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Do We Know What We Know? Self- Assessment Across the Lifespan

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DO WE KNOW WHAT WE KNOW?
SELF-ASSESSMENT ACROSS THE LIFESPAN

By

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Abstract

Self-knowledge can play a critical role in navigating physical, cognitive, and social changes in late life. To protect and preserve one's sense of self against these changes, individuals may engage in self-enhancing and self-serving biases in areas important to self-esteem. The importance attached to these areas may change with age, and self-knowledge of these psychological processes may vary with age. We investigated self-enhancing biases and metacognitive awareness of abilities in adulthood. Participants ranging in age from 20 to 80 completed a series of tests assessing the better-than-average effect across a variety of age-relevant domains as well as objective memory and intelligence tests. Results yielded an overall better-than-average effect as well as higher positive biases in young, middle-aged, and older adults on age-congruent domains. Younger and older adults were accurate in their assessments of recall ability and processing speed, respectively. Differences between performance predictions and actual performance scores on four cognitive tasks were generally smaller after test than before, suggesting a preservation of monitoring accuracy in late life. Implications for task feedback and training programs for the elderly are discussed as well as the ability for individuals, even in late adulthood, to continue to "self-make" and grow in self-knowledge.

Signature Page

I certify that I have read this thesis and find that, in scope and quality, it satisfies the requirements for the degree of Master of Arts.

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George Santayana believed that "in endowing us with memory, nature has revealed to us a truth utterly unimaginable to the unreflective creation, the truth of immortality." And so, our memories allow moments, people, and places that have been eternally preserved in our minds to be revisited so that they may continue to enrich and shape our lives long after they are gone. Being a scholar of memory, I am constantly amazed at memory's unique ability to continue to, according to Soren Kierkegaard, make our lives "more divine." But, as a memory scholar, I am also painfully aware of age's erosive effects on this marvelous faculty. Shakespeare, too, was aware of the possibility of a fading memory, and to compensate, he immortalized his beloveds in the pages on which he wrote. I, too, would like to remember and acknowledge the individuals who have left an indelible mark on my journey thus far, and who I hope will continue to do so, by forever committing them to these pages.

First and foremost, I would like to make it clear that I will not remember Dr. Jane Berry for the integral role she played in cultivating my research and writing skills, nor for her relentless support and guidance. Rather, I will remember her for our early morning workouts, wine nights, last-minute editing sessions, 8:15 tea runs, little monster creations and raisin talk. I see her not as my thesis advisor, but rather the closest person I had to a family away from home and I thank her for that. To call her a brilliant and kind mentor would fall short, and so, I cherish her not as such, but instead, as a dear friend.

I would also like to thank Danny for his hand gestures, Teri for her sushi runs, and Jamie, our honorary graduate student and man assistant, for his inherent nerdiness. Our

friendships and adventures will forever remain in the deepest, most treasured part of my heart. Without them, I could not have survived.

Lastly, I would like to acknowledge all the raisins for their wisdom, and in particular, one very special raisin. Though he is no longer here, it was the childhood memories I had with my grandfather that inspired me to pursue Developmental Psychology. This academic focus, moreover, unearthed my curiosity and desire to discover and unlock the secrets of aging— and how we, as individuals, have a special and unique capacity to develop and transform into the wisest and happiest of beings in old age.

In the serendipitous of all ways, my master's thesis was completed on August 3, 2010, my grandfather's birthday. I'd like to believe that this is just another reminder of how our memories have the extraordinary ability to enable our beloveds, though gone, to still affect and impact our lives, whether they are the impetus for the pursuit of a career or the inspiration behind newly discovered life passions.

Do we know what we know? Self-Assessment across the Lifespan

Knowing what one can and cannot do is vital to one's self-concept because it can influence goal setting, effort expenditure and feelings of self-efficacy and self-worth (Bandura, 1986; Markus & Wurf, 1987; Rosenberg, 1979; Trope, 1986). The knowledge that one is succeeding or failing at a task has substantial implications for ongoing and future actions related to task performance and sense of mastery (Ehrlinger & Dunning, 2003). Such careful self-assessment and self-awareness is crucial for successful aging, and can be even more influential in late life when adults begin to experience functional changes in multiple domains. Possessing an accurate view of one's skills and expertise can serve as a compensatory mechanism because by knowing exactly what one can and cannot do, and therefore, what still is and is not possible, individuals can decide which deficiencies to accept and which to attempt to improve as they navigate through physical, cognitive and social changes in late adulthood. Current research suggests that individuals in late adulthood may grow, develop and even thrive in multiple life domains (Levy, Slade, Kunkel, & Kasl, 2002). Though older adults face inevitable and normative losses in both cognitive and physical abilities, the self is not "set in plaster" (Srivastava, John, Gosling & Potter, 2003). Throughout adulthood, individuals have the capacity to make, choose and shape development in active and integrative ways (Markus & Wurf, 1987; Bruner, 1990; Brandtstadter, 1984; Labouvie-Vief, 1981; Helson & Soto, 2005; Frazier, Hooker, Johnson, & Kaus, 2000). Indeed, although late life is commonly seen as a time of cumulative losses against diminishing gains (Baltes & Baltes, 1990), research suggests that positive self-views can mediate negative declines and changes in late life. The goal of this study is to examine self-assessment in adulthood from an integrative theoretical and methodological framework.

Self-Assessment across the Lifespan

According to Festinger (1954), individuals are highly motivated to ascertain their capabilities through self-assessment. This can be achieved through social comparison processes. For example, individuals may engage in upward comparisons by comparing themselves to another person who is superior in functioning in an important domain. Such comparisons serve a self-evaluative function, playing an important role in accurate self-assessment and evaluating progress toward the attainment of self-improvement goals (Wood & Taylor, 1991). In contrast, downward comparisons are self-evaluative in a different way. These comparisons are sometimes made in order to view the self as better than one actually is by comparing one's self with a less fortunate other, thereby enabling one to feel better about one's own situation (Taylor & Brown, 1988; Wills, 1981). Such comparisons often serve to maintain subjective well-being and life-satisfaction, especially in a threatening situation, such as age-related cognitive decline (Wills, 1981). Thus, research suggests that people may make downward comparisons to enhance self-esteem and upward comparisons when they believe they can improve in a certain domain (Taylor & Lobel, 1989), identify with superior others (Wheeler, 1966) or seek inspiration (Collins, 1996). As such, social comparisons assist in self-assessment, self-improvement and self-enhancement throughout the lifespan (Heckhausen & Krueger, 1993).

Young adulthood is a prime time for self-assessment and goal setting because developmental changes are still perceived to be largely controllable during early and middle adulthood. Less can be done to modify the course of change in old age, so well-being in later adulthood is often fostered by self-enhancement (Heckhausen & Krueger, 1993). Self-enhancement refers to the act of seeking a positive self-concept in order to maintain self-esteem; it involves the preference for positive over negative self-views. People can self-enhance by exhibiting a self-serving bias (SSB) in which they take credit for personal success but blame external factors for personal failure (Miller & Ross, 1975). While this phenomenon is wide-ranging, we are primarily interested in another form of self-enhancement known as the better-than-average (BTA) effect, that is, when individuals believe that they are above average in areas important to their self-esteem (Alicke, 1985; Brown, 1986; Sedikides, Gaertner & Toguchi, 2003; Kruger, 1999). In fact, when measuring ability against performance, most people tend to inaccurately assess themselves, believing they are luckier, fairer, more virtuous and better drivers than their peers (Sevenson, 1981; Weinstein, 1980; Epley & Dunning, 2000; Messik, Bloom, Boldizar & Samuelson, 1985; Harre, Foster & O'Neill, 2005).

Self-assessment is usually evaluated via self-other comparisons. The literature suggests that these comparisons are guided by different goals, depending on the age group being evaluated. For instance, Heckhausen and Krueger (1993) contrasted expectations of change for self across the lifespan with change expected for "most other people." They proposed that the increasing risk of decline associated with late life might be construed by people as a threat, thereby eliciting self-enhancing social comparisons, in which people compare themselves to targets that are relatively inferior to themselves (Krueger, 1998; Taylor, Neter & Wayment, 1995; Heckhausen & Brim, 1997). Results showed that individuals between the ages of 50 and 80 indicated that they would experience fewer declines in desirable attributes and fewer increases in undesirable attributes compared to others. Additionally, older and middle-aged adults reported larger discrepancies between self and others (e.g., greater self-enhancement) than younger adults on negative personality traits. These findings are consistent with research showing that people expect more positive future outcomes for themselves than for others (Regan, Snyder & Kassin, 1995). For example, Martini and Dion (2001) tested adults across the lifespan, asking them to evaluate either themselves or an unknown other person of the same sex at one of three specified "target ages" (20, 45 or 70 years) using a modified Aging Semantic Differential Scale to assess attitudes and quantify bias and negative stereotypes. Results indicated that evaluations of the self became more positive with increasing target age, and evaluations of others declined with increasing target age. These data suggest that self-enhancement appears to have a developmental component as threats associated with age-related declines emerge in middle age and continue into late life; self-enhancement tendencies may increase in certain domains during middle adulthood to compensate for the emergence of declines in midlife. Further, participants' views of the discrepancies between self and other were relatively small by middle-aged participants and larger by older participants, demonstrating a larger self-enhancing effect in late life.

Although adults may self-enhance in some domains, in late adulthood, they may not always do so. In fact, some theorists have argued that the gains in intrapersonal wisdom (Baltes & Staudinger, 2002; Baltes & Smith, 2008; Erikson, 1968) that come with age offset the need to self-enhance as aging adults become more accepting of themselves. Ego integrity, according to Erikson, is achieved by accepting successes and failures in life as the life one lived, and shedding regrets over things done and left undone. Other theorists agree and see late adulthood not as a time of deteriorating emotional health but of shifting self-conceptions, as older adults come to more balanced and realistic views of themselves, a process referred to as "the life review" (Butler, 1974).

When older adults are faced with self-assessment challenges, they may be less likely to idealize the actual self, and instead, bring the ideal self closer to the actual self (Dittmann-Kohli, 1990). In this model, older adults become more accepting of themselves and begin to focus on remaining strengths. Research supports this claim. In one study, young, middle-aged, and elderly adults evaluated themselves on six dimensions of psychological well-being according to present, past, future, and ideal self-assessments (Ryff, 1991). Young and middle-aged adults saw considerable improvement in themselves from the past to present on all dimensions of well-being, however, the elderly indicated stability with prior levels of functioning. In other words, young and middle-aged adult positively enhanced the difference between past and present selves, whereas older adults reported no such enhanced difference between past and present selves. These results imply that as individuals age they may become more realistic in accepting the unlikelihood of domain improvement in late life

An increase in acceptance of actual self in late adulthood is consistent with the theory of selective optimization with compensation (SOC; Baltes & Baltes, 1990; Freund

& Baltes, 2002). This theory suggests that as losses in biological, psychological, and social domains begin to accrue, older adults begin to maximize gains and minimize losses by selectively optimizing strengths and compensating for weaknesses (Freund, Li, & Baltes, 1999). This theory can be applied to bringing actual and ideal selves into alignment. Minimizing the discrepancy between ideal and actual selves, and thus becoming more accurate and realistic in self-assessment, can be viewed as a compensatory strategy that helps to prevent damage to self-concept and maintain high self-esteem (Brandtstadter & Greve, 1994). This reining in of personal ideals, as older adults become more realistic in discerning what they can and cannot do, suggests a later life gain wherein the ideal self aligns with the real self. Further, it might seem futile for older adults to attempt to self-enhance in domains that inevitably deteriorate with age (e.g., physical strength, reflexes). Instead, it may be more fulfilling to focus on strengths by mastering and maintaining domains where functioning is high and satisfying. Thus, self-enhancement may become more domain specific in older adults. Research by Ryff (1993) is suggestive here. Older women completed self-reports of physical health, upward and downward social comparison questions, and rated positive and negative aspects of psychological adaptation. Results showed that poorer physical health was linked to more frequent usage of social comparisons. Women were more motivated to make self-enhancing social comparisons in domains in which age-related loss typically occurs (i.e., physical health; Heidrich & Ryff, 1993).

Prediction-Performance Miscalibrations

Although individuals are highly motivated to ascertain their capabilities (Festinger, 1954), they are generally not adept at spotting the limits of their knowledge and expertise. In many social and intellectual domains, people are simply unaware of their incompetence and innocent of their ignorance (Kruger & Dunning, 1999). Poor metacognitive skills may be responsible for such miscalibrations. For instance, research on expertise reveals that novices possess poorer metacognitive skills than experts. In the domain of tennis, novices are less likely than experts to successfully gauge whether specific strategies were successful (McPherson & Thomas, 1980). Similarly, physics novices are less accurate than experts in judging the difficulty of physics problems (Chi, 1982). The incompetent are also less able than the competent in gauging their own level of aptitude. For instance, students doing poorly on tests are less accurate at predicting which questions they will get right than students doing well (Sinkavich, 1995) and unskilled readers are less able to assess their text comprehension than more skilled readers (Maki, Jonas, & Kallod, 1994).

Poorer performers also tend to self-enhance and overestimate their abilities, holding self-perceptions that are falsely positive or somewhat exaggerated, rating themselves in various domains in a more positive light than how others actually perceive them, or than their actual abilities would indicate (Bromgard, Trafimow, & Bromgard, 2006; Sedikides, Campbell, & Reeder, 1998; Sedikides & Gregg, 2008). For instance, on tests of logic, grammar, and the ability to spot funny jokes, individuals at the low end of the performance distribution overestimated their performance by approximately 40 to 50 points, believing they were outperforming the majority of their peers (Kruger & Dunning, 1999). Similar effects have been found among medical residents assessing their patient-interviewing skills (Hodges, Regehr, & Martin, 2001) and among medical lab technicians assessing their knowledge of medical terminology and everyday problem solving ability (Haun, Zeringue, Leach, & Foley, 2000). Research suggests that people use their preconceived beliefs (Lineweaver et. al., 2009) about their skills and abilities to estimate how well they are doing on specific tests; most people tend to hold an inflated view of their skills that cannot be justified by their objective performances.

Why do people miscalibrate and self-enhance?

Individuals may desire an accurate self-evaluation of performance ability in order to know if they have sufficient skill to perform a specific task successfully. For example, though one may want to believe that he is a great mechanic, an accurate self-assessment should be sought before deciding whether to repair a car engine himself. Not all self-assessments are accurate.

Miscalibrated assessments may be due to a lack of feedback such as that garnered through adequate task experience and feedback, or due to social comparison, in which insight into competence is gained by watching the behavior of others (Festinger, 1954; Gilbert, Giesler & Morris, 1995). Assessments may also be miscalibrated simply because the person lacks the metacognitive skill to accurately appraise the situation (Kruger & Dunning, 1999).

We are primarily interested in miscalibrations that represent overestimations of one's ability (i.e., self-enhancement). There are a few reasons why people may miscalibrate and self-enhance. One is that individuals may simply lack the metacognitive skills to accurately appraise their abilities (Kruger & Dunning, 1999). A second possibility is that self-enhancement may occur as a means of self-protection when confronted with threats to self-esteem; in this case, people self-enhance to provide a sense of subjective well-being, self-worth, mastery and control. A third and final possibility involves the role of self-esteem. While self-protection may be the most common reason for enhancement, it is not a necessary condition. In fact, people just tend to be generally positively biased in rating "self" compared to "others." They rate themselves more favorably than others on positive attributes (Brown, 1986) and abilities (Campbell, 1986). This "self-serving bias" is attenuated in people who are low in self-esteem (Brown, 1986); in fact, people with high self-esteem seek out, interpret and recall self-relevant information that confirms and enhances their positive self-views (Brown & Dutton, 1995).

Age-Related Domains of Functioning Across the Lifespan

While becoming more aware of one's capabilities is vital to healthy and successful aging, protecting one's sense of self and self-esteem is just as important. Taking inventory of one's actual capabilities may make one painfully aware of declining abilities. Such acute awareness may lower self-esteem and damage one's self-concept. To cope with this possibility, individuals may adjust actual self closer to ideal self by self-enhancing, that is, seeking positive self-views by inflating the appraisal of the actual self. In fact, it is adaptive for individuals to self-enhance and focus on domains that are important to self-concept and necessary for effective functioning. To that end, self-esteem contingency theory posits that people have "staked" their self-esteem on the successes and failures in particular domains (e.g., virtue, family support, academic competence, appearance, job performance) that matter most to them and on which their self-esteem is contingent (Crocker, 2002; Crocker & Wolfe, 2001; Sedikides, Gaertner, & Toguchi, 2003). The "staking" of self-esteem, moreover, is an example of how older adults may utilize the Baltes and Baltes (1990) SOC model to deal with age-related losses by selecting, focusing on, and enhancing in domains that are controllable and are important to self-esteem. The effect of self-evaluations on self-esteem depends on the importance one attaches to the domains (Rosenberg, Schooler, & Schoenbach, & Rosenberg, 1995). For example, Harter (1993) reported higher correlations between self-perceived ability and self-esteem in important domains than in less important domains.

Competencies in different domains develop (and decline) at different rates throughout the life span. Individuals are faced with different problems to solve in childhood relative to adolescence, adulthood, and senescence. These problems require different skill sets. Research on problem solving shows that adults of different ages solve problems differently. For example, everyday problem solving tasks are ecologically representative of individuals' daily challenges; solutions to such dilemmas require individuals to draw on personal knowledge accumulated through social experience (Allaire & Marsiske, 2002; Baltes, Staudinger, & Lindenberger, 1999). Effective performance on traditional problem-solving tasks declines after middle age (Birren & Fisher, 1995; Salthouse, 1990), whereas effective performance on everyday problem-solving tasks increases with age. Cornelius and Caspi (1987) compared adults ranging in age from 20 to 78 years on everyday problem solving abilities and on traditional measures of cognitive abilities. They administered an inventory that assessed problem solving in situations that adults might encounter in everyday life, and a series of traditional cognitive tasks including the Verbal Meaning test and Letter Series test. Results revealed that performance on everyday problems and verbal ability tests increased with age, whereas performance on a traditional problem-solving test declined after middle age. A study by Artistico et. al. (2003) corroborates these findings. They found that older adults performed better and had higher confidence for "age-ecological" problems than younger adults who performed better and had higher confidence on "young" problems. Thus, individuals are competent in different domains at different points in the lifespan; they are most adept at and confident in solving problems that are most relevant to their cohort.

