STEREOTYPES, ATTITUDES ABOUT AGING, AND OPTIMISM AND THEIR IMPACTS ON VOCABULARY PERFORMANCE

by

CAITLIN TYRRELL

B.S., Washington State University Vancouver, 2008

M.A., University of Colorado Colorado Springs, 2014

A dissertation submitted to the Graduate Faculty of the University of Colorado Colorado Springs in partial fulfillment of the requirements for the degree of Doctor of Philosophy

Department of Psychology

2017
This dissertation for the Doctor of Philosophy degree by

Caitlin Tyrrell

has been approved for the

Department of Psychology

by

Molly Maxfield, Chair

Lori James

Michael Kisley

Daniel Segal

Heather Albanesi

Date 05/02/2017
Age-related attitudes and stereotypes about aging have been shown to impact a variety of outcomes, including older adults’ cognitive performance. Past research has often focused on memory, a variable which does show age-related decline. The present research explored the relationship of such attitudes and stereotypes with vocabulary, a novel outcome variable in this area that differs from memory in that it remains stable well into older adulthood. Study 1 used data from 3631 participants in a large dataset to explore the ability of attitudinal variables (i.e., aging satisfaction, aging expectations, and optimism) to predict vocabulary performance. Optimism was the only statistically significant attitudinal predictor of vocabulary, though it did not have strong practical significance. Study 2 was designed to test the impacts of experimentally manipulated age-based stereotype threat on vocabulary performance and confidence in vocabulary performance in 71 young adults and 74 older adults. Participants were presented with a stereotype threat manipulation stating that their age group was either expected to do better or worse on vocabulary performance than the other age group. Older adults performed better on the vocabulary task and were more confident in their performance, consistent with past findings. However, the hypothesized effect of stereotype threat on older adults’ vocabulary performance, related to young adults’, was not found. Interpretation of the impact of stereotype threat is limited, however, as many participants
did not accurately respond to a manipulation check item. Overall, this research did not support a relationship between age-related attitudes, optimism, age-based stereotypes, and vocabulary performance.

*Keywords: age-based stereotype threat, age-related attitudes, optimism, vocabulary performance, aging, cognitive aging, social cognition*
# TABLE OF CONTENTS

## CHAPTER

I. INTRODUCTION .................................................................................................................. 1  
   Attitudes about Aging and Ageism ................................................................. 2  
   Vocabulary and Aging ....................................................................................... 12  

II. STUDY 1 ......................................................................................................................... 16  
   The Present Study .................................................................................................. 16  
   Method ....................................................................................................................... 19  
   Results ......................................................................................................................... 27  
   Discussion ................................................................................................................... 32  

III. STUDY 2 ......................................................................................................................... 39  
   Stereotype Threat ...................................................................................................... 39  
   Stereotype Threat in Older Adults .......................................................................... 42  
   Mechanisms of Age-Based Stereotype Threat ....................................................... 46  
   The Present Study ...................................................................................................... 51  
   Method ......................................................................................................................... 56  
   Results ......................................................................................................................... 65  
   Discussion ................................................................................................................... 82  

IV. SUMMARY AND GENERAL DISCUSSION ......................................................................... 91  
   Strengths of the Present Studies ............................................................................. 94  
   Limitations of the Present Studies ........................................................................... 95
LIST OF TABLES

TABLE

1. Correlations between Demographic Variables, Attitudinal Variables, and Cognitive Variables for Study 1 Participants.........................................................29

2. Results of Hierarchical Regression Examining Predictors of Vocabulary Performance from Study 1.................................................................31

3. Results of Hierarchical Regression Examining Predictors of Memory Performance from Study 1.................................................................33

4. Descriptive Statistics for Study 2 Measures ...........................................66

5. Means of Vocabulary Score and Vocabulary Confidence Ratings for Older and Young Adult Participants from Study 2........................................72

6. Correlations between Demographic Variables, Attitudinal Variables, Vocabulary Score, and Vocabulary Confidence Ratings for Full Study 2 Sample.................................................................75

7. Correlations between Demographic Variables, Attitudinal Variables, Vocabulary Score, and Vocabulary Confidence Ratings for Older Adults in Study 2.................................................................................75

8. Correlations between Demographic Variables, Attitudinal Variables, Vocabulary Score, and Vocabulary Confidence Ratings for Young Adults in Study 2.................................................................................76
Attitudes about aging have been found to impact a variety of cognitive and physical variables, and research has demonstrated a measurable impact of negative views and stereotypes on older adults’ performance across a number of areas. Vocabulary, however, is a novel outcome for studies involving attitudes and stereotypes about aging and their relationships to cognitive variables. Vocabulary performance is a measure on which increased age is typically associated with improved performance, on both within-person and between-person differences, making it unique as an outcome in this type of research. Many of the outcomes associated with age-based stereotype research (e.g., memory, physical ability) do tend to show some age-related decline. The purpose of this research, then, is to examine the relationship of attitudinal variables and impact of age-based stereotypes on an outcome for which there does not appear to be a widely known stereotype. Examining a variable that should be stable (or even improve) with increasing age can help to explore the power of attitudinal variables and stereotypes. Finding a relationship with negative attitudes and age stereotypes may help to illustrate the power of such beliefs about aging in the experiences of older adults themselves. However, finding no relationships with negative attitudes and age stereotypes may indicate that some outcomes are robust to such attitudinal variables.
Attitudes about Aging and Ageism

It is often noted that ageism, or the stereotyping of or discrimination against people based on age, is a unique prejudice. Those who hold ageist views, as aging individuals themselves, have the potential – and typically the desire – to join the out-group (in this case, older adults) against which their views are held, something that makes ageism different from stereotypes and discrimination against other groups (e.g., Nelson, 2005; North & Fiske, 2012). Despite the universality of the experience of growing older, attitudes about both older adults and the aging process itself are frequently negative. For example, Hummert (1990) noted several stereotypical “subcategories” of both young and old individuals (e.g., the “Inflexible Senior Citizen,” the “John Wayne Conservative,” or the “Young Professional”). Though both positive and negative subcategories existed for both age groups, young adults tended to rate subcategories based on positive stereotypes as more typical for young adults, subcategories based on negative stereotypes were viewed as more typical for older adults. This finding illustrates the belief that most older adults fall into categories that could be best exemplified by such negative traits as “greedy,” “forgetful,” and “ill-tempered.” Similar research showed that middle-aged and older adults, in addition to young adults, shared several archetypes of older adults (Hummert, Garstka, Shaner, & Stralm, 1994). Although some of these archetypes were positive (e.g., the “Perfect Grandparent” or the “Golden Ager”), the majority were negative (e.g., the “Mildly Impaired,” the “Shrew/Curmudgeon,” or the “Recluse”) and were again subcategories of older adults categorized largely by negative traits.

A meta-analysis by Kite, Stockdale, Whitley, and Johnson (2005) showed that, across published studies with a variety of experimental conditions and participants, older
adults were typically viewed more negatively than young adults on a number of variables. Specifically, older adults were rated more negatively in the domains of attractiveness, competence, and behavior. Negative evaluations of older adults were found to be moderated by such variables as increased information regarding the older adult being rated on the outcome measure, respondent age, and gender of both the target and respondent. Overall, though, a clear bias against older adults emerged in this meta-analysis. Older adults themselves, as illustrated in the research by Hummert et al. (1994), tend to internalize these general negative ideas about aging, thus influencing their own aging experiences (for a review, see North & Fiske, 2012). Positive or negative attitudes about the aging process have been shown to affect cognitive measures (e.g., Marquié & Huet, 2000; Rahhal, Hasher, & Colocombe, 2001) as well as other outcome measures in older adult participants, such as health-promoting behaviors (Kim, 2009) and physical activity levels (Meisner, Weir, & Baker, 2013). This phenomenon will be reviewed in more depth later in this paper.

**Self-rated well-being and health in older adulthood.** Diehl and Wahl (2009) provide a thorough review of gerontological work assessing awareness of age-related change. They review research exploring older adults’ reported awareness of change, including physical, cognitive, and interpersonal changes. In spite of reported awareness of such changes, life satisfaction is typically maintained in older adulthood, though, similar to aging expectations, this varies by individual (Staats & Stassen, 1987). For example, older subjective age and greater number of health issues have been found to have a linear relationship with decreased life satisfaction in older adulthood (Kleinspehn-Ammerlahn, Kotter-Grühn, & Smith, 2008). Age, gender, and geographical location are
among the other variables that can impact middle-aged and older adults’ particular expectations for older adulthood (Timmer, Bode, & Dittman-Kohli, 2003), which ultimately impact the positive or negative views they hold of their own future.

Kleinspehn-Ammerlahn, Kotter-Grühn, and Smith (2008) reported that older adult participants tended to rate themselves highly on a variety of domains of well-being, including health and life-satisfaction. One potential explanation of such ratings is social comparison, in which people assess their same-aged peers as a basis for judging their own subjective well-being. Young and older adults both appear to use social comparison to the same degree to help determine the standard for their sense of subjective well-being. Factors such as one’s subjective somatic and functional experiences have some weight when it comes to subjective health ratings (Benyamini, Leventhal, & Leventhal, 1999), and social comparison may provide a basis for understanding when those somatic and functional experiences are unexpected or problematic. Barring some exceptions related to illness, most older adults maintain the belief that they are doing well “for someone my age” (Kleinspehn-Ammerlahn et al., 2008). Social comparison, then, provides for older adults a different basis of comparison by which to judge their own well-being (e.g., an 80-year-old may have a different idea of what is successful based on same-age peers than a 20-year-old may have), but this very phenomenon underlines that there is a unique set of expectations for older adulthood.

The self-perceived aging experience has been found to be a complex process with multiple dimensions, including physical health, personal development, social support, and a philosophical component regarding life reflection (Keller, Leventhal, & Larson, 1989; Steverink, Westerhof, Bode, & Dittmann-Kohli, 2001). Steverink et al. (2001)
found that middle-aged and older adults differed in each of these broad domains, and the domains appear to be related to assessments of the personal aging experience. For example, physical activity or view of aging impacted subjective assessments of aging, indicating that aging is an idiographic experience. It is therefore no surprise that other studies have also found individual differences in the self-assessment of aging and expectations regarding older adulthood. For example, Martin, Palmer, Rock, Gelston, and Jeste (2015) found that participants in the young-old age range (i.e., ages 50 - 74) were more likely to base their ratings of self-perceived successful aging on cognitive and physical performance than participants in the old-old category (i.e., ages 75 - 99), whose subjective ratings were predicted only by physical performance, and to a significantly lesser degree than the ratings of the young-old participants. These old-old participants appeared to have more positive views about their health in the face of increased reports of physical and cognitive issues relative to the young-old participants. Sarkisian, Shunkwiler, Aguilar, and Moore (2006) also found education to impact expectations regarding aging, with lower levels of education leading to more negative expectations for older adulthood. Education level has been found to be related to higher income and more hope, all of which also relate to higher levels of optimism in self-perceived aging (Steverink et al., 2001).

**Internalized ageism.** Despite individual differences, negative views about the aging process are a consistent and pervasive finding in much of the research focusing on attitudes regarding older adulthood for participants in any age group (Kite & Johnson, 1988; Kite et al., 2005). However, stereotypes held about older adults can be both negative (e.g., expectations regarding poor memory and frail health) and positive (e.g.,
assumptions that older adults will be kind or wise). Regardless of their valence, such ageist stereotypes can have subtle and complex consequences, as reviewed by North and Fiske (2012). North and Fiske note that ageism influences a number of areas of society, including the medical care, media representation, employment opportunities, and even family support that older adults experience. This pervasive societal influence no doubt impacts older adults when coming from external sources. However, another consequence of pervasive ageism is that, as people who have developed such beliefs age themselves, they as older adults may have an internalized pessimism regarding what their own aging will look like. Bennett and Gaines (2010) review different mechanisms by which aging stereotypes may negatively impact older adults. There is stereotype threat, in which people tend to respond in accordance with stereotypes, typically negative stereotypes, when the stereotype is made salient. This will be reviewed in more depth in a future section. Another mechanism suggested by Bennett and Gaines is comparison, by which older adults may view themselves as doing better or worse than other older adults, a process often impacted by the age-related stereotypes that the older adult holds. Finally, they suggest that stereotypes can be internalized (i.e., applied inward to one’s self in older adulthood) and externalized (i.e., negative facets of aging are viewed as normal or inevitable). The authors conclude that, no matter the pathway, stereotypes that are self-relevant may have particular power over that individual, acting as a self-fulfilling prophecy for a variety of outcomes.

Research has explored the different ways in which internalized ageism and negative attitudes toward aging impact older adults’ performance and outcomes. Sarkisian and colleagues (2002, 2003, 2005) have found that negative views regarding
aging can have a variety of detrimental impacts on health and health-seeking behaviors. For example, older adults who attributed symptoms of depression to old age were less likely to seek treatment for these potentially treatable symptoms (Sarkisian, Lee-Henderson, & Mangione, 2002). More generally, negative expectations regarding aging have been found to lead older adults to expect to have more physical and cognitive issues, an expectation that is related to less engagement in health-promoting behaviors (Kim, 2009; Sarkisian, Hays, & Mangione, 2002). Furthermore, negative expectations regarding aging were related to lower engagement in physical activity in older adults, even when other variables such as health status were taken into account (Meisner, et al., 2013; Sarkisian, Prohaska, Wong, Hirsch, & Mangione, 2005). Negative perceptions of aging were associated with slower walking speed and longer time rising from a chair among older adult participants in a laboratory setting, again holding true when other health variables were taken into account (Robertson, Savva, King-Kallimanis, & Kenny, 2015). Making negative age stereotypes salient was also related to higher ratings of loneliness and lower subjective health ratings among older adults (Coudin & Alexopoulos, 2010).

Taken together, these studies show that age expectations and attitudes can have a measurable impact on outcomes in older adult participants. However, in this review of the literature, no examination of the relationship between age expectations and language variables, including vocabulary, was found. Therefore, the impacts of age expectations and attitudes in this area are as of yet unknown.

**Optimism, positive views of aging, and health-related outcomes.** In addition to the influence of negative stereotypes and views of aging, optimism and positive expectations for older adulthood appear to be associated with positive outcomes.
Optimism, or the extent to which people hold positive expectations for their future (at large, not specific to the aging process), has been found to be associated with both subjective well-being and medical outcomes (Carver, Scheier, & Segerstrom, 2010). For example, one study followed women, ranging in age from 33 to 72 years ($M = 58.02$, $SD = 10.83$) who had been diagnosed with breast cancer over the course of 12 months. Optimism, measured in an initial assessment, predicted less distress, better mood, and higher quality of life at the 12-month follow-up interview, despite all participants being active in cancer treatment over the year-long period (Carver et al., 1993).

Optimistic expectations about one’s own aging, as a particular category of optimism regarding the future, are also associated with positive outcomes. Older adults with positive perceptions of their own aging had overall increased longevity compared to similar individuals with more negative views, even after controlling for other variables such as functional health (Levy, Slade, Kunkel, & Kasl, 2002) and were more resistant to heart disease up to 38 years after the initial measure of optimism regarding aging (Levy, Zonderman, Slade, & Ferrucci, 2009). Positive age expectations were also associated with better treatment engagement and ultimately better recovery from health issues that caused impairment in daily activities (e.g., stroke) among older adults (Levy, Slade, Murphy, & Gill, 2012). Resistance to age stereotypes was associated with lower prevalence of suicidal ideation, anxiety, and posttraumatic symptoms in a sample of older veterans (Levy, Pilver, & Pietrzak, 2014).

Past research has indicated that optimism and positive attitudes are associated with enhanced self-efficacy, which is a possible mechanism by which optimism relates to health-related behavior and aging. Optimism may reflect a person’s belief in his or her
abilities to succeed, therefore increasing the likelihood that he or she will engage in
helpful behaviors. For example, optimism has been found to relate to increased
engagement in health-promoting behaviors in older adults, such as engaging in treatment
recommendations that promote further recovery (Levy & Langer, 1994). Taken together
with research reviewed in the prior section suggesting that negative aging expectations
were associated with fewer health-promoting behaviors (e.g., Kim, 2009; Sarkisian et al.,
2002), there is strong evidence that attitudes, both positive and negative, can be important
predictors of health behaviors, and thus health outcomes. Positive views regarding the
future may also be linked to proactive behaviors in other areas, including financial
planning for the future (Aspinwall, 2005).

General optimism can also have a range of health-related effects beyond
engagement in health-related behaviors, including physiological and psychological
effects. For example, it may also limit the cardiovascular stress response, thus providing
another mechanism leading to positive outcomes (Levy, Hausdorff, Hencke, & Wei,
2000; Levy et al., 2012). Wurm and Benyamini (2014) found that negative views of
aging predicted worse health-related outcomes in older adult participants, but general
optimism for the future moderated the effect of these negative views on self-rated health,
depression symptoms, and physical functioning. Given the wide-ranging effects of
optimism about aging (and in some cases general optimism), it may also prove to be an
important factor in the discussion of cognitive variables and aging. Also, given the
association between health outcomes and subjective aging satisfaction (e.g., Martin et al.,
2015), it may be that optimism is also an important attitudinal variable related to age-
related outcomes.
Age expectations and cognitive outcomes. In addition to physical variables, expectations about aging have been found to relate to cognitive abilities, particularly memory. Adults of all ages are typically aware that there will be changes in memory and cognition over the lifespan (Cherry, Blanchard, Walker, Smitherman, & Lyon, 2014), and older adults report subjective awareness of age-related changes in cognition as they age (Diehl & Wahl, 2009). Older age is associated with poorer memory self-efficacy relative to young and middle-aged adults (Marquié & Huet, 2000). Research has also shown that older adults do tend to perform more poorly on memory tasks relative to young adults (e.g., Spencer & Raz, 1995) and that they tend to show decline when tested longitudinally on memory tasks (e.g., Lamar, Resnick, & Zonderman, 2003).

Empirical work has shown that reminding older adult participants of the typical (or stereotypical) changes in memory that come with aging can impact memory performance. Simply introducing a task explicitly as a memory task (versus describing the task as an orientation task) reduced older adult participants’ performance, with memory self-efficacy moderating effects on both performance and expectations regarding performance (Desrichard & Köpetz, 2005). Lower memory self-efficacy was related to both lower memory performance and expectations regarding memory performance, an effect not found when the same task was introduced as an orientation task less explicitly related to memory (Desrichard & Köpetz, 2005). Describing a task as a memory test may be responsible for impacting older adults’ performance due to expectations related to age and memory performance (Rahhal et al., 2001). Similarly, older adult participants who were induced to categorize themselves as either Younger or Older (based on manipulated age ranges given for each category) differed in their average scores on a short cognitive
screen, with those in the Older category typically performing worse on this measure (Haslam et al., 2012). Taken together, these findings imply that the salience of attitudes about aging has an impact on related cognitive outcomes.

**Framework for understanding the impact of attitudes on older adults.**

Stereotype embodiment theory (Levy, 2009) was developed to explain the pattern of findings in which older adults with more positive self-perceptions of the aging process experience more positive outcomes, including better health outcomes (Levy et al., 2009) and increased longevity (Levy et al., 2002). There are four components to this theory that explain how stereotypes of aging can have such pervasive effects. First, people are believed to internalize stereotypes, which are largely negative, about older age throughout the lifespan, beginning with exposure to such stereotypes as children. As described in a prior section, aging stereotypes are ubiquitous and easily available to impact the beliefs and attitudes of people of any age (North & Fiske, 2012), and adults of all age groups tend to hold negative views of aging and older individuals (e.g., Kite & Johnson, 1988; Kite et al., 2005). The second component of the theory describes the unconscious operation of these stereotypes and the influence the activation of these unconscious stereotypes can have on many domains, including outcomes related to health and health-related decisions (e.g., Levy et al., 2000; Levy et al., 2012), mental health outcomes (e.g., Levy et al., 2014), and physical ability (e.g., Robertson et al., 2015). Third, these stereotypes gain salience and become increasingly relevant with age (e.g., Rothermund, 2005), as the individual grows into the group affected by these stereotypes. Finally, Levy (2009) hypothesizes that stereotypes have influence in more than one way, with impacts that are psychological (e.g., expectations developed about aging),...
behavioral (e.g., engagement in health-related behaviors), and physiological (e.g., autonomic nervous system activation in reaction to negative stereotypes about age). With different paths on which these internalized stereotypes can unconsciously activate, their effects can be profound, and the older adults being influenced may not be aware of the impact on their health and functioning.

The literature reviewed in support of stereotype embodiment theory suggests mechanisms by which age-related stereotypes and attitudes may ultimately influence a number of outcomes, including cognitive outcomes, which is of particular interest to the present research. However, no studies were found in the literature review of this topic that examined the influence of such age-related expectations or manipulations on vocabulary outcomes. Only general cognition, as measured by a cognitive screen, and episodic memory tasks have been used as cognitive outcome measures in the literature compiled. That said, given the range of other measures impacted by aging expectations, including psychological and physical health outcomes, there is a potential for language tasks to show some relationship with age-related expectations. In order to further form the research question for this project, general performance on verbal tasks in older adulthood will be reviewed in the next section.

**Vocabulary and Aging**

Verhaeghen (2003) conducted a meta-analysis of studies concerning age and vocabulary scores and came to the general conclusion that both age and education were positively related to performance on vocabulary measures. In this meta-analysis, improvements associated with age were found for multiple-choice vocabulary tests, where participants are asked to choose the definition from a number of presented options.
(e.g., the Nelson-Denny Reading test; Nelson & Denny, 1960). Improvements in performance associated with increasing age were also found for production tests, where participants are asked to generate a definition for each vocabulary item (e.g., the Wechsler Adult Intelligence Scale – Revised [WAIS-R] vocabulary subscale; Wechsler, 1981), though to a lesser degree than on multiple-choice measures. A longitudinal study found that performance on vocabulary production tends to be maintained throughout the lifespan, with decreases not seen until well into the 80s or 90s (Singer, Verhaeghen, Ghisletta, Lindenberger, & Baltes, 2003). Bowles, Grimm, and McCardle (2005) also analyzed longitudinal data and found two dimensions in multiple-choice vocabulary performance, which they labeled basic vocabulary, or less-difficult items, and advanced vocabulary, or more-difficult items. In doing this, they found differential trends for the two dimensions. Basic vocabulary scores were highest for participants in their 30s and then showed an age-related decline, while advanced vocabulary scores peaked after age 45 and tended to remain consistent. These results do suggest that vocabulary knowledge across the lifespan may be differentially maintained. Young adults typically perform better on word retrieval tasks such as picture naming (i.e., tasks where a conceptual representation is provided and participants must generate a word in response), but older adults outperform young adults on measures of vocabulary (i.e., tasks where a word is provided and participants must recognize or generate the word’s meaning; Kavé & Mashal, 2012; Kavé & Yafé, 2014). Kavé and Halamish (2015) found that older adults performed better on a multiple-choice vocabulary measure than young adults and were also more confident in their knowledge of vocabulary than the young adult group.
Cohort effects related to differences in education between age groups have been identified as one possible reason for age differences in vocabulary. For example, when cohort effects on education were controlled for statistically, Alwin and McCammon (2001) found a reduced age difference in multiple-choice vocabulary performance; they hypothesized that differences in education across cohorts of adults may account for some of the differences in vocabulary performance observed across cohorts. This impact of education on vocabulary performance is consistent with other findings (Keuleers, Stevens, Mandera, & Brysbaert, 2015). That said, education cannot explain the results of longitudinal data (e.g., Singer et al., 2003) suggesting that vocabulary performance increases with age. On the whole, results support the idea of increased vocabulary performance with age.

