	6	7

As you are reading a novel, how often do you have trouble remembering what you have read?

	always			sometimes			never
a. the paragraph just before the one you are currently reading	1	2	3	4	5	6	7
b. the sentence before the one you are currently reading	1	2	3	4	5	6	7

How well do you remember things that occurred?

	very bad			fair			very good
a. between 1 and 5 years ago	1	2	3	4	5	6	7
b. between 6 and 10 years ago	1	2	3	4	5	6	7

HEF ID# __________ LSU ID# _______

Seriousness of Forgetting

When you actually forget in these situations, how serious of a problem do you consider the memory to be?

	very serious			somewhat serious			not serious
a. names	1	2	3	4	5	6	7
b. faces	1	2	3	4	5	6	7
c. where you put things (e.g., keys)	1	2	3	4	5	6	7
d. directions to places	1	2	3	4	5	6	7
e. beginning to do something and forgetting what you were doing	1	2	3	4	5	6	7

Retrospective Functioning

How is your memory compared to the way is was?

	much worse			same			much better
a. 1 year ago?	1	2	3	4	5	6	7
b. 5 years ago?	1	2	3	4	5	6	7
c. 10 years ago?	1	2	3	4	5	6	7
d. 20 years ago?	1	2	3	4	5	6	7
e. when you were 18?	1	2	3	4	5	6	7

Mnemonics Usage

How often do you use these techniques to remind yourself about things?

	always			sometimes			never
a. keep an appointment book	1	2	3	4	5	6	7
b. write yourself reminder notes	1	2	3	4	5	6	7
c. make lists of things to do	1	2	3	4	5	6	7
d. make grocery lists	1	2	3	4	5	6	7
e. plan your daily schedule in advance	1	2	3	4	5	6	7
f. mental repetition	1	2	3	4	5	6	7
g. associations with other things	1	2	3	4	5	6	7
h. keep things you need to do in a prominent place where you will notice them	1	2	3	4	5	6	7

APPENDIX C- MEMORY CONTROLLABILITY INVENTORY: MCI

HEF ID# ________ LSU ID# ________

The Memory Controllability Inventory (MCI)
(Courtesy of Lachman, Bandura, Weaver, & Elliott, 1995)

This is a questionnaire about your memory. Please indicate the extent to which you agree or disagree with each statement. Provide the answer that is right for you by filling in the bubble that best describes your beliefs. For example, if you strongly agree with the statement, you would fill in the bubble under strongly agree. If you strongly disagree with the statement, you would fill in the bubble under strongly disagree. If you are neutral, you would fill in the bubble under neutral.

	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
1. There's not much I can do to keep my memory from going downhill.	o	o	o	o	o	o	o
2. I can remember the things I need to.	o	o	o	o	o	o	o
3. I can't seem to figure out what to do to help me remember things.	o	o	o	o	o	o	o
4. No matter how much I use my memory, it is bound to get worse as I get older.	o	o	o	o	o	o	o
5. Alzheimer's disease is a common problem among the elderly.	o	o	o	o	o	o	o
6. As I get older I'll need to rely on others to remember things for me.	o	o	o	o	o	o	o
7. If I work at it, I can improve my memory.	o	o	o	o	o	o	o
8. I'm not good at remembering things.	o	o	o	o	o	o	o
9. If I use my memory a lot, it will stay in shape, just like my muscles do if I exercise.	o	o	o	o	o	o	o

MCI continued

HEF ID# __________ LSU ID# __________

	Strongly Disagree	Disagree	Slightly Disagree	Neutral	Slightly Agree	Agree	Strongly Agree
10. I can find ways to improve my memory.	O	O	O	O	O	O	O
11. When I forget something I am apt to think I have Alzheimer's disease.	O	O	O	O	O	O	O
12. I can't remember things, even if I want to.	O	O	O	O	O	O	O
13. I think there's a good chance I will get Alzheimer's disease.	O	O	O	O	O	O	O
14. If I use my memory often I won't lose it.	O	O	O	O	O	O	O
15. As I get older I won't have to rely on others to remember things for me.	O	O	O	O	O	O	O
16. I can think of strategies to help me keep up my memory.	O	O	O	O	O	O	O
17. If I want to have a good memory I need to have others to help me remember.	O	O	O	O	O	O	O
18. I sometimes think that I have Alzheimer's disease.	O	O	O	O	O	O	O
19. When it comes to memory, there is no way I can make up for the losses that come with age.	O	O	O	O	O	O	O

APPENDIX D- IRB FORM

ACTION ON PROTOCOL CONTINUATION REQUEST

Institutional Review Board
Dr. Robert Mathews, Chair
130 David Boyd Hall
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TO: Katie Cherry
Psychology

FROM: Robert C. Mathews
Chair, Institutional Review Board

DATE: May 14, 2014
RE: IRB# 2370

TITLE: Determinants of Human Longevity and Healthy Aging: Contributions of Episodic Memory to Healthy Aging

New Protocol/Modification/Continuation: Continuation

Review type: Full ___ Expedited X **Review date:** 5/13/2014

Risk Factor: Minimal X Uncertain ______ Greater Than Minimal_______

Approved X **Disapproved**__________

Approval Date: 5/13/2014 **Approval Expiration Date:** 5/12/2015

Re-review frequency: (annual unless otherwise stated)

Number of subjects approved: 400

LSU Proposal Number (if applicable): __________

Protocol Matches Scope of Work in Grant proposal: (if applicable)_______

By: Robert C. Mathews, Chairman ____________________

PRINCIPAL INVESTIGATOR: PLEASE READ THE FOLLOWING –
Continuing approval is CONDITIONAL on:

1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
7. Notification of the IRB of a serious compliance failure.
8. SPECIAL NOTE:

**All investigators and support staff have access to copies of the Belmont Report, LSU's Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at http://www.lsu.edu/irb*

VITA

Bethany Lyon earned her bachelor degrees in Psychology and Biology at Augustana College, Rock Island, Illinois in 2012. She is now working toward completion of the doctoral program in Cognitive and Developmental Psychology under the direction of Dr. Katie E. Cherry.