Marked age differences in competencies have been found in measures of memory and intelligence. For instance, although older adults perform poorly on most episodic memory recall tasks, they are relatively good at memory recognition tasks (Dixon et al., 2004; Light & Healy, 2004). Similarly, although older adults suffer losses in fluid intelligence, as measured by processing speed and abstract reasoning (Bryan & Luszcz, 1996; Salthouse, 2004) they maintain crystallized intelligence, as measured by semantic and vocabulary abilities (Parkin & Java, 1999; Horn & Cattell, 1967). In a longitudinal study conducted by Lachman (1983), older adults were administered a battery of personality and intelligence tests two years apart. Results show that the average level of perceptual speed and memory span increased. Older persons who functioned higher on

Fluid ability and Internal Control also maintained a more positive view of their intellectual activity. Thus, while memory and intelligence is thought to generally decline in old age, research shows that the size of the age differences in these domains varies by the type of task.

Not only do individuals perform better in particular domains across the lifespan but they also appear to be more interested in particular life tasks and domains at different points in the lifespan. For example, as people enter adulthood, there is a shift from the pursuit of knowledge-related goals (e.g., knowledge acquisition, career planning, development of new social relationships, family life) to emotion-related goals (e.g., pursuit of emotionally gratifying interactions, emotion regulation). Several studies support this shift in goal orientation (Carstensen, Blanchard-Fields, Jahnke, & Camp, 1995; Sansone & Berg, 1993; Strough, Berg, & Sansone, 1996; Brandstadter & Renner, 1990; Baltes et. al., 1984). Moreover, individuals begin to be more concerned with other people (e.g., their children; Nurmi, Pullianen & Salmelero, 1992) and interdependency, intimacy and generativity become more salient (Erikson, 1963; McAdams, de St. Aubin, & Logan, 1993; Veroff & Veroff, 1980).

This motivational shift can affect the ways in which individuals solve problems as people at different life stages may solve everyday problems using different strategies (Blanchard-Fields et. al.. 1995; Blanchard-Fields & Camp, 1990). For instance, older adults prefer to use more emotion-focused strategies (Watson & Blanchard-Fields, 1998) and they also tend to employ more strategies overall when solving emotionally salient problems (Blanchard-Fields et al., 1995; Blanchard-Fields, 2007; Blanchard-Fields, Mienaltowski, & Seay, 2007). Additionally, older adults are poorer at solving instrumental, logic-based problems than their younger counterparts, but they excel in solving complex social problems. In one study, young, middle-aged and older participants were given 40 descriptions of fictitious people, each consisting of equal amounts of positive or negative behavioral information relating to either honesty or intelligence, and were asked to provide impression ratings for each one based on this information (Leclerc & Hess, 2007). Results showed that older adults spent a disproportionate amount of time studying diagnostic behaviors relative to younger and middle-aged adults. Both middle-aged and older adults were more likely than younger adults to incorporate trait-diagnostic information into impression judgments. Further, increasing the salience of trait-diagnostic information by increasing both the number and descriptive extremity of target behaviors increased the extent to which younger adult's ratings were based on this information. These data suggest that younger adults do not have the accessibility or breadth of application of knowledge that older adults have as social experts. The accumulation of social expertise throughout adulthood results in the establishment of knowledge structures about the social world. Young adults seem to require the same amount of behavioral information to confirm that someone exemplified a given trait dimension (e.g., smart).

The Role of Self-Efficacy and Beliefs on Performance

Research on the effects of beliefs and metamemory on performance of cognitive tasks has increased significantly in the last decade (Berry, 1999; Hertzog & Hultsch, 2000). People's beliefs about cognition, task behavior (e.g., strategy use, resource allocation) and affective responses are self-regulatory factors that influence cognition. One such model of cognitive self-regulation posits that older adults can modify performance outcomes by choosing to allocate particular resources that will advance performance (Stine-Morrow, Miller, & Hertzog, 2006). Such choices, however, are constrained by ability, knowledge, motivation, interests, affect, feedback and task demands. Accordingly, a person's initial performance levels on a task may lead to general positive or negative self-perceptions that will influence subsequent performance levels (Bandura, 1997). Poor performance on a task (e.g., memory recall) may lead to negative affect (e.g., low self-esteem, self-doubt), withdrawal from strong investment in the task (e.g., failure to employ memory strategies), and poor performance on subsequent tasks (due to lack of practice and interest).

Because self-regulatory processes can be specific to task context and involve beliefs about performance, affective reactions, and processing strategies, they may be highly influential in determining how and when older adults can overcome memory deficits. For example, Lineweaver, Berger and Hertzog (2009) examined expectations about memory change in young, middle-aged and older adults who rated memory abilities of target adults across the adult life span. Targets with positive personality traits (e.g., active, sociable, independent) were rated as having better memory ability and less age-related memory decline than target adults with negative personality traits (e.g., tired, fragile, stubborn). Results indicated that although adults of all ages expected memory to decline across the lifespan, these beliefs varied when applied to different types of individuals. Targets who fit positive stereotypes of aging, were viewed as having better overall memory and to decline less than targets who fit negative stereotypes of aging.

Metacognition, particularly metamemory, is also influential in cognitive functioning. Metacognition is the ability to know how well one is performing, when one is likely to be accurate in judgment, and when one is likely to be in error (Everson & Tobias, 1998; Metcalfe & Shimamura, 1994; Yzerbyt, Lories & Dardenne, 1998; Flavell, 1976). Most individuals have an imperfect degree of metacognitive insight. Kruger and Dunning (1999) believe that incompetent individuals are especially unable to judge their performances accurately. Their lack of skill prevents them from forming appropriate responses to situational demands and from recognizing when judgments will be accurate and when they will be erroneous. In fact, in a series of studies across multiple cognitive tasks, low performers overestimated their abilities and high performers underestimated their abilities. Interestingly, in manipulations where participants' metacognitive skills were improved, their self-appraisal accuracy improved as well (Kruger & Dunning, 1999).

One component of metacognition is self-efficacy, defined as people's judgments of their capabilities to attain a given level of performance (Bandura, 1986). Developmental research has shown that self-assessments of memory are related to age differences in actual memory performance (Cavanaugh & Murphy, 1986). While some studies have shown that old adults are more inaccurate in their predictions than young adults (Bruce, Coyne & Botwinick, 1982), Rebok and Balcerak (1989) found neither age differences in prediction inaccuracy nor varying congruence between self-efficacy and performance across age groups. Young and old adults received either training in the method of loci task or no training and were given either performance feedback or no feedback on a serial-word recall task. Self-efficacy strength (e.g., on a scale of 0 to 100 how sure are you that you can recall all words) and self-efficacy level (e.g., total number of words you predict you will recall) level were rated at pre and post testing. Results showed that training with feedback improved recall performance in both age groups but did not increase self-efficacy strength or level. Age differences were found not in prediction inaccuracy but rather in the direction of predictions; older adults overpredicted their performance to the same extent that young adults underpredicted theirs. The authors attributed his paradoxical finding to the possibility that rather than being overconfident about their memory capacity, older adults actually underestimated the difficultly level of the task. With greater experience, older adults accurately monitored their memory abilities vis-à-vis the task. Contrastingly, younger adults appear to overestimate task difficulty, which would account for their underestimating.

A meta-analysis has shown a positive association between such levels of self-efficacy and task performance (Sadri & Robertson, 1993). For example, in the domain of memory beliefs and self-efficacy older adults are also relatively less certain and more negative in their self-judgments of memory ability than younger adults as indicated on several different measures of memory self-efficacy (Berry, West, & Dennehy, 1989; Hertzog, Dixon & Hultsch, 1990; West, Dennehy, Basile, & Norris, 1996).

The purpose of this research was to investigate age-related differences in self-assessment across multiple behavioral domains. First, we conducted a pilot study of self-assessment in cognitive, social, interpersonal, physical, and emotional domains to test the better-than-average effect across age and behavioral domains. The first part of the pilot study was a questionnaire study. We also compared self-assessments of ability to *actual* ability in a domain that is highly age-sensitive – episodic memory functioning. This domain allowed us to test whether adults' self-assessments of ability are accurate. This domain was an obvious choice for tests of assessment accuracy because episodic memory tasks yield robust negative age differences (Dixon et al., 2004; Salthouse, 2004). However, it is not known whether self-assessments of younger and older adults reflect this behavioral difference. Memory is also a domain of significant personal importance to many older adults, for whom cognitive deficits may represent a threat to self-esteem and well-being. Some older adults may rate their memory abilities higher than warranted by performance, in order to self-enhance and self-protect in this domain (Ponds & Jolle, 1996).

The results from the pilot study were meant to inform our hypotheses for a larger study of self-enhancing across the life span, which would represent the major study of the master's thesis project (see CURRENT STUDY). We present results from pilot work next.

PILOT STUDY

Our pilot study focused on assessments of abilities in adulthood. We were interested in the better-than-average effect in different age groups and different domains of functioning. We expected individuals to rate themselves more favorably than others, but that these positively-biased ratings would be adjusted downward and upward depending upon a) the age of the comparison "other" and b) the behavioral domain of comparison.

We predicted that the group overall would show self-enhancing tendencies, i.e., rate themselves as better-than-average across multiple domains. We also took a developmental approach to self-enhancement, predicting that individuals would show less positive bias in domains that were not age-normative strengths. Age-normative "strength" domains were defined as follows: wisdom-related areas for older adults (e.g., forgiveness, compassion, wisdom; Baltes et. al., 2003); work-related mastery (Schaie & Schooler, 1998), generativity (Erikson, 1959), and creativity (Jung, 1971) for middle-aged adults, and physical (e.g., health, strength, reflexes) and cognitive domains (e.g., memory, attention; Salthouse, 2004) for young adults.

Method

Participants. Participants ranging in age from 17 to 88 years old (N = 258) were recruited. Although the total sample was used to develop measures for the main study, we selected a subsample (N = 100) of this group to test our pilot hypotheses. The subsample was selected to match the three age comparison groups on our questionnaire measure of the better-than-average effect.

Measures and Procedure. The Better-than-Average Questionnaire (BTAQ; see Appendix A) is a 66-item measure developed in our lab to assess self versus other ratings in 22 domains (e.g., driving ability, health, intelligence, happiness, attractiveness, wisdom) crossed with three different age cohorts (college, midlife, elderly). For example, the driving domain items ask participants to compare themselves to other drivers by rating the degree to which they agree on a 6-point scale from Strongly Disagree (1) to Strongly Agree (6) with the following statement(s): "I am a better driver than the average 80 year old" (with two companion items comparing self to the average 45 year old, and to the average college student).

The BTAQ items were derived from research on possible selves and important life domains across adulthood (Hooker & Kaus, 1994; Cross & Markus, 1991; Hooker, 1992; Hooker, Fiese, Jenkins, Morfei & Schwagler, 1996). Three age-normative domain subscales were created from the 66 BTAQ items. The older adult domain was comprised of five facets that define a peak interpersonal and intrapersonal domain (compassionate, forgiving, mature, moral, wise). The middle adult domain was comprised of four facets that define a peak career productivity domain (creative, generous, intelligent, successful). The young adult domain was comprised of five facets that define a peak physical and cognitive fitness domain (attention, health, memory, reflexes, strength). Estimates of internal consistency for each domain subscale were determined by computing coefficients alpha (α) for both the total ($N = 258$) and subset samples ($N = 100$). All domains had satisfactory reliability: Old Domain, total $\alpha = .79$, subset $\alpha = .78$; Middle Domain, total $\alpha = .78$, subset $\alpha = .80$; Young Domain, total $\alpha = .80$, subset $\alpha = .82$.

Participants completed the BTAQ and a memory task; other data were collected and will be reported elsewhere. For the memory task, participants studied and recalled a list of 40 common English words. Prior to study and test, participants predicted how many words of 40 they expected to recall. We calculated the difference between these prediction and performance scores to serve as both a measure of metacognitive knowledge and as measure of bias to compare to memory bias item on the BTAQ.

For analysis purposes, three age groups were created to correspond to the age categories (college, 45-year-olds, 80-year-olds) on the BTAQ: College-aged (n = 38, 17 to 22 years old), middle-aged (n = 32, 40 to 50 years old), and older (n = 30, 75 to 85 years old) adults.

Results

Better-than-Average (BTA) Effects. A one-sample t-test comparing the average BTAQ score ($M = 4.04$, $SD = 0.57$) to the neutral (non-biased) midpoint of the BTAQ (3.50) was significant, $t(1, 99) = 9.48$, $p = .000$, see Figure 1. The BTA effect was significant within each age group as well: Young (n = 38, $M = 3.96$, $SD = 0.43$, $t(37) = 6.18$, $p = .001$), Midlife (n = 32, $M = 4.31$, $SD = 0.55$, $t(53) = 8.59$, $p = .001$), Old (n = 30, $M = 3.84$, $SD = 0.64$, $t(29) = 2.62$, $p = .000$). There were significant age differences on BTAQ scores, $F(2,99) = 6.44$, $p = .002$. Post hoc tests indicated that middle-aged adults were more positively biased than younger and older adults, both p's $\geq .002$. Finally, the larger sample (N = 258) was also positively biased, $t(1,257) = 17.29$, $p = .000$. The curvilinear trend in bias (midlife adults significantly more biased than younger or older adults) is also supported by a non-significant bivariate correlation, $r(258) = -.051$, $p = .418$. Our results are consistent with other research on self-enhancing and the BTA effect (Harre et. al., 2005; Sedikides, 1998; Alicke, 1985; Brown, 1986; Sedikides et. al., 2003). Moreover, to our knowledge this is the first study to report the BTA effect in midlife and older adults, and age differences on the BTA effect, thereby extending this literature.

Better-than-Average Effects Across Age Groups and Domains. It was also predicted that individuals would be most likely to self-enhance in domains of age-relevant strengths. This prediction would be supported by a significant interaction of age group by domain, i.e., highest scores for older adults in wisdom-related areas, middle-aged adults in work-related areas, and young adults in physical and cognitive areas. A 3x3 mixed ANOVA with Age Group (College, Middle, Old) and Domain (College, Middle, Old) yielded significant Age Group, Domain, and Age Group x Domain effects. Middle-aged adults ($M = 4.33$) were significantly more biased than younger ($M = 3.93$) and older ($M = 3.82$) adults, who did not differ from each other. Bias scores were significantly lower in the young ($M = 3.89$) domain relative to the middle ($M = 4.05$) and older ($M = 4.14$) domains, both p's $\leq .005$. Bias scores did not differ between the middle and older domains.

Simple effects tests of the interaction were conducted both within domain and within age group. Within age group, only older adults' BTAQ scores varied by domain, $F(2, 97) = 7.63, p = .001$; college and midlife adults were equally biased across domains. Older adults' BTAQ scores were highest in the old domain and lowest in the college domain with the middle domain scores falling between the two extremes. All pairwise comparisons were significant, p's $\leq .001$. Within domain, age differences were significant in all three domains. Pairwise comparisons between age groups indicated that for the young domain, older adults' BTAQ scores were significantly lower than midlife and college adults, whose scores did not differ. For the midlife domain, midlife adults' scores were significantly higher than college and older adults' scores, whose scores did not differ. For the older domain, college students' had significantly lower scores than midlife or older adults, whose scores did not differ. See Figure 2. Taken together, these results show that older adults were the most biased for the young domain, middle-aged adults were the most biased for the middle domain and young adults were the least biased for the old domain.

Prediction and Performance in the Memory Domain. A 3(Age Group) x 2 (Memory: prediction/performance) mixed ANOVA yielded significant age, $F(2, 92) = 11.33$, $p = .000$, and Age x Memory effects, $F(2, 92) = 7.68$, $p = .001$. Post hoc tests of age differences on the within subjects memory prediction/performance scores indicate that older adults ($M = 13.61$, $SD = 6.06$) had lower prediction/performance scores than both the middle-aged ($M = 18.60$, $SD = 5.66$) and young adults ($M = 18.28$, $SD = 4.67$) both p's $\leq .001$. Simple effects tests were conducted on the interaction effect. Age differences were significant for memory recall scores, $F(2,96) = 21.48$, $p = .000$, but not for memory prediction scores. Post hoc tests indicated that older adults had lower recall scores ($M = 11.86$, $SD = 4.89$) than college ($M = 19.55$, SD = 4.91) and midlife (M = 17.88, SD = 4.90) adults, whose scores did not differ. Within age groups, younger adults underpredicted their performance scores, $t(1,37) = -2.77$, $p = .009$ and older adults overpredicted their scores, $t(1,26) = 2.57$, $p = .016$. The differences between prediction and performance scores were non-significant for midlife adults. See Figure 3.

The results of our pilot study show that, overall, individuals are biased. This bias emerges by age group, moreover, only in age-relevant domains. When rating themselves on neutral domains, individuals did not exhibit any significant bias effects. These findings suggest that self-enhancement is domain dependent. Only enhancing in domains that are important to one's self-esteem may be a valuable strategy that enables individuals to focus their strengths and energy solely on the domains that are most important to them. This becomes increasingly helpful and important in old age when older adults will simply not have the physical and cognitive capacity to perform sufficiently on all domains. Rather, they can select the domains that are most important to optimize (Baltes & Baltes, 1990).