Frameworks for understanding vocabulary across the lifespan. Perhaps the most frequently used explanation for age differences in vocabulary is that of fluid and crystallized intelligence, developed by Cattell and Horn (Cattell, 1963; Horn & Cattell, 1966, 1967). This framework posits that vocabulary is a type of crystallized knowledge that would not rely on such variables as processing speed, which may be vulnerable to age-related effects (e.g., Ullstadius, Gustafsson, & Carlstedt, 2002). Crystallized knowledge is typically considered to be maintained throughout older adulthood, in contrast to fluid intelligence, a related but separate intelligence construct that does tend to decline with age (Horn & Cattell, 1967; Wang & Kaufman, 1993).

One cognitive framework accounting for age differences in language performance and vocabulary is the transmission deficit hypothesis (TDH; MacKay & Abrams, 1998; MacKay & Burke, 1990). The TDH is grounded in node structure theory (NST; MacKay,
1987), which proposes a framework in which lexical knowledge is organized into nodes. Each node represents a specific piece of semantic, phonological, or orthographic information, and new information is represented by a new node. Priming spreads between the nodes, with the strength of a particular connection increased by repeated priming or weakened by disuse. Weakening of connections and reduced transmission of priming between nodes throughout the network can also be expected with age. Though connections are typically intact and can transmit adequate priming to allow a node to be activated, this priming transmission is less efficient in older than young adults (Burke, MacKay, & James, 2000). Connections do, however, tend to be maintained over the lifespan, with age differences in performance on cognition accounted for by differential age effects in top-down processes (e.g., retrieval of phonology) versus bottom-up processing (e.g., comprehension and word meaning; James & MacKay, 2007). Most information, then, continues to be stored over the lifespan, even with only occasional priming, with performance differences relating to ease of retrieval of this information rather than presence of information. On the contrary, given their greater experience with lexical information, older adults may have more lexical nodes and more connections among semantically-related pieces of information, resulting in a larger semantic network (Laver & Burke, 1993), thus accounting for increased vocabulary performance with age. However, in the case of words that are infrequently used, connections can eventually degrade and become unusable, potentially explaining the eventual vocabulary loss seen in very old age (e.g., Singer et al., 2003).
CHAPTER II
STUDY 1

The Present Study

The reviewed literature has demonstrated that general attitudinal variables, including optimism and the age-related attitudinal variables of aging satisfaction and aging expectations, have some impact on outcome measures among older adult participants, including performance in cognitive domains. However, no studies have explored the relationship between these attitudinal variables and vocabulary, a variable which tends to remain stable in older adulthood. Research has primarily revolved around measures of memory, an area in which older adults do show some decline as they age (e.g., Lamar et al., 2003) and do tend to perform more poorly than their young counterparts (e.g., Spencer & Raz, 1995). Most older adults are aware of changes in several aspects of cognition, including episodic memory (see Diehl & Wahl, 2009), but expectations for vocabulary performance were not found in the reviewed literature. Vocabulary does not seem to have been investigated in terms of its relationship to optimism and aging attitudes and expectations. Therefore, the intent of this study was to explore vocabulary and its relationship with optimism and specific age-related attitudinal variables.

Optimism was chosen as a general attitudinal variable of interest based on the reviewed literature suggesting that it may be related to self-efficacy and positive health and cognitive outcomes. In addition to optimism, aging satisfaction and expectations
about aging were chosen as predictor variables for this research. Literature reviewed suggested that these two variables may be associated with performance on cognitive variables and that negative aging experiences and expectations may in particular relate to poorer performance on cognitive variables. Overall, it seems reasonable to expect positive relationships between these attitudinal variables and vocabulary. However, a lack of these relationships may indicate that vocabulary somehow differs from those variables that are impacted by attitudinal variables.

Older adults are found to perform well on language tasks, particularly vocabulary comprehension measures, consistently into late life (e.g., Verhaeghen, 2003). Furthermore, older adults tend to be confident in their knowledge of vocabulary (e.g., Kavé & Halamish, 2015). This makes the question of the impact of attitudes on vocabulary one of particular interest, as this is not a cognitive process in which age-related declines are expected. Should a relationship be found, it would suggest that vocabulary, a variable that typically shows little age-related decline before the age of 80 (e.g., Singer et al., 2003), can be impacted by negative views of aging, demonstrating the power of such attitudes. However, no relationship may mean that at least some realms of cognition are robust to the influence of negative views of aging. The purpose of this study was to investigate the relationship between the attitudinal variables, including aging satisfaction, aging expectations, and optimism, and vocabulary, because of its uniqueness as an outcome relative to memory or other cognitive functions. A large data set was used to assess the ability of optimism, or a general positive view of one’s future, to predict vocabulary score. In addition to overall optimism, two more specific age-related attitudes,
aging satisfaction and aging expectations, were tested as predictors of vocabulary performance.

Memory is more studied in relation to age, with more solid support as a variable associated with age-related attitudes than vocabulary. Memory was therefore used as the outcome variable in a second analysis to aid interpretation of the results of the analysis on vocabulary. Because the association between memory and the attitudinal variables is better established by the literature reviewed, should this association be found but the association between vocabulary and attitudinal variables not be supported, it would lend more confidence to the conclusion that these data do not support the relationship with vocabulary.

**Hypotheses for Study 1.** There were two hypotheses for Study 1, regarding the relationship of attitudinal variables and the cognitive outcomes of vocabulary performance and memory performance.

**Hypothesis 1: Attitudinal variables as predictors of vocabulary performance.** It was hypothesized that the set of attitudinal variables (i.e., aging satisfaction, aging expectations, and general optimism) would predict performance on a vocabulary measure. This was hypothesized to be true even when age and education, variables found to be related to vocabulary performance (e.g., Alwin & McCammon, 2001, Keuleers et al., 2005), were controlled for statistically.

**Hypothesis 2: Attitudinal variables as predictors of memory performance.** It was hypothesized that the same set of attitudinal variables that was hypothesized to predict vocabulary (i.e., aging satisfaction, aging expectations, and general optimism) would also predict performance on a memory measure. This was hypothesized to be true even when
age and education were controlled for statistically. It should be noted that the second hypothesis is largely intended for comparison with the results of the first hypothesis, because memory is a better-studied variable when it comes to relationships to attitudinal variables.

Method

Participants. This study used data from the 2010 wave of the Health and Retirement Study (HRS; University of Michigan, 2012). This large-scale longitudinal study included a nationally representative sample of Americans. Approximately 20,000 participants were contacted every two years as part of the HRS. More information about the study and data from the 2010 wave in particular is supplied in the Materials section below. Overall, data from 3631 total participants (60 – 89 years old) were used in Study 1. These participants had a mean age of 73.67 (SD = 6.58). Two thousand forty-four (56%) were women, and 1587 (44%) were men. The majority of the sample was White, with 3086 (85%) reporting their race as White/Caucasian. Four hundred twenty (12%) reported their race as Black or African American, and 125 (3%) identified themselves as being part of another racial group (American Indian, Alaskan Native, Hawaiian Native, Pacific Islander, Asian, or Other). In terms of ethnicity, 219 (6%) identified as Hispanic, while 3412 (94%) identified as Non-Hispanic. Years of education for this group ranged from 0 to 17 years, with a mean of 13.48 (SD = 3.30). Three thousand five hundred and fifty-three participants (98%) were interviewed in English, while 78 (2%) were interviewed in Spanish. Interviews were conducted by telephone for 3445 participants (95%), while 186 participants (5%) were interviewed in person. Reasons for these differences are discussed in more detail in the next section.
HRS data collection. The purpose of the HRS was to examine the patterns of work and retirement among older adults. Variables identified that may affect the retirement experience included patterns of wealth accumulation and how economic, family, and program resources affect the key outcomes in this research of retirement, health decisions, and placement decisions. The HRS is made up of 11 core modules, to which participants are asked to respond during each wave of data collection. Items in these modules typically relate to the main questions of interest for the overall HRS study: health; work and retirement; income and wealth; and family information and characteristics. Data used in the present study were collected as part of these core modules. In addition to the core modules, a number of questionnaires, labeled experimental modules in the HRS, gather information not directly related to the original HRS questions of interest. Despite the name, the experimental modules contain no manipulation of variables and are largely questionnaires, similar to the core modules. These modules are labeled experimental because they are administered to a randomly selected subset of the total HRS sample, and as such, data are not available for every participant from every wave. Each wave, a participant completes only one experimental module. Experimental modules, in contrast to the core modules, may also differ between waves, such that the specific measures used in the 2010 wave, particularly in the experimental modules, differ from those used in 2012, etc. The 10 experimental modules available from the 2010 wave included information on the following: possessions and relocation; health literacy; perceptions of illness and Alzheimer’s disease; disaster preparation and disability; personality; pain; credit cards; financial literacy investment decision-making; proxy reports regarding health and cognition; and altruism.
Interviews for the HRS are performed through the Survey Research Center of the Institute for Social Research at the University of Michigan (University of Michigan, 2012). Biennial interviews are conducted in either English or Spanish, depending on participants’ proficiency and ability to answer survey questions in either language. Rather than relying on family members or professionals for translations, HRS researchers developed a Spanish version of the questionnaires to maintain reliability with the original English version. This was administered by proficient interviewers. Interviews are conducted primarily over the phone, although exceptions can be made for participants who either do not have a telephone or, for medical reasons, would be unable to complete an hour-long interview over the telephone. In-person interviews are also conducted for participants who were participating in the HRS for the first time. It should be noted that the majority of the HRS sample used in this study was interviewed in person (98%, as reported above). While telephone is the more common method, this study used some items from the Leave Behind Questionnaire, a questionnaire that was randomly assigned to participants who had been seen for a face-to-face interview and was, as the name suggests, left for them to complete and return after the initial HRS data collection. Those few participants who completed the Leave Behind Questionnaire over the phone were likely those for whom a telephone interview was conducted as an exception. See the next section for more information on how the particular sample used in Study 1 was obtained.

**Selection of the HRS subsample.** The HRS database was obtained from the University of Michigan online, following the steps recommended to obtain data from the study (University of Michigan, 2012). The initial dataset contained a total of 38,183 participants with data from the 2010 wave of the HRS. Participants with no vocabulary
score were deleted, leaving 16,030 participants. Additionally, as there were only 5 vocabulary items with a possible total score of 10, any vocabulary score with an impossible value (i.e., anything over 10) was deleted, as this score was assumed to be due to an error in data entry, eliminating another 127 participants. The remaining participants were then selected to exclude anyone under the age of 60, eliminating data from another 5572 participants. Other relevant variables were then examined, and anyone missing data for age satisfaction, age expectations, optimism, or delayed recall were also eliminated. This left a final sample of 3631.

*Missing data analysis for the selected HRS subsample.* Patterns of missing data in the full sample of 38,183 were analyzed in SPSS to determine if there were significant determinants of those participants who were excluded from the final sample. Based on the results of the missing data analysis, it appears that the data have largely arbitrary patterns of missing values, meaning that, for example, participants who are missing vocabulary could also be missing age, but missing one did not appear to predict missing the other. There was one prominent exception to this. The most common patterns of missing data indicated that the items coming from the Leave Behind Questionnaire (i.e., the optimism and aging satisfaction questionnaires) were missing together. This pattern reflects the design of the HRS study, as not all participants were selected to complete the Leave Behind Questionnaire. In addition, only some participants would have been assigned to complete the vocabulary task, which was administered to each participant only every other HRS wave. The majority of participants excluded from the Study 1 analysis were excluded because they had not completed these questionnaires, which were chosen as predictor variables for this analysis. Of attitudinal variables, 30,299 (79%)
were missing aging satisfaction and 30,546 (80%) were missing optimism. When data points are missing from the dataset, HRS coding does not indicate the reason for missing data (e.g., participant was not assigned to complete a task versus the participant chose not to complete a task), so further exploration of these data is not possible. However, based on knowledge of the structure of HRS data collection, it is likely that a majority of them simply were not randomly assigned to the subsample of HRS participants asked to complete the Leave Behind Questionnaire during collection of data for the 2010 wave. In addition to aging satisfaction and optimism, 18,301 (48%) were missing aging expectations, which came from a different questionnaire, part of one of the core HRS modules. In terms of the outcome variable, 22,155 (58%) of participants were missing vocabulary scores, which was also obtained from one of the core modules.

Little’s Missing Completely at Random (MCAR) test did not suggest that data points that were missing from the full HRS dataset obtained for Study 1 were missing completely at random, $\chi^2 (60, N = 38183) = 34083.82, p < .001$. From this analysis, then, it could not be concluded that those missing data points were missing entirely independently of other variables (i.e., completely at random). MCAR data is the ideal pattern, as it can be assured that other variables, whether observed or not in the study design, are not influencing missingness and that therefore there is no systematic pattern of missingness that might skew interpretation of the results (Little & Rubin, 2002; Rubin 1976). However, much more common patterns of missing data are missing at random (MAR), meaning that the missing pattern is not systematically related to observed data points, or missing not at random (MNAR), indicating that the systematic missingness may influence interpretation of study results (Feng, Cong, & Silverstein, 2012). From
observation of the missing data patterns, the data in the overall HRS dataset obtained appears to be a mix of MAR and MNAR data, a common pattern of missingness in large datasets (Feng et al., 2012).

Given that data is not being imputed, the larger concern regarding missing data for Study 1 was not the specific pattern of missingness. Rather, the concern for was whether or not there was a bias in the variables determining the Study 1 sample, which was created by deleting participants with missing variables. Given that the data missing from the overall dataset were not completely random (i.e., were not MCAR), it is likely that there is some kind of bias in the subsample obtained. However, looking at the Missing Data Patterns available through SPSS did not reveal an obvious bias, other than the issue of the Leave Behind Questionnaire previously discussed (meaning that aging satisfaction and optimism tended to be missing together, as a result of the study design). Therefore, it can be concluded that the patterns of missing data were arbitrary, even if not completely random, and that the study could continue with some cautions about generalization of the results based on this sample.

**Materials and Procedure.** HRS items of particular interest to the present study from both the core modules and the relevant experimental modules are described in more detail below.

**Demographic information.** Demographic information on HRS participants who have participated in all modules of interest for the present research was gathered. Participant characteristics examined included age, gender, race/ethnicity, and level of education. In addition to providing descriptive information about the sample used, these variables were tested for significant relationships with the dependent variable, and some
of these variables were considered as potential covariates. For example, level of education has been found to be positively correlated with vocabulary score in past research (e.g., Keuleers et al., 2015). Associations between these variables were assessed, as discussed in the Results section below.

**Optimism questionnaire.** The variable of optimism was assessed in the HRS materials using 12 items, to which participants responded on a 6-point Likert scale, ranging from *strongly disagree* (1) to *strongly agree* (6). Total scores range from 12 to 72. The optimism questionnaire used in the HRS is based on the Life Orientation Test (Scheier & Carver, 1985; Scheier, Carver, & Bridges, 1994). Items on this scale are related to a general sense of the future and the participant’s well-being (e.g., “Overall, I expect more good things to happen to me than bad,” and “The future seems hopeless to me and I can’t believe that things are changing for the better.”). Negatively worded items were reverse coded, and then all items were summed to provide a total optimism score for each participant. Higher scores indicate higher levels of optimism. For the current study, the measure showed good internal consistency, \( \alpha = .81 \), per the guidelines suggested by George and Mallery (2003).

**Age satisfaction and expectations questionnaires.** The HRS included eight items regarding the individual’s experience of aging to which participants responded on a 6-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (6), with total scores ranging from 8 to 48. This questionnaire was unique to the HRS (Smith et al., 2013), though it was modeled after the Philadelphia Geriatric Center Morale Scale (Lawton, 1975; Liang & Bollen, 1983). Items include questions regarding experienced age-related changes (e.g., “The older I get, the more useless I feel.”) as well as
satisfaction with the aging experience (e.g., “So far, I am satisfied with the way I am aging.”). Ratings on these eight items were reverse coded where necessary and summed to create a single age satisfaction score for each participant, with higher scores indicating higher satisfaction. For the current study, the measure showed good internal consistency, $\alpha = .81$.

In addition to these questions assessing current experience and satisfaction with the aging process, the HRS included an item related to aging expectations. HRS participants were asked to rate the likelihood of being alive 15 years in the future. The item asks whether being alive is as likely as not being alive, and participants respond on a continuous scale ranging from 0% to 100%. Lower scores, then, mean that being alive is more likely, while higher scores mean that being alive is less likely, with 50% meaning that there is an equal chance of being alive or dead 15 years in the future. Target age 15 years in the future varied by participant, as the question specified that the participant add 15 years onto their current age. This item was developed for inclusion in the HRS (Steffick, 2000).

**Vocabulary assessment.** Vocabulary performance, the primary outcome variable of interest to this study, was assessed in one of the core modules of the HRS using a measure adapted from the WAIS-R (Wechsler, 1981). This was a production-type vocabulary measure. Participants were asked only five words from the total Vocabulary subscale. There were two different sets of five items randomly assigned across participants, such that they were either asked to define *repair, fabric, domestic, remorse,* and *plagiarize,* or *conceal, enormous, perimeter, compassion,* and *audacious.* The first item in either set of words was introduced with the phrase, “What is the meaning of the
“word…?” with this phrase repeated as necessary for the other four items. Scoring for these items is based on the WAIS-R, so each is worth up to two points, with one point awarded for partially correct responses. Therefore, a total of 10 points is possible on this vocabulary measure. For this study, the measure showed poor internal consistency ($\alpha = .56$).

**Memory assessment.** Memory performance in the HRS was assessed using a 10-item list learning task, a modified version of the Rey Auditory Verbal Learning Test (RAVLT; Rey, 1964). There were four versions of this test, and each participant was randomly assigned to learn one version for both immediate and delayed recall. The memory variable chosen for this analysis was the number of words from the list correctly recalled after a delay; though the time period of the delay was not specified in the literature available from the HRS website (University of Michigan, 2012), participants were asked to respond to a short mood questionnaire and perform a serial subtraction task and two backwards counting tasks during the delay interval, suggesting that it was likely 10 to 15 min in length.

**Results**

**Descriptive statistics.** Scores obtained on the vocabulary measure fell in the full range possible for this measure, from 0 to 10, with a mean of 5.69 ($SD = 1.99$). Scores on the memory measure also fell in the full range possible for this measure, from 0 to 10, with a mean of 4.09 ($SD = 1.88$). The mean score for aging satisfaction was 30.58 ($SD = 8.10$). The mean score for aging expectations was 47.86 ($SD = 32.36$). The mean score for optimism was 51.30 ($SD = 9.98$). Means for age and education of the sample used in Study 1 were reported in an earlier section (See *Participants*).
**Hypothesis testing for Study 1.** There were two hypotheses for Study 1, regarding the relationship of attitudinal variables and the cognitive outcomes of vocabulary performance and memory performance, which were both tested using hierarchical multiple regression.

**Hypothesis 1: Attitudinal variables as predictors of vocabulary performance.**

The first hypothesis for Study 1 was that the set of attitudinal variables of interest to this study (i.e., aging satisfaction, aging expectations, and optimism) would predict vocabulary performance, when controlling statistically for education and its impact on vocabulary.

**Bivariate correlations and relationships between predictor and outcome variables.** Prior to setting up the regression model to test the first hypothesis, relationships between variables were tested using bivariate correlations. The values of all correlations between cognitive, attitudinal, and demographic variables can be found in Table 1. However, of importance to this hypothesis, aging satisfaction, aging expectations, and optimism all significantly correlated with vocabulary performance, $p < .001$. Education also significantly correlated with vocabulary performance, $p < .001$, though age did not, $p = .07$. Therefore, all variables had small correlations (per guidelines set forth by Cohen, 1988, who suggests .10 to .29 as the range for a small correlation) but statistically significant relationships, with the exception of age and vocabulary. Those variables with statistically significant relationships were all included in the regression model.

Practical significance was also examined by calculating $r^2$ values, which represent the proportion of shared variance between each pair of variables. In terms of vocabulary
Table 1

Correlations between Demographic Variables, Attitudinal Variables, and Cognitive Variables for Study 1 Participants

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Vocabulary</td>
<td>1</td>
<td>.29*</td>
<td>.44*</td>
<td>-.03</td>
<td>.12*</td>
<td>.04*</td>
<td>.27*</td>
</tr>
<tr>
<td>2. Memory</td>
<td>1</td>
<td>.27*</td>
<td>-.26*</td>
<td>.15*</td>
<td>.13*</td>
<td>.22*</td>
<td></td>
</tr>
<tr>
<td>3. Education</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>-.04*</td>
<td>.16*</td>
<td>.10*</td>
<td>.31*</td>
</tr>
<tr>
<td>4. Age</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>-.15*</td>
<td>-.33*</td>
<td>-.02</td>
</tr>
<tr>
<td>5. Aging Satisfaction</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.30*</td>
<td>.49*</td>
</tr>
<tr>
<td>6. Aging Exp.</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.16*</td>
</tr>
<tr>
<td>7. Optimism</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
</tr>
</tbody>
</table>

* Significant at the $p < .001$ level.

performance, aging satisfaction ($r^2 = .01$) and aging expectations ($r^2 = .001$) had negligibly small practical effects, indicating that little variance was shared between these variables and vocabulary performance. Optimism ($r^2 = .07$) shared 7% of variance with vocabulary, indicating a more practically significant effect than the other attitudinal variables. Age also had a negligible effect size ($r^2 = .001$) when it came to vocabulary, whereas education ($r^2 = .19$) had a medium effect size (Cohen, 1988).