Our results also showed that older adults had a positive bias in their memory prediction scores which were much higher than their memory performance scores. Older adults may have self-enhanced in order to self-protect. In fact, older adults have reported that memory-related selves are their most feared possible selves (e.g., dementia) and that, for older adults, the greatest dread for the future was related to memory loss (Dark-Freudeman, West, & Viverito, 2006). Moreover, older adults have less self-confidence in their personal cognitive skills (Hultsch, Hertzog, & Dixon, 1987) and they make more self-enhancing social comparisons in domains with age-related loss (i.e., physical health; Heidrich & Ryff, 1993). Young adults, on the other hand, may have self-enhanced for another reason. Rather than as a means of self-protection, self-enhancement may function as a type of self-improvement, in which young adults, because they still have the capacity to change and improve, may try and bring their actual selves closer to their ideal selves.

CURRENT STUDY

The purpose of this study was to investigate self-enhancement biases and the better than average effect in younger and older adults by comparing their self-assessments of abilities to their actual abilities in two behavioral domains. Thus, we revised and expanded the BTAQ and administered it to a new sample, and we selected four tasks from the cognitive aging research literature that show consistent age effects: recall memory, recognition memory, vocabulary knowledge, and processing speed. The main question driving this research was: Are individuals aware of their abilities and do these vary by age and type of task?

Our pilot study examined age differences in self-enhancement tendencies. In that study, we focused on bias at the social comparison level, that is, individuals rated whether or not they believed they were better than an anonymous, average "other" (of different ages) on a variety of age-related (and neutral) dimensions. We learned that young, midlife, and older adults are indeed biased, and that these biases differ by domains defined by normative age strengths. To extend these findings, the current study sought to understand what happens when people are held accountable for their predictions of their ability in different domains. When an ability marker is available, will individuals adjust inflated ratings downward to match performance outcomes? Do individuals become less biased under these conditions?

Research has shown that people are inaccurate raters of themselves because they self-protect (Dark-Freudeman, West, Viverito, 2006) and they lack metacognitive awareness (Kruger & Dunning, 1999). However, this literature has not examined the possible role of related constructs such as self-esteem, metacognition, self-efficacy, and domain importance to the bias to self-enhance. These variables may be related to age differences in self-enhancing and the better-than-average effect. It is important to fill this gap in the literature because self-assessment becomes important in new ways in late life. Accurate knowledge of one's capabilities can help the aging adult navigate the social, physical and cognitive changes they face by allowing them to identify and focus on their strengths to compensate for their losses (Baltes & Baltes, 1990). Doing so will facilitate the transition into late life and optimize the probability of positive aging.

Performance in Age-Relevant Domains

In our pilot study, we tested assessments of ability against performance in only one domain-- memory. In this study, we extended our tests in the memory domain by adding a memory recognition task while replicating tests of the memory recall task in the pilot. We also expanded our analyses to include the domain of adulthood intelligence. We focused on memory and intelligence because there is clear evidence for age-related preservation and loss of abilities in each. We were interested in whether assessments of abilities on these tasks are congruent with actual abilities on these tasks. Our research question was driven in part by a recent meta-analysis of the self-serving bias, which found that several moderators (e.g., gender, task importance, self-esteem, perceived task difficulty) influence the strength of the self-serving bias (Campbell & Sedikides, 1999) but age was not among the moderators analyzed by these authors. In fact, our exhaustive search of the literature did not turn up one study of the effects of aging on the self-serving bias *per se*. We seek to expand the self-enhancement research on aging by examining the relationship of adulthood age to biases in self-assessment of abilities.

We will administer two measures of memory and two measures of intelligence to assess how bias is manifested on tasks that are and are not preserved with age. We predict that older adults will perform relatively well on recognition and vocabulary tasks and more poorly on recall and speed of processing tasks (Dixon et. al., 2004). If they are aware of their differential abilities in these domains, their self-evaluations should reflect this.

It is clear that some abilities decline with age and others are retained. Do aging individuals know this? Are they aware of differential decline? Older adults excel on vocabulary tasks (Cornelius and Caspi, 1987); however, it is unknown whether they know they are better at such tasks. Analyses of prediction-performance accuracy will allow us to understand how individuals self-assess and how well aging individuals know themselves.

Modifications to the Better-than-Average Questionnaire (BTAQ)

The version of the BTAQ used in our pilot study used items referring to college students as the young comparison group (i.e., "I am a better than the average college student."). However, the young participants were mostly all past college age (*M* age = 29.42, *SD* = 5.03, range = 22-39). (Recall, however, that for our pilot analyses, we created a college-aged group by selecting a random subset of the college-aged (17 to 22 years) participants in that study, to rectify the discrepancy between our measure and our young adult sample). Thus, the new comparison group anchor terms are "average young adult," "average middle-aged adult," and "average elderly adult." A second revision to the BTAQ was the addition of items representing our four performance tasks: recall, recognition, vocabulary and processing speed to allow us to compare specific domain biases to specific domain performance. The new measure is labeled the Perceptions of Competence Questionnaire, and is described in more detail in the next section.

Measuring Self-Worth

Self-esteem is a variable that is closely related to self-enhancement. Because self-enhancement biases can serve as ways in which individuals can maintain ideal functioning by helping maintain positive feelings of self worth, such evaluations also allow individuals to reclaim feelings of mastery, self-worth and self-esteem, rather than confront threats to self-image (Fein & Spencer, 1997). Self-enhancement can also vary across domains that are important to self-esteem (Crocker, 2002). Thus, self-enhancement and self-esteem are intimately related. In order to investigate these relationships and the association of self-enhancement to sense of self-worth in adulthood, we measured self-esteem with the Rosenberg Self-Esteem Scale (1965) and domain importance with a measure developed in our lab, the Domain Importance Scale, described in the next section.

Extension of Extant Research

There have been few studies that examine self-assessment across a large number of age-related domains of functioning. There has also been little interest in the self-enhancing literature (but cf. Krueger & Dunning) in analyzing discrepancies between self-reports and objective performance outcomes and how they vary across the lifespan.

Our overarching aim was to determine whether individuals are aware of the social and cognitive changes associated with their own development and aging in different domains of functioning. Our results should also yield insights into how various measures of self-evaluation (e.g., self-enhancement, self-efficacy, self-esteem) are interrelated. In sum, this study investigated self-assessment of abilities in cognitive, physical, and social domains of functioning in adulthood.

Research Questions

1. In what age groups and on what tasks are self-assessments of abilities biased?
2. When are self-assessments of abilities accurate?
3. What roles do self-esteem and self-efficacy play in self-assessment beliefs and performance in different domains in younger and older adults.

Hypotheses

1. Young adults will be more positively biased than older adults because of the age-based domains of self-assessment. That is, we expect younger adults to rate themselves higher overall than older adults rate themselves.
2. Older adults should show greatest positive bias when comparing self to other older adults.
3. Self-assessments will vary as a function of age and domain. Specifically, younger adults will rate themselves higher on recall and speed of processing tasks than will older adults and older adults will rate themselves higher on vocabulary tasks than will younger adults. Ratings on the recognition memory task should be

comparable between the two age groups because age differences on single-item recognition tasks are typically non-significant (Dixon et al., 2004).

4. Older adults will be more likely than younger adults to overestimate their memory abilities. Exploratory analyses of age differences in prediction accuracy on vocabulary and processing speed will be conducted.

Method

Participants. Participants ranging in age from 20 to 80 years old (*M* = 48.54, *SD* = 26.05) were recruited from the University of Richmond and the greater Richmond community through flyers, ads, electronic message boards, and word of mouth. Participants were paid $10.00 per hour. The sample (N = 95, 58 women) included 84 Caucasian (89.2%), 3 African American (3.2%), 2 Asian (2.2%), 3 Hispanic/Latino (3.2%) and 1 Other Race/Ethnicity (2.2%) individuals.

Participants were divided into two groups: Young (n = 46; 20 to 30 years old) and old (n = 49; 70 to 80 years old). The mean number of years of educated completed was 15.87 (*SD* = 2.47, range = 12 – 24). Older adults had completed more years of education (*M* = 16.82, *SD* = 2.47) than younger adults (*M* = 14.87, *SD* = 1.52), $F(1,94) = 17.37, p = .000$. There were also no age differences in self-reported health (*M* = 7.78, *SD* = 1.80) and vision (*M* = 8.00, *SD* = 1.75) but younger adults had higher self-reported hearing scores (*M* = 8.49, *SD* = 1.58) than older adults (*M* = 7.27, *SD* = 1.95), $F(1, 90) = 10.68, p = .000$.

Young adults had a mean age of 21.93 (SD = 2.49) and reported their subjective age as 21.59 (SD = 2.83). This difference was non-significant. Older adults had a mean age of 73.51 (SD = 2.93) but reported a significantly lower subjective age of 60.58 (SD = 7.80), $t(47) = -12.89$, $p = .000$. These results are consistent with Rubin and Bernsten (2006), who showed that, on average, people over 40 years of age report feeling 20% younger than their actual age. Our older adults reported feeling 17.6% younger than their actual age.

<u>Materials and Procedure.</u> Half of the testing materials were mailed to individuals to be completed at home. These included the consent form, demographics sheet, Rosenberg Self-Esteem Scale, Perceptions of Competencies (formerly, the BTAQ), and the Domain Importance Scale. All measures were counterbalanced to avoid order effects.

Demographics. Subjects were asked to provide demographic and other background information including age, sex, race/ethnicity, education level, self-rated health status, and medications (Appendix B).

Subjective Age Identity. Subjective age was assessed using Montepare and Lachman's (1989) method. Specifically, respondents were asked to specify, in years, the age that most closely corresponds to 1) the way they feel, 2) the way they look, 3) the age of the person whom their interests and activities are most like, and 4) the age that they would like to be if they could pick their age right now. Participants were also presented with an age time-line beginning with Young and ending with Old. They were asked to indicate where along the time-line they believed they were at that moment. Research on subjective age has shown that when asked what age most closely corresponded to the way they felt and the way they looked, younger individuals often perceived themselves as slightly older than their actual age and older adults generally perceive themselves as younger than their actual age (Montepare & Lachman, 1989; Montepare, 2009; Rubin & Berntsen, 2006). Our five items measuring subjective age, collected with the background information at the outset of the study, will allow us to assess the degree of concordance between actual and perceived age of participants.

Self-Esteem. We used the 10-item Rosenberg Self-Esteem Scale (Appendix C; Rosenberg, 1965), the most widely-used and psychometrically sound measure of global self-esteem (Gray-Little, Williams & Hancock, 1997; Robins et al., 2002).

Perceptions of Competencies. Self-enhancement was tested with the Perceptions of Competencies Questionnaire (PCQ). The prior version of this questionnaire was referred to as the Better-than-Average Questionnaire (BTAQ), however, the name has been changed to reflect a more neutral stance on the question of self-enhancing and the better-than-average effect. Specifically, we do not know whether participants are actually exhibiting any self-enhancing and BTA effects until the data are collected and analyzed.

The PCQ is an 81-item measure developed in our lab to assess self-ratings of competencies in 27 domains. These domains (e.g., driving ability, health, memory, wisdom, happiness, intelligence, problem solving) were selected based on our review of the research on cognitive and functional aging reviewed above, as well as possible selves (Frazier et. al., 2000; Hooker & Kaus, 1992; 1994) and domain-specific self-esteem

(Harter, 1993) research which describes which domains are salient and important to individuals at different points in their lives.

Age cohort (young adult, middle aged adult, older adult) is nested within domain on the PCQ. Items are phrased such that participants rate their competencies relative to a typical younger adult, middle-aged adult, and elderly adult, thus yielding three age-comparative ratings for each of the 27 domains. For example, the driving domain items ask participants to compare themselves to other drivers by rating the degree to which they agree on a 6-point scale from Strongly Disagree (1) to Strongly Agree (6) with the following statement(s): "I am a better driver than the average young adult," "I am a better driver than the average middle-aged adult," and "I am a better driver than the average older adult." The 81 items on the PCQ are presented in random order to avoid response set bias by item type (Appendix D).

Domain Importance. The Domain Importance Scale (DIS) is a 27-item measure developed in our lab to assess domain importance (Appendix E). This scale was modeled after the Contingency of Self-Worth Scale (Crocker, Luhtanen, Cooper, & Bouvrette, 2000). Participants indicated how important, on a scale from Least Important (1) to Most Important (5) each of the 27 domains are to their self-esteem. This allowed us to test our designations of age-related competency domains and to assess whether the self-enhancing effect is stronger for domains important to self-esteem, as the literature suggests.

*Performance Tasks.*_ The remaining tasks were administered on campus in the lab. These included two performance tasks (memory and intelligence) and their corresponding self-efficacy, prediction and post-prediction measures. Before completing each performance task, participants provided self-efficacy ratings for each in order to generate a confidence rating and a single-item prediction to compare against performance scores as an index of prediction accuracy. Each performance domain included two types of measures, specifically, one that shows relatively greater age differences and one that shows relatively smaller age differences. For example, memory recall tasks show greater age differences than memory recognition tasks (Dixon et. al., 2004). Likewise, our measures of intelligence reflect well-established negative age differences in fluid intelligence (Digit Symbol) and positive age differences in crystallized intelligence (Vocabulary; Park et al., 2002; Salthouse, 2004). This approach will allow us to determine how self-assessments, performance predictions, and self-esteem track performance, and how these vary with age. We included items in the PCQ that matched these performance measures to allow us to measure self-enhancing tendencies in these actual domains, e.g., "I have a bigger vocabulary than the average young adult." Tasks within each test domain were counter-balanced so that half the participants received recall then recognition, and half received vocabulary then digit symbol.

Memory. All participants were first administered computerized word recall and word recognition tasks, each comprised of four parts to be completed in the following order: self-efficacy measure, single-item prediction, the task itself, and three-item post-prediction (Appendix F).

Word Recall. Before beginning the word recall task, respondents rated their confidence in their ability to perform the task on a scale from 0 (completely uncertain) to 100 (completely certain). Ratings were ordered by increasing difficulty from "If I studied a set of 30 words for 3 minutes, I could recall 1-5 of the words, if tested for recall immediately after studying the set" to "If I studied a set of 30 words for 3 minutes, I could recall 26-30 of the words, if tested for recall immediately after studying the set." Sample words were provided before the task to provide context for making these self-efficacy (SE) ratings. After providing SE ratings, participants predicted the number of words they believed they could remember before beginning the word recall task.

During the word recall task, thirty common English words were each presented one at a time on a computer screen for 4 seconds each. After presentation, participants were given two minutes to write down as many words as they can remember. Both recall and recognition word lists were generated using the Paivio, Yuille and Madigan (1968) Word List Generator (http://www.math.yorku.ca/SCS/Online/paivio/), which allows users to select a randomly sampled set of words with specified characteristics from a pool of nouns scaled for word frequency in printed text (10 to 60) and number of letters (5 to 9). Once the word recall task was completed, respondents made three estimates of their ability and test performance by estimating how their "general ability to recall a list of words" and test performance compared with that of other participants by providing their percentile ranking (see Kruger & Dunning, 1999). They also indicated how many words out of 30 they believed they recalled.

Word Recognition. Before beginning the word recognition task, participants were also shown sample words to provide context for making SE confidence ratings before rating items beginning with "If I studied a set of 30 words for 3 minutes, I could recognize 1-5 of the words on a 60-item list of studied and not-studied words" and ending with the most difficult item, "If I studied a set of 30 words for 3 minutes, I could recognize 26-30 of the words on a 60-item list of studied and not-studied words." After providing SE ratings, individuals predicted the number of words they believed they could recognize before beginning the word recognition task.

Thirty common English words were presented one at a time on the computer screen for 4 seconds in the recognition task. Following study, 30 English words (including 15 randomly selected words from study and 15 new words) were presented for 6 seconds each. During this time, participants were asked to indicate whether they recognized the displayed word as a previously studied word or not. After the task, participants were asked to estimate how their "general ability to recognize words" and performance compared with that of the other participants by providing their percentile ranking (see Kruger & Dunning, 1999). They also estimated how many words out of 30 they believe they recognized correctly.

Intelligence. The vocabulary portion of the Verbal Comprehension Index (Ekstrom, French & Harman, 1979) and the Digit Symbol subtest of the Wechsler Adult Intelligence Scale-Revised (WAIS-R; Wechsler, 1983) were used to measure crystallized intelligence and processing speed, respectively. Each task was comprised of four parts to be completed in the following order: self-efficacy measure, single-item prediction and the task itself (Appendix G).

<u>Vocabulary.</u> Before each task, participants reported SE ratings of their confidence in their ability to perform the tasks on scales ranging from 0 (completely uncertain) to 100 (completely certain) attached to different levels of task difficulty. For

the 18-item vocabulary test, participants provided confidence ratings for a series of questions ordered by increasing difficulty beginning with "From a list of 18 vocabulary words, I can pick the best synonym for 1-3 words on the list" and ending with the most difficult level, "From a list of 18 vocabulary words, I can pick the best synonym for 16-18 words on the list." After providing SE ratings, participants predicted the number of items they thought they could answer correctly before beginning the vocabulary task in which they were asked to pick the best synonym for a set of 18 words, each with 5 possible synonyms. Upon task completion, participants estimated how their "general ability to identify synonyms of common English word" and test performance compared with that of the other participants by providing their percentile ranking (see Kruger & Dunning, 1999). They also indicated how many items out of 18 they believed they answered correctly.

Processing Speed. Self-efficacy ratings for the Digit Symbol task were also ordered by increasing difficulty, from "On a 93-item digit-symbol test, I can fill in 1-10 symbols in the blank boxes in 90 seconds" to "On a 93-item digit-symbol test, I can fill in all 93 symbols in the blank boxes in 90 seconds." A practice digit-symbol task was administered before the actual task to provide context for making SE ratings. After rating, participants predicted the number of symbols they thought they could complete and then began the Digit Symbol task. This task provided participants with a key featuring 9 different number-symbol pairings; each number had a symbol displayed in the box below the number (e.g., the square symbol corresponds to the number 4). Below the key were 93 numbers with empty boxes below each; participants were asked to fill in as many symbols as possible in 90 seconds. Once the task was completed, respondents estimated how their "general ability to process symbolic information" and performance compared with that of the other participants by providing their percentile ranking, as well as how many symbols out of 93 they believed they completed (see Kruger & Dunning, 1999).

Results

The primary aim of this study was to investigate self-enhancing biases, particularly the better-than-average effect, across different age groups and domains. We approached our task with an integrative framework of related constructs. Specifically, we measured self-reports of abilities and compared a subset of these to performance indicators in four domains. We analyzed metacognitive accuracy through measures of performance predictions before and after testing. Finally, we also explored the possible roles of general and domain-contingent self-esteem (e.g., its contingency on domain importance) and task-specific self-efficacy to self-enhancing in adulthood.

There were three foci in the current study. The first was an investigation of the better-than-average effect and how it changes across the lifespan and across different age-related competency domains. Here, we focused on replicating the self-enhancing bias we obtained in our pilot study, and its dependence on age of participant and type of domain. The second was also a replication and extension of our pilot. We examined accuracy across four objective measures of two cognitive domains: memory and intelligence. We expected individuals to adjust their predictions of ability according to their actual ability levels on tasks that typically show age-related differences, both positive (vocabulary) and negative (recall memory, processing speed) and tasks that don't vary with age (e.g., recognition memory). Analyses of prediction and performance, absolute accuracy and relative accuracy across age group and performance tasks were conducted. A third and final focus was age-related differences in metacognition, as measured by task-specific self- efficacy for each of the four performance tasks.

Better-than-average effects. We tested the hypothesis that the better-than-average effect would vary across domains and age groups. Specifically, we expected an interaction between age group and domain such that older adults would have rate themselves higher (be positively biased) on the wisdom-related domain and younger adults would rate themselves higher (be positively biased) on the physical and cognitive fitness domain.

Prior to analysis of age by domain effects, we asked whether there was a better-than-average effect operating at the group level across all 81 items on the PCQ. This would be supported if the mean score PCQ score was positive and significantly different from 3.50, the midpoint of the scale and thus the point of no bias. The mean PCQ score ($M = 4.06$, $SD = .59$) for the sample was significantly greater than 3.50, $t(94) = 9.36$, $p = .000$, Mdiff = .57. This result replicates the better-than-average (BTA) effect we obtained in our pilot study. The overall BTA effect was also obtained within each age group as both young (n = 46, $M = 4.16$, $SD = .50$, $t(45) = 9.06$, $p = .000$) and older adults (n = 49, $M = 3.98$, $SD = .66$, $t(48) = 5.06$, $p = .000$) had mean PCQ scores greater than 3.50. PCQ scores did not vary by age group, $F(1,93) = 2.43$, $p = .123$. The range of bias scores was

2.44 to 5.48, indicating that some participants had bias scores below the midpoint of 3.50. See Figure 4.

Age and Domain-Specificity of Better-than-Average Effects. Our main hypothesis focused on bias as a function of domains of competence across the adult life span. We predicted that individuals would show less bias in domains outside of age-relevant strengths. Three subscales from the PCQ items were constructed. The young adult domain was comprised of 15 items (5 domains by 3 age groups: attention, health, memory, reflexes, physical strength). The coefficients alpha for the total sample, young adults, and older adults were .92, .85, and .92 respectively. The older adult domain was comprised of 15 items (5 domains by 3 age groups: compassion, forgiveness, maturity, morality, wisdom; total α .91, young $\alpha = .87$, old $\alpha = .93$). A neutral domain was also created and included 15 items (5 domains by 3 age groups: attractiveness, friendliness, happiness, social network, consideration; total α .89, young $\alpha = .90$, old $\alpha = .92$). These items were originally included as filler items on both the BTAQ and PCQ and were not expected to show age-related effects.

A two-way mixed ANOVA with Age Group (young, old) x Domain (young, old, neutral) yielded a significant main effect for Domain, $F(2, 92) = 6.59, p = .002$ and a significant interaction effect, $F(2, 92) = 58.91, p = .000$. The age effect was non-significant. The old domain had higher bias scores ($M = 4.11$, $SD = .72$) than the neutral ($M = 4.05$, $SD = .68$) and young domains ($M = 3.87$, $SD = .81$). Simple effects tests of the interaction were conducted examining domain effects within age group. Domain effects were significant for both the young, $F(1, 93) = 25.43, p = .000$ and older adults,

$F(1, 93) = 106.42, p = .000$. Among young adults, bias was higher for the young domain ($M = 4.33$, $SD = .63$) than the old domain ($M = 3.87$, $SD = .60$) and among older adults, bias was higher for the old domain ($M = 4.34$, $SD = .75$) than the young domain ($M = 3.44$, $SD = .72$). This pattern of mean differences is displayed in Figure 5. Additional simple effects tests were conducted to examine age differences within domain. Significant effects were obtained for both the young, $F(1, 93) = 40.67, p = .000$, and old domain, $F(1, 93) = 11.08, p = .001$. Younger adults had higher bias scores ($M = 4.33$, $SD = .63$) than older adults ($M = 3.44$, $SD = .72$) in the young domain; conversely, older adults had higher bias scores ($M = 4.34$, $SD = 3.87$) than younger adults ($M = 3.87$, $SD = .60$) for the old domain. Age differences were non-significant for the neutral domain, $F(1, 93) = 2.47, p = .120$, Young ($M = 4.16$, $SD = .64$) and Old ($M = 3.94$, $SD = .72$). Thus, age differences in bias were only significant in the age-congruent domains.

Age Differences on Recall versus Recognition Memory Tasks.

A 2 (Age: young, old) x 2 (Memory Tasks: recall, recognition) mixed ANOVA yielded significant age, $F(1, 93) = 54.83, p = .000$, Memory, $F(1, 93) = 1301.70, p = .000$, and Age x Memory interaction effects, $F(1, 93) = 27.20, p = .000$. Results can be seen in Figure 6. Younger adults ($M = 20.18$, $SD = 2.43$) had higher memory scores overall than older adults ($M = 16.47$, $SD = 2.47$) and recognition scores ($M = 25.35$, $SD = 3.35$) were higher overall than recall scores ($M = 11.18$, $SD = 4.11$). Simple effects tests within type of memory task yielded significant age differences on both tasks: recall, $F(1, 93) = 91.47, p = .000$, recognition, $F(1, 93) = 6.34, p = .014$. Younger adults (Recall, $M = 14.15$, $SD = 3.40$; Recognition, $M = 26.17$, $SD = 2.87$) performed better than older adults (Recall, $M = 8.39$, $SD = 2.42$; Recognition, $M = 24.53$, $SD = 3.59$) on both tasks. Although there was a significant difference between age groups on both types of memory tasks, the difference (Mdiff = 1.69) was not as large on the recognition task compared to the recall task (Mdiff = 5.76), consistent with previous aging literature that shows smaller age differences on recognition tasks (Dixon et al., 2004). Next, we turn to age differences on prediction and performance within recall, recognition, vocabulary, and speed of processing tasks.

Age and Prediction/Performance Effects on Memory and Intelligence Tasks.

Memory. Results for word recall and word recognition accuracy effects by age group are reported in the next section. Typically, recall scores are lower than recognition scores of the same items because recall tests are harder than recognition tests but this difference is often greater in older adults (Dixon et al., 2004; Schonfield, 1965). We did not test for this effect in this study, but rather, focused on age differences in accuracy on recall and recognition tasks separately.

Word Recall Prediction Accuracy. To test age differences in recall prediction accuracy, a 2 (Age: young, old) x 2 (Recall Task Type: prediction, performance, post-prediction) mixed ANOVA yielded significant Age, $F(1, 91) = 13.64, p = .000$, Task Type, $F(2. 90) = 8.87, p = .000$, and Age x Task Type interaction effects, $F(2, 90) = 10.31, p = .000$. Overall, younger adults ($M = 13.89$, $SD = 2.59$) had higher scores than older adults ($M = 10.92$, $SD = 4.51$). Prediction scores ($M = 13.71$, $SD = 4.66$) and post-prediction scores ($M = 12.39$, $SD = 8.74$) were both higher than performance scores ($M = 11.25$, $SD = 4.13$), both p's $\leq .05$, suggesting positive prediction biases overall. Post-prediction scores did not differ significantly from prediction scores. Simple effects tests within age group revealed significant differences for older adults, $F(1, 91) = 19.26, p = .000$, but not for younger adults. Older adults' predictions ($M = 13.40$, $SD = 4.56$) were higher than both post-prediction ($M = 11.30$, $SD = 11.86$), $p = .026$, and performance ($M = 8.40$, $SD = 2.47$) scores, $p = .000$. Prediction and post-prediction scores were not significantly different. See Figure 7.

Word Recognition Prediction Accuracy. To test age differences in recognition prediction accuracy, a 2 (Age: young, old) x 3 (Recognition Task Type: prediction, performance, post-prediction) mixed ANOVA yielded significant Age, $F(1, 93) = 8.49$, $p = .004$, Task Type, $F(2, 92) = 165.73, p = .000$, and Age x Task Type effects (2, 92) = 4.38, $p = .015$. Overall, younger adults ($M = 21.55$, $SD = 4.25$) had higher scores than older adults ($M = 18.93$, $SD = 4.51$). Prediction scores ($M = 15.91$, $SD = 5.18$) and post-prediction scores ($M = 19.35$, $SD = 8.88$) were significantly lower than performance scores ($M = 25.35$, $SD = 3.35$, both p's = .000; Figure 8). Simple effects tests within each age group revealed significant prediction effects for both young, $F(2, 44) = 103.16, p = .000$, and older adults $F(2, 47) = 86.98, p = .000$. Younger adults had significantly lower prediction ($M = 18.26$, $SD = 4.04$) and post-prediction ($M = 20.18$, $SD = 8.75$) scores than their performance ($M = 26.22$, $SD = 2.87$) scores; prediction and post-prediction score differences were non-significant. In contrast, all pairwise comparisons were significantly different for older adults, all p's $\leq .001$. Whereas both groups underestimated their recognition memory performance scores at prediction and post-prediction, older adults' post-prediction scores ($M = 18.57$, $SD = 8.01$) were significantly smaller (closer to performance, $M = 24.53$, $SD = 3.59$) than their prediction scores ($M = 13.69$ $SD = 5.20$). Older adults, but not younger adults, adjusted post-predictions following test but both groups underestimated their abilities on this task at both prediction points.

Intelligence. Scores for vocabulary and digit symbol tasks were transformed to percentage correct. A 2(Age: young, old) x 2 (Intelligence Task Type: vocabulary, digit symbol) mixed ANOVA yielded significant Age, $F(1, 85) = 23.08, p = .000$, Task Type, $F(1, 85) = 255.29, p = .000$, and Age x Task Type effects, $F(1, 85) = 75.55, p = .000$. Overall, younger adults had higher scores ($M = .78$) than older adults ($M = .69, p = .000$). Vocabulary scores ($M = .89$, $SD = .11$) were also higher than digit symbol scores ($M = .57$, $SD = .19, p = .000$). Simple effects tests of task type differences within age group yielded significant effects for both young adults, $F(1, 37) = 14.41, p = .001$, and older adults, $F(1, 48) = 682.02, p = .000$. Both groups had higher percent correct scores for vocabulary (Young, $M = 0.85$, $SD = 0.14$; Old $M = 0.92$, $SD = 0.07$) than for digit symbol (Young, $M = 0.71$, $SD = 0.15$; Old $M = 0.46$, $SD = 0.13$) scores. Additional simple effects tests of age differences within task type yielded significant age effects on vocabulary, $F(1, 93) = 15.84, p = .002$ and digit symbol, $F(1, 85) = 73.99, p = .000$ Older adults had higher vocabulary scores ($M = .92$, $SD = .07$) than younger adults ($M = .85$, $SD = 0.14$), whereas younger adults had higher digit symbol scores ($M = 0.71$, $SD = 0.15$) than older adults ($M = 0.46$, $SD = 0.13$). Results are displayed in Figure 9. This pattern of effects is consistent with the classic aging pattern (Cornelius & Caspi, 1986) in which older adults, despite losses in fluid intelligence (e.g., processing speed) outperform younger adults on tests of crystallized intelligence (e.g., vocabulary). We next asked whether performance predictions before and after test tracked these age differences.

Vocabulary Prediction Accuracy. Using raw scores, a 2 (Age: young, old) x 3 (Vocabulary Task Type: prediction, performance, post-prediction) mixed ANOVA yielded significant Age effects, $F(1, 93) = 7.59, p = .007$, Task Type effects, $F(2, 92) = 77.85, p = .000$, and Age x Task Type effects $F(2, 92) = 10.24, p = .000$. Older adults ($M = 14.64$, $SD = 3.91$) had higher scores than younger adults ($M = 12.76$, $SD = 2.57$). Figure 10 shows that performance scores ($M = 15.84$, $SD = 2.19$) were greater than prediction ($M = 11.91$, $SD = 3.18$), $p = .000$, and post-prediction ($M = 13.45$, $SD = 8.68$) scores, both p's $\leq .000$; prediction and post-prediction scores did not differ significantly. Simple effects tests of age differences within vocabulary task type revealed that older adults had higher performance ($M = 16.64$, $SD = 1.31$) and post-prediction ($M = 15.71$, $SD = 11.18$) scores than younger adults (performance, $M = 14.98$, $SD = 2.6$; post-prediction, $M = 11.04$, $SD = 3.55$), both p's $\leq .001$. There were no significant age differences on prediction scores. Additional simple effects tests of task type differences within age group showed that all pairwise comparisons between prediction, performance, and post-predictions were significant for younger adults. For older adults, prediction scores were less than performance and post-prediction scores. Post-prediction scores did not differ from performance scores, suggesting that older adults adjusted their post-test predictions to more accurately reflect their (high) vocabulary knowledge. Interestingly, younger adults' post-predictions were significantly lower than their predictions suggesting even less confidence in their vocabulary abilities following test.

Digit Symbol Prediction Accuracy. A 2(Age: young, old) x 3 (Digit Symbol Task Type: prediction, performance, post-prediction) mixed ANOVA yielded significant Age, $F(1, 85) = 36.87, p = .000$, Task Type, $F(2, 84) = 10.88, p = .000$, and Age x Task Type effects, $F(2, 84) = 5.76, p = .005$. Overall, younger adults ($M = 58.50$, $SD = 13.40$) had higher scores than older adults ($M = 41.06$, $SD = 13.18$, $p = .000$). Performance scores ($M = 53.20$, $SD = 17.24$) were greater than prediction ($M = 43.57$, $SD = 21.27$, $p = .000$) and post-prediction scores ($M = 49.38$, $SD = 21.37$, $p = .009$); prediction scores were lower than post-prediction scores, $p = .000$, see Figure 11. Simple effects tests of task type differences within age group were significant for the young group, $F(2, 84) = 13.50$, $p = .000$, but not the older group. Younger adults' performance scores ($M = 66.47$, $SD = 13.55$) were greater than their prediction ($M = 47.37$, $SD = 20.04$, $p = .029$) and post-prediction ($M = 61.92$, $SD = 19.32$, $p = .000$) scores. Post-prediction was also significantly greater than prediction ($p = .000$). Effects for older adults were non-significant, suggesting older adults were more accurate than younger adults in their performance predictions on this task. Younger adults had significantly higher digit symbol performance ($M = 66.47$, $SD = 13.55$) scores than older adults (performance, $M = 42.90$, $SD = 11.96$, $p = .000$), replicating one of the most robust effects in the cognitive aging literature.

Assessing Metacognitive Accuracy. In order to test metacognitive awareness of abilities on our four performance measures, we calculated both absolute and relative accuracy scores for each task by subtracting performance scores from prediction scores. Absolute accuracy scores were then transformed to absolute values, indicating *degree* of inaccuracy. Absolute accuracy scores convey by how much the performance prediction is different from 0 (zero). Thus, higher scores mean poorer accuracy. Relative accuracy scores convey the *direction* of metacognitive inaccuracy. Positive scores are over-predictions and negative scores are under-predictions. Again, a score of 0 would indicate perfect accuracy. Analyzing both types of accuracy allow us to test whether age groups are differentially accurate in their metacognitive awareness and in what direction.

A MANOVA with age group as the independent variable and recall, recognition, vocabulary, and digit symbol pre-test absolute accuracy scores was significant, multi$F(4, 80) = 4.21, p = .004$ (Figure 12). Univariate effects were significant for recognition, $F(1, 83) = 6.90$, p = .01, and vocabulary, $F(1, 83) = 7.13, p = .009$. Older adults were more inaccurate (Recognition, $M = 11.06$, $SD = 5.63$; Vocabulary, $M = 5.02$, $SD = 2.83$) than younger adults (Recognition, $M = 8.26$, $SD = 3.76$; Vocabulary, $M = 3.38$, $SD = 2.78$). A MANOVA with age group as the independent variable and post-predictions for recall, recognition, vocabulary and digit symbol absolute accuracies was non-significant, suggesting that younger and older adults were equally (in)accurate when predictions were made after test.

We also tested age differences in relative prediction accuracy, results of which would indicate whether younger and older adults are overestimating or underestimating their abilities. This set of analyses would serve to inform our larger research question of biases in self-assessments of abilities by revealing positive biases in the form of overestimations of ability.

A MANOVA with age group as the independent variable and pre-test relative accuracy scores for all four performance tasks was significant, multi$F(4, 80) = 13.97$, $p = < .001$. All univariate tests were significant, all p's $\leq .019$ (Figure 13). Older adults (Recall, $M = 5.0$, $SD = 4.97$; Recognition, $M = -10.89$, $SD = 5.96$; Vocabulary, $M = 5.01$, $SD = 2.84$) were more inaccurate than younger adults (Recall, $M = -.32$, $SD = 6.05$; Recognition, $M = -8.21$, $SD = 3.88$; Vocabulary, $M = -2.99$, $SD = 3.21$) on all tasks except digit symbol (Young, $M = -19.11$, $SD = 23.05$; Old, $M = -3.49$, $SD = 22.47$). Similar to the MANOVA post-prediction absolute accuracy results, a MANOVA with age group as the independent variable and the post-prediction relative accuracy scores for the performance tasks yielded non-significant results.