Regression model examining attitudinal variables as predictors of vocabulary performance. The first hypothesis for this study was that aging satisfaction and expectations, as well as general optimism, would be predictive of vocabulary performance. The ability of these variables to predict vocabulary was hypothesized to be true even when age and education were taken into account. This hypothesis was tested using multiple regression. Specifically, variables were entered in two steps into a hierarchical regression. The first step included the demographic variables that correlated with the outcome variable (i.e., education for vocabulary performance). The second step
included attitudinal variables with significant correlations with the outcome variable: aging satisfaction, aging expectations, and optimism.

Table 2 shows the hierarchical regression results for predictors of vocabulary performance. Step 1 (including education) significantly predicted vocabulary performance, $R = .44$, $F(1, 3629) = 848.06$, $p < .001$. Step 2 (including education and the attitudinal variables) also significantly predicted vocabulary, $R = .46$, $F(4, 3626) = 243.39$, $p < .001$. The increase in $R^2$, which increased from 0.19 in Step 1 to .21 in Step 2, was statistically significant, $F(3, 3626) = 34.10$, $p < .001$. Total variance explained by the model after the addition of Step 2 was 21.2%. However, the small amount of change in $R^2 (.02)$ did not suggest a meaningful change in the variance accounted for by the regression model with the addition of the attitudinal variables. Post hoc regression analyses, examining the effects of each individual demographic and attitudinal variable, supported this idea. In Step 1, education was a significant predictor of vocabulary performance, $p < .001$. With the addition of Step 2, education continued to be a significant predictor of vocabulary performance, $p < .001$, and optimism was found to be a significant predictor of vocabulary performance, $p < .001$. However, aging satisfaction and aging expectations were not significant predictors in this model, $ps = .37$ and .11 respectively.

**Hypothesis 2: Attitudinal variables as predictors of memory performance.** The second hypothesis for Study 1 was that the set of attitudinal variables of interest to this study (i.e., aging satisfaction, aging expectations, and optimism) would predict memory performance, when controlling statistically for education and age and their impacts on memory.
Table 2

Results of Hierarchical Regression Examining Predictors of Vocabulary Performance from Study 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>F</th>
<th>R²</th>
<th>( \beta )</th>
<th>S.E.</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocabulary</td>
<td>848.06</td>
<td>.19</td>
<td>&lt;.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>.31</td>
<td>.01</td>
<td>29.12 &lt;.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>.28</td>
<td>.01</td>
<td>25.04 &lt;.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aging Satisfaction</td>
<td>-.004</td>
<td>.004</td>
<td>-0.89 .37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aging Expectations</td>
<td>-.002</td>
<td>.001</td>
<td>-1.58 .11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimism</td>
<td>.03</td>
<td>.004</td>
<td>9.37 &lt;.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Bivariate correlations and relationships between predictor and outcome variables.** Prior to setting up the regression model to test the second hypothesis, relationships between variables were tested using bivariate correlations. The values of all correlations between cognitive, attitudinal, and demographic variables can be found in Table 1. Of importance to this hypothesis, aging satisfaction, aging expectations, and optimism all significantly correlated with memory performance, \( ps < .001 \). Education and age also significantly correlated with memory, \( ps < .001 \). Therefore, all variables had small (per guidelines set forth in Cohen, 1988) but statistically significant relationships. Those variables with statistically significant relationships were all included in the regression model.

Practical significance of these relationships was again examined by calculating \( r^2 \) values. Aging satisfaction \( (r^2 = .01) \), aging expectations \( (r^2 = .02) \), and optimism \( (r^2 = .05) \) had negligibly small practical effect sizes in their relationship with memory performance, indicating little shared variance between attitudinal variables and memory.
Education ($r^2 = .07$) and age ($r^2 = .07$) also shared a small amount of variance with memory, though these showed greater practical significance than the attitudinal variables.

Regression model examining attitudinal variables as predictors of memory performance. Table 3 shows the hierarchical regression results of predictors of memory performance to provide a basis of comparison for the hierarchical regression results looking at vocabulary performance. Step 1 (including age and education) significantly predicted memory performance, $R = .36$, $F(2, 3620) = 276.74, p < .001$. Step 2 (including age, education, and the attitudinal variables) was also statistically significant, $R = .39$, $F(5, 3625) = 130.30, p < .001$. The increase in $R^2$ from 0.13 in Step 1 to 0.15 in Step 2, was statistically significant, $F(3, 3625) = 28.47, p < .001$. Total variance explained by the model was 15%. However, the small amount of change in $R^2$ (.02) did not suggest a meaningful change in the variance accounted for by the regression model with the addition of the attitudinal variables. Post hoc regression analyses, examining the effects of each individual demographic and attitudinal variable, supported this idea. In Step 1, education and age were significant predictors of memory performance, $ps < .001$. With the addition of Step 2, age and education continued to be significant predictors of memory performance, $ps < .001$, and optimism was also found to be a significant predictor of memory performance, $p < .001$. However, aging satisfaction and aging expectations were not significant predictors in this model, $ps = .73$.

Discussion

Correlations run to determine whether possible predictors were related to the outcome variables showed that all attitudinal variables were significantly correlated with
Table 3

*Results of Hierarchical Regression Examining Predictors of Memory Performance from Study 1*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Step 1</th>
<th>Step 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Memory</td>
<td>276.74</td>
<td>130.30</td>
</tr>
<tr>
<td>Step 1</td>
<td>.13</td>
<td>.15</td>
</tr>
<tr>
<td>Age</td>
<td>-.07</td>
<td>-.07</td>
</tr>
<tr>
<td>Education</td>
<td>.17</td>
<td>.17</td>
</tr>
<tr>
<td>Aging Satisfaction</td>
<td>.001</td>
<td>.001</td>
</tr>
<tr>
<td>Aging Expectations</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>Optimism</td>
<td>.03</td>
<td>.03</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>β</th>
<th>β</th>
<th>S.E.</th>
<th>t</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory</td>
<td>-.07</td>
<td>-.07</td>
<td>-.1587</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td>16.66</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aging Satisfaction</td>
<td>.001</td>
<td>.001</td>
<td>.35</td>
<td>.73</td>
<td>.73</td>
</tr>
<tr>
<td>Aging Expectations</td>
<td>.000</td>
<td>.001</td>
<td>.35</td>
<td>.73</td>
<td>.73</td>
</tr>
<tr>
<td>Optimism</td>
<td></td>
<td></td>
<td>7.89</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

vocabulary performance, as was education. Age was not significantly correlated with vocabulary performance, but this finding was not surprising, as age differences in vocabulary performance found in the literature are typically lifespan findings indicating differences between older and young adults. Vocabulary is typically maintained in older adulthood, with the exception of adults over 80 (e.g., Singer et al., 2003). This non-significant correlation points to the maintenance of vocabulary knowledge in this subsample of older adults. Attitudinal variables, as well as education and age, were significantly correlated with memory. Given that the decline of memory with age has been more clearly documented (e.g., Taylor, Miller, Tinklenberg, 1992) than vocabulary (e.g., Singer et al., 2003), these results are not unexpected and reflect patterns found in past research.

Despite the significant correlations found, there was little support for the hypotheses of Study 1. Examination of the $R^2$ values in addition to beta coefficients for both models indicates that most of the variance in vocabulary performance was accounted
for by education. The regression model containing the age-related attitudinal variables and optimism along with education appeared to explain little more variance in vocabulary performance than the regression model containing education alone. Therefore, it does not appear that attitudinal variables contribute meaningfully to the prediction of vocabulary performance. Attitudinal variables were not significant individual predictors within the model, with the exception of optimism, which was a significant predictor. Optimism had the most practical significance in terms of the effect sizes as well, though its relationship with vocabulary performance was still small by Cohen’s (1988) standards. Though the small practical effect size of optimism is not enough for a definitive conclusion of the ability of optimism to predict vocabulary, it is enough to warrant follow-up in future studies. Overall, the first hypothesis, that attitudinal variables would predict vocabulary performance, was not supported.

Results of the regression model testing the second hypothesis also indicated that attitudinal variables did not contribute to the prediction of memory performance above and beyond education and age. The addition of the step containing attitudinal variables accounted for little more variance than the demographic variables alone. Again, optimism was the only significant attitudinal predictor in the model. Therefore, the second hypothesis, that attitudinal variables would predict memory performance, was also not supported. Past research has shown that explicitly naming tasks as memory tasks can impact the performance of older adults (e.g., Desrichard & Köpetz, 2005), as can making age group salient (e.g., Haslam et al., 2012). In the structure of the HRS, the memory measure would have been included as one of several general cognitive tasks performed, whereas the attitudinal measures were completed prior to the administration of
questionnaires from the core HRS modules in a questionnaire that was left behind for participants to complete. This distal presentation, with no particular manipulation making age or the relationship between age and memory salient prior to completion of the memory measure, may contribute to the discrepancy between the present results and past findings. In most attitudinal research, data are collected at one time point. The collection of 2010 HRS data includes a delay between collection of the cognitive data during the HRS interview and the completion of the attitudinal measures in the Leave Behind Questionnaire at the participants’ convenience following data collection for the core modules. Perhaps, in absence of any explicit salience of age group or age-related attitudes regarding cognition, there is not a powerful influence of age-related expectations.

In both hierarchical regression analyses, the addition of Step 2 (i.e., the attitudinal variables) was statistically significant. However, in both cases, Step 2 appeared to account for little more of the variance in either vocabulary performance or memory performance than Step 1 accounted for alone. This indicates that perhaps the statistical significance of Step 2 in both regression models was driven by the large sample size and should be interpreted with caution in terms of how meaningful the attitudinal variables were as predictors. Statistical significance of the correlations should be interpreted with similar caution. The large sample used in Study 1 appeared to contribute to the statistical significance of small correlations, which held little practical significance. Missing data may also have contributed to a bias in the subsample used in this analysis, as missing data analyses indicated that the data were not purely MCAR. This indicates a probable relationship between missing data and other unobserved variables. The Study 1 sample was a small portion of the overall HRS sample, primarily chosen based on participation
not only in data collection for the core HRS modules but also the Leave Behind Questionnaire, from which the attitudinal variables were drawn. This sample was overall not as nationally representative as the originally identified sample, and was primarily Caucasian, with minority groups under-represented. Sarkisian et al. (2006) identified differences in age-related expectations in different racial and ethnic groups. Perhaps losing this variability also resulted in reduced variability in optimism and aging satisfaction, which were overall high for the Study 1 sample. The restricted range may have limited the predictive power of these attitudinal variables. The lack of diversity of the sample should also be noted when considering the generalizability of Study 1 findings. Participants identifying as White were somewhat overrepresented in the Study 1 sample compared to the original 2010 HRS sample (85% in Study 1 versus 74% in the overall HRS sample). Similarly, those who identified as Non-Hispanic were somewhat overrepresented in the final sample (94% in Study 1 versus 87% in the overall HRS sample). A strength of the HRS dataset is its attention to maintaining a nationally representative sample, thereby making results more generalizable. The Study 1 sample, however, was drawn only from those participants who had completed all items, including the subset of HRS participants to whom the Leave Behind Questionnaire had been randomly assigned. The final sample of Study 1 was subsequently less diverse than the original HRS sample, with participants of racial and ethnic minorities represented in smaller percentages than in the original dataset. Of the research reviewed for Study 1, some reported diverse, nationally representative samples (e.g., Swift, Abrams, & Marques, 2013; Wurm & Benyamini, 2014), whereas others also had samples that were somehow demographically restricted (e.g., the sample of only Veterans in Levy et al.,
indicating that there are differences in the generalizability of the research results reviewed based on demographics. However, a number of studies reviewed did not include demographic information, so more thorough comparisons were not possible.

Finally, though none of the attitudinal measures from the HRS had less than acceptable reliability, these questionnaires differ from those measures often used in the literature to assess these attitudes in past research. For example, the aging expectations item available for Study 1 was only one item related to expected life span, which is not comprehensive, particularly when compared to other measures related to this construct (e.g., the 38-item measure used by Sarkisian et al., 2002). The aging satisfaction is frequently measured by the Attitude Toward Own Aging subscale of the Philadelphia Geriatric Center Morale Scale (Lawton, 1975), which is comprised of only 5 items. The HRS aging satisfaction items were based on this scale but include three more items, meaning that the aging satisfaction construct as measured in the HRS may differ slightly from the aging satisfaction work using the original (e.g., as used in Kleinspehn-Ammerlahn et al., 2008). In particular, the items that were added to the HRS measure are a direct query about aging satisfaction, loss of pleasurable activities, and the aging process bringing with it “many things that I do not like.” Finally, the optimism scale included in the HRS was based on the Life Orientation Test (Scheier & Carver, 1985; Scheier et al., 1994), a measure comprised of 6 optimism items and 4 filler items. Rather than filler items, the 10 items of the HRS measure all relate to optimism, asking about feasibility of reaching goals, hopelessness, and expectations of achieving desires in addition to the original Life Orientation Test items. The difference in the measures
included in the HRS for the attitudinal variables selected may account for the difference in results seen in Study 1 compared to prior research.

**Summary and future directions.** Overall, vocabulary and memory performance were not predicted by attitudinal variables, but future work might investigate these relationships in other contexts. The similarity of the results across both regression models supports the idea that vocabulary performance does not differ from memory performance in terms of its relationship to attitudinal variables, indicating that these two cognitive outcomes share similar patterns of relationships with the attitudinal variables selected for this study. Results of Study 1 indicate that, in the absence of an experimental manipulation making age-related attitudes salient, these attitudinal variables failed to predict vocabulary performance. They also failed to predict memory performance, even though memory has been found to be impacted by experimental manipulations regarding age-related attitudes (e.g., the experimental manipulations seen in Desrichard & Köpetz, 2005, or Rahhal et al., 2001). Performance on both memory and vocabulary tasks in this large dataset was not conclusively related to attitudinal variables, but it may be that these relationships become more pronounced in the presence of a related experimental manipulation. These results suggest a potential follow-up in terms of conducting such a manipulation with vocabulary performance as the outcome. This was the basis of Study 2, a quasi-experimental study examining effects of age-based stereotype threat on vocabulary performance.
CHAPTER III

STUDY 2

The purpose of Study 1 was to examine relationships between optimism, aging satisfaction and expectations, and vocabulary in data collected from older adults as a part of a large survey. A hierarchical regression showed that optimism was the only attitudinal variable to be a statistically, but not practically, significant predictor of vocabulary. Overall, it appeared that age-related attitudes and optimism did not relate to vocabulary performance in absence of any kind of experimental manipulation. The purpose of Study 2 was to test whether vocabulary scores could be impacted by an experimental manipulation related to aging attitudes. In this study, an age-based stereotype threat induction was employed to test its impact on vocabulary performance in both young and older adults. Stereotype threat relies not on one’s assessment of one’s self, but on the external pressure of the expectations of others. Therefore, in addition to the relationships between attitudes and cognition reviewed for the prior study, Study 2 necessitates a review of literature regarding stereotype threat.

Stereotype Threat

Stereotype threat has been defined as a situational pressure that individuals who are members of a particular group experience to conform to stereotypes about the group of which they are members (Steele, 1997; Steele & Aronson, 1995). In other words, being a member of a particular group that is not expected to perform well on a task can lead
individuals to underperform on that task when the related stereotype is made salient. Steele and Aronson (1995) describe stereotype threat as a “self-evaluative threat” (p. 797) that stems from the knowledge of stereotypes about one’s own group and the self-fulfilling prophecy that this knowledge and subsequent pressure to perform can create. Their research supports this idea: African American undergraduates who were told they were undergoing difficult intellectual testing, intended to diagnose strengths and weaknesses, performed more poorly than African American undergraduates performed on the same measure when it was described as non-diagnostic (Steele & Aronson, 1995). White students, for whom there was presumably no stereotype threat on this test of verbal ability, performed equally well whether the test was presented as diagnostic or not. The authors conclude that this threat, perhaps by interfering with processing due to the external pressure, can impact task performance for stereotyped groups.

Individuals who find themselves in a situation where a group stereotype is salient may in fact belong to more than one stereotyped group, and research has found that making one identity salient over the other can have differing results. For example, Asian-American women are subject to the negative stereotype that women tend to have poor quantitative skills. However, a more positive stereotype – that Asians have superior quantitative skills – can also be applied to this group. Shih, Pittinsky, and Ambady (1999) found that, for female Asian-American undergraduates, making their gender identity salient resulted in poorer performance on a math test compared to a control group, whereas making their ethnic identity salient resulted in better performance compared to the control group. This serves to illustrate that stereotype threat does seem to be
situational, as different stereotypes can be activated within the same group, and also that positive stereotypes may be as impactful as negative stereotypes.

Self-reported awareness of stigmas associated with an individual’s in-group has been shown to affect how one reacts to stereotype threat, with higher stigma consciousness typically associated with higher impact and ultimately worse outcomes (Brown & Pinel, 2003). Stigma consciousness moderates not only the stereotyped individual’s performance but can have an interpersonal impact. For example, women who were high in stigma consciousness were more likely to be critical of male partners who appeared sexist in an intergroup context, thus increasing the likelihood of those male partners to rate the women’s performance in a stereotypically negative light (Pinel, 2002). This demonstrates that stereotypes can impact both the individual’s performance and others’ perceptions of the individual.

On the opposite end of the spectrum, denial of a stereotype and the associated expectation of incompetence is another type of response to a stereotype threat (Von Hippel et al., 2005). Wei (2009) also found that allowing participants to self-affirm by stating positive values about themselves, or alternately to refute the stereotype in question, tended to lead to more likelihood of rejecting the stereotype. In this study, women who were given a stereotype manipulation in the form of a question (e.g., “Do you agree or disagree with the statement that ‘math is more for boys than for girls’?”) performed better than women who were not able to respond to this question in a self-affirming way, an effect not seen in men who participated. This increased performance in the face of the threat of a negative stereotype is referred to as reactance. Reactance resulting from self-affirmation or refutation of the stereotype can be protective in the face
of stereotype threat and has the potential to negate underperformance seen in stereotype threat situations. Reactance, however, may be situational and affected by how stereotype threat is induced. Kray, Thompson, and Galinsky (2001) found that, under most circumstances, gender stereotypes were affirmed in negotiation situations in dyads of one man and one woman, with men being the stronger negotiators in their results. However, when the manipulation involved an explicit tie of the characteristics of successful negotiators to gender roles, women were more successful in their negotiations, exhibiting reactance to the stereotype.

**Stereotype Threat in Older Adults**

Research has shown that making salient the common stereotypes of older adults having poor cognition, particularly memory, can impact their performance on cognitive measures. Lamont, Swift, and Abrams (2015), in a meta-analytic review of age-based stereotype threat, found that older adults can be impacted by stereotype threat in a number of different ways. Age-based stereotype threat effects were particularly strong after a social stereotype induction, which expresses the age-based stereotype as a common belief (e.g., “Many people believe that memory gets worse with age.”), compared to more fact-based stereotypes, which express the age-based stereotype as an empirical finding (e.g., “Past research has shown that memory gets worse with age.”). These social age-based stereotype threats, as opposed to fact-based stereotypes about age, showed an overall moderate effect size on a number of outcome measures, including memory, performance on a cognitive screen, physical ability, skill acquisition, and driving. Social comparison with young adult participants can lead older adults to perform more poorly; however, these effects can be partially attenuated by intergenerational
contact prior to an assessment situation involving social comparison, particularly when that contact is paired with the presentation of a positive stereotype, such as increased wisdom with age (Abrams, Eller, & Bryant, 2006; Swift, Abrams, & Marques, 2006). Finally, age-based stereotypes that are related to the particular realm of outcome being measured tend to impact performance more than an age-based stereotype based on a different realm. For example, physical stereotypes typically do not impact cognitive outcomes as strongly as cognitive stereotypes do (Lamont et al., 2015).

Stereotype threat can be induced by way of a more explicit prime (e.g., a fact-based prime stating a stereotype), but it can also be primed more implicitly (e.g., without the individual’s explicit awareness). Lamont et al. excluded the implicit stereotype prime from their meta-analysis, but acknowledge that this type of stereotype manipulation has also been shown to impact older adults’ behavioral outcomes (e.g., Hess, Hinson, & Statham, 2004). For the purposes of this paper, studies using both the explicit age-based stereotype threat and implicit negative age-based primes are reviewed. Though these types of studies may differ in terms of methodology and theoretical framework (i.e., work related to implicit primes are not typically explained in light of stereotype threat as the mechanism of action), both are relevant to Study 2 in terms of exploring how negative views and stereotypes of aging can affect outcomes in older adults.

It should be noted that some studies do fail to find a significant impact of age-based stereotype threat effects. Lamont et al. (2015) comment that there is particular bias in published literature, where unpublished studies were more likely to produce a small age-based stereotype effect size and were less likely to find statistical significance compared to the published works found in their literature search. Further, some published
research has found a lack of impact of stereotype threat. For example, Horton, Baker, Pearce, and Deakin (2010) found no impact of a fact-based stereotype threat manipulation on either cognitive outcomes (i.e., recall and reaction time) or physical outcomes (i.e., grip strength, flexibility, and walking speed). Horton et al. suggest that some older adults may be immune to age-based stereotype threat. Their older adult participants, who had on average 14 years of education, did not show stereotype threat effects on recall, suggesting that education may help to offset stereotype threat effects in older adults. Similarly, Andreoletti and Lachman (2004) found that, when education was dichotomized (as less than 16 years or 16 years and over), education was a significant predictor variable, and those in the higher education category showed more resilience in the face of stereotype threat. However, some studies with education levels comparable to the sample of Horton et al. have found effects of stereotype threat (e.g., Barber & Mather, 2013; Kang & Chasteen, 2009). Hess et al. (2009) actually found lower recall performance after stereotype threat in older adults with higher education and proposed that perhaps education is a proxy variable for importance of cognitive skills, meaning that those with higher education might be more susceptible to stereotype threat manipulations regarding cognitive abilities. Lamont et al. also suggest that level of education may have an impact on age-based stereotype threat, though none of the studies in their meta-analysis showed this specifically. Education may not be enough to explain all of the variation in reactions to stereotype threat, and the particular impact of higher education is unclear, but it appears to be a relevant variable to take into consideration.