Memory. Relative accuracy scores for recall and recognition memory were analyzed in two mixed ANOVAs to test for age differences in this type of accuracy and whether accuracy is better following test. For recall memory, a 2(Age: young, old) x 2 (Relative Recall Accuracy: pre-test, post-test) mixed ANOVA yielded significant Age effects, $F(1, 91) = 13.63$, $p = .000$ (Figure 14). Older adults' scores were positive ($M = 3.81$, $SD = 7.13$) and significantly greater than younger adults' scores, which were near 0 ($M = -0.39$, $SD = 3.34$). For recognition memory, a 2(Age: young, old) x 2 (Relative Recognition Accuracy: pre-test, post-test) mixed ANOVA yielded significant differences between pre-test and post-test accuracy scores, $F(1, 93) = 16.33$, $p = .000$ (Figure 15). Relative accuracy scores were significantly more negative at pre-test ($M = -9.44$, $SD = 5.19$) than at post-test ($M = -5.99$, $SD = 8.28$), suggesting that participants monitored their performance and became relatively more accurate (by underestimating less) following test.

Intelligence. Relative accuracy scores for vocabulary and digit symbol were analyzed in two mixed ANOVAs to test for age differences in this type of accuracy and whether accuracy is better following test. For vocabulary, a 2(Age group: young, old) x 2 (Relative Vocabulary Accuracy: pre-test, post-test) mixed ANOVA yielded a significant Age x Accuracy interaction effect, $F(1, 93) = 9.43, p = .003$ (Figure 16). Simple effects tests of accuracy differences within age group were significant for both younger, $F(1, 45) = 8.62, p = .005$, and older adults, $F(1,48) = 6.34, p = .015$. Younger adults underestimated their vocabulary scores at pretest ($M = -2.72$, $SD = 3.19$) and significantly more so at posttest ($M = -3.93$, $SD = 3.19$). Older adults also underestimated their scores at pretest ($M = -5.07$, $SD = 2.86$) and significantly less so at post-test ($M = -.93$, $SD = 11.53$).

For digit symbol, a 2 (Age group: young, old) x 2 (Relative Digit Symbol Accuracy: pre-test, post-test) mixed ANOVA yielded significant Age, $F(1, 85) = 8.51, p = .005$, Accuracy, $F(1, 85) = 7.26, p = .009$, and Age x Accuracy effects, $F(1, 85) = 9.50, p = .003$ (Figure 17). Overall, younger adults underestimated their digit symbol scores ($M = -11.83$, $SD = 2.33$) to a greater degree than did older adults ($M = -2.76$, $SD = 2.06$) and prediction scores ($M = -9.62$, $SD = 24.31$) were more negative (underestimated performance more) than post-prediction scores ($M = -3.82$, $SD = 12.56$). Simple effects tests of pretest/post-test accuracy differences within age group were significant for young adults, $F(1, 37) = 14.94, p = .000$, but not for older adults. Younger adults underestimated their digit symbol scores significantly more at pre-test (M = - 19.11, SD = 23.05) than at post-test (M = -4.55, SD = 12.23),

Exploratory Analyses.

Self-Esteem. The overall self-esteem score was 3.28 (SD = .49); there were no age differences in self-esteem, thus it was dropped from further analyses of age differences. Correlations between self-esteem and the ten age-related domains comprising the young and old domains were computed. Health (r = .24, p = .020), memory (r = .40, r = .000), reflexes (r = .44, p = .000), attention span (r = .49, p = .000), and morality (r = .24, p = .020) were correlated positively with self-esteem. Interestingly, the first four of these domains were components of the overall Young Domain scale that we created for our analyses of the better-than-average effect. Thus, these domains may be worthy of future study.

Domain Importance. Participants' self-esteem linked to different domains was measured with the Domain Importance Scale; they were asked to rate how important each domain was to their self-esteem. A MANOVA with age group as the independent variable and the 27 domains as the dependent variables was significant, multi$F$(27, 44) = 7.03, p = .000. At the univariate level, 13 of the 27 domains (see Appendix E) yielded significant age differences, all p's $\leq$ .046. Positive age differences, indicating that these domains were more important to one's self-esteem for older than younger adults, were obtained on the 9 items: driving ability, longevity, memory, reflexes, attention, word recall, word recognition, grammar ability, and logical reasoning. Negative age differences, indicating that these domains were more important to self-esteem for younger than older adults, were obtained on 4 items: attractiveness, intelligence, success, happiness. These are intriguing findings and suggest a very different set of important domains to one's well-being for older compared to younger adults. We plan to explore these further in follow-up studies. We also examined whether the tendency to self-enhance is stronger for domains important to self-esteem, as the literature suggests (Crocker, 2002). To do so, we computed the correlation between average domain importance scores (across all 27 items) and average PCQ scores, *r*(domain importance, total bias) = .34, $p = .001$. Results suggest that people who had higher scores on the importance of various abilities to their self-esteem are also more likely to rate themselves as better than average others. Within age groups, for younger adults $r = .35, p = .018$, and for older adults, $r = .47, p = .001$. These exploratory results suggest some connection between domain-specific self-esteem and self-ratings of ability across domains, and merit further investigation.

Self-Efficacy. Mean self-efficacy strength scores (task confidence) were calculated for each of the four performance tasks. A MANOVA with age as the independent variable and self-efficacy scores for recall, recognition, vocabulary, and digit symbol as dependent variables was significant, multi$F(4, 85) = 9.66, p = .000$. Older adults had significantly lower self-efficacy strength scores on all four tasks, all p's $\leq$ .004, see Figure 18. One-tailed correlations between self-efficacy and performance scores on recall, recognition, vocabulary, and digit symbol tasks were computed. As expected, self-efficacy was positively correlated with performance on three of the four tasks: recall ($r = .37, p = .001$), recognition ($r = .19, p = .037$), digit symbol ($r = .32, p =$

.002). The correlation for vocabulary, $r = .15$, was non-significant. Correlations within age group were highly inconsistent and difficult to interpret. For younger adults, the correlations were -0.05 (recall), -0.03 (recognition), 0.34 (vocabulary, p=.01), and -0.07 (digit symbol). For older adults, the correlations were .13 (recall), .09 (recognition), .39 (vocabulary, $p = .004$), and .29 (digit symbol, $p = .024$). These within group correlations are highly inconsistent with the correlations for the sample overall and will not be further interpreted, except to note that the wording of the self-efficacy measures was not a good fit with the actual task instructions and procedures, and thus represents a flaw in the design of those procedures in this study.

Discussion

Our hypothesis that self-enhancing biases vary as a function of age group and behavioral domain was supported. The "better-than-average" (BTA) effect emerged on our Perceptions of Competence Questionnaire (PCQ), thus replicating our pilot study results. This is consistent with research on self-enhancing biases in younger adults (Sedikides et. al., 1998) and suggests continuation and preservation of the effect in older adults. To our knowledge, this is the first study to document the BTA in older adulthood. Thus, despite the cumulative losses experienced by older adults in cognitive, physical, our results suggest that older adults' self-perceptions are positive, and when compared to hypothetical average "others," inflated. We also found that older and younger adults had comparable levels of self-esteem, further bolstering our claim of a healthy self-concept in older adulthood.

One of our main goals in this study, however, was to replicate our pilot study finding in which the better-than-average effect varied by domains of ability across the adult life span. It was predicted that individuals would self-enhance less in domains outside of areas of age-relevant strengths and that they would be more highly confident in certain domains at different points in adulthood. This would indicate that people are generally aware of limitations in their abilities (and the abilities of others) as they age. Specifically, younger adults might realize they do not yet possess the experience and maturity that accompany older adult strengths such as compassion and forgiveness. Likewise, older adults might realize that the peak ages associated with strength, speed, and memory are decades earlier than their present age. Thus, older adults should experience relatively greater competence in wisdom-related areas (including intrapersonal and interpersonal knowledge) while younger adults should thrive in physical and cognitive areas. These predictions were confirmed by our significant cross-over interaction: Younger adults had higher bias scores in the young domain than did older adults and older adults had higher bias scores in the old domain than did younger adults. These results replicated our pilot study, which also obtained this interaction effect between age group and domain. Moreover, age differences were non-significant for the neutral domain, indicating that age differences in bias were only significant in the age-congruent domain. A robust age and bias interaction emerged only on age-relevant domains.

Overall, bias scores on the PCQ were highest in the old domain, as indicated by a significant main effect for domain. Thus, despite the contingent bias effects obtained in the interaction, participants – young and old alike – rated themselves most favorably in the domain that represented older adult strengths. This makes sense to us. Research indicates that the extent of self-enhancement depends on the degree to which a particular quality is objectively verifiable by others; individuals tend to self-enhance on ambiguous and subjective attributes rather than specific and objective attributes (Taris, 1999). This explains why bias scores were higher in the old domain, which was comprised of complex character traits such as compassionate, moral, and forgiving. Self-enhancing (or positive self-bias) effects are more likely in domains that are ambiguous and harder to verify and test (dispute) objectively, such as these. In contrast, items comprising the young domain represented relatively concrete and relatively more verifiable qualities and behaviors, such as health, strength, and quick reflexes. These are easy to test and assess against self-evaluations, so self-enhancing is less likely in these domains. Indeed, our data are consistent with this reasoning.

Another goal of our study was to investigate when self-assessments are accurate and which individuals are accurate. Our analyses comparing prediction scores with actual performance scores on our objective memory recall task found that, only the middle-aged adults were accurate. We attributed this miscalibrated overestimation to older adults need to self-protect in an age-sensitive domain and the tendency for young adults, who still have the ability to improve in domains, to self-enhance. Based on these findings, we extended our investigation of self-assessment to performance tasks in additional age-related cognitive domains, with the expectation that metacognitive accuracy would vary by age and task domain. Specifically, we hypothesized that individuals would be more accurate in domains in which they typically excelled, based on research by Kruger and Dunning (1999) who found that less competent performers on several cognitive tasks were bad at estimating their performance scores – they highly overestimated their abilities. Thus, we reasoned that younger adults would be more accurate (less inaccurate) than older adults at predicting their performance on recall and speed of processing tasks while older adults would be more accurate (less inaccurate) than younger adults on vocabulary tasks.

To test these hypotheses, we conducted a series of mixed ANOVAs on prediction, performance, and post-prediction scores as well as on relative and absolute accuracy. Our hypotheses were partially supported. First note that our results yielded classic age-related performance differences on vocabulary (older better than younger) and speed and memory tasks (younger better than older). We then examined age differences in prediction accuracy on these tasks.

On the memory tasks, younger adults accurately assessed recall ability but not recognition ability; in fact, they significantly underestimated their abilities. Older adults, on the other hand, overpredicted their recall ability and underestimated their recognition ability, suggesting a self-enhancement effect for recall ability. This replicated our pilot study in which older adults overestimated recall scores, perhaps as a means of self-protection (Dark-Freudeman, West, Viverito, 2006). They were, contrary to our hypotheses, unaware of their recognition ability, a task that older adults have been found to perform better in. In both tasks, both age groups' post-prediction scores were closer to their performance scores, indicating that, post-test, they had become more aware of their ability.

Similar results were found for the intelligence tasks. Older adults were accurate both at pre- and post-test assessments of processing speed ability. Younger adults underpredicted their scores, but trends suggest that they become more accurate post-test. Further, both age groups equally underpredicted their vocabulary ability pre-test. Among older adults, the difference between post-prediction and performance was non-significant, indicating that after the test, older adults became accurate in judging their ability. Conversely, younger adults, after test, significantly lowered their estimates, underpredicting to a greater degree than initially predicted, suggesting an awareness of not knowing the material.

Thus, our results show that there are differences between age groups in accuracy across different cognitive tasks. Our hypothesis that self-assessments would vary as a function of age and domain was partially confirmed; younger adults were more accurate than older adults in recall ability and older adults were more accurate than young adults in assessing processing speed. We expected that older adults would be more accurate than younger adults in assessing their vocabulary abilities.

We were interested in accuracy itself, as well as directional inaccuracies, that is, overestimations and underestimations, and whether accuracy varied by type of task. Older adults overestimated only in the recall domain. This is consistent with previous research that has shown that young adults were accurate in their predictions of performance on an unrelated paired associates task while older adults overestimated their ability. This is also consistent with previous research on possible selves that shows that certain selves that are most central to an individual's self-concept differ with age. While both young and old adults report cognitive selves as being central to their identity, only older adults report memory-related possible selves (Dark-Freudeman et. al., 2006). Pairing this research with our results, we believe that older adults overestimated (e.g., were biased) recall ability because of its importance to them and possibility as a way to self-protect in such an age-sensitive domain. Other possibilities include the shift in midlife to greater memory monitoring and less stable memory functioning as the source of overestimations of ability (Berry, 1999). These claims are speculative and need further empirical validation. Additionally, our results are also consistent with research on monitoring (Hacker, Dunlosky, & Graesser, 1998; Metcalfe & Shimamura, 1994).

Our results show that, initially, individuals are not accurate in predicting their performance ability; they are unaware of their abilities. After task completion, however, individuals were able to become more, if not completely in some cases (e.g., older adults in vocabulary task) accurate, in assessing their abilities. In fact, a significant difference between prediction and performance combined with a non-significant difference between post-prediction and performance would be indicative of an individual becoming more accurate after task completion. This result was evident in young and old adults who became more accurate in assessing their vocabulary ability. While this was the only tasks that showed a significant prediction/performance difference and non-significant post-prediction/performance, individuals showed similar trends of more accurate post-predictions than prediction across all tasks. This is consistent with metacognitive analyses that focus on the degree to which individuals can accurately assess their cognitive systems and whether they use such assessments to guide learning.

Metacognitive models usually conceptualize the cognitive system as involving separate monitoring and control functions (Nelson & Narens, 1990). Monitoring provides feedback to control systems about the status of processing and processing outcomes, enabling the individual to self-regulate; poor monitoring to control learning can lead to lower levels of learning, especially among older adults (Cavanaugh, 1989). Research investigating age differences in monitoring has shown that no major impairments occur for monitoring accuracy among older adults. For example, Hertzog, Kidder, Powell-Moman & Dunlosky (2002) found that older adults had superior judgment of learning accuracy for unrelated paired associates in most instances and had equivalent relative judgment of learning accuracy compared with younger adults. Our results are consistent with this research; older adults that were not initially accurate in their predictions were able to successfully monitor their abilities post-task, becoming more accurate and aware of their cognitive abilities.

Although our main hypotheses regarding self-enhancing biases were confirmed, the hypotheses regarding age-related metacognitive awareness were generally not supported. In fact, our data also showed that in several instances respondents were not aware of how much they actually knew in certain tasks; the younger underpredicted their processing speed ability, and both age groups underpredicted their vocabulary ability. Although our study was mainly concerned with overestimations, future research should focus on the nature of such underpredictions, specifically, what are the underlying processes that can account for not knowing one's abilities. For example, Kruger and Dunning (1999) attribute inflated self-assessments to deficits in metacognitive skill. They found that participants scoring in the bottom quartile on tests of humor, grammar and logic grossly overestimated their test performance and ability. Participants, moreover, became significantly more accurately calibrated after their logical reasoning skills were improved, supporting the assertion that lack of metacognitive awareness can lead to miscalibration. It would be beneficial to investigate the motivations (e.g., simply unaware, self-deprecation) underlying miscalibrations. While overestimations can, in part, be explained by the need to self-enhance and lack of metacognitive skill, it would be wise to study whether similar motivations underlie underpredictions, much like the ones we saw in our analyses.

Limitations. There were several limitations to this study. We believe that a larger sample size would have resulted in more significant and clearer age differences. Such a sample size would allow us to test causal hypotheses via structural equation modeling. Another limitation was the ages of participants. We initially planned to test middle-aged adults in addition to younger and older adults. That design was beyond the scope of this Masters level research project, i.e., it was not feasible to test an additional 50 middle-aged adults given the time limitations. Conceptually, adding a middle-aged group is desirable because it would allow us to test age trajectories. We plan a follow-up study to this one by adding a middle-aged group. Adding a middle-aged group would also be informative to our investigation of metacognitive accuracy. Doing so would allow us to pinpoint when performance predictions and metacognitive awareness begin to change with age, and on what tasks (Berry, 1999).

Our measures were also limited in several ways, although we chose and designed them with careful deliberation. In hindsight, it would have been interesting to administer a non-age-related version of the BTAQ in order to test age differences in the BTA effect relative to the average non-aged "other." We plan to develop such a measure in follow-up studies to this one. We should also have run a condition where half the participants were informed of upcoming performance tests. We suspect that participants' bias scores would be less positively biased if they knew upcoming tests of abilities would be administered. Finally, and relatedly, we should have counterbalanced the order of the BTAQ and the prediction-performance tasks (i.e., recall, recognition, vocabulary, digit symbol; these were always completed following the BTAQ, which was completed at home in a packet of materials mailed to the participants' homes.

Many of our predictions were based on domain importance. We predicted that domain importance would be relevant to age differences in the self-enhancing bias. We thought that positive bias would be higher in age-relevant domains and that awareness and accuracy would track age-related task abilities. Results were inconsistent, however, as younger adults were more accurate in domains that older adults were expected to be accurate in and vice versa (i.e., recall and processing speed). Thus, in future studies, we plan to examine both domains that show age-differences (e.g., memory, vocabulary, processing speed, problem-solving) but also domains that are personally salient to individuals and to their self-esteem (Crocker, 2002). For example, even though older adults generally perform poorly on digit symbol (speed of processing) tasks, the adults in our study were more accurate than younger adults assessing processing speed abilities. Perhaps older adults are acutely aware of their declines in processing speed and the concomitant limitations in thinking, acting, and mobility. In turn, self-confidence, self-esteem, and metacognitive monitoring accuracy may be affected accordingly.

We examined domain-related self-esteem in our exploratory analysis of age differences on the 27-item Domain Importance questionnaire. Results showed that nine domains were more important to one's self-esteem for older than younger adults: driving ability, longevity, memory, reflexes, attention, word recall, word recognition, grammar ability and logical reasoning. Conversely, four domains were important to one's self-esteem for younger rather than older adults: attractiveness, intelligence, success, happiness. These domains suggest a very different set of important domains to different age groups than we expected. In fact, we believed that cognitive and physical domains would have been more important to the younger age group. Perhaps, it is the loss of domains that are more typical to young adults that becomes important in late adulthood. These are interesting findings and should be the subject of future research.

This study also assessed age differences in self-efficacy confidence for four performance domains. We found robust negative age differences on all four tasks, with older adults reporting less confidence than younger adults on all four tasks, including vocabulary knowledge, which we expected to yield positive age differences. These results are quite consistent with other research on lower memory self-efficacy with age (Berry, Hastings, West, Lee, Cavanaugh, 2010).

The correlations between self-efficacy and performance were inconsistently significant, and lower than we would anticipate based on the self-efficacy literature. Our self-efficacy measures were complicated and did not map onto the performance tasks as well as they should. Thus, we recommend that these measures be refined by changing the wording to better describe the tasks. For instance, for the recall self-efficacy, the directions should be much more detailed, explaining that the participants would only be exposed to each word once, and for 4 seconds. Without enough prior description of the tasks, the participants may have had a difficult time deciding how confident they were. A final limitation that should be addressed is the setting in which participants were tested. Participants were tested in mixed age and sex groups. Because they are asked to compare (predict) their performance against that of other participants, the mixed age testing context may have contaminated these ratings. Thus, we recommend that this variable should be controlled by measuring it statistically or testing participants in same-age groupings. Doing so would control for extraneous variables that may influence the ways in which individuals rate and compare themselves to others, as well as how they actually perform on the cognitive tasks.

Implications. This study has several implications for general well-being and successful aging. Paired with previous literature on monitoring accuracy, our results cast a positive view on aging. While older adulthood is typically seen as a time of decline, it is also a time in which older adults are still able to understand and monitor their abilities. This has implications for the roles that task feedback and training programs may have for the elderly; because monitoring accuracy is not significantly impaired in late life, perhaps training programs can have a greater focus on task feedback when training older adults in memory, intelligence and other cognitive tasks. While well-being may be best fostered by self-enhancement as little can be done to change the course of age-related decline, our results show that self-improvement is not solely for the young; self-improvement, and subsequently, self-awareness, is still possible in late adulthood, even in cognitive domains that may wan in late life. Further, because the better-than-average effect varied by age across different age-related domains, it can be seen as an indication of the individuals' intrapersonal intelligence (Gardner, 1993), knowing and understanding what they are capable of. People, at different stages of their life, are able to focus on what they believe to be their particular strengths at that time by optimizing strengths to compensate for weaknesses. The self is a dynamic entity which individuals can continually shape and re-make (Baltes & Staudinger, 2003) by focusing on different strengths at various points in their life. While self-assessment and accuracy is important in late life when making crucial life decisions, a little self-inflation is also probably a good thing. In older adulthood, the resiliency of individuals possessing a range of psychological resources (e.g., wisdom in applying selection, optimization, and compensation; domain-specific expertise; and self-enhancement) may allow them to recover from or adjust to challenges, misfortune, and miscalibrations more readily. Self-enhancement, and a little miscalibration, may allow aging individuals, in the face of risks, stressors, losses, and challenges, to flourish in late life (Pinquart, 2002).

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Table 1

Correlation matrix between self-efficacy and performance score variables for all 6 performance tasks. Significant correlations are indicated in bold.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Recall SEST	1											
2. Recognition SEST	**.671**	1										
3. Vocabulary SEST	**.517**	**.517**	1									
4. Digit Symbol SEST	**.478**	**.443**	**.728**	1								
5. Logical Reasoning SEST	**.450**	**.498**	**-.842**	**.693**	1							
6. Grammar SEST	.081	.124	**-.263**	.057	**.267**	1						
7. Recall Score	**.365**	**.499**	**.272**	**.249**	**.306**	.065	1					
8. Recognition Score	**.258**	**.188**	.134	.109	.062	-.058	**.349**	1				
9. Vocabulary Score	-.008	-.085	.148	.109	**.175**	**.345**	**-.191**	-.143	1			
10. Digit Symbol Score	**.392**	**.439**	**.291**	**.318**	.348	.027	**.606**	**.364**	**-.219**	1		
11. Logical Reasoning Score.	**.404**	**.427**	**.514**	**.494**	**.527**	**.481**	**.366**	.159	-.063	**.471**	1	
12. Grammar Score	**.295**	**.320**	**-.536**	**.422**	**.538**	**.135**	**.333**	**.190**	**-.083**	**.327**	**.498**	1

Table 2

Correlation matrix between self-efficacy and performance score variables for all 6 performance tasks among young adults. Significant correlations are indicated in bold.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Recall SEST	1											
2. Recognition SEST	**.654**	1										
3. Vocabulary SEST	**.476**	**.617**	1									
4. Digit Symbol SEST	**.298**	**.387**	**.625**	1								
5. Logical Reasoning SEST	**.272**	**.519**	**.812**	**.521**	1							
6. Grammar SEST	.171	**.499**	**.628**	**.467**	**.539**	1						
7. Recall Score	-.050	.016	-.112	-.070	.014	.008	1					
8. Recognition Score	**.320**	.034	.045	-.026	-.073	-.127	**.199**	1				
9. Vocabulary Score	.215	.116	**.344**	.231	**.406**	**.267**	.045	-.057	1			
10. Digit Symbol Score	-.261	-.121	-.138	-.068	-.141	-.216	-.063	.202	**-.201**	1		
11. Logical Reasoning Score	.097	**.309**	**.375**	**.396**	**.249**	.367	-.007	.075	.059	.116	1	
12. Grammar Score	.275	.213	-.389	**.488**	**.326**	.244	**.056**	**.186**	.086	**.074**	.295	1

Table 3

Correlation matrix between self-efficacy and performance score variables for all 6 performance tasks among old adults. Significant correlations are indicated in bold.

	1	2	3	4	5	6	7	8	9	10	11	12
1. Recall SEST	1											
2. Recognition SEST	**.505**	1										
3. Vocabulary SEST	**.392**	**.281**	1									
4. Digit Symbol SEST	**.442**	**.327**	**.741**	1								
5. Logical Reasoning SEST	**.368**	**.277**	**.825**	**.743**	1							
6. Grammar SEST	**.370**	**.316**	**.835**	**.688**	**.856**	1						
7. Recall Score	.128	**.414**	.221	.169	.102	.222	1					
8. Recognition Score	.043	.090	.038	.054	-.037	.111	**.321**	1				
9. Vocabulary Score	**.271**	**.242**	**.389**	**.372**	**.406**	**.375**	**.315**	-.059	1			
10. Digit Symbol Score	**.374**	**.319**	**.265**	**.290**	**.290**	**.344**	**.414**	**.369**	**.342**	1		
11. Logical Reasoning Score	**.278**	.159	**.448**	**.425**	**.528**	**.429**	.074	.022	**.336**	**.320**	1	
12. Grammar Score	.040	**.080**	**.504**	**.271**	**.536**	**.426**	.082	.045	.115	.114	**.417**	1

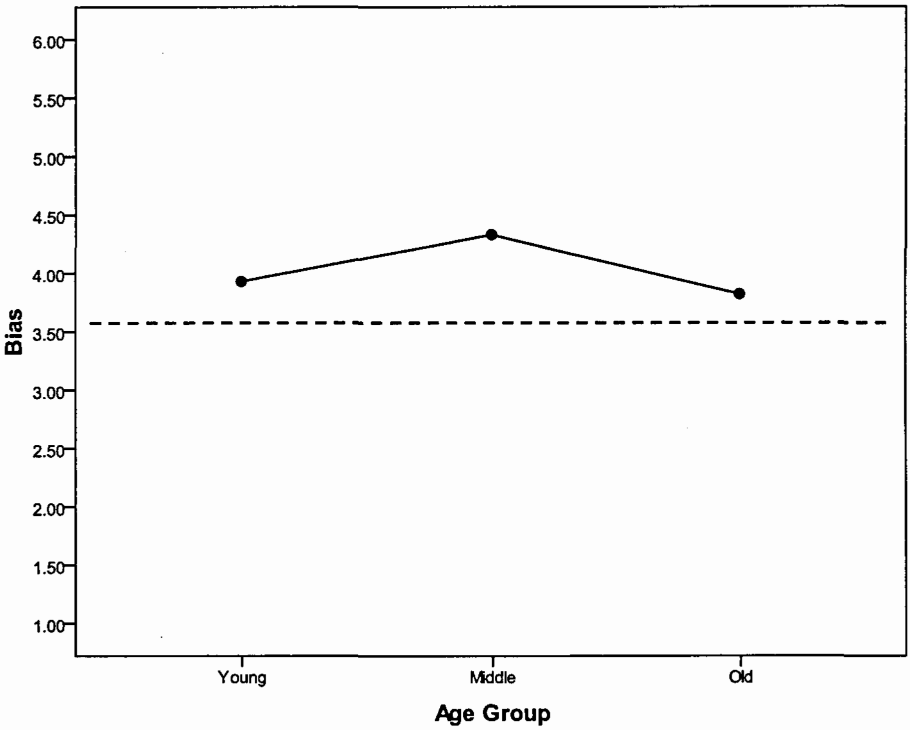


Figure 1. Mean better-than-average scores by age group.

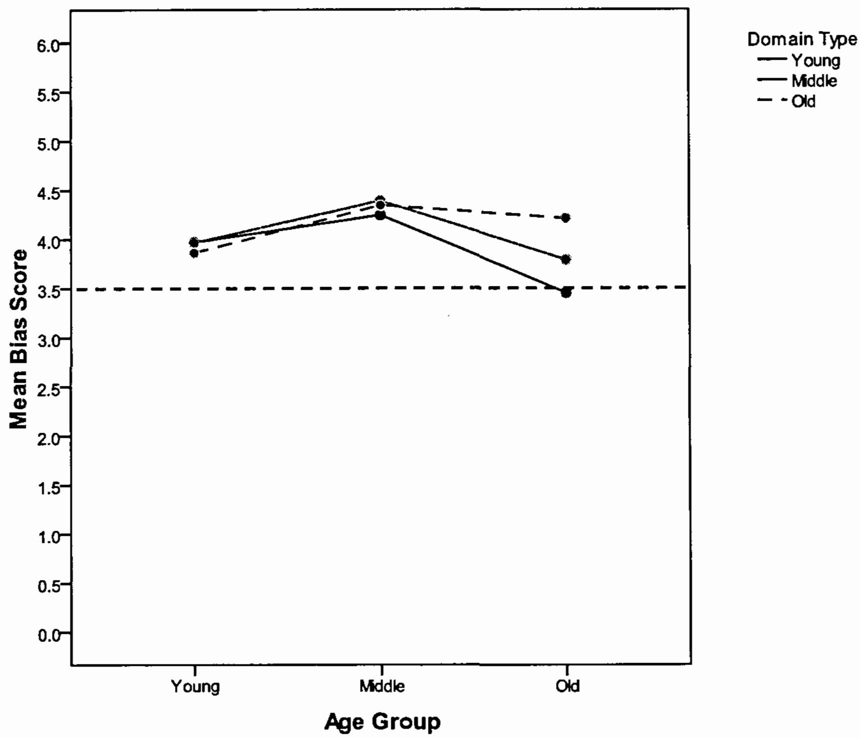


Figure 2. Mean better-than-average scores by age group and age-competency domains.

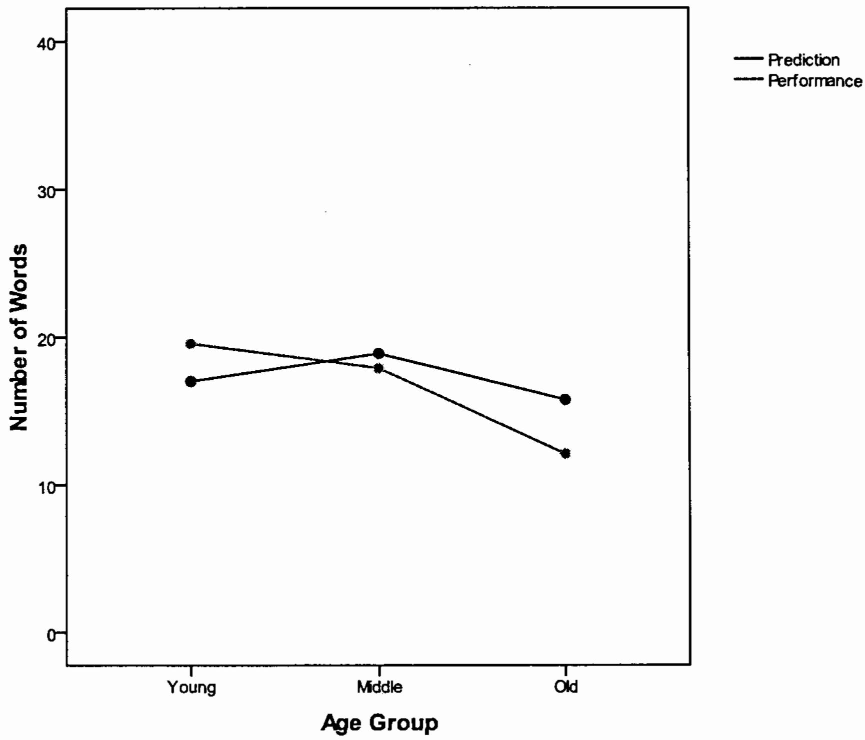


Figure 3. Mean memory prediction and performance scores by age group.

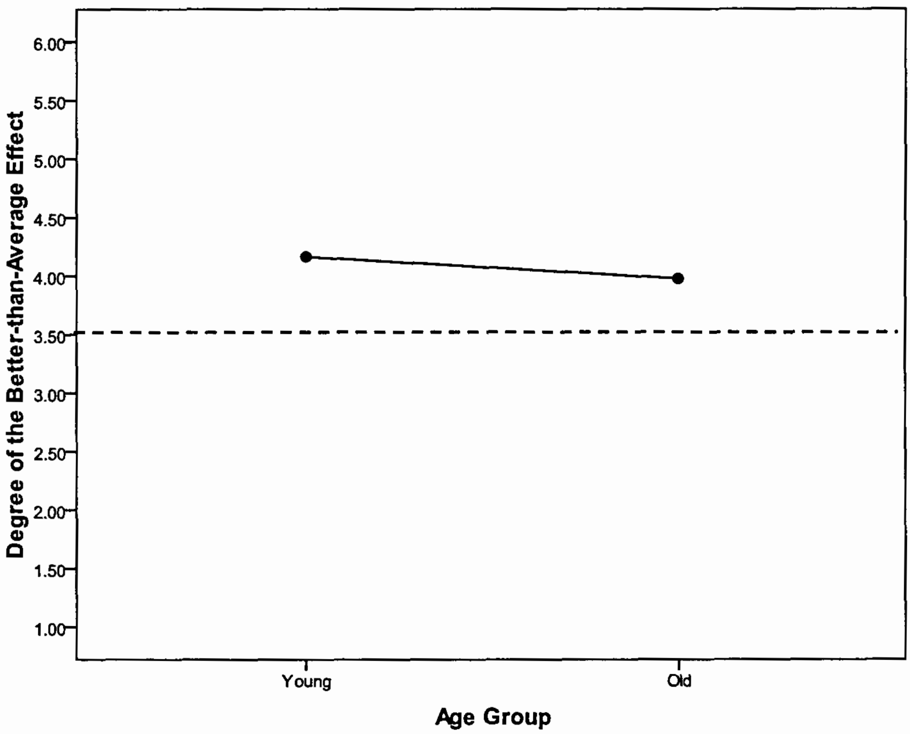


Figure 4. Mean Perceptions of Competency scores by age group.

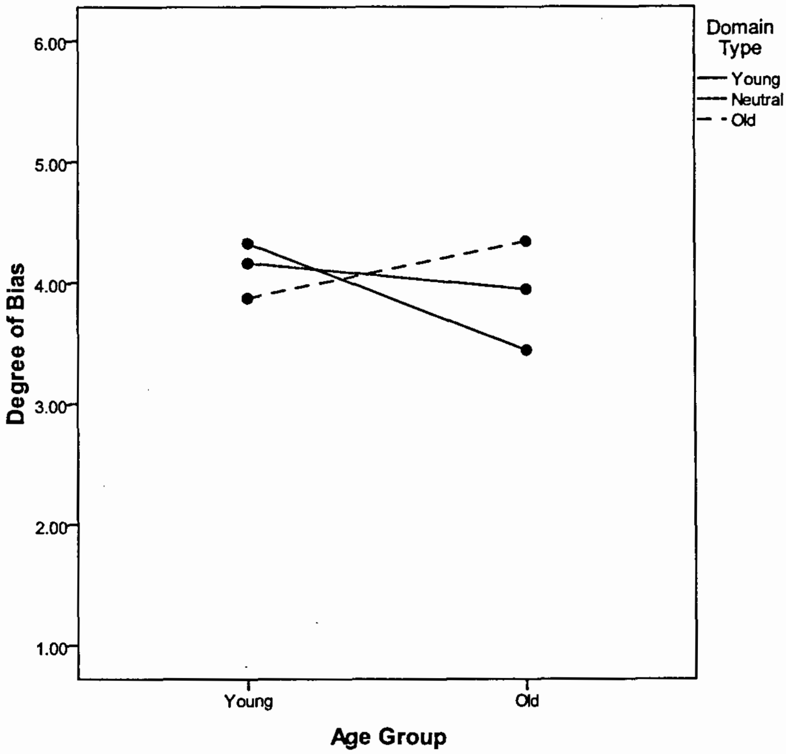


Figure 5. Mean Perceptions of Competencies scores by age group and domain.