**Specific outcomes impacted by age-based stereotype.** A review of the literature shows that a common outcome measure in stereotype threat research with older adults is
memory performance, which is perhaps unsurprising when considering that people are typically aware of an expected age-related decline in memory (Cherry et al., 2014). Studies typically find that induction of a negative age-based stereotype threat results in poorer memory performance among older adult participants (e.g., Chasteen, Bhattacharyya, Horhota, Tam, & Hasher, 2005; Hess, Auman, Colcombe, & Rahhal, 2003), a finding that holds when the processes of encoding (i.e., the processing of information for storage in memory) and retrieval (i.e., the recall of information stored in memory) are examined as two separate variables (Krendl, Ambady, & Kensinger, 2015).

In addition to performance on memory tasks, stereotype threat resulted in older adults’ poorer performance on a simulated driving task (Joanisse, Gagnon, & Voloaca, 2013). Stereotype threat based on negative age stereotypes also increased feelings of loneliness and dependency in older adults (Coudin & Alexopoulos, 2010).

Related stereotype prime research has found that older adults exposed subliminally to positively valenced words relating to age and cognition (e.g., sage) performed better on the Mini-Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) than those who were exposed to negatively valenced words related to age and cognition (e.g., dementia; Levy & Leifheit-Limson, 2009). Levy, Ashman, and Dror (2000) similarly found that a subliminal prime presenting either positive or negative words related to aging impacted participants’ willingness to accept hypothetical medical interventions, such that those in the negatively valenced condition reported less willingness to engage in life-prolonging medical treatment than those in the positively valenced condition. This indicates that, even when not explicitly presented as a stereotype threat, negative views of aging can impact outcomes, perhaps related to the different
mechanisms of action of negative age stereotypes proposed by Bennett and Gaines (2010). No stereotype threat or stereotype prime studies using language or vocabulary tasks as outcome measures were found during this review of the literature, so the impact of age-based stereotype threat on such a task is a novel question in this area of research.

**Mechanisms of Age-Based Stereotype Threat**

Evidence shows that those affected by stereotype threat perform poorly on a variety of tasks, including cognitive tasks (Steele, Spencer, & Aronson, 2002). One mechanism used to explain stereotype threat in any age group is that being faced with a stereotype requires emotion regulation, thereby depleting the cognitive resources that the individual has to devote to task performance (e.g., Johns, Inzlicht, & Schmader, 2008). This executive control framework has been used to explain poorer performance after stereotype threat induction and has been supported by research that shows that young adult participants with high baseline working memory abilities, who by definition should have more cognitive resources and thus be better able to withstand a reduction in executive control, do tend to perform better after a stereotype threat induction than those with low baseline working memory abilities (Régner et al., 2010).

This executive control hypothesis has received somewhat mixed support in stereotype threat research with older adult participants. For example, Popham and Hess (2013) suggest that emotion regulation may be a moderating factor in the individual’s response to stereotype threat. They included a measure of emotion regulation (the Emotion Regulation Questionnaire; Gross & John, 2003) in their stereotype threat research and found an interaction where low scores on emotion regulation were related to worse performance in young adults exposed to stereotype threat (in this case relating to
the expected performance of students of different majors, rather than age groups) versus those in the control condition. However, older adult participants’ performance did not change across levels of emotion regulation, suggesting that perhaps another mechanism is responsible for reactions to stereotype threat in older adults. Being exposed to stereotype threat has been found to undermine older adults’ working memory performance in some prior studies (e.g., Mazerolle, Régner, Morisset, Rigalleau, & Huguet, 2012) but not in others (e.g., Hess, Hinson, & Hodges, 2009), showing variable results in terms of stereotype threat on an executive functioning outcome. Overall, there is some evidence that executive control relates to response to stereotype threat. However, evidence for executive control is inconsistent, and other authors have hypothesized an alternative mechanism for stereotype threat effects, in particular related to age differences in stereotype threat effects.

Barber and Mather (2013) tested the idea of executive control interference against an alternate hypothesis based on the regulatory-fit hypothesis (Grimm, Markman, Maddox, & Baldwin, 2009; Seibt & Forester, 2004). According to this hypothesis, people’s performance will differ based on whether they are more sensitive to the presence of gains (i.e., a promotion focus) or to the presence of losses (i.e., a prevention focus). People should perform better when a task’s reward structure is aligned with this dispositional tendency (e.g., when emphasizing gains for someone who is promotion-focused). This tendency is considered a trait, but a particular state can be manipulated experimentally, influencing a promotion-focused person to pay more attention to loss prevention and vice versa. Stereotype threat was proposed to be one such manipulation. According to the regulatory fit hypothesis, people would be vigilant about poor
performance under stereotype threat and thus would be better aligned with a reward structure that emphasized loss and loss prevention (e.g., being punished for forgotten items). Thus, a regulatory-fit account would predict not a main effect of stereotype threat, but an interaction between stereotype threat and reward structure. Barber and Mather found this interaction when looking at the effects of stereotype threat on memory: Older adult participants who were not exposed to stereotype threat performed similarly despite reward structure, whereas those in the threat condition performed better than those in the control condition when punished for forgetting items but worse than those in the control condition when rewarded for remembering items.

Overall, Barber and Mather (2013) concluded that there are age differences in the mechanisms of stereotype threat effects, with regulatory fit, rather than the executive control interference, being a better underlying mechanism to explain stereotype threat effects in older adults. Though it may be costly for young adults to regulate their emotions in the face of stereotype threat, leading to effects on performance (as suggested by the executive control interference account), older adults appear to need fewer cognitive resources to regulate emotions and thus have a different mechanism (i.e., prevention focus) underlying their reactions to stereotype threat. Popham and Hess’s (2013) results on emotion regulation, described earlier, also support the idea that there are two mechanisms operating differentially across young and older adults. However, more research is needed to support the idea that stereotype threat acts through a different mechanism in older adults versus young adults.

**Moderators of age-based stereotype threat.** Some important moderators of and factors influencing stereotype threat effects have been identified in older adult
participants. Hess and Hinson (2006) found that older adults’ beliefs about aging could be affected by a stereotype threat manipulation. Degree of change in beliefs about age moderated performance on a memory measure after exposure to an age-based stereotype threat manipulation, such that older adults with a higher level of self-reported belief in age-based stereotypes performed more poorly on the memory task than older adults with a lower level of belief in age-based stereotypes following a stereotype threat manipulation. In other words, beliefs about memory controllability and general aging concerns decreased from before to after a stereotype threat manipulation, and that change in memory and aging concerns predicted a change in memory performance more than exposure to the stereotype threat manipulation alone. Higher levels of education have been found to lead to less belief in age-related stereotypes (e.g., Andreoletti & Lachman, 2004), indicating that there is a potential for education to play a part in participants’ beliefs about and reactions to stereotype threat.

Kang and Chasteen (2009) found that age-group identification also played a role in response to stereotypes, such that age-based stereotypes had less impact on those who did not identify with the age group that was the subject of the stereotype. In their study, older adult participants’ performance on a free recall task was lower as a function of strong affiliation with an age-group identity (i.e., affiliation with other older adults) after a stereotype threat manipulation compared to the control group. Stronger age-group identification also resulted in a marginal increase in negative affect, but this was an interaction, such that these results held only in the control condition and were not seen in the stereotype threat condition. This suggests that, to some degree, identity can moderate response to stereotype threat, and the age-based stereotype threat must be aligned with
one’s age-group identity for stereotype threat effects to occur. Stigma consciousness is an
important factor in reaction to age-based stereotypes as well, such that older adults with
higher awareness of age-related stigma tended to perform more poorly after a stereotype
threat induction (Hess, Hinson, & Hodges, 2009).

**Culture as a factor in age-based stereotype threat.** Stereotype threat studies are
frequently conducted in the United States and rely on the stereotypes about aging and
older adults commonly held in Western culture (e.g., Kite et al., 2005). It stands to
reason, then, that other cultures may have different ideas and stereotypes about aging that
might change the nature of stereotype threat in older adults from that culture. Levy and
Langer (1994) compared young and older adults from American mainstream culture to
young and older adults from both American deaf and Chinese cultures. The latter two
were chosen because they were seen as similarly separate from American mainstream
culture and as having more positive views of aging than American mainstream culture
tends to have. When asked to fill out the Facts on Aging Quiz (Palmore, 1980) and to
identify their own thoughts and descriptions of aging, American deaf and Chinese
participants of both age groups tended to generate more positive views of aging. After
completing these activities, young adults from all three cultures performed similarly on a
series of memory tasks. However, older adults from American mainstream culture
performed more poorly on the memory tasks than older adults from the other two
cultures. The authors conclude that negative age-based stereotypes, commonly held in the
United States, may act as a self-fulfilling prophecy, contributing to observed age-related
cognitive changes in memory. However, a more recent study comparing the attitudes of
young and older adults from both American and Chinese cultures presents a more
complicated picture. No differences were found between American and Chinese descriptions of aging, suggesting that both cultures hold both negative and positive views of aging (Boduroglu, Yoon, Luo, & Park, 2006). From this literature, one can conclude that while culture may play a part in forming age-based stereotypes, these attitudes can be complex and consist of both negatively and positively valenced views. It is possible that, regardless of culture, negative views of aging are related to response to age-based stereotype threat. Past research has found ageism across cultures, suggesting that stereotypes about older adults are pervasive (Cuddy, Norton, & Fiske, 2005), and supporting the conclusion that age-based stereotypes are complex but common.

The Present Study

Stereotype threat literature shows the phenomenon to be a complex one, with many different individual variables to consider. Age-based stereotype threat, as a specific category of stereotype threat, has been found to have an impact on cognitive variables across a number of studies. Specifically, it led to lower memory performance in older adult participants (e.g., Chasteen et al., 2005). Performance on language tasks has not been examined in this area of work, and therefore it is not known whether age-based stereotype threat may similarly influence performance on a vocabulary measure. Whereas the intent of Study 1 was to examine the potential relationship between aging attitudes and performance on a vocabulary measure, the intent of Study 2 was to investigate whether this relationship could be manipulated experimentally. Older adults typically perform well on vocabulary measures and are confident in their performance (e.g., Kavé & Halamish, 2015). Given that they tend to be confident in their performance on this type of test, a negative impact on performance in this domain following age-based stereotype
threat would illustrate how powerful this effect can be; conversely, a lack of impact would illustrate how resilient older adults’ vocabulary performance is to stereotype threat. Therefore, Study 2 manipulated exposure to age-based stereotype threat in both young and older adult participants to compare effects on a production-type vocabulary measure. The intent was to examine age differences in response to age-based stereotypes. The expectation, based on the literature reviewed, was that an age-based stereotype in a cognitive domain would lead to stereotype threat, evidenced by decreased performance, on a cognitive outcome. Furthermore, it was expected that older adults would be more vulnerable to stereotype threat following an age-based manipulation.

Vocabulary was selected as the outcome measure because much past research has focused on memory, a cognitive ability about which people tend to have previously held beliefs (e.g., Cherry et al., 2014). Vocabulary is a novel outcome measure in stereotype threat research. Another advantage of this outcome measure is that, given that there is not a pervasive age-based stereotype regarding vocabulary performance identified in the literature reviewed, participants would not necessarily identify a fabricated stereotype stating that older adults should perform worse on vocabulary. This is an important point, because presenting a stereotype that is clearly false might lead to reactance or perhaps simply no effect of the stereotype manipulation on performance. As reviewed, older adults do not typically perform worse than young adults on vocabulary measures (e.g., Verhaeghen, 2003), but there is no well-documented stereotype concerning vocabulary in different age groups. Therefore, an age-based stereotype threat impact on vocabulary would illustrate the power of such stereotypes to influence performance on a measure that does not normally decline with age. Participants were exposed to a fabricated age-based
stereotype threat that favors either their age group or the other age group; in other words, they were told that their age group is said to perform better or worse than the other age group being studied on the measure prior to examining their performance on the outcome measure, a vocabulary production measure.

**Hypotheses for Study 2.** There were three hypotheses for Study 2. The first two related to testing the effects of stereotype threat on vocabulary performance, whereas the third related to testing the effects on participants’ confidence in their vocabulary performance. These hypotheses are as follows:

*Hypothesis 1: Effects of age and stereotype threat on vocabulary performance.*

The first hypothesis for this study put forth predictions for the effects of the variables of age group and stereotype threat condition on vocabulary performance. Two main effects and one interaction effect were predicted.

*Hypothesis 1A.* It was predicted that older adults would perform better on a vocabulary task overall than young adults, as found in previous studies (e.g., Kavé & Mashal, 2012; Kavé & Yafé, 2014).

*Hypothesis 1B.* It was predicted that the performance of participants in both age groups would be lower in the condition in which they were subjected to age-based stereotype threat compared to the non-threat condition.

*Hypothesis 1C.* It was predicted that there would be an interaction of age group and threat condition variables, given the susceptibility of older adults to age-based stereotype threats regarding cognition. It was hypothesized that young adults would perform better in the non-threat condition than in the stereotype threat condition. It was hypothesized that older adults would also perform better in the non-threat condition than
in the stereotype threat condition, but that the difference in older adults’ performance across threat condition levels would be even larger than that of the young adults’ performance across threat condition levels, showing greater vulnerability to the effects of stereotype threat in the older adult group.

**Hypothesis 2: Covariates related to the effects of age and stereotype threat.** A second hypothesis, based on the literature reviewed, was that education, emotion regulation, and optimism would be significant covariates in the analysis of age group and threat condition on vocabulary performance. Education was included based on its relationship to vocabulary (e.g., Alwin & McCammon, 2001), a relationship that was supported by Study 1. Emotion regulation was included based on its relationship to age-based stereotype threat (e.g., Popham & Hess, 2013). Optimism was included based on its relationship to vocabulary performance in Study 1, in which it was the only attitudinal variable to have a practically significant relationship with vocabulary performance. It was hypothesized that these variables would be significant covariates such that controlling for them statistically would strengthen the age group and stereotype threat effects predicted in Hypothesis 1.

**Hypothesis 2A.** It was predicted that older adults would perform better on a vocabulary task overall than young adults, a relationship strengthened by controlling for the covariates of education and optimism.

**Hypothesis 2B.** It was predicted that the performance of participants of both age groups would be lower overall in the condition in which they were subjected to age-based stereotype threat compared to the non-threat condition, a relationship strengthened by controlling for the covariates of emotion regulation and optimism.


**Hypothesis 2C.** It was predicted that there would be an interaction of age group and threat condition variables. It was hypothesized that young adults would perform better in the non-threat condition than in the stereotype threat condition. It was hypothesized that older adults would also perform better in the non-threat condition than in the stereotype threat condition, but that the difference in older adults’ performance across threat condition levels would be even larger than that of the young adults’ performance across threat condition levels, showing greater vulnerability to the effects of stereotype threat in the older adult group. This relationship was predicted to be strengthened by controlling for the covariates of education, emotion regulation, and optimism.

**Hypothesis 3: Effects of age and stereotype threat on confidence in vocabulary performance.** The final hypothesis of this study was that there would be effects of age group and threat condition on confidence ratings regarding vocabulary performance, in addition to the actual vocabulary performance discussed in the above hypotheses.

**Hypothesis 3A.** It was predicted that older adults would be more confident in their vocabulary performance overall than young adults, as found in previous studies (e.g., Kavé & Halamish, 2015).

**Hypothesis 3B.** It was predicted that the confidence ratings of participants of both age groups would be lower overall in the condition in which they were subjected to age-based stereotype threat compared to the non-threat condition.

**Hypothesis 3C.** It was that there would be an interaction of age group and threat condition on vocabulary confidence. It was hypothesized that young adults would be more confident in the non-threat condition than in the stereotype threat condition. It was
hypothesized that older adults would also be more confident in the non-threat condition than in the stereotype threat condition, but that the difference in older adults’ confidence across threat condition levels would be even larger than that of the young adults’ confidence across threat condition levels, showing greater vulnerability to the effects of stereotype threat in the older adult group. This hypothesis reflects the prediction that older adults are particularly vulnerable to age-based stereotype threat, such that it would affect perception of performance as well as actual performance on the vocabulary task.

Method

Participants. Seventy-one young adults (18 – 32 years old) participated in this study in exchange for course credit. Young adult participants were undergraduates at the University of Colorado Colorado Springs (UCCS) and were recruited through an online recruiting system. One participant was excluded because English was not his first language and this may have affected his vocabulary performance regardless of experimental condition. Another participant was excluded due to prior knowledge of the purpose of the study. Therefore, the total sample of young adults was 69, with 34 randomly assigned to the condition in which young adults were said to do better on vocabulary (in this group, the non-threat condition) and 35 assigned to the condition in which older adults were said to do better on vocabulary (the stereotype threat condition; see the Materials section for further information on this manipulation). The age of the final sample of young adults ranged from 18 to 32 years, with a mean of 22.04 (SD = 4.09). Forty (58%) of the young adult participants were women and 29 (42%) were men. The majority (67%) identified as White. Nine participants (13%) identified as Hispanic, four (6%) identified as Black/African American, five (7%) identified as Asian, one (1%)
identified as Native American or Native Alaskan, and four (6%) identified as Other. Years of education for this group ranged from 12 to 17, with a mean of 13.88 years ($SD = 1.31$).

Seventy-four older adults (60 – 85 years old) participated in this study and were offered $10 in compensation. These participants were community-dwelling older adults, recruited from a registry maintained by UCCS. One older adult was excluded for not completing the vocabulary task as instructed, supplying associations for the words in the task rather than defining them. Therefore, the total sample of older adults was 73, with 38 assigned to the condition in which young adults were said to do better on vocabulary (in this group, the stereotype threat condition) and 35 assigned to the condition in which older adults were said to do better on vocabulary (the non-threat condition). The age of the final sample of older adults ranged from 60 to 85 years, with a mean of 72.15 ($SD = 6.16$). Forty-eight (66%) of the older adult participants were women and 25 (34%) were men. The majority (93%) identified as White. Two participants (3%) identified as Hispanic, one (1.3%) identified as Black/African American, one (1.3%) identified as Native American or Native Alaskan, and one (1.3%) identified as Other. Years of education for this group ranged from 12 to 24, with a mean of 16.47 years ($SD = 2.77$); older adults’ mean years of education was significantly higher than for the young adults, $t(140) = 7.06, p < .001$.

The percentage of participants of each gender did not differ significantly between age groups, $\chi^2 (1, N = 142) = 0.91, p = .34$. There were 40 young women, 48 older women, 29 young men and 25 older men. The percentage of participants of each gender did not differ significantly between levels of threat condition, $\chi^2 (1, N = 142) = 1.26, p =$
.26. There were 46 women in the non-threat condition and 42 women in the stereotype threat condition. There were 23 men in the non-threat condition and 31 men in the stereotype threat condition. Therefore, it did not appear that the distribution of men and women across levels of the predictor variables was a factor in interpretation of the results of Study 2. Gender also did not interact significantly with age group or threat condition in any analyses of participant characteristics, other variables of interest, or the main outcomes for hypothesis testing, $ps \leq .05$, and so is not considered in the main presentation of these analyses. Full information and results of these analyses are presented in the Appendix. Also, older adult participants, when divided into young-old (60 to 74 years of age) and old-old (75 years of age and older) groups, did not differ on any of the variables of interest with the exception of the second aging expectations item, $p = .002$. Older adults are therefore treated as a single age group for the analyses presented in Study 2. Full information and results of these analyses can also be found in the Appendix.

**Materials.** Participants were asked to complete packets containing materials described below in the order they were presented.

**Optimism questionnaire.** In order to include optimism as a potential covariate, the questionnaire regarding optimism that was included in the HRS database (Smith et al., 2013) was recreated for this study. Using items from the HRS allowed for follow-up discussion of the same constructs analyzed in Study 1. See the description of this questionnaire in Study 1 for further information about the items. For the present study, this measure showed acceptable internal consistency, $\alpha = .73$ per the guidelines suggested by George and Mallery (2003). When looking only at young adult participants, this
measure still showed acceptable internal consistency, $\alpha = .71$, but when looking at older adult participants, the measure showed questionable internal consistency, $\alpha = .65$.

**Emotion Regulation Questionnaire (ERQ).** The ERQ (Gross & John, 2003), a 10-item scale assessing the tendency to regulate emotions, is a 7-point Likert-type scale. Popham and Hess (2013) found the two subscales of the ERQ, one measuring reappraisal of emotions as a regulation strategy and the other measuring suppression of emotions as a regulation strategy, to have good internal consistency ($\alpha$s = .77 and .81, respectively), whereas Gross and John (2003) reported overall good internal consistency of the scale ($\alpha = .72$). The total of all scores is taken (ranging from 10 to 70), with higher scores indicating more emotion regulation; subscales can be used to indicate the particular strategy of emotion regulation that a person appears to favor, but typically a full score is calculated to indicate overall level of emotion regulation. Though information on emotion regulation was not available for analysis in Study 1, this variable was measured in Study 2 as a potential covariate in terms of reaction to the stereotype threat manipulation. For this study, this measure showed acceptable internal consistency, $\alpha = .74$. When looking only at young adult participants, this measure still showed acceptable internal consistency, $\alpha = .71$, as was true when looking at only older adult participants, $\alpha = .77$.

**Age-based stereotype threat manipulation.** The experimental manipulation for this study described a fabricated socially held age-based stereotype for either young or older adults, with the intention of inducing age-based stereotype threat effects in the older adult participants. The manipulation, modeled after a stereotype threat manipulation employed by Abrams, Eller, and Bryant (2006), was introduced as a paragraph to be read prior to completing the vocabulary measure, which explained the purpose of the study as
an examination of age differences in vocabulary performance. One version stated that it was widely assumed that young adults perform better on vocabulary measures, and older adults were expected to perform worse. The other version reversed this, stating that it was widely assumed that older adults perform better on vocabulary measures, and young adults were expected to perform worse. Participants in each age group were randomly assigned to a stereotype threat condition in which they were exposed to either an age-based stereotype threat favoring young adults (i.e., young adults are thought to perform better than older adults) or one favoring older adults (i.e., older adults are thought to perform better than young adults). In other words, participants were in a condition that either favored their age group (a non-threat condition) or did not (a stereotype threat condition). This manipulation was polarized and included no neutral control. This was by design, in order to examine the responses of both older and young adults in a stereotype threat condition that specifically addressed their age group.

**Vocabulary measure.** The 5-item vocabulary measure from the HRS, examined in Study 1, was expanded in Study 2 to include more items, and thus have more potential for variability. This was a concern in Study 2, which had far fewer participants than the larger dataset used in Study 1 and would therefore have less power to detect small effects. To better detect any possible influence of the stereotype threat manipulation, Study 2 adopted a longer vocabulary measure with a higher level of difficulty. These items were taken from the Wechsler Adult Intelligence Scale – 4th edition (WAIS-IV; Wechsler, 2008). The easiest seven items were eliminated (e.g., apple), including some items presented in picture form, leaving 23 words for which participants were asked to provide definitions. The original scoring protocol from the WAIS-IV was used: participants
earned either 2 points (full credit), 1 point (partial credit), or 0 points (no credit) for each answer they produced, according to the scoring criteria provided in the WAIS-IV manual (Wechsler, 2008). Scoring from the WAIS-IV manual still provided a useable framework by which to score the vocabulary items. For this study, vocabulary items were scored by two independent raters, each using the 0 to 2 scoring protocol from the original WAIS-IV Vocabulary test for the relevant 23 items. Therefore, 46 total points were possible on this vocabulary measure, with higher scores indicating greater vocabulary knowledge.

Note that the written presentation in the present research differed from the original WAIS-IV Vocabulary protocol, an orally presented version of these vocabulary items (i.e., an examiner read the word, and the examinee responded aloud with his or her definition). Though the current measure was not the original method of presentation for this WAIS-IV subscale, the vocabulary test was standardized across this set of participants. The two raters agreed on 99.7% of ratings. Nonetheless, disagreements in scoring individual items were discussed and an agreement reached, so that each participant had a single score for each item. For this study, this measure showed good internal consistency, \( \alpha = .86 \). When looking only at young adult participants, this measure still showed good internal consistency, \( \alpha = .82 \), as was true when looking at only older adult participants, \( \alpha = .85 \).

**Age satisfaction and expectations questionnaires.** In addition to optimism, questions examined in Study 1 concerning satisfaction and expectations regarding aging were included in this study as another potential covariate. Again, the questionnaire from the HRS (Smith et al., 2013) was used to measure aging satisfaction. See the description of this questionnaire in Study 1 for further information about the items. For this study,
aging satisfaction questionnaire measure was found to have good internal consistency, $\alpha = 0.81$. When looking only at young adult participants, this measure showed acceptable internal consistency, $\alpha = .75$, though it had good internal consistency when looking at only older adult participants, $\alpha = .84$.

The aging expectation item from the 2010 wave of the HRS was utilized in Study 2. Participants were asked to rate the percent likelihood, on a continuous scale ranging from 0% to 100%, that they would be alive in the next 15 years. Target age varied by participant, as the question specified that the participant add 15 years onto their current age. This item was developed for inclusion in the HRS (Steffick, 2000). An additional item regarding aging expectations, this one taken from the 2012 wave of the HRS, was also used in Study 2. The second item, under the assumption that the participant is still alive 15 years in the future, asks “What are the chances that you will be free of serious problems in thinking, reasoning, or remembering things that would interfere with your ability to manage your own affairs?” This item is also responded to on a continuous scale ranging from 0% to 100%. This item was included given its relationship to cognition and the cognitive nature of Study 2. These two items were both included as measures of aging expectations, but were analyzed separately.

**Age-group identification scale (AIS).** The AIS, taken from Garstka, Schmitt, Branscombe, and Hummert (2004), consists of 5 items measured on a Likert-type scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with scores ranging from 5 to 35. After an introduction that instructs participants as to which age category they belong (young adult, middle-aged adult, or older adults, based on chronological age ranges), participants are asked to respond to five items assessing affiliation with that particular
age group (e.g., “I have a clear sense of my age group identity and what it means to me.”). Garstka et al. found that this measure was internally consistent with both young adult (α = .80) and older adult (α = .82) participants. Kang and Chasteen (2009) found an overall high internal consistency of α = .97 for these items this scale. Scoring consisted of calculating a mean age-identification score, with higher scores indicating greater age group identification. This measure was included to assess age identification as a potential covariate. For the present study, this measure was found to have good internal consistency, α = .85. When looking only at young adult participants, this measure still showed good internal consistency, α = .84, as when looking at only older adult participants, α = .87.

**Questionnaire regarding the experiment.** As the manipulation on this study is based on social expectations and personal reactions to these expectations, a short questionnaire provided as the last portion of the study assessed participants’ reactions to the study, thoughts on the true nature of the study prior to debriefing, and their reactions to the stereotype threat manipulation. This questionnaire included a manipulation check item asking participants, “Which age group was expected to perform better on vocabulary?” This item was intended as a manipulation check to determine whether participants maintained awareness of the stereotype threat manipulation after completing measures for all other variables. In other words, regardless of age group or threat condition, a participant should indicate that older adults were expected to do better on vocabulary if that was the information presented to them earlier in the study as part of the stereotype threat manipulation. This item was included under the assumption that if a participant had “learned” the age-related expectation for vocabulary and could accurately
reproduce it at the end of the study, then this indicated that they were aware of the information and that it could therefore have impacted their performance. Another item in this questionnaire was a self-rating of how well participants felt they did on the vocabulary measure, ranging from *very poorly* to *very well*. Anchors provided were in increments of 10, ranging from 0 to 100, providing a percentage of confidence in vocabulary performance. This item was included as the dependent variable for the third hypothesis in Study 2, which was that age and stereotype threat condition would impact confidence in performance on the vocabulary measure.

**Demographic questionnaire.** Participants were asked to complete a demographics questionnaire to obtain sample characteristics, including age, gender, racial/ethnic group, and level of education. This information was used to provide descriptive information about the sample.

**Procedure.** This study was introduced to participants as an investigation of emotions and cognition. Two different researchers conducted the study; one was the author, and the other was an undergraduate research assistant trained in the protocol through observation. The undergraduate research assistant ran fewer overall participants but interacted with a similar number of older (*n* = 9) and young (*n* = 6) participants. Given the relatively small number of participants run by the undergraduate research assistant, comparisons by experimenter were not completed, as the difference in sample sizes between experimenters would not have been ideal for meaningful comparison. Both experimenters were older than the traditional college-aged student but younger than the older adult group. After consenting to participate in research, participants were given a packet of the previously described materials to complete at their own pace. Materials
were presented in the order in which they were described above. The packets were identical across the two stereotype threat conditions, except for the threat inductions presented at the beginning of the vocabulary measure.

Participants were randomly assigned to stereotype threat condition, and the experimenter was blind to condition. Young and older participants were tested in same-age groups of up to eight participants. Group sizes ranged from one to eight, with the modal being groups of three participants. Participants from only one age group at a time were tested to avoid potential stereotype threat from the presence of participants belonging to a different age group. This type of cross-generational exposure has been used as an age-based stereotype threat on its own in past research (e.g., Kang & Chasteen, 2009). However, the researcher remained in the room while participants completed the packets to answer questions and discourage discussion of the study among participants. After finishing the packet, participants were debriefed and compensated. The study typically took between 25 and 45 minutes total.

Following participation, vocabulary performance was scored by two independent raters using the protocol described in the Materials section. Both raters were blind to condition; one was blind to age group, though the other was not, as this experimenter was also responsible for assigning participant identification numbers to the packets after they were completed and identification numbers were assigned based on age group for tracking purposes.

**Results**

**Participant characteristics and other variables of interest.** Basic descriptive statistics for participant characteristics measures can be found in Table 4. Several
Table 4

*Descriptive Statistics for Study 2 Measures*

<table>
<thead>
<tr>
<th>Measure</th>
<th>M (SD)</th>
<th>Cronbach’s α</th>
<th>Possible Range</th>
<th>Obtained Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimism Scale (from the HRS)</td>
<td>53.63 (7.29)</td>
<td>.73</td>
<td>12 – 72</td>
<td>36 – 67</td>
</tr>
<tr>
<td>Emotion Regulation Questionnaire (ERQ)</td>
<td>46.83 (8.92)</td>
<td>.74</td>
<td>7 - 70</td>
<td>25 – 70</td>
</tr>
<tr>
<td>Vocabulary Measure (adapted from WAIS-IV)</td>
<td>31.18 (8.36)</td>
<td>.86</td>
<td>0 – 46</td>
<td>6 – 46</td>
</tr>
<tr>
<td>Aging Satisfaction Scale (from the HRS)</td>
<td>32.94 (7.99)</td>
<td>.81</td>
<td>8 – 48</td>
<td>14 – 48</td>
</tr>
<tr>
<td>Aging Expectations Item #1</td>
<td>44.65 (31.07)</td>
<td>N/A</td>
<td>0 – 100</td>
<td>0 – 100</td>
</tr>
<tr>
<td>Aging Expectations Item #2</td>
<td>57.01 (32.93)</td>
<td>N/A</td>
<td>0 – 100</td>
<td>0 – 100</td>
</tr>
<tr>
<td>Age-group Identification Scale (AIS)</td>
<td>5.09 (1.33)</td>
<td>.85</td>
<td>1.40 – 7.00</td>
<td>1.00 – 7.00</td>
</tr>
</tbody>
</table>

Analyses of variance (ANOVAs) were conducted to determine whether or not participants significantly differed across age group or stereotype threat condition on measured variables other than the dependent variables. Significant effects are reported briefly here; the full analyses, as well as means and standard deviations, can be found in the Appendix.

*Measures occurring prior to the stereotype threat manipulation.* Optimism and emotion regulation, potential covariates identified in Hypothesis 2, could not have been impacted by stereotype threat, as they were presented prior to the stereotype threat manipulation. However, analyses of these variables helped to ensure that random assignment of participants was successful and resulted in similar groups across conditions. There was a main effect of age on optimism scores, with older adults scoring higher than young adults on the measure, $p < .001$. The main effect of threat condition was not significant, $p = .88$, but there was a significant interaction, $p = .02$. Post hoc comparisons showed that older adults in the non-threat condition scored significantly
higher than young adults in the non-threat condition, \( p < .001 \), an age difference that was not found in the stereotype threat condition, \( p = .15 \). There were no significant effects found on emotion regulation, \( ps > .17 \).

**Measures occurring after the stereotype threat manipulation.** Age identification, aging satisfaction, and the two aging expectations items were presented after the stereotype threat manipulation, so it is possible that stereotype threat manipulation impacted these outcomes. Analyses also helped to identify any age differences on these measures. There were no main effects of age group, \( p = .79 \), or threat condition, \( p = .49 \), on aging satisfaction. There was a significant interaction of age group and threat condition on aging satisfaction, \( p = .04 \), though post hoc tests showed no significant differences between young and older adults across threat condition or between non-threat and stereotype threat condition across age groups (\( ps > .10 \)). There were no significant effects of age group or threat condition on age identification, \( ps > .30 \).

There was a significant main effect of age on the first aging expectations item, regarding the likelihood of being alive 15 years in the future. Older adults rated themselves as less likely to be alive in the future than young adults did, \( p < .001 \). There was no main effect of threat condition, \( p = .72 \), nor was there a significant interaction on this item, \( p = .63 \). For the second aging expectations item, regarding the likelihood of being free of cognitive problems 15 years in the future, there was no main effect of age, \( p = .41 \), or of threat condition, \( p = .10 \). However, there was a significant interaction, \( p = .05 \). Post hoc tests showed that older adults in the stereotype threat condition rated themselves as more likely to have cognitive problems 15 years in the future than young adults in the stereotype threat condition, \( p = .05 \), an age difference that was not present.
between older and young adults in the non-threat condition, $p = .43$. Young adults in the stereotype threat condition rated themselves as more likely to experience cognitive problems in 15 years than young adults in the non-threat condition, $p = .01$, but older adults did not differ across threat conditions, $p = .83$.

**Manipulation check.** Participants responded to an item at the end of the study regarding which age group was expected to perform better in vocabulary. This manipulation check item was analyzed in two different ways. First, open-ended answers were coded into three general categories: (1) the participant thought young adults were expected to do better on vocabulary; (2) the participant thought older adults were expected to do better on vocabulary; or (3) the participant had some answer other than these two possibilities, often indicating that they thought middle aged adults would do the best (e.g., “Probably around 30-40”) or indicating that they did not know or did not understand the question (e.g., “? – Expected by whom?”). Overall, regardless of age group or threat condition, 29 participants (20%) expected young adults to do better on vocabulary, 64 (45%) expected older adults to do better on vocabulary, and 49 (35%) had some answer other than the young or older adult age groups. The general trend, then, was for participants to assume that older adults would do better on the vocabulary measure, with a large proportion (over 1/3 of participants) indicating an age group that was not addressed in the stereotype threat manipulation or otherwise demonstrating an answer outside of one of the two indicated age groups in the stereotype threat manipulation.

In the case of this manipulation check, however, the more useful knowledge is not who participants believed would have the best vocabulary, but whether or not their responses corresponded with the information they had been given as a part of the
stereotype threat manipulation earlier in the study. Therefore, an additional dummy coded variable was created based on whether answers provided to this item were “right” (i.e., consistent with the version of the stereotype threat manipulation that participant had been exposed to) or “wrong” (i.e., inconsistent with the version of the stereotype threat manipulation that participant had been exposed to). All answers in the third category, indicating something other than either young or older adults, were coded as “wrong” for the purposes of this analysis, as they appeared to indicate that the participant either did not recall or attend to the information given in the stereotype threat manipulation or misunderstood the manipulation check item. In terms of this evaluation of accuracy, 83 participants (59%) were wrong in their identification of the age group expected to do better, and 59 (41%) were correct in their identification of the age group expected to do better. Two 2 x 2 x 2 ANOVAs (age group x threat condition x manipulation check accuracy) were run to assess interaction of manipulation check accuracy (coded as accurate vs. not accurate) with age group and threat condition. The two dependent variables for these analyses were vocabulary performance and vocabulary confidence. These analyses indicated that accuracy on this item did not interact significantly with age group or threat condition to affect either outcome variable, as all two-way and three-way interactions including accuracy were non-significant, $p > .41$.

Further analysis sought to examine the distribution of this accuracy rating between the age groups and levels of threat condition to determine whether participants were differentially accurate about age group expectations for vocabulary performance in different conditions. This was done with a logistic regression analysis, given that the outcome variable was categorical (consistent or inconsistent with stereotype threat
manipulation information). A hierarchical logistic regression examined the ability of the variables of age group, threat condition, and the age group participants were told would do worse (separate from threat condition, as stating that older adults would do worse would be the threat condition to older adults but not to young) to predict whether participants were accurate in their age expectations for vocabulary performance. The predictors were dummy coded, and the outcome was dichotomous (consistent or inconsistent with stereotype threat manipulation information). The first step contained only the predictor variables for the Study 2 hypotheses (age group and threat condition), while the second step added age group said to do worse as another predictor to the model.

A chi-square indicated that the second step of the regression, the model containing all three predictors, was also a good fit for the data, $\chi^2 (2, N = 142) = 6.88, p = .03$. However, the model as a whole accounted for only 4% (Cox & Snell R-Square) to 6% (Nagelkerke R-Square) of the variance in accuracy in age-related expectations for vocabulary performance and correctly classified 56% of cases. For reference, the model including only the constant as the predictor correctly classified 59% of cases. In the first step of the logistic regression model, age group did not predict accuracy of age expectations for vocabulary performance, $\beta = -.27, SE = .35, p = .46$. Threat condition did predict accuracy of age expectations for vocabulary performance, $\beta = -.86, SE = .35, p = .01$.

A chi-square indicated that the second step of the regression, the model containing all three predictors, was also a good fit for the data, $\chi^2 (3, N = 142) = 14.44, p = .03$. In this case, the model as a whole accounted for 9% (Cox & Snell R-Square) to 13% (Nagelkerke R-Square) of the variance in accuracy in age-related expectations for
vocabulary performance and correctly classified 63% of cases. In this step of the logistic regression model, age group still did not predict accuracy of age expectations for vocabulary performance, $\beta = -.34$, $SE = .36$, $p = .35$. Threat condition did predict accuracy of age expectations for vocabulary performance, $\beta = -.92$, $SE = .36$, $p = .01$. Age group said to do more poorly on vocabulary also predicted accuracy on the manipulation item, $\beta = .98$, $SE = .36$, $p = .007$.

The odds ratio of 0.40 indicates that going from the non-threat condition (dummy coded as 0) to the stereotype threat condition (dummy coded as 1) increases one’s accuracy, but the size of the odds ratio indicates very little practical change between threat conditions in terms of accuracy. The odds ratio for threat condition is indeed smaller than the odd ratio of 0.71 for the non-significant predictor of age. However, the odds ratio of 2.66 indicates that being told older adults would do better at vocabulary (dummy coded as 1) led to participants being 2.66 times more likely to be accurate on this item than being told that young adults would do better (dummy coded at 0). Overall, it appears that threat condition can significantly predict the accuracy of participant responses in terms of consistency with the information they were presented in their stereotype threat manipulation, but the distinction between stereotype threat condition and non-threat condition is not a strong one. The age group participants were told would do better on vocabulary had a stronger relationship with accuracy on the manipulation check than the age group of the participant or stereotype threat condition to which the participant had been assigned.

**Hypothesis Testing for Study 2.** There were three hypotheses for Study 2, regarding vocabulary performance and confidence in vocabulary performance, and
related covariates. Table 5 shows all means and standard deviations for vocabulary performance and vocabulary confidence. Described below are the hypotheses, their components, and the results of the relevant analyses.

Table 5

Means of Vocabulary Score and Vocabulary Confidence Ratings for Older and Young Adult Participants from Study 2

<table>
<thead>
<tr>
<th></th>
<th>Age Group</th>
<th>Vocabulary Score</th>
<th>Vocabulary Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Older Adults</td>
<td>M (SD)</td>
<td>Young Adults</td>
</tr>
<tr>
<td></td>
<td>Stereotype Threat</td>
<td>M (SD)</td>
<td>Total</td>
</tr>
</tbody>
</table>

Hypothesis 1: Effects of Age and Stereotype Threat on Vocabulary

Performance. The first hypothesis for this study included predictions about the effects of age group and threat condition on vocabulary performance. A 2 x 2 (age group x threat condition) ANOVA provided tests of the main effect of age group (Hypothesis 1A), the main effect of threat condition (Hypothesis 1B), and the interaction of age group and threat condition (Hypothesis 1C). Post hoc tests (pairwise comparisons using a Bonferroni correction in SPSS to adjust for multiple comparisons, $\alpha = .05$) were run to further examine significant omnibus values.

Hypothesis 1A. It was predicted that older adults would perform better on a vocabulary task overall than young adults did. Results of the ANOVA showed that there
was a significant main effect of age on vocabulary score, $F(1, 138) = 37.32, p < .001, \eta^2_p = .21$. Older adults ($M = 34.87, SD = 7.31$) had higher vocabulary scores than young adults ($M = 27.27, SD = 7.61$).

**Hypothesis 1B.** It was predicted that the performance of participants of both age groups would be lower overall in the condition in which they were subjected to age-based stereotype threat compared to the non-threat condition. Results of the ANOVA showed that there was a significant main effect of threat condition, $F(1, 138) = 4.43, p = .04, \eta^2_p = .03$, but not the predicted effect. Those in the non-threat condition ($M = 29.79, SD = 8.39$) had lower vocabulary scores than those in the stereotype threat condition ($M = 32.49, SD = 8.16$).

**Hypothesis 1C.** It was predicted that there would be an interaction of age group and threat condition variables, such that older adults’ performance would be lower in the stereotype threat condition than the non-threat condition to an even greater degree than young adults’ performance would be lower in the stereotype threat condition relative to the non-threat condition. There was not a significant interaction of age and threat condition on vocabulary score, $F(1, 138) = 0.29, p = .59, \eta^2_p = .002$.

**Hypothesis 2: Covariates Related to the Interaction of Age and Stereotype Threat.**

**Threat.** A second hypothesis, based on the literature reviewed, was that education, emotion regulation, and optimism would be significant covariates in the analysis of age group and threat condition on vocabulary performance and that controlling for them statistically would strengthen the age group and stereotype threat effects predicted in Hypothesis 1. A 2 x 2 (age group x threat condition) analysis of covariance (ANCOVA) provided tests of the main effect of age group (Hypothesis 1A), the main effect of threat
condition (Hypothesis 1B), and the interaction of age group and threat condition (Hypothesis 1C), while controlling for the proposed covariates. Post hoc tests (pairwise comparisons using a Bonferroni correction) were run to further examine significant omnibus values.