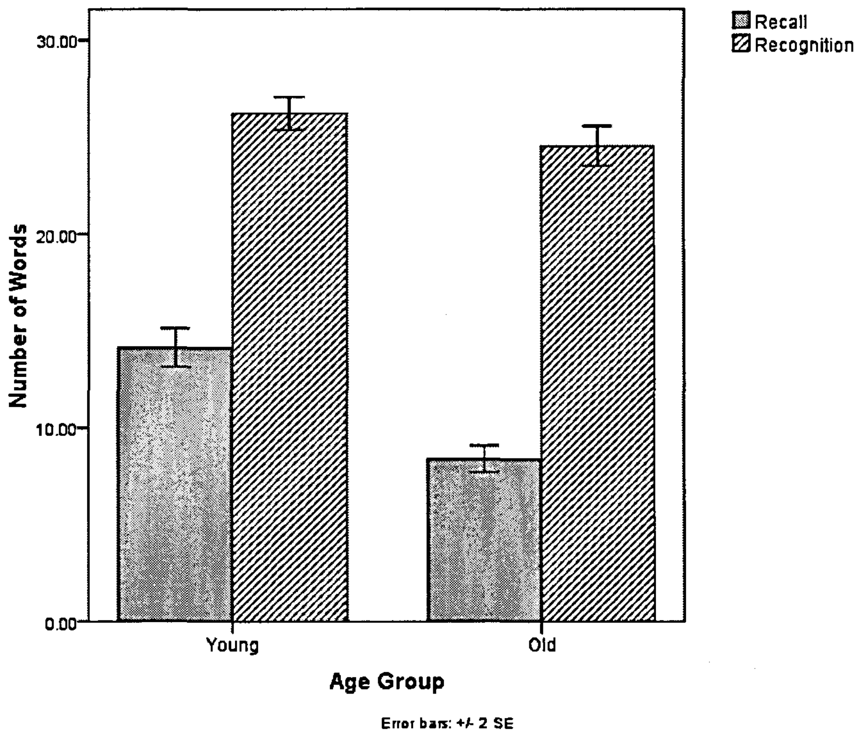


Figure 6. Mean memory recall and recognition scores by age group.

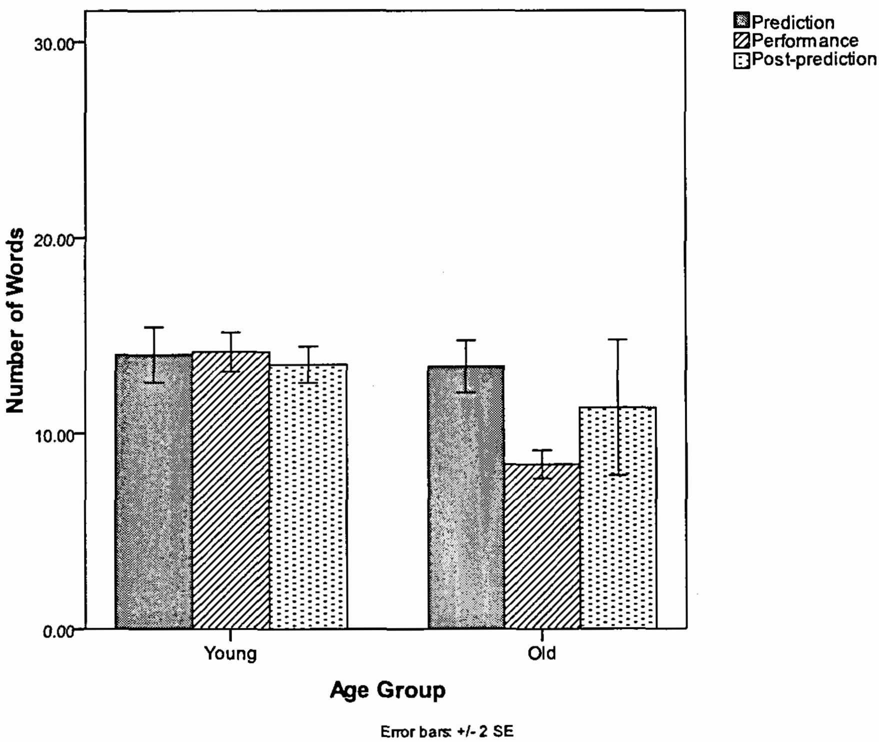


Figure 7. Mean memory recall prediction, performance and post-prediction scores by age group.

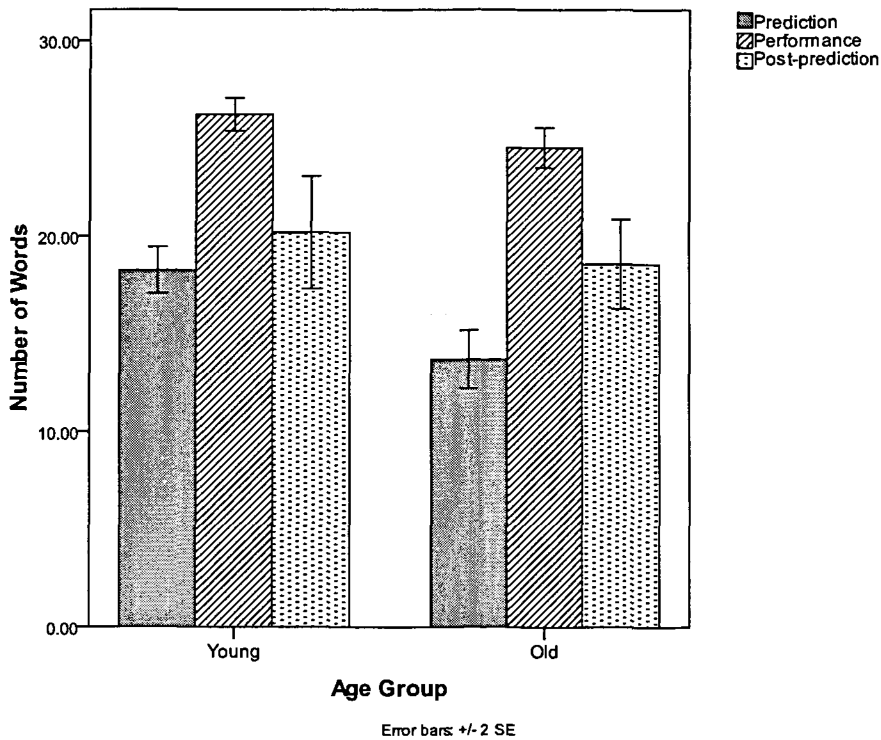


Figure 8. Mean memory recognition prediction, performance, and post-prediction scores by age group.

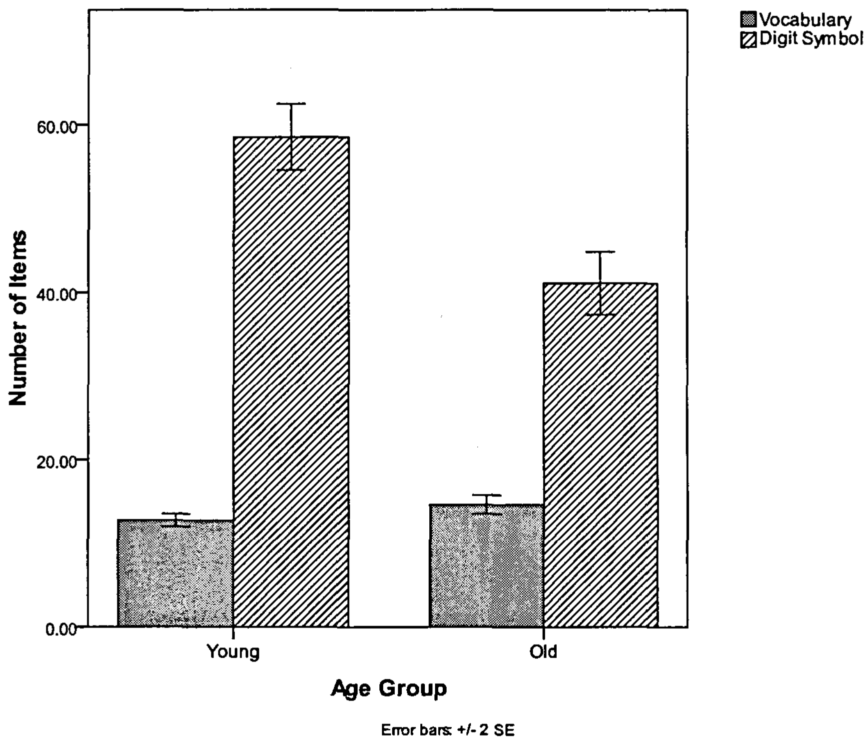


Figure 9. Mean vocabulary and digit symbol percent correct scores by age group.

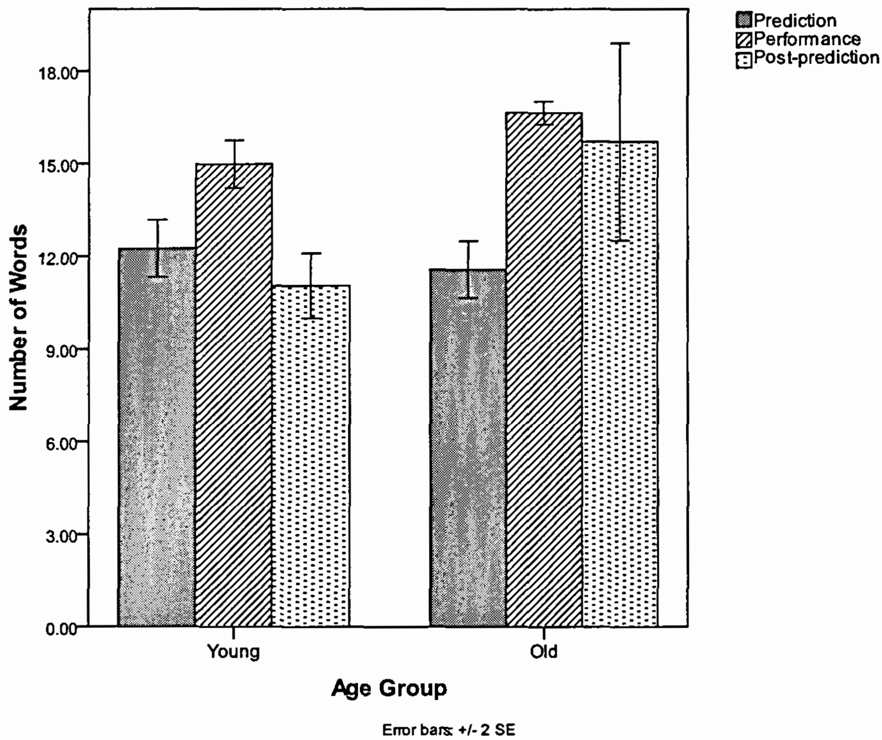


Figure 10. Mean vocabulary prediction, performance and post-prediction raw scores by age group.

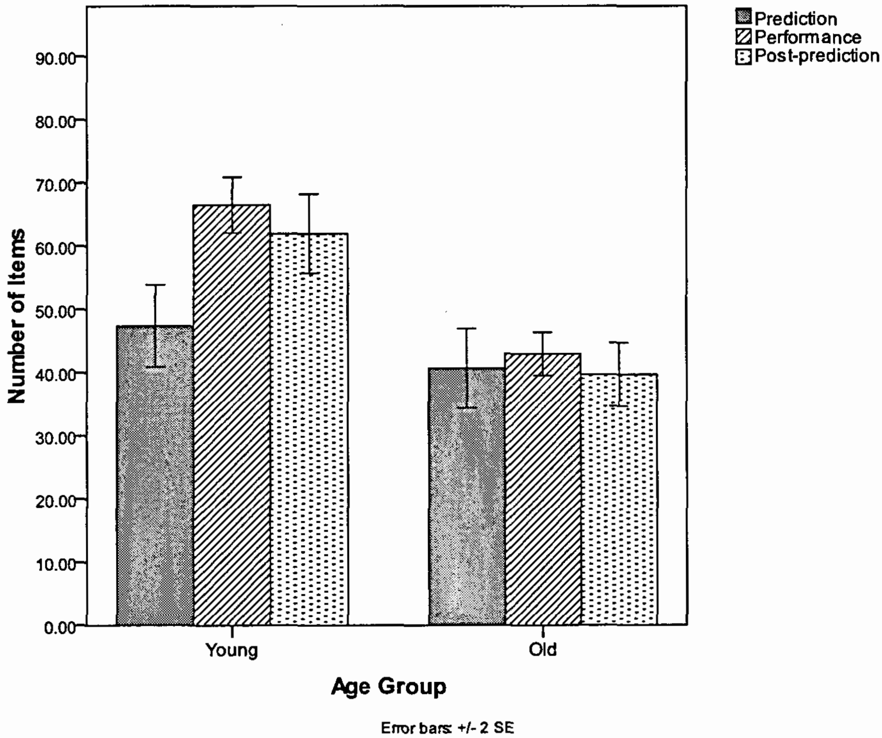


Figure 11. Mean digit symbol prediction, performance and post-prediction raw scores by age group.

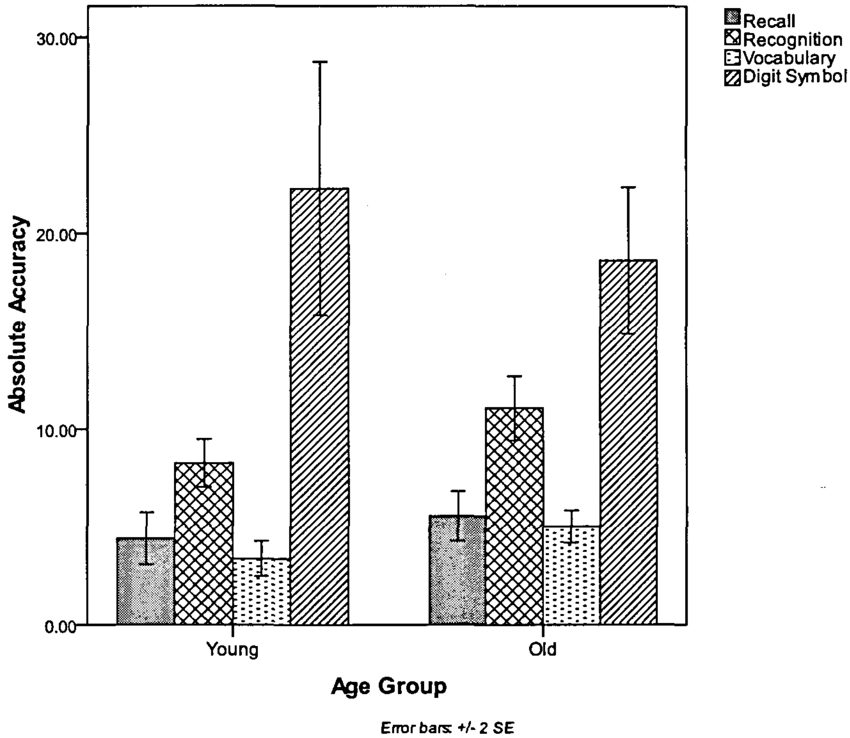


Figure 12. Mean absolute accuracy prediction scores for performance tasks by age group.

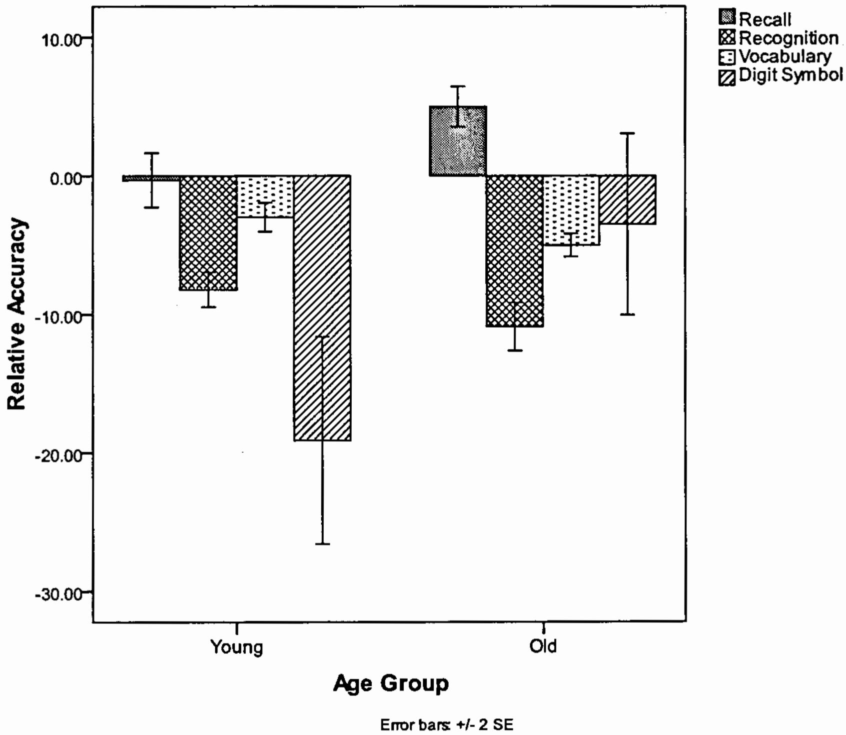


Figure 13. Mean relative accuracy prediction scores for performance tasks by age group.