**Bivariate correlations and relationships between covariates and the dependent variable.** Good covariates are variables that correlate significantly with the dependent variable of interest but not with each other (Tabachnick & Fidell, 2013). Correlations between the relevant Study 2 variables are all displayed in Table 6. (Note that correlations specific to older and young adult participants are displayed in Tables 7 and 8 respectively). Relevant to this analysis, education was significantly correlated with vocabulary, \( r = .45, p < .001 \), as was optimism, \( r = .19, p < .05 \). However, emotion regulation was not, \( r = -.14, p > .05 \). Therefore, education and optimism were included as covariates for this analysis, but emotion regulation was not. Education and optimism were also significantly correlated with each other, \( r = .31, p < .01 \). It is not ideal for covariates in an ANCOVA analysis to share too much variance (e.g., \( r \geq .50 \)), but in this case, the relationship of education and optimism did not exceed that threshold (Tabachnick & Fidell, 2013), and so these variables were considered appropriate covariates. Results of the ANCOVA showed that education was a significant covariate, \( F(1, 135) = 11.66, p = .001, \eta^2_p = .08 \). However, optimism was not, \( F(1, 135) = 0.04, p = .83, \eta^2_p < .001 \). Results for each of the components of Hypothesis 2 were as follows:

**Hypothesis 2A.** It was predicted that older adults would perform better on a vocabulary task overall than young adults did, a relationship strengthened by controlling for the covariates of education and optimism. When controlling for the covariates, there
### Table 6

**Correlations between Demographic Variables, Attitudinal Variables, Vocabulary Score, and Vocabulary Confidence Ratings for Full Study 2 Sample**

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Vocab. Score</td>
<td>1</td>
<td>.53*</td>
<td>.45*</td>
<td>-.02</td>
<td>.14</td>
<td>-.03</td>
<td>-.12</td>
<td>.19*</td>
<td>-.14</td>
</tr>
<tr>
<td>2. Vocab. Conf.</td>
<td>--</td>
<td>1</td>
<td>.37*</td>
<td>.21*</td>
<td>.21*</td>
<td>.23*</td>
<td>.10</td>
<td>.34*</td>
<td>-.08</td>
</tr>
<tr>
<td>3. Education</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.06</td>
<td>.26*</td>
<td>-.09</td>
<td>.07</td>
<td>.31*</td>
<td>-.08</td>
</tr>
<tr>
<td>4. Aging Sat.</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>-.03</td>
<td>.33*</td>
<td>.44*</td>
<td>.50*</td>
<td>.11</td>
</tr>
<tr>
<td>5. Aging Exp. 1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.14</td>
<td>.15</td>
<td>.13</td>
<td>-.02</td>
</tr>
<tr>
<td>6. Aging Exp. 2</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.24*</td>
<td>.19*</td>
<td>.01</td>
</tr>
<tr>
<td>7. Age Ident.</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.22*</td>
<td>.17*</td>
</tr>
<tr>
<td>8. Optimism</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.02</td>
</tr>
<tr>
<td>9. Emotion Reg.</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
</tr>
</tbody>
</table>


### Table 7

**Correlations between Demographic Variables, Attitudinal Variables, Vocabulary Score, and Vocabulary Confidence Ratings for Older Adults in Study 2**

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Vocab. Score</td>
<td>1</td>
<td>.23</td>
<td>.38*</td>
<td>-.06</td>
<td>-.07</td>
<td>-.10</td>
<td>-.21</td>
<td>.11</td>
<td>-.02</td>
</tr>
<tr>
<td>2. Vocab. Conf.</td>
<td>--</td>
<td>1</td>
<td>.11</td>
<td>.27*</td>
<td>.00</td>
<td>.34*</td>
<td>.17</td>
<td>.20</td>
<td>.04</td>
</tr>
<tr>
<td>3. Education</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.02</td>
<td>.10</td>
<td>-.18</td>
<td>.02</td>
<td>.17</td>
<td>-.05</td>
</tr>
<tr>
<td>4. Aging Sat.</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>-.02</td>
<td>.39*</td>
<td>.51*</td>
<td>.51*</td>
<td>.06</td>
</tr>
<tr>
<td>5. Aging Exp. 1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.19</td>
<td>.13</td>
<td>.03</td>
<td>.09</td>
</tr>
<tr>
<td>6. Aging Exp. 2</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.17</td>
<td>.19*</td>
<td>.02</td>
</tr>
<tr>
<td>7. Age Ident.</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.20</td>
<td>.15</td>
</tr>
<tr>
<td>8. Optimism</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.01</td>
</tr>
<tr>
<td>9. Emotion Reg.</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 8

Correlations between Demographic Variables, Attitudinal Variables, Vocabulary Score, and Vocabulary Confidence Ratings for Young Adults in Study 2

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Vocab. Score</td>
<td>1</td>
<td>.50*</td>
<td>.14</td>
<td>.02</td>
<td>-.11</td>
<td>.08</td>
<td>-.15</td>
<td>-.02</td>
<td>-.20</td>
</tr>
<tr>
<td>2. Vocab. Conf.</td>
<td>--</td>
<td>1</td>
<td>.20</td>
<td>.22</td>
<td>-.10</td>
<td>.30*</td>
<td>-.03</td>
<td>.23</td>
<td>-.07</td>
</tr>
<tr>
<td>3. Education</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.16</td>
<td>-.16</td>
<td>.15</td>
<td>.06</td>
<td>.19</td>
<td>.02</td>
</tr>
<tr>
<td>4. Aging Sat.</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>-.08</td>
<td>.30*</td>
<td>.36*</td>
<td>.54*</td>
<td>.19</td>
</tr>
<tr>
<td>5. Aging Exp. 1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.21</td>
<td>.12</td>
<td>-.10</td>
<td>-.04</td>
<td></td>
</tr>
<tr>
<td>6. Aging Exp. 2</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.32*</td>
<td>.26*</td>
<td>.03</td>
<td></td>
</tr>
<tr>
<td>7. Age Ident.</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.20</td>
<td>.22</td>
<td></td>
</tr>
<tr>
<td>8. Optimism</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td>9. Emotion Reg.</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>


was a main effect of age on vocabulary score, $F(1, 135) = 12.52, p = .001, \eta^2_p = .09$.

Older adults ($M = 34.92, SD = 7.35$) had higher vocabulary scores than young adults ($M = 27.27, SD = 7.61$).

**Hypothesis 2B.** It was predicted that the performance of all participants would be lower overall in the condition in which they were subjected to age-based stereotype threat compared to the non-threat condition, a relationship strengthened by controlling for the covariates of emotion regulation and optimism. Emotion regulation was not found to be a suitable covariate and so was not added to the model. When controlling for optimism and education, there was a significant main effect of threat condition on vocabulary score, $F(1, 135) = 4.29, p = .04, \eta^2_p = .03$. Contrary to prediction, those in the non-threat condition ($M = 29.77, SD = 8.45$) had lower vocabulary scores than those in the stereotype threat condition ($M = 32.49, SD = 8.16$).
Hypothesis 2C. It was predicted that there would be an interaction of age group and threat condition variables, such that older adults’ performance would decrease in the stereotype threat condition to an even greater degree than young adults’ performance would decrease in the stereotype threat condition, a relationship predicted to be strengthened by controlling for the covariates of education, emotion regulation, and optimism. There was no significant interaction of age and threat condition on vocabulary score, \( F(1, 135) = 0.52, p = .47, \eta^2_p = .004 \).

Hypothesis 3: Effects of Age and Stereotype Threat on Confidence in Vocabulary Performance. The third hypothesis for this study included predictions about the effects of age group and threat condition on confidence in vocabulary performance. A 2 x 2 (age group x threat condition) ANOVA provided tests of the main effect of age group (Hypothesis 3A), the main effect of threat condition (Hypothesis 3B), and the interaction of age group and threat condition (Hypothesis 3C). Post hoc tests (pairwise comparisons using a Bonferroni correction) were run to further examine significant omnibus values.

Hypothesis 3A. It was predicted that older adults would be more confident in their vocabulary performance overall than young adults were. Results of the ANOVA showed that there was a main effect of age on vocabulary confidence, \( F(1, 137) = 57.22, p < .001, \eta^2_p = .30 \). Older adults (\( M = 87.43, SD = 14.61 \)) had higher confidence in their vocabulary performance than young adults (\( M = 66.67, SD = 18.60 \)).

Hypothesis 3B. It was predicted that the confidence ratings would be lower overall for participants of both age groups in the condition in which they were subjected to age-based stereotype threat compared to participants in the non-threat condition.
Results of the ANOVA showed that there was a marginally significant main effect of threat condition, $F(1, 137) = 3.47, p = .07, \eta^2_p = .03$. Contrary to the predicted effect, those in the non-threat condition ($M = 74.64, SD = 21.53$) tended to indicate lower confidence in their vocabulary performance than those in the stereotype threat condition ($M = 79.79, SD = 17.37$).

*Hypothesis 3C.* It was predicted that older adults would be again differentially impacted, showing more of a difference in confidence between the stereotype threat condition and the non-threat condition than young adults’ difference between threat conditions. Results of the ANOVA showed that there was a significant interaction of age and threat condition on vocabulary confidence, $F(1, 137) = 4.26, p = .04, \eta^2_p = .03$. Older adults in the stereotype threat condition ($M = 87.16, SD = 15.39$) did not differ in vocabulary confidence from older adults in the non-threat condition ($M = 87.71, SD = 13.95$), $p = .89$, whereas young adults in the stereotype threat condition ($M = 72.00, SD = 16.05$) had higher confidence in their vocabulary performance than those in the non-threat condition ($M = 61.18, SD = 19.66$), $p = .01$. In both the non-threat and stereotype threat conditions, older adults rated themselves as significantly more confident than young, $ps < .001$. Older adults did not differ between threat conditions, though young adults did, indicating that the main effect of threat condition (Hypothesis 3B) was driven largely by young adult participants.

*Covariates related to confidence in vocabulary performance.* Though not a specific hypothesis of this study, education and the attitudinal variables were assessed as potential covariates for the analysis of vocabulary confidence. See Table 6 for all correlations. Vocabulary confidence was significantly associated with more variables
than the more objective vocabulary score. Education and optimism were significantly correlated with vocabulary confidence, $p < .001$, as they were with vocabulary, $p < .02$. Aging satisfaction, and the two aging expectation items were also significantly associated with vocabulary performance, $p = .01$, but these measures were presented after the stereotype threat manipulation and were not ideal covariates. Therefore, education and optimism were once again the only covariates. A $2 \times 2$ (age group x threat condition) ANCOVA showed that education was not a significant covariate, $F(1, 134) = 1.95, p = .17$, $\eta^2 = .01$, but optimism was, $F(1, 134) = 3.84, p = .05$, $\eta^2 = .03$.

Hypothesis 3A with covariates. It was predicted that older adults would be more confident in their vocabulary performance overall than young adults were. Results of the ANCOVA showed that there was a main effect of age on vocabulary confidence, $F(1, 134) = 24.91, p < .001$, $\eta^2 = .16$. Older adults ($M = 87.43, SD = 14.61$) had higher confidence in their vocabulary performance than young adults ($M = 66.67, SD = 18.60$).

Hypothesis 3B with covariates. It was predicted that the confidence ratings of all participants would be lower overall in the condition in which they were subjected to age-based stereotype threat compared to the non-threat condition. Results of the ANCOVA showed that there was a marginally significant main effect of threat condition, $F(1, 134) = 3.59, p = .06$, $\eta^2 = .03$. Those in the non-threat condition ($M = 74.64, SD = 21.53$) tended to indicate lower confidence in their vocabulary performance than those in the stereotype threat condition ($M = 79.79, SD = 17.37$).

Hypothesis 3C with covariates. It was predicted that older adults would be again differentially impacted, showing even lower rates of confidence in the stereotype threat condition than young adults. Results of the ANCOVA showed that there was no
significant interaction of age and threat condition on vocabulary confidence, $F(1, 134) = 2.79, p = .10, \eta^2_p = .02$.

**Analyses based on accurate response to manipulation check.** A large number of participants did not accurately endorse the information presented in the stereotype threat manipulation by the end of the study. This suggests that either they did not attend to the information or perhaps, if they did, they did not believe it or otherwise did not utilize the information from the manipulation to accurately respond to the manipulation check item. Overall, as attention to the manipulation was important to lead to effects of threat condition on subsequent outcome measures, the low accuracy on the manipulation check item suggests that participants were not impacted by the manipulation. The analyses for the tests of Hypotheses 1 and 3 were repeated with only those participants who did accurately respond to the manipulation check item to see if the patterns of results among these participants differed significantly from those who did accurately not identify the information later in the study. The number of older adults who accurately identified age-related expectations for vocabulary did not differ from the number of young adults who were accurate, $\chi^2 (1, N = 142) = 0.63, p = .43$. The number of those in the stereotype threat condition who accurately identified age-related expectations for vocabulary was significantly higher than the number of those in the non-threat condition who were accurate, $\chi^2 (1, N = 142) = 6.24, p = .01$. It should be noted that there were relatively equal numbers of young adults who were accurate in their manipulation check response (16 in the stereotype threat condition and 15 in the non-threat condition). However, there were 21 older adults in the non-threat condition and only 7 in the stereotype threat condition who accurately recalled the information from the stereotype threat
manipulation. Given the small and unequal numbers in these cells, subsequent analyses should be interpreted with caution.

In the analysis of vocabulary performance, there was a main effect of age, $F(1, 55) = 11.64, p = .001, \eta^2_p = .18$. Older adults ($M = 35.41, SD = 6.16$) performed significantly better on vocabulary than young adults ($M = 28.97, SD = 8.16$). There was no main effect of threat condition, $F(1, 55) = 2.14, p = .15, \eta^2_p = .04$. Those in the stereotype threat condition ($M = 32.74, SD = 6.16$) did not significantly differ on the vocabulary task from those in the non-threat condition ($M = 32.57, SD = 8.72$). There was no significant interaction of age group and threat condition, $F(1, 55) = 0.32, p = .58, \eta^2_p = .006$. Older adults did not differ between the stereotype threat condition ($M = 36.76, SD = 4.76$) and the non-threat condition ($M = 34.95, SD = 6.60$), $p = .56$, nor did young adults differ between the stereotype threat condition ($M = 30.97, SD = 6.58$) and the non-threat condition ($M = 26.83, SD = 9.31$), $p = .12$.

In the analysis of confidence in vocabulary performance, there was a main effect of age, $F(1, 55) = 7.84, p = .007, \eta^2_p = .13$. Older adults ($M = 86.43, SD = 15.69$) were more confident in their vocabulary than young adults ($M = 71.29, SD = 14.77$). There was no main effect of threat condition, $F(1, 55) = 1.22, p = .27, \eta^2_p = .02$. Those in the stereotype threat condition ($M = 74.35, SD = 17.54$) did not differ from those in the non-threat condition ($M = 81.11, SD = 16.17$). There was a significant interaction of age group and threat condition, $F(1, 55) = 5.42, p = .02, \eta^2_p = .09$. Older adults were significantly less confident in the stereotype threat condition ($M = 75.71, SD = 15.69$) than in the non-threat condition ($M = 90.00, SD = 8.37$), $p = .03$, but young adults did not differ in confidence between the stereotype threat condition ($M = 73.75, SD = 13.10$) and
the non-threat condition ($M = 68.67, SD = 16.42$), $p = .34$. Young and older adults in the stereotype threat condition did differ significantly, $p < .001$, but not in the non-threat threat condition, $p = .77$.

**Discussion**

Overall, there was mixed support for the hypotheses of this study, which was weakened by the issue regarding accurate report of the stereotype threat manipulation. The first hypothesis, regarding age group and threat condition effects on vocabulary performance, was partially supported. Older adults did perform better overall than young adults, an outcome that was both statistically and practically significant, with a large effect size measure per the guidelines set forth by Cohen (1988), replicating previous findings (e.g., Kavé & Mashal, 2012; Kavé & Yafé, 2014). However, contrary to the hypothesized result, those in the stereotype threat condition actually performed better on vocabulary overall than those in the non-threat condition. This outcome was statistically significant, though had a small effect size measure. The results of the testing of Hypothesis 1B suggest that, if stereotype threat has any impact on vocabulary performance, it may actually lead to reactance, wherein the group in the threat category reacted to the stereotype and performed better than the group not exposed to the respective age-related stereotype threat. This result was not expected based on the literature reviewed, as older adults did not typically show reactance in the face of age-based stereotype threat in the research reviewed (e.g., Chasteen et al., 2005, Hess et al., 2003). The effects of an age-based stereotype manipulation were less clear for young adults. However, based on the reactance research (e.g., Wei, 2009), reactance would not be expected in this case, given that neither young nor older participants were given a
chance to respond to the age-based stereotype threat or to self-affirm following the stereotype threat manipulation. It should be noted that only the main effect of age was present in the analysis including only participants who accurately recalled the stereotype threat manipulation information at the end of the study. In this analysis, the stereotype threat effect and interaction were not statistically or practically significant.

The lack of a significant interaction indicates that both young and older adults’ performance on vocabulary may have benefitted from the presentation of the age-related stereotype regarding their age group, with no differential effects on the two age groups. Were reactance the explanation for these results, however, it is unclear why participants, older adults in particular, would be reactant in the face of this stereotype threat manipulation when they have not shown reactance in other studies involving stereotype threat (e.g., Chasteen et al., 2005; Hess & Hinson, 2006). It has been noted that the mechanisms behind stereotype threat effects on memory in older adults are not well understood (Hess & Hinson, 2006), and that is even more true of vocabulary, since it is a novel outcome in this type of research. Another possibility to be considered, based on the analyses of data related to the manipulation check in particular, is that this manipulation simply did not impact participants as intended or at all.

The second hypothesis was that education, emotion regulation, and optimism would be significant covariates and that controlling for these covariates statistically would strengthen the predicted effects of Hypothesis 1. Though the results did not support Hypothesis 1, it was still relevant to test Hypothesis 2 to see if the addition of covariates strengthened the relationships found. As in the first ANOVA, older adults did better than young adults on vocabulary performance. However, this effect was actually
smaller in the ANCOVA, as evidenced by a drop in the effect size from .21 (or 21% of the variance accounted for, a large effect size) in the ANOVA result for Hypothesis 1A to .09 (or 9% of the variance accounted for, also a large effect size) in the ANCOVA result for Hypothesis 2A. This does not support the hypothesis. Furthermore, this change in effect size appears to indicate that some of the significant difference in vocabulary is due to education, a variable that was significantly higher for older adults than young. However, the significance of the ANCOVA interaction, even when statistically controlling for education, indicates that there is a significant age difference above and beyond the effect of education. Controlling for the covariates of education and optimism did not appear to change the strength of the main effect of threat condition or the interaction of age group and threat condition from the analyses of Hypothesis 1, indicating that these covariates did not affect the relationships established in Hypothesis 1. Overall, the results for Hypothesis 2 were similar to the results for Hypothesis 1. The same unexpected main effect of threat condition, also with a small effect size, and lack of a statistically or practically significant interaction of age group and threat condition were observed in this analysis, though this finding is also qualified by low participant accuracy in terms of identifying the stereotype threat manipulation.

One finding of note from the analysis of covariates was the significant correlation between education and optimism. Strong correlations are not ideal for covariates in an ANCOVA (Tabachnick & Fidell, 2013). Though a correlation of .31 is only a moderate correlation per the guideline suggested by Cohen (1988), the finding indicated that these variables shared some variance. This may help explain why only education was a significant covariate in the ANCOVA analysis, even though optimism was also
significantly correlated with vocabulary performance. Though beyond the scope of this research, there may be some relationship between education, optimism, and vocabulary score (e.g., perhaps education influences both optimism and vocabulary score, or perhaps there is some sort of mediating relationship present) that might be explored in future research. Another notable finding from the Hypothesis 2 analyses was that emotion regulation was not a significant covariate and was dropped from subsequent analyses.

The third hypothesis, regarding the effects of age group and threat condition on confidence ratings regarding vocabulary performance, was again partially supported. Older adults did rate themselves as being more confident overall in their vocabulary than young adults, and this result was practically significant, with a large effect size. Education was not a significant covariate related to confidence in vocabulary performance, and the addition of optimism as a covariate did not change this pattern. Those in the stereotype threat condition rated themselves as more confident than those in the non-threat condition, which did not support the component of the hypothesis related to this main effect. Though this effect was marginally significant and had a small effect size, it was the same pattern seen in the analysis of main effects for the more objective vocabulary performance scores, and perhaps demonstrated another instance of reactance to the stereotype threat manipulation. The significant interaction showed that this main effect appears to be driven by young adult participants. Older adults did not differ in their confidence ratings across threat conditions, whereas young adults had higher confidence ratings in the stereotype threat condition than in the non-threat condition. This interaction was statistically significant but had low practical significance, as the effect size was small.
A major concern in the interpretation of the results of Study 2 were the findings related to the manipulation check. An item included in a questionnaire regarding the experiment near the end of the study asked participants to state which age group was expected to do better on vocabulary. The majority of participants (59%) were inaccurate in reporting information about which age group should do better on vocabulary based on the manipulation presented earlier in the study. Though this manipulation check item was included on a page of items related to the present study in which they were participating, the item itself did not explicitly refer back to the information presented in the stereotype threat manipulation paragraph. It was therefore somewhat difficult to interpret what the pattern of inaccuracy indicates about participant responses. Participants may not have recalled the information presented in the paragraph, or may not have attended to it. However, inaccuracy may also indicate a failure of the information to establish or to contradict previously held beliefs about vocabulary performance (not measured in this study) or perhaps even other reasons for inaccuracy, such as misunderstanding the question (e.g., including an age group outside of the scope of this study, such as middle-aged adults). Due to this difficulty in interpretation, definitive conclusions about the inaccuracy of the majority of participants could not be made, though the analysis of accuracy in response to this question did indicate that people were more accurate in response to the manipulation check item when they had been previously told that older adults would do better. Follow-up analyses of the main hypothesis testing of Study 2 were done to explore the patterns of response of those participants who did accurately respond to the manipulation check item (and therefore had higher likelihood of being impacted by the stereotype threat manipulation).
The pattern of results in terms of confidence in vocabulary performance differed in an analysis using only those participants who accurately recalled information from the stereotype threat manipulation at the end of the study. In this analysis, there was still a main effect of age, with older adults overall being more confident in their vocabulary performance. However, there was a significant interaction wherein older adults were significantly less confident in the stereotype threat condition while young adults did not differ between threat conditions. Older adults in the stereotype threat condition in fact had confidence scores comparable to the young adults, whereas those in the non-threat condition were significantly more confident than young adults in the non-threat condition. These results, then, support the hypothesis, though they are based on small and unequal cell sizes.

Lamont et al. (2015) suggest several elements that have made stereotype threat manipulations more effective in past research. One is group-specificity of the stereotype threat, meaning that the group referred to in the stereotype threat manipulation must be one with which participants identify in order for them to be impacted by stereotype threat effects. Older and young adults both had high ratings of age group identity (comparable to means from the original study; see Garstka et al., 2004), indicating that they did identify with the groups named in the stereotype threat manipulation used in Study 2. Lack of group-specificity, then, is not thought to be a factor in the lack of effectiveness of this manipulation. The stereotype threat manipulation was also directly related to the cognitive domain in question, another variable that Lamont et al. note can affect outcomes in stereotype threat studies, so this should not have impacted the results of Study 2.
Another issue discussed in Lamont et al. (2015) regarding stereotype threat manipulations was that manipulations relying on presented facts (e.g., “Research has shown that older adults perform more poorly on memory tests.”) were not as effective as stereotype-based manipulations relying on presented opinions (e.g., “It is widely believed that older adults do not perform as well on memory tests.”). Although the present study used a stereotype-based manipulation, it may be that the effectiveness of a stereotype-based manipulation is based on its ability to impact participants’ beliefs about their performance (e.g., Hess & Hinson, 2006). Perhaps participants came in with no prior opinions about vocabulary performance, as it is not as widely discussed as memory as an ability impacted by aging, and older adults are aware of changes in memory but do not typically report changes in vocabulary (Diehl & Wahl, 2009). It may be that this manipulation did not succeed in persuading participants of either age group that they should be worried about their performance in this area of cognitive functioning, which does not appear in the literature to be as salient to older adults as memory functioning. If anything, the analysis of predictors of accuracy in response to the manipulation check item indicates that accuracy was higher among participants of both age group who were told that older adults should do better on the vocabulary task, which may be evidence for preexisting beliefs that favor older adults in terms of vocabulary. Hess et al. (2003) also found stereotype threat effects to be greater in older adults who placed higher value on their memory abilities than on older adults who placed relatively lower value on their memory abilities. Because value of vocabulary as a cognitive skill (either in general or for performance on this task in particular) was not assessed, the impact of this variable cannot be further explored. Participants of both age groups placed relatively high
confidence in their vocabulary performances as well. Though confidence was measured after the manipulation and could not be examined as a covariate in this case, high confidence may be protective in the face of stereotype threat. Finally, intergenerational contact has been found to have a moderating effect on the impact of age-based stereotype threat (Abrams et al., 2006). The particular issue of age of the experimenter in age-based stereotype threat research was not found in the reviewed literature, but given the findings of Abrams et al., there is a possibility that the presence of the experimenters (one a young adult and one a middle-aged adult) had some impact on the effectiveness of the age-based stereotype threat manipulation used in Study 2. However, the intent was for participants of both age groups to perceive the experimenters as outgroup members in terms of age
group.

Analysis of predictors of manipulation check accuracy indicated that threat condition and age group stated to do worse on vocabulary were significant predictors of consistency with information presented in the stereotype threat manipulation. The distinction between being told that young or older adults would do best on the vocabulary task was a stronger relationship. Participants were more than two times as likely to be accurate on the manipulation check item when they had been told that older adults would do better on vocabulary. This is potential evidence that there are expectations that older adults have better vocabularies, meaning that this information would be congruent with prior expectations and perhaps lead to more accuracy later on. This is more evidence to suggest that follow-up studies looking at expectations regarding vocabulary would aid this line of research.
Significant age differences were found in optimism, something that replicates findings of previous research (e.g., You, Fung, & Isaacowitz, 2009). However, this was qualified by a significant interaction effect wherein older adults in the non-threat condition scored significantly higher than young adults in the non-threat condition, but older adults did not differ from young adults in the stereotype threat condition. This particular measure occurred prior to the stereotype threat manipulation, so these results likely reflect dispositional differences in older adults randomly assigned to the non-threat condition that were not impacted by the manipulation. Aging satisfaction was also found to have a significant omnibus interaction effect, though post hoc comparisons found no significant differences between age groups across threat conditions (or vice versa).

Given the lack of accuracy of participants in their responses to the manipulation check item, the interpretability of analyses of measures occurring after the stereotype threat manipulation is questionable. Results of Study 2 indicated that older adults rated themselves as less likely to be alive 15 years in the future than young adults, which reflects accurate life expectancy differences between the two groups. The second item, assessing likelihood of being free of cognitive difficulties 15 years in the future, displayed a significant interaction effect, wherein young adults in the stereotype threat condition rated themselves as more likely to experience cognitive problems 15 years in the future than young adults in the non-threat condition, but older adults did not differ between threat conditions. Given the issues with the stereotype threat manipulation, this interaction may simply represent dispositional differences in older adults randomly assigned to the non-threat condition that were not impacted by the manipulation.
CHAPTER IV

SUMMARY AND GENERAL DISCUSSION

Overall, these studies were intended to explore the relationship of age-related attitudinal variables and general optimism to vocabulary, a novel cognitive outcome in the area of stereotype threat research. Study 1 sought to explore this relationship in a large sample from the HRS database. Optimism, aging satisfaction, and aging expectations were examined as predictors of vocabulary performance. Of these variables, optimism was the only one to significantly predict vocabulary performance. The practical significance of this relationship was very small, indicating that the statistical significance was driven by the large sample size. No attitudinal variables significantly predicted vocabulary performance. However, education was a significant demographic predictor of vocabulary, supporting the relationship of education and vocabulary performance found in other research (e.g., Alwin & McCammon, 2001; Keuleers et al., 2005). Age did not significantly predict vocabulary. Because this study included only older adults, this finding supports the stability of vocabulary in older adulthood found in past research (e.g., Singer, et al., 2003). Overall, Study 1 results did not support the hypothesis that attitudinal variables would be predictors of vocabulary performance. This pattern was similar to that found in the analysis of memory, which indicated that optimism, age and education were the only significant predictors of memory performance, though optimism had small practical significance in predicting both vocabulary and memory. The main effect of age supports past findings that older age relates to memory performance (e.g.,
Craik & McDowd, 1987). Attitudinal variables, however, did not have relationships with either of the two cognitive outcome variables in this study.

Study 2 was a cross-sectional study of older and young adults, half of whom were randomly assigned to be exposed to a stereotype threat manipulation wherein they were told that either their own age group was expected to have worse vocabulary performance than the other age group prior to completing a vocabulary task. Older adults did better overall than young adults in vocabulary and had higher confidence in their vocabulary performance. Being in the stereotype threat condition, however, actually led to higher performance in vocabulary, a pattern that held even when controlling for the significant covariates of optimism and education. Being in the stereotype threat condition also increased confidence in vocabulary performance, although this was qualified by a marginally significant interaction wherein young adults appeared to have higher confidence in the stereotype threat condition and the older adults did not differ between conditions. Study 2 findings must be interpreted with caution, however, as the majority of participants in both age groups were unable to accurately report the information presented in the stereotype threat manipulation in a manipulation check item presented at the end of the study. When the results were analyzed using only those participants who did accurately identify the stereotype threat manipulation they had been presented with, the age effects held, but there was no significant threat condition effect or interaction effect on vocabulary performance. A main effect of age group with an interaction of threat condition and age group was found for vocabulary confidence in the group of participants who accurately identified the stereotype threat manipulation in the hypothesized pattern. Older adults in the stereotype threat condition were less confident than older adults in the
non-threat condition, but young adults did not differ in confidence in their vocabulary ratings across threat conditions.

Education was a significant predictor of vocabulary in Study 1, supporting the relationship established in previous research (e.g., Alwin & McCammon, 2001; Keuleers et al., 2015). However, age was not a significant predictor, indicating that vocabulary was stable in this sample of older adults across the range of ages. Similarly, Study 2 replicated prior results that older adults perform better than young adults on vocabulary tests (e.g., Kavé & Mashal, 2012; Kavé & Yafé, 2014), a finding that remained even when education was included as a covariate. Results of Study 2 support findings that age is related to vocabulary performance even when education is taken into consideration.

Study 2 also replicated a previous finding that older adults are more confident in their vocabulary performance on multiple choice tasks (Kavé & Halamish, 2015), though this time using a task in which participants were asked to generate a definition for vocabulary items. On the whole, these two studies add support to the conclusion that vocabulary increases with age and stays relatively stable across older adulthood. Both Studies 1 and 2, then, offer further support for frameworks of vocabulary and aging that explain the maintenance of vocabulary performance in older adulthood. Results of this study are consistent with the model of crystallized intelligence (Cattell, 1963; Horn & Cattel, 1966, 1967), as vocabulary performance was not predicted by age in a large group of older adults and was higher in a group of older adults than young adults. Older adults in Study 2 also had more years of education than the young adults, presumably meaning that they had more crystallized knowledge to draw from on the vocabulary task. Together, the results of the two present studies are also consistent with NST (McKay, 1987), which
proposes that lexical knowledge is organized into nodes which tend to maintained throughout older adulthood, even if transmission of priming between these nodes can weaken with age. Under this theory, older adults would be expected to maintain their vocabulary performance, particularly on a task where the word itself is presented, activating an associated lexical node. Both recency and frequency of node activation help older adults to maintain lexical nodes that were committed earlier in life, and young adults have not yet committed the number of lexical nodes for lower frequency words that older adults have (Burke, McKay, & James, 2000). This framework for understanding vocabulary is consistent with both the results of Study 1, where vocabulary did not decline in an older adult sample, and Study 2, where older adults performed better on a vocabulary measure than young adults.

**Strengths of the Present Studies**

A major strength of the present studies is that they examined attitudinal variables, age-related attitudes and general optimism, in two different types of research design. The first study used a large dataset comprised of only older adults, allowing for examination of attitudinal variables and their relationship with vocabulary in a more naturalistic way (i.e., in the absence of an experimental manipulation). On the other hand, the second study allowed for a smaller group to be tested in an experimental setting, with the intention of permitting causal conclusions to be drawn. Young adults were also included as a comparison group, something that is true of some but not all age-based stereotype research. This cross-sectional quasi-experimental design tested age differences in reaction to stereotype threat. These complementary designs allowed for a more thorough exploration of these relationships than either study would have individually. Study 1
benefited from a large sample size, so it can be assured that no small effects went undetected in this analysis. Study 2, on the other hand, was designed for the purpose of testing stereotype threat in a quasi-experimental design, and so held constant more variables, including the setting and researchers, than Study 1 did.

Another strength of both of these studies was that vocabulary performance, the variable of interest, was a novel outcome measure for research looking at attitudes and stereotypes of young and older adults. Research on attitudes and age-related stereotypes has typically focused on memory as the outcome. Vocabulary differs from memory because it typically improves with age (e.g., Verhaeghen, 2003), whereas memory does not (e.g., Craik & McDowd, 1987), but the general public sentiment about aging seems to not focus on the improved vocabulary that comes with healthy aging. Therefore, this research offered the opportunity to test whether a cognitive variable that is not expected to show decline with age could still be impacted by an age-related stereotype threat. Though the present results are inconclusive in determining this, the use of vocabulary as a dependent variable remains a strength of these studies that could be built upon in future research using different manipulations related to age-based stereotype threat or stereotype priming.

**Limitations of the Present Studies**

Study 2 tested groups of older and young adults who were recruited from university resources (i.e., undergraduates seeking extra credit and older adults who had agreed to be included in a research participant registry). Racial/ethnic and cultural diversity were limited by the available participant pool. Study 1 used a much larger, nationally selected population. However, only a subsample of these participants,
determined by the random assignment of the Leave Behind Questionnaire by HRS researchers, was used for analyses of the results of Study 1, and analysis of missing data indicated that there may have been some bias in the resulting subsample. The result may mean that the Study 1 sample was no longer as representative as the original HRS sample was selected to be. Overall, the homogeneity of the samples of both studies may limit the generalizability of the present results to more heterogeneous populations.

As noted in the Study 1 Discussion, the questionnaires drawn from the HRS may have been a limitation in both studies. The questionnaires differ from those frequently used to measure the same constructs discussed. In particular, the aging expectations measure in this research consisted of only one (Study 1) or two (Study 2) items, which differs from what is typical in other research. A limitation to note in particular for Study 1 is that the HRS is a large database with pre-selected measures, meaning that design and selection of different measures is not possible when using that data set. For Study 2, the largest limitation is the failure of participants to accurately respond to the manipulation check item. This was discussed in detail in the Study 2 Discussion section, but it is worth noting that the results of Study 2 are difficult to interpret because the stereotype threat manipulation did not have the intended effect, as the hypothesis of Study 2 were not supported, and it is unclear whether the manipulation had any effect on participants.

**Future Directions**

Overall, Study 1 and Study 2 failed to provide strong evidence that age-related attitudinal variables or general optimism were related to vocabulary performance. It appeared that optimism, a more general attitudinal variable, was positively correlated with vocabulary, and that this relationship may be partially explained in light of the
relationship of both variables to education. The results of Study 1 and Study 2 together appear to indicate that vocabulary is a robust cognitive ability that, in this research project, was not impacted by age-related attitudinal variables or general optimism. However, future research could explore other situations in which vocabulary might be impacted by these or similar variables, for instance, by inducing age-related anxiety around cognitive difficulties in a different manner than the manipulation used in Study 2.

The stereotype manipulation used in Study 2 did not appear to be effective and was potentially not noticed by many participants. Further work is therefore needed to support the conclusion that vocabulary is resistant to stereotypes. More blatant stereotype threat manipulations (e.g., Hess & Hinson, 2006) have been shown to impact memory performance. Another possibility is that the manipulation may be presented in some way that is more likely to catch participants’ attention (e.g., having the experimenter read the task instructions aloud, as in Chasteen et al., 2005). However, vocabulary has not been tested in this regard, and using different manipulations related to stereotypes of aging may reveal relationships between the attitudinal variables selected for the present studies and vocabulary that were not clear in the findings of this research. The manipulation may not have succeeded in inducing stereotype threat in either age group, perhaps because vocabulary performance is not as salient as memory performance in terms of areas of cognitive concern for older adults. Beliefs about vocabulary performance and ideas relating to confidence (e.g., are older adults confident in their vocabulary performance because they do not subjectively experience decline in that area as in memory?) may be areas of exploration for future cognitive aging work. The effects of stereotypes in this area might be further explored in the face of these beliefs, as well. For example, beliefs
about the stereotype threat manipulation could be examined immediately following the stereotype induction, which would indicate impact of the manipulation and also promote attention to the manipulation itself. Confidence could also be examined in future research as a protective factor in light of age-based stereotype threat, as older adults’ confidence may differ between vocabulary and memory performance. Another area for future research would be exploring the effect of age-based stereotype threat on vocabulary in middle-aged adults, an age group not included in the cross-sectional design of Study 2. Given the developmental trajectory of vocabulary, which typically increases throughout the lifespan into older adulthood, a design including adults of all age groups could further explore the impact of stereotype threat on vocabulary with more of a lifespan focus.

Aging satisfaction and age identification were measured after the stereotype threat manipulation in Study 2, but they present an interesting pattern of results, though these results are based on analyses including participants who did not accurately respond to the stereotype threat manipulation question. There were not age differences in aging satisfaction, regardless of threat condition. In addition, results indicated that young adults did not identify more with their age, comparable to previous findings (see Garstka et al., 2004). Young and older adults also did not differ in aging satisfaction nor were they more satisfied with their age. Previous research has found that aging satisfaction tends to decrease in older adulthood, though this change was attenuated by other variables, such as baseline health status (e.g., Kleinspehn-Ammerlahn et al., 2008). Comparisons of young and older adults on aging satisfaction were not found in the literature review conducted for this research, though past research has shown that older adults demonstrate more overall life satisfaction than young adults (Montepare & Lachman, 1989), making
this a somewhat unexpected finding. Although it is possible that aging satisfaction ratings were impacted by the stereotype threat manipulation, the pattern from Study 1 supports the high aging satisfaction in older adults (albeit with no young adult comparison group for the HRS data). In Study 1, older adults from the HRS sample scored above the midpoint on average, with relatively narrow variation around the mean. Aging satisfaction did not predict vocabulary performance in Study 1 but was significantly positively correlated with vocabulary, memory, and education. As there is a correlation between aging satisfaction and vocabulary but aging satisfaction is not a predictor of vocabulary performance, the direction of the effect may be reversed. Increased trouble with cognitive performance may impact aging satisfaction, rather than aging satisfaction being the predictor for cognitive performance. Higher levels of education are also associated with less belief in age-related stereotypes (e.g., Andreoletti & Lachman, 2004), which may ultimately impact aging satisfaction if lower levels of belief in (and presumably, per the mechanisms discussed by Bennett and Gaines, 2010, internalization and externalization of) age-related stereotypes were related to higher aging satisfaction. Given the correlations found between these variables in Study 1, future research to clarify the relationships between aging satisfaction and these other variables may be warranted.

Level of education may have also impacted the results of Study 2, as both age groups were highly educated. Aging satisfaction was not discussed with age-based stereotype threat in any of the studies found in this review of the literature, and the relationship of the two may be an area for future research.

Vocabulary was chosen for this study because it was thought to be a cognitive variable about which people would not have the same age-related stereotype-based
expectations as they might for memory. However, specific age-related expectations for vocabulary were not tested as part of this research, and it is possible that such expectations did influence the results of both Study 1 and particularly Study 2. A useful focus of future research might be to assess expectations related to vocabulary (and other cognitive variables less well-studied than memory) and perhaps to explore these expectations in the context of future age-based stereotype research. Participants were more accurate in responding to the manipulation check item when they were in the stereotype threat condition that stated that older adults would do better at vocabulary. This result could be explained by participants having the prior belief that older adults have better vocabularies and may be evidence that some participants had previously held expectations regarding vocabulary performance.

Past research has shown that older adults are better than young adults at vocabulary tasks such as the vocabulary measures utilized in these two studies, where a word is given and a meaning must be generated (e.g., Kavé & Mashal, 2012; Kavé & Yafé, 2014). However, older adults do have more difficulty with tip-of-the-tongue speech errors (i.e., a failure to retrieve a specific desired word that is typically accompanied by a feeling of knowing and a sense of frustration at the inability to access the word in question; James & Burke, 2000). A potential direction for future research is to explore the effects of a stereotype threat manipulation on a different type of vocabulary measure, one in which participants are asked to generate a word in response to a definition, wherein tip-of-the-tongue states may occur. On this type of vocabulary test, older adults might be expected to perform worse than young adults. Examining the effects of stereotype threat
on this type of vocabulary task in addition to the type utilized in Study 2 might be an informative next step.

**Conclusions**

These studies supported previous findings of age differences in vocabulary but did not support the hypothesized relationship of vocabulary to attitudinal variables, including age-related attitudes and general optimism. Memory has been established in the literature as a variable that is impacted by age-related attitudes and age-based stereotype threat. Though there are some caveats to the interpretation of the results of these two studies, neither supported the idea that vocabulary was related to attitudinal variables. Attitudinal variables did not predict vocabulary performance in Study 1, at least in terms of practical significance, nor was vocabulary impacted by a stereotype threat manipulation in Study 2. Overall, these results suggest that vocabulary performance and confidence may be cognitive variables that are resistant to age-related attitudes and stereotypes. The finding that a cognitive variable could be resistant to negative views of aging is an important one, as it suggests that some aspects of cognitive performance may be more resilient than others. In particular, vocabulary – both performance and confidence – is a reasonable area in which older adults may display resilience. Objective measures show that older adults retain skills in terms of vocabulary performance, meaning that the confidence shown in this area reflects accurate awareness. In terms of the present studies, neither objective vocabulary performance nor subjective vocabulary confidence were impacted by attitudinal variables.
REFERENCES


University of Michigan. (2012). Health and Retirement Study [Public use data set]. Produced and distributed by the University of Michigan with funding from the National Institute on Aging (grant number NIA U01AG009740). Ann Arbor, MI. Retrieved from http://hrsonline.isr.umich.edu/


APPENDIX A

Participant Characteristics for Study 2

Several analyses of variance (ANOVAs) were conducted to determine whether or not participants significantly differed across age group or stereotype threat condition on measured variables other than the dependent variables. All significant omnibus tests were followed up with pairwise comparisons using a Bonferroni correction for multiple analyses. Although stereotype threat was not expected to significantly impact these participant characteristics (and indeed some measures were presented to participants prior to the stereotype threat manipulation), analyses were conducted to ensure that random assignment of participants resulted in similar groups across conditions and to assess for any differences in older and young adults in terms of participant characteristics. Variables assessed were optimism, emotion regulation, age satisfaction, age identification, and age expectations. Means for these and all measures in this section can be found in Table 4.

Measures occurring prior to the stereotype threat manipulation. Optimism and emotion regulation were participant characteristic measures completed prior to the stereotype manipulation. There was a main effect of age on optimism, \( F(1, 137) = 17.60, p < .001, \eta_p^2 = .11 \). Older adults \((M = 55.96, SD = 6.83)\) scored higher in optimism than young adults \((M = 51.20, SD = 7.00)\). There was not a significant main effect of threat condition on optimism, \( F(1, 137) = 0.02, p = .88, \eta_p^2 < .001 \). Because this measure was given prior to the stereotype threat manipulation, that means that participants randomly assigned to the stereotype threat group \((M = 53.74, SD = 6.71)\) did not differ significantly
from those randomly assigned to the non-threat group \((M = 53.51, SD = 7.91)\). However, there was a significant interaction, \(F(1, 137) = 4.85, \ p = .02, \eta^2 = .03\). Post hoc pairwise comparisons showed that older adults in the stereotype threat group \((M = 54.84, SD = 6.86)\) did not score higher on optimism than young adults in the stereotype threat group \((M = 52.54, SD = 6.43), p = .15\), but older adults in the non-threat group \((M = 57.21, SD = 6.69)\) scored significantly higher than young adults in the non-threat group \((M = 49.82, SD = 7.38), p < .001\). However, young adults in the stereotype threat group were not significantly higher than young adults in the non-threat group, \(p = .10\), and older adults in the stereotype threat group were not significantly higher than older adults in the non-threat group, \(p = .15\).

There was no main effect of age on emotion regulation, \(F(1, 136) = 1.88, \ p = .17, \eta^2 = .01\). Older adults \((M = 45.82, SD = 9.02)\) did not differ from young adults \((M = 47.90, SD = 8.76)\). There was no main effect of threat condition on emotion regulation, \(F(1, 136) = 0.10, \ p = .75, \eta^2 = .001\). Because this measure was given prior to the stereotype threat manipulation, this means that participants randomly assigned to the stereotype threat group \((M = 46.57, SD = 8.38)\) did not differ significantly from those randomly assigned to the non-threat group \((M = 47.10, SD = 9.52)\). There was no significant interaction, \(F(1, 136) = 0.08, \ p = .78, \eta^2 = .001\). Older adults in the stereotype threat condition had a mean emotion regulation score of 45.79, \((SD = 8.86)\), and older adults in the non-threat condition had a mean emotion regulation score of 45.85 \((SD = 9.33)\). Young adults in the stereotype threat condition had a mean emotion regulation score of 47.44, \((SD = 7.84)\), and young adults in the non-threat condition had a mean emotion regulation score of 48.35 \((SD = 9.69)\).
Measures occurring after the stereotype threat manipulations. Age identification as well as aging satisfaction and aging expectations were presented after the stereotype threat manipulation. There was no main effect of age on age identification, $F(1, 138) = 1.11$, $p = .30$, $\eta^2_p = .008$. Older adults ($M = 5.21$, $SD = 1.37$) did not differ from young adults ($M = 4.97$, $SD = 1.29$). There was no main effect of threat condition on age identification, $F(1, 138) = 0.09$, $p = .77$, $\eta^2_p = .001$. Participants in the stereotype threat group ($M = 5.06$, $SD = 1.50$) did not differ significantly from those in the non-threat group ($M = 5.12$, $SD = 1.14$). There was no significant interaction, $F(1, 137) = 0.10$, $p = .75$, $\eta^2_p = .001$. Older adults in the stereotype threat condition had a mean age identification score of 5.21 ($SD = 1.53$), and older adults in the non-threat condition had a mean age identification score of 5.21 ($SD = 1.19$). Young adults in the stereotype threat condition had a mean age identification score of 4.90 ($SD = 1.46$), and young adults in the non-threat condition had a mean age identification score of 5.04 ($SD = 1.09$).

There was no main effect of age on aging satisfaction, $F(1, 138) = 0.07$, $p = .79$, $\eta^2_p = .001$. Older adults ($M = 33.08$, $SD = 8.88$) did not differ from young adults ($M = 32.78$, $SD = 7.00$). There was no main effect of threat condition on aging satisfaction, $F(1, 137) = 0.46$, $p = .49$, $\eta^2_p = .003$. Participants in the stereotype threat group ($M = 33.34$, $SD = 7.99$) did not differ significantly from those in the non-threat group ($M = 32.51$, $SD = 8.03$). There was a significant interaction, $F(1, 137) = 4.16$, $p = .04$, $\eta^2_p = .03$. However, post hoc pairwise comparisons showed that older adults in the stereotype threat group ($M = 32.21$, $SD = 8.87$) did not score higher on aging satisfaction than young adults in the stereotype threat group ($M = 34.57$, $SD = 6.83$), $p = .21$, nor did older adults in the non-threat group ($M = 34.03$, $SD = 8.92$) score significantly higher than young
adults in the non-threat group ($M = 30.94, SD = 6.78$), $p = .11$. Young adults in the stereotype threat group were not significantly higher than young adults in the non-threat group, $p = .10$, and older adults in the stereotype threat group were not significantly higher than older adults in the non-threat group, $p = .15$.

The two aging expectations items were analyzed independently. There was a main effect of age on the first aging expectations item, $F(1, 138) = 37.32$, $p < .001$, $\eta^2_p = .21$. Older adults ($M = 58.49, SD = 30.58$) rated themselves as less likely to be alive in the next 15 years than young adults ($M = 30.00, SD = 24.25$). There was no main effect of threat condition on the first aging expectation item, $F(1, 138) = 0.13$, $p = .72$, $\eta^2_p = .001$. Participants in the stereotype threat group ($M = 43.97, SD = 32.61$) did not differ significantly from those in the non-threat group ($M = 45.36, SD = 29.58$). There was no significant interaction, $F(1, 138) = 0.24$, $p = .63$, $\eta^2_p = .002$. Older adults in the stereotype threat condition had a mean likelihood rating of 56.58, ($SD = 32.41$), and older adults in the non-threat condition had a mean likelihood rating of 60.57 ($SD = 28.79$). Young adults in the stereotype threat condition had a mean likelihood rating of 30.29, ($SD = 27.17$), and young adults in the non-threat condition had a mean likelihood rating of 29.71 ($SD = 21.25$).

There was no main effect of age on the second aging expectations item, $F(1, 138) = 0.68$, $p = .41$, $\eta^2_p = .005$. Older adults ($M = 54.74, SD = 29.41$) rated themselves as likely as to be free of cognitive problems in the next 15 years as young adults ($M = 59.42, SD = 36.34$). There was no main effect of threat condition on the second aging expectations item, $F(1, 138) = 2.75$, $p = .10$, $\eta^2_p = .02$. Participants in the stereotype threat group ($M = 61.23, SD = 32.53$) did not differ significantly from those in the non-
threat group ($M = 52.55, SD = 32.98$). There was a significant interaction, $F(1, 138) = 3.84, p = .05, \eta^2 = .03$. Post hoc pairwise comparisons showed that older adults in the stereotype threat group ($M = 53.95, SD = 29.91$) rated themselves as more likely to have cognitive problems in the next 15 years than young adults in the stereotype threat group ($M = 69.14, SD = 33.81$), $p = .05$, but older adults in the non-threat group ($M = 55.60, SD = 29.27$) did not differ from young adults in the non-threat group ($M = 49.41, SD = 36.59$), $p = .43$. Young adults in the stereotype threat condition rated themselves as significantly more likely to experience cognitive problems in 15 years than young adults in the non-threat condition, $p = .01$, and older adults in the stereotype threat condition did not differ significantly from older adults in the non-threat condition, $p = .83$.

**Age Differences within the Older Adult Group**

Young-old and old-old were compared on participant characteristic measures to determine if older adults responded uniformly as a group or if there were age differences within the older adult group. For the purposes of this study, the young-old group was defined as 60 to 74 years of age, as the old-old group was defined as those 75 years of age or older. Seventy-five is a typical cut-off for assessment of differences among older adult groups (e.g., Martin et al., 2015). Using these definitions, this study included 49 young-old participants and 23 old-old participants.

On optimism, young-old ($M = 56.31, SD = 7.35$) did not differ significantly from old-old participants ($M = 55.22, SD = 5.65$), $t(70) = 0.63, p = .53, d = .17$. On emotion regulation, young-old ($M = 46.38, SD = 9.05$) did not differ significantly from old-old participants ($M = 44.71, SD = 9.05$), $t(70) = 0.74, p = .46, d = .18$. On age identification, young-old ($M = 5.19, SD = 1.40$) did not differ significantly from old-old participants ($M$
On age satisfaction, young-old (\(M = 33.59, SD = 9.95\)) did not differ significantly from old-old participants (\(M = 32.04, SD = 6.20\)), \(t(71) = 0.70, p = .49, d = .19\). On the first aging expectation item, young-old (\(M = 57.14, SD = 30.96\)) did not differ significantly from old-old participants (\(M = 61.25, SD = 30.26\)), \(t(71) = 0.54, p = .59, d = .13\).

The only significant difference between the young-old and old-old groups came on the second aging expectation item. On this item, which asks the likelihood of being free from significant cognitive problems 15 years in the future, young-old participants (\(M = 62.16, SD = 26.52\)) felt this was significantly more likely than old-old participants (\(M = 39.58, SD = 29.71\)), \(t(71) = 3.28, p = .002, d = .80\). In other words, old-old participants felt they were more likely to be experiencing cognitive problems in the future than young-old participants. To ensure that this was not due to age differences in response to stereotype threat among older adult participants, a 2 x 2 (older age group x threat condition) ANOVA compared young-old and old-old on this aging expectation item. This ANOVA supported the difference between young-old and old-old on the second aging expectation item, \(F(1, 69) = 10.79, p = .002, \eta^2_p = .14\). However, there was no main effect of stereotype threat, \(F(1, 69) = 0.24, p = .63, \eta^2_p = .003\), as those in the stereotype threat condition (\(M = 53.95, SD = 29.91\)) did not differ from those in the non-threat condition (\(M = 55.60, SD = 29.27\)). There was also no significant interaction, \(F(1, 69) = 0.35, p = .56, \eta^2_p = .005\). The 28 young-old in the stereotype threat condition had a mean of 58.93 (\(SD = 26.85\)), while the 21 young-old in the non-threat condition had a mean of 66.48 (\(SD = 26.09\)). The 10 old-old in the stereotype threat condition had a mean of 40.00 (\(SD = 34.96\)), while the 14 old-old in the non-threat condition had a mean of 39.29 (\(SD = 34.96\)).
Given the lack of a significant interaction or main effect of threat condition, it was likely this result simply reflects the realistic belief that, as age increases, the likelihood of experiencing cognitive problems also increases. This belief, however, is somewhat interesting when taken into consideration with the fact that young-old and old-old did not differ in their estimation of mortality, only in this belief about cognitive ability. However, standard deviations show a wide degree of variability in the estimation of both age expectation items, indicating that there are likely individual differences influencing this issue.

**Assessment of Gender Distribution and Gender Effects**

**Effects of gender and age.** Gender was analyzed as a variable, along with age, in a 2 x 2 (age group x gender) ANOVA in order to determine if men and women responded differently to participant characteristic items overall or across age groups.

**Measures occurring prior to the stereotype threat manipulation.** Optimism and emotion regulation were each assessed using a 2 x 2 (age group x gender) ANOVA. There was a significant main effect of age group on optimism, $F(1, 137) = 14.00$, $p < .001$, $\eta^2_p = .09$. Older adults ($M = 55.96$, $SD = 6.83$) scored higher on optimism than young adults ($M = 51.20$, $SD = 7.00$). There was no significant main effect of gender on optimism, $F(1, 137) = 0.44$, $p = .51$, $\eta^2_p = .003$. Men ($M = 53.91$, $SD = 7.22$) did not score higher on optimism than women ($M = 53.46$, $SD = 7.37$). There was no significant interaction of gender and age group on optimism, $F(1, 137) = 1.26$, $p = .26$, $\eta^2_p = .009$. Older men ($M = 55.60$, $SD = 6.73$) did not differ from young men ($M = 52.45$, $SD = 7.41$), $p = .10$. Older women ($M = 56.15$, $SD = 6.95$) did differ from young women ($M = 50.30$, $SD = 6.63$), $p < .001$, though the overall interaction effect was not significant.
There was no significant main effect of age group on emotion regulation, $F(1, 136) = 2.85, p = .09, \eta^2_p = .02$. Older adults ($M = 45.82, SD = 9.02$) did not score higher on emotion regulation than young adults ($M = 47.90, SD = 8.76$). There was no significant main effect of gender on emotion regulation, $F(1, 136) = 0.55, p = .46, \eta^2_p = .004$. Men ($M = 47.65, SD = 9.72$) did not score higher on optimism than women ($M = 46.31, SD = 8.40$). There was no significant interaction of gender and age group on emotion regulation, $F(1, 136) = 3.08, p = .08, \eta^2_p = .02$. Older men ($M = 44.80, SD = 9.12$) did differ from young men ($M = 50.10, SD = 9.71), $p = .03$. Older women ($M = 46.36, SD = 9.02$) did not differ from young women ($M = 46.26, SD = 7.71$), $p = .96$.

Measures occurring after the stereotype threat manipulation. Age identification, aging satisfaction, and the two aging expectations items were each assessed using a 2 x 2 (age group x gender) ANOVA. There was no significant main effect of age group on age identification, $F(1, 138) = 1.47, p = .23, \eta^2_p = .01$. Older adults ($M = 5.21, SD = 1.37$) did not score higher on age identification than young adults ($M = 4.97, SD = 1.29$). There was no significant main effect of gender on age identification, $F(1, 138) = 1.22, p = .27, \eta^2_p = .009$. Men ($M = 5.24, SD = 1.29$) did not score higher on age identification than women ($M = 5.00, SD = 1.35$). There was no significant interaction of gender and age group on age identification, $F(1, 138) = 0.18, p = .67, \eta^2_p = .001$. Older men ($M = 5.44, SD = 1.33$) did not differ from young men ($M = 5.06, SD = 1.26$), $p = .36$, nor did older women ($M = 5.09, SD = 1.38$) differ from young women ($M = 4.91, SD = 1.32$), $p = .29$.

There was no significant main effect of age group on aging satisfaction, $F(1, 138) = 0.00, p = .99, \eta^2_p < .001$. Older adults ($M = 33.08, SD = 8.88$) did not score higher on aging satisfaction than young adults ($M = 32.78, SD = 7.00$). There was no significant
main effect of gender on aging satisfaction, $F(1, 138) = 0.09, p = .76, \eta^2_p = .001$. Men ($M = 32.67, SD = 7.27$) did not score higher on aging satisfaction than women ($M = 33.10, SD = 8.44$). There was no significant interaction of gender and age group on aging satisfaction, $F(1, 138) = 0.55, p = .46, \eta^2_p = .004$. Older men ($M = 32.12, SD = 8.80$) did not differ from young men ($M = 33.14, SD = 5.77$), $p = .64$, nor did older women ($M = 33.58, SD = 8.98$) differ from young women ($M = 32.53, SD = 7.83$), $p = .54$.

There was a significant main effect of age group on the first aging expectations item, $F(1, 138) = 34.32, p < .001, \eta^2_p = .20$. Older adults ($M = 58.49, SD = 30.58$) rated themselves as less likely to be alive 15 years in the future than young adults ($M = 30.00, SD = 24.25$). There was no significant main effect of gender on the first aging expectations item, $F(1, 138) = 0.37, p = .55, \eta^2_p = .003$. Men ($M = 45.00, SD = 33.24$) did not rate themselves as more or less likely to be alive 15 years in the future than women ($M = 44.43, SD = 29.86$). There was no significant interaction of gender and age group on the second aging expectations item, $F(1, 138) = 0.15, p = .70, \eta^2_p = .001$. Older men ($M = 59.20, SD = 33.66$) did differ from young men ($M = 32.76, SD = 28.02$), $p = .001$, and older women ($M = 58.13, SD = 29.22$) differed from young women ($M = 28.00, SD = 21.27$), $p < .001$, but these age group effects were previously accounted for by the main interaction of age, and the lack of significance of the omnibus test indicated that there were no gender differences in the main effect of age.

There was no significant main effect of age group on the second aging expectations item, $F(1, 138) = 0.70, p = .41, \eta^2_p = .005$. Older adults ($M = 54.74, SD = 29.41$) did not rate themselves as more likely to be experiencing cognitive problems 15 years in the future than young adults ($M = 59.42, SD = 36.34$). There was no significant
main effect of gender on the second aging expectations item, \( F(1, 138) = 0.38, \ p = .54, \ \eta_p^2 = .003 \). Men \((M = 59.44, \ SD = 32.06)\) did rate themselves as more or less likely to be experiencing cognitive difficulties in the next 15 years than women \((M = 55.52, \ SD = 33.53)\). There was no significant interaction of gender and age group on the second aging expectations item, \( F(1, 138) = 0.80, \ p = .78, \ \eta_p^2 = .001 \). Older men \((M = 56.00, \ SD = 29.86)\) did not differ from young men \((M = 62.41, \ SD = 34.09), \ p = .48\), nor did older women \((M = 54.08, \ SD = 29.47)\) differ from young women \((M = 57.25, \ SD = 38.16), \ p = .66.\)

**Effects of gender and threat condition.** In addition to age, gender was analyzed as a predictor variable, along with threat condition, in a 2 x 2 (threat condition x gender) ANOVA in order to determine if men and women responded differently to participant characteristic questions overall or across threat condition.

**Measures occurring prior to the stereotype threat manipulation.** Optimism and emotion regulation were each assessed using a 2 x 2 (threat condition x gender) ANOVA. There was no significant main effect of threat condition on optimism, \( F(1, 137) = 0.06, \ p = .81, \ \eta_p^2 < .001 \). Those in the stereotype threat condition \((M = 53.74, \ SD = 6.71)\) did not differ from those in the non-threat condition \((M = 53.51, \ SD = 7.92)\). There was no significant main effect of gender on optimism, \( F(1, 137) = 0.09, \ p = .76, \ \eta_p^2 = .001 \). Men \((M = 54.26, \ SD = 6.41)\) were not more optimistic than women \((M = 53.46, \ SD = 7.37)\). There was no significant interaction effect on optimism, \( F(1, 137) = 0.16, \ p = .69, \ \eta_p^2 = .001 \). Men in the stereotype threat condition \((M = 54.26, \ SD = 6.41)\) did not differ from men in the non-threat condition \((M = 53.43, \ SD = 7.91), \ p = .69\), and women in the
stereotype threat condition ($M = 53.36, SD = 6.98$) did not differ from women in the non-threat condition ($M = 53.56, SD = 7.80$), $p = .90$.

There was no significant main effect of threat condition on emotion regulation, $F(1, 136) = 0.24, p = .63$, $\eta^2_p = .002$. Those in the stereotype threat condition ($M = 46.57, SD = 8.38$) did not differ from those in the non-threat condition ($M = 47.10, SD = 9.52$). There was no significant main effect of gender on emotion regulation, $F(1, 136) = 0.83, p = .36$, $\eta^2_p = .006$. Men ($M = 47.65, SD = 9.72$) did not differ in emotion regulation from women ($M = 46.31, SD = 8.40$). There was no significant interaction effect on emotion regulation, $F(1, 136) = 0.08, p = .78$, $\eta^2_p = .001$. Men in the stereotype threat condition ($M = 47.13, SD = 8.45$) did not differ from men in the non-threat condition ($M = 48.35, SD = 11.38$), $p = .62$, and women in the stereotype threat condition ($M = 46.15, SD = 8.40$) did not differ from women in the non-threat condition ($M = 46.47, SD = 8.49$), $p = .87$.

**Measures occurring after the stereotype threat manipulation.** Age identification, aging satisfaction, and the two aging expectations items were each assessed using a 2 x 2 (threat condition x gender) ANOVA. There was no significant main effect of threat condition on age identification, $F(1, 138) = 0.16, p = .69$, $\eta^2_p = .001$. Those in the stereotype threat condition ($M = 5.06, SD = 1.50$) did not differ from those in the non-threat condition ($M = 5.12, SD = 1.14$). There was no significant main effect of gender on age identification, $F(1, 138) = 1.09, p = .30$, $\eta^2_p = .008$. Men ($M = 5.24, SD = 1.29$) did not differ in age identification from women ($M = 5.00, SD = 1.35$). There was no significant interaction effect on age identification, $F(1, 138) = 0.03, p = .87$, $\eta^2_p < .001$. Men in the stereotype threat condition ($M = 5.18, SD = 1.52$) did not differ from men in
the non-threat condition ($M = 5.31, SD = 0.91$), $p = .72$, and women in the stereotype threat condition ($M = 4.98, SD = 1.49$) did not differ from women in the non-threat condition ($M = 5.03, SD = 1.23$), $p = .85$.

There was no significant main effect of threat condition on aging satisfaction, $F(1, 138) = 0.06$, $p = .80$, $\eta^2_p < .001$. Those in the stereotype threat condition ($M = 33.34, SD = 7.99$) did not differ from those in the non-threat condition ($M = 32.51, SD = 8.03$).

There was no significant main effect of gender on aging satisfaction, $F(1, 138) = 0.07$, $p = .80$, $\eta^2_p < .001$. Men ($M = 32.67, SD = 7.27$) did not differ in aging satisfaction from women ($M = 33.10, SD = 8.44$). There was no significant interaction effect on aging satisfaction, $F(1, 138) = 2.37$, $p = .13$, $\eta^2_p = .02$. Men in the stereotype threat condition ($M = 31.90, SD = 6.35$) did not differ from men in the non-threat condition ($M = 33.70, SD = 8.39$), $p = .42$, and women in the stereotype threat condition ($M = 34.40, SD = 8.94$) did not differ from women in the non-threat condition ($M = 31.91, SD = 7.87$), $p = .15$.

There was no significant main effect of threat condition on the first aging expectations item, $F(1, 138) = 0.002$, $p = .96$, $\eta^2_p < .001$. Those in the stereotype threat condition ($M = 43.97, SD = 32.61$) did not rate themselves as less likely to be alive 15 years in the future than those in the non-threat condition ($M = 45.36, SD = 29.58$). There was no significant main effect of gender on the first aging expectations item, $F(1, 138) = 0.001$, $p = .97$, $\eta^2_p < .001$. Men ($M = 45.00, SD = 33.24$) did not rate themselves as more or less likely to be alive 15 years in the future than women ($M = 44.43, SD = 29.86$). There was no significant interaction of threat condition and gender on the first aging expectations item, $F(1, 138) = 1.62$, $p = .21$, $\eta^2_p = .01$. Men in the stereotype threat condition ($M = 48.06, SD = 35.16$) did not differ from men in the non-threat condition ($M$
= 40.87, SD = 30.74), p = .40, and women in the stereotype threat condition (M = 40.95, 
SD = 30.67) did not differ from women in the non-threat condition (M = 47.61, SD = 
29.07), p = .32.

There was no significant main effect of threat condition on the second aging 
expectations item, F(1, 138) = 1.75, p = .18, ηp² = .002. Those in the stereotype threat 
condition (M = 31.23, SD = 32.53) did not rate themselves as more likely to be 
experiencing cognitive problems 15 years in the future than those in the non-threat 
condition (M = 52.55, SD = 32.98). There was no significant main effect of gender on the 
second aging expectations item, F(1, 138) = 0.34, p = .56, ηp² = .002. Men (M = 59.44, 
SD = 32.06) did rate themselves as more or less likely to be experiencing cognitive 
difficulties in the next 15 years than women (M = 55.52, SD = 33.53). There was no 
significant interaction of threat condition and gender on the second aging expectations 
item, F(1, 138) = 0.32, p = .57, ηp² = .002. Men in the stereotype threat condition (M = 
61.29, SD = 33.44) did not differ from men in the non-threat condition (M = 56.96, SD = 
30.67), p = .63, and women in the stereotype threat condition (M = 61.19, SD = 32.25) 
did not differ from women in the non-threat condition (M = 50.35, SD = 34.19), p = .13.
APPENDIX B

University of Colorado
Colorado Springs

Institutional Review Board (IRB) for the Protection of Human Subjects

Date: 12/28/2015

IRB Review

IRB PROTOCOL NO.: 16-096
Protocol Title: Emotions and Cognition
Principal Investigator: Caitlin Tyrrell
Faculty Advisor if Applicable: Molly Maxfield
Application: New Application
Type of Review: Expedited 7
Risk Level: No more than Minimal Risk
Renewal Review Level (if changed from original approval) if Applicable: N/A No Change
This Protocol Involves a Vulnerable Population: N/A (No Vulnerable Population)
Expires: 27 December 2016

Note: If exempt: If there are no major changes in the research protocol does not require review on a continuing basis by the IRB. In addition, the protocol may match more than one review category not listed
Externally funded: ☒ No ☐ Yes
OSP #: Sponsor:

Thank you for submitting your Request for IRB Review. The protocol identified above has been reviewed according to the policies of this institution and the provisions of applicable federal regulations. The review category is noted above, along with the expiration date, if applicable.

Once human participant research has been approved, it is the Principal Investigator’s (PI) responsibility to report any changes in research activity related to the project:
- The PI must provide the IRB with all protocol and consent form amendments and revisions.
- The IRB must approve these changes prior to implementation.
- All advertisements recruiting study subjects must also receive prior approval by the IRB.
- The PI must promptly inform the IRB of any unanticipated serious adverse events (within 24 hours). All unanticipated adverse events must be reported to the IRB within 1 week (see 45CFR46.103b). Failure to comply with these federally mandated responsibilities may result in suspension or termination of the project.
- Renew study with the IRB prior to expiration.
- Notify the IRB when the study is complete.

If you have any questions, please contact Research Compliance Specialist in the Office of Sponsored Programs at 719-255-3903 or irb@uccs.edu

Thank you for your concern about human subject protection issues, and good luck with your research.

Sincerely yours,

Zeb Cypress Valkyrie

Zeb Cypress Valkyrie, PhD
IRB Reviewer