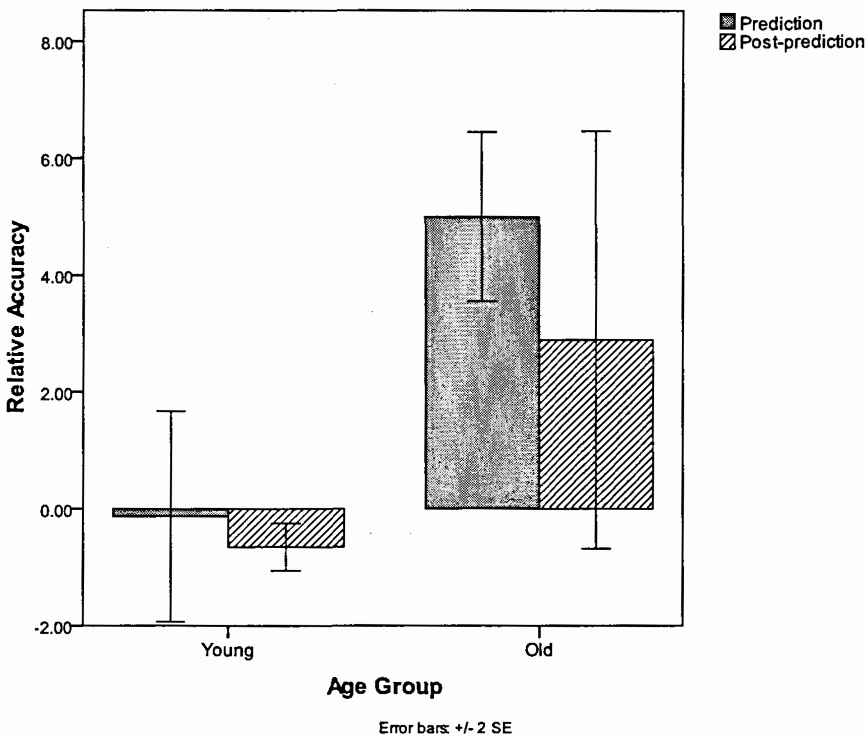


Figure 14. Mean relative accuracy recall prediction and post-prediction scores by age group.

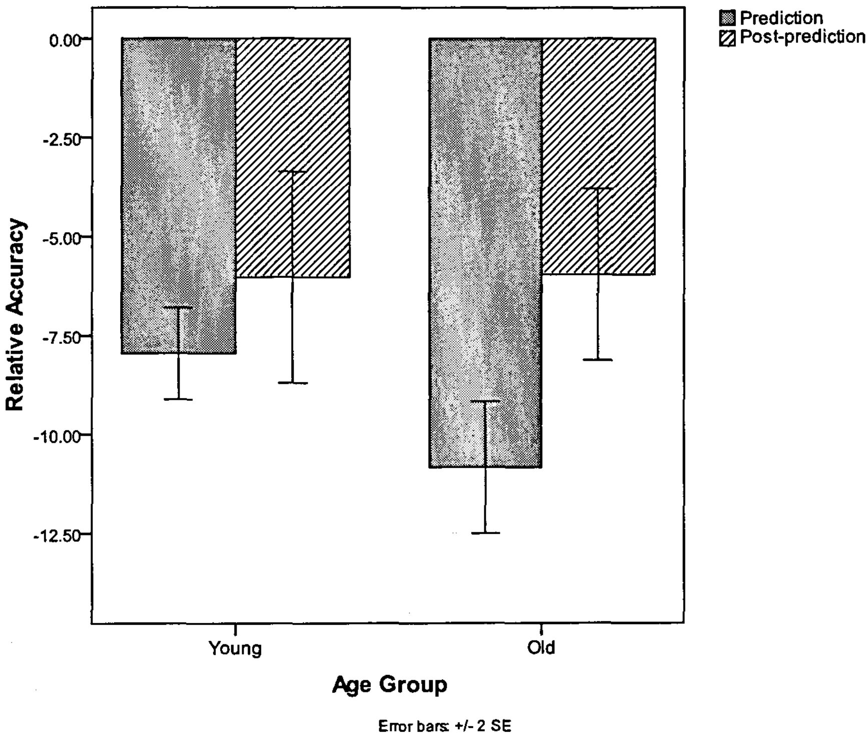


Figure 15. Mean relative accuracy recognition prediction and post-prediction scores by age group.

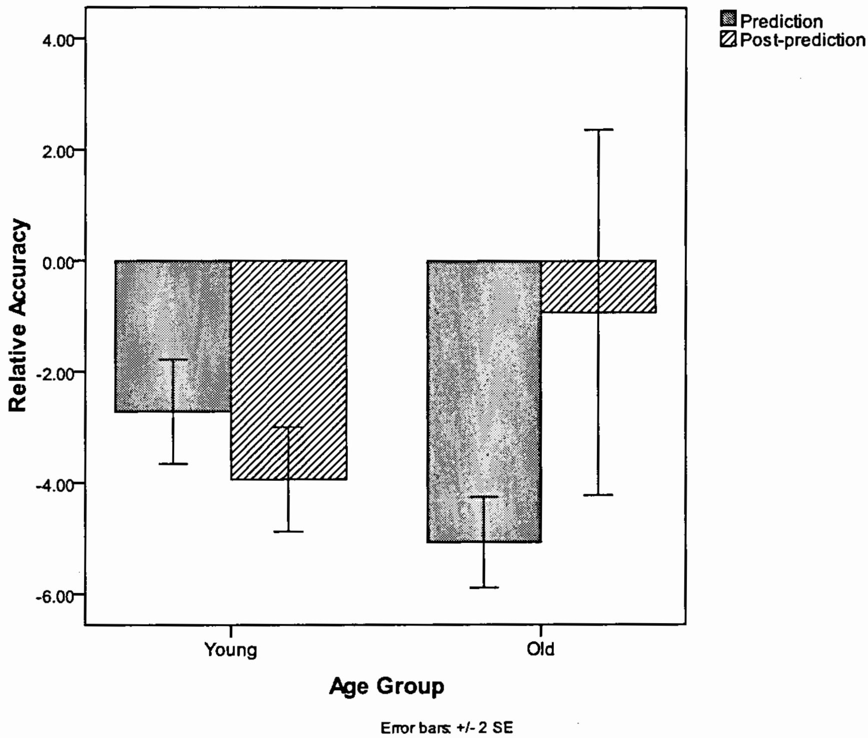


Figure 16. Mean relative accuracy vocabulary prediction and post-prediction scores by age group.

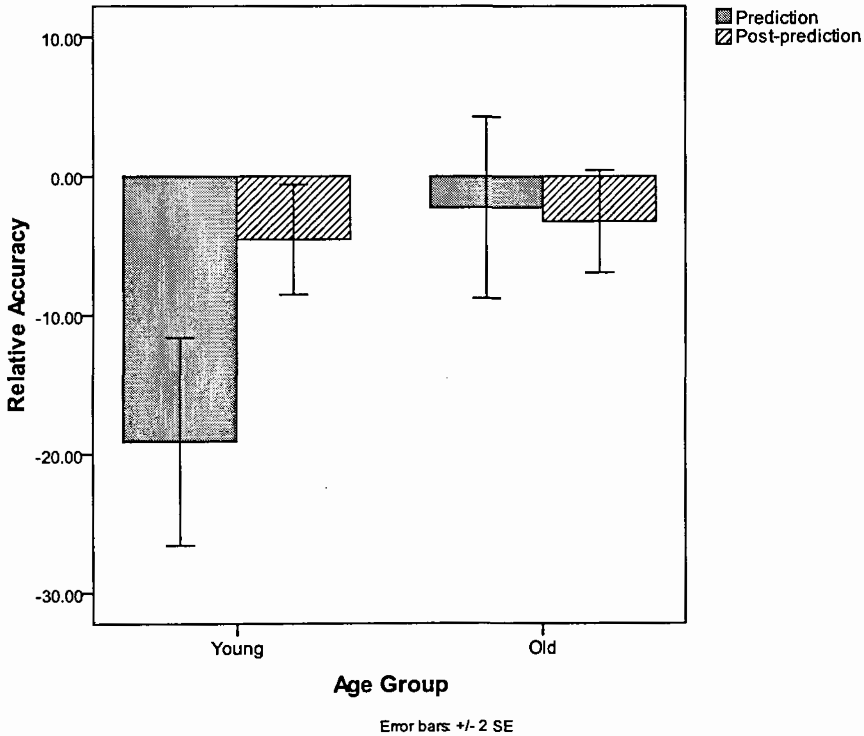


Figure 17. Mean relative accuracy for digit symbol prediction and post-prediction scores by age group.

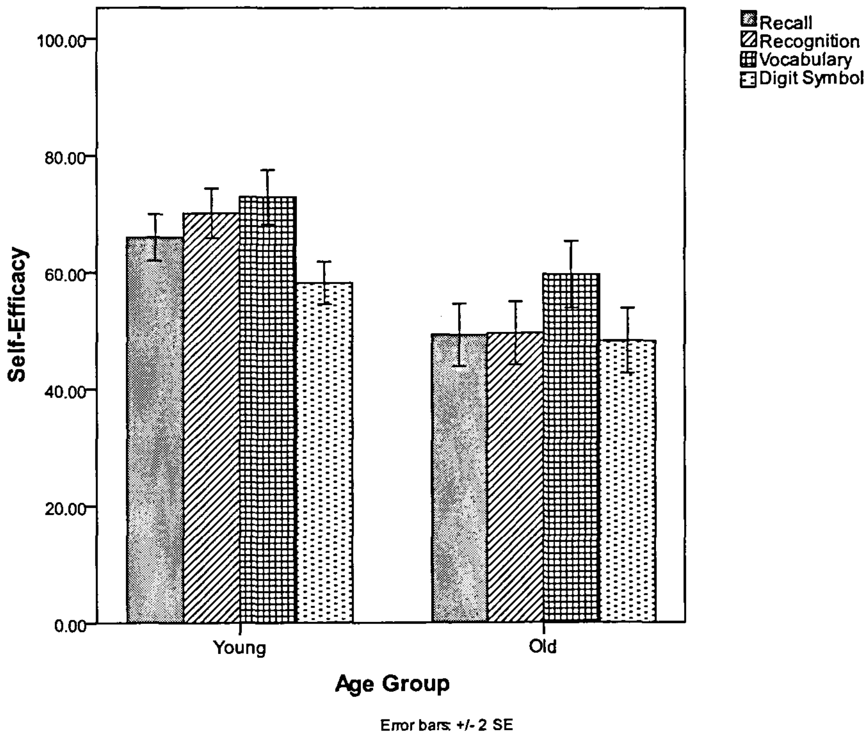


Figure 18. Mean self-efficacy scores for four performance tasks by age group.

Appendix A

Sample of first page of random version of Better-than-Average Questionnaire.

Please circle a number that corresponds to your answer to these items below that compare you to other people across different dimensions of thinking, feeling, and behaving, where 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Slightly Disagree (SLD), 4 = Slightly Agree (SLA), 5 = Agree (A), and 6 = Strongly Agree (SA).

	SD 1	D 2	SLD 3	SLA 4	A 5	SA 6
1. I am more mature than the average 45 year old.	1	2	3	4	5	6
2. I am more likely to succeed than the average 45 year old.	1	2	3	4	5	6
3. I am more creative than the average 80 year old.	1	2	3	4	5	6
4. I have faster reflexes than the average 45 year old	1	2	3	4	5	6
5. I am more popular than the average college student.	1	2	3	4	5	6
6. I have a better memory than the average 45 year old	1	2	3	4	5	6
7. I have a higher GPA than the average 45 year old had in college	1	2	3	4	5	6
8. I am more forgiving than the average college student.	1	2	3	4	5	6
9. I am more forgiving than the average 80 year old	1	2	3	4	5	6
10. I am more likely to succeed than the average 80 year old	1	2	3	4	5	6
11. I am more mature than the average 80 year old	1	2	3	4	5	6
12. I am happier than the average college student	1	2	3	4	5	6
13. I have faster reflexes than the average 80 year old	1	2	3	4	5	6
14. I have a better attention span than the average 45 year old.	1	2	3	4	5	6
15. I have a better attention span than the average college student.	1	2	3	4	5	6
16. I am nicer than the average 45 year old	1	2	3	4	5	6
17. I am a better driver than the average 80 year old	1	2	3	4	5	6
18. I will live longer than the average 45 year old	1	2	3	4	5	6
19. I am healthier than the average 45 year old	1	2	3	4	5	6
20. I am healthier than the average college student	1	2	3	4	5	6
21. I am more friendly than the average 80 year old	1	2	3	4	5	6
22. I have higher moral principles than the average 45 year old.	1	2	3	4	5	6

Appendix B

Sample Demographics Sheet

What is your birth date? ____________________

What is your race? ____________________

What is your sex? ____________________

What is your marital status? Married Single Divorced Widowed

What is your current occupation? ____________________

If retired, or unemployed, what was your occupation? ____________________

How many years of education have you completed, starting with 1st grade? ___________

What degrees have you earned? HS/HSE, Associate's Degree (community college) Etc.

How did you find out about this project? ______________________________

Can we contact you again? Y N

<u>Health Status</u>

On the following scale, please rate your health:

0	1	2	3	4	5	6	7	8	9	10
poor					average					excellent

Please rate your corrected vision on the following scale:

0	1	2	3	4	5	6	7	8	9	10
poor					average					excellent

Please rate your corrected hearing on the following scale:

poor average excellent

Are you currently taking any medications? If so, please list below, indicating for what problem you are taking them (please include birth control pills and hormone replacement medication):

Do you currently have any health problems?

Please specify, in years, the age that most closely corresponds to...

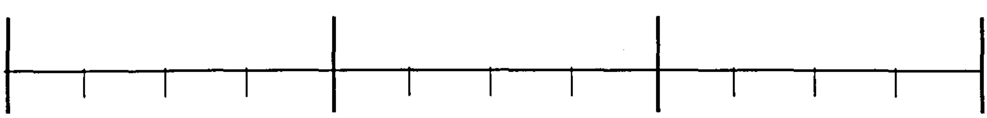
The way you feel: ____________________

The way you look: ____________________

The age of the person whom your interests and activities are most like: _______________

The age that you would like to be if you could pick your age right now: _______________

Please indicate on the Age Range Scale below where you believe you fall.



YOUNG MIDDLE OLD

Appendix C

ROSENBERG SELF-ESTEEM SCALE

Below is a list of statements dealing with your general feelings about yourself. If you strongly agree, circle **SA**. If you agree with the statement, circle **A**. If you disagree, circle **D**. If you strongly disagree, circle **SD**.

1.	On the whole, I am satisfied with myself.	SD	D	A	SA
2.	At times, I think I am no good at all.	SD	D	A	SA
3.	I feel that I have a number of good qualities.	SD	D	A	SA
4.	I am able to do things as well as most other people.	SD	D	A	SA
5.	I feel I do not have much to be proud of.	SD	D	A	SA
6.	I certainly feel useless at times.	SD	D	A	SA
7.	I feel that I'm a person of worth, at least on an equal plane with others.	SD	D	A	SA
8.	I wish I could have more respect for myself.	SD	D	A	SA
9.	All in all, I am inclined to feel that I am a failure.	SD	D	A	SA
10.	I take a positive attitude toward myself.	SD	D	A	SA

Appendix D

PERCEPTIONS OF COMPETENCIES QUESTIONNAIRE

Please circle a number that corresponds to your answer to these items below that compare you to other people across different dimensions of thinking, feeling, and behaving, where 1 = Strongly Disagree (SD), 2 = Disagree (D), 3 = Slightly Disagree (SLD), 4 = Slightly Agree (SLA), 5 = Agree (A), and 6 = Strongly Agree (SA).

	SD	D	SLD	SLA	A	SA
1. I have better general logical reasoning ability than the average middle-aged adult.	1	2	3	4	5	6
2. I am a better driver than the average elderly adult	1	2	3	4	5	6
3. I am more forgiving than the average elderly adult	1	2	3	4	5	6
4. I have faster reflexes than the average elderly adult	1	2	3	4	5	6
5. I am a better driver than the average middle-aged adult	1	2	3	4	5	6
6. I have better general logical reasoning ability than the average young adult.	1	2	3	4	5	6
7. I will live longer than the average middle-aged adult	1	2	3	4	5	6
8. I am more compassionate than the average middle-aged adult	1	2	3	4	5	6
9. I am friendlier than the average elderly adult	1	2	3	4	5	6
10. I am more intelligent than the average middle-aged adult	1	2	3	4	5	6
11. I am more creative than the average young adult	1	2	3	4	5	6
12. I am a more attractive than the average elderly adult	1	2	3	4	5	6
13. I am more considerate than the average young adult	1	2	3	4	5	6
14. I have a bigger vocabulary than the average elderly adult	1	2	3	4	5	6
15. I am happier than the average middle-aged adult	1	2	3	4	5	6
16. I am more considerate than the average elderly adult	1	2	3	4	5	6
17. I am a better driver than the average young adult	1	2	3	4	5	6
18. I have a bigger vocabulary than the average young adult	1	2	3	4	5	6
19. I am more successful than the average young adult	1	2	3	4	5	6
20. I have a better memory than the average middle-aged adult	1	2	3	4	5	6
21. I can identify grammatically correct standard English better than the average young adult.	1	2	3	4	5	6
22. I am better at recalling previously studied words than the average young adult.	1	2	3	4	5	6
23. I am more responsible than the average middle-aged adult	1	2	3	4	5	6
24. I am more generous than the average elderly adult	1	2	3	4	5	6
25. I am better at recalling previously studied words than the average elderly adult.	1	2	3	4	5	6

	SD	D	SLD	SLA	A	SA
26. I am better at recalling previously studied words than the average middle-aged adult.	1	2	3	4	5	6
27. I am more responsible than the average elderly adult	1	2	3	4	5	6
28. I am physically stronger than the average elderly adult	1	2	3	4	5	6
29. I will live longer than the average young adult	1	2	3	4	5	6
30. I am more responsible than the average young adult	1	2	3	4	5	6
31. I process symbolic information faster than the average young adult	1	2	3	4	5	6
32. I have a better attention span than the average middle-aged adult	1	2	3	4	5	6
33. I process symbolic information faster than the average middle-aged adult.	1	2	3	4	5	6
34. I am more generous than the average young adult	1	2	3	4	5	6
35. I am a more attractive than the average middle-aged adult	1	2	3	4	5	6
36. I am happier than the average young adult	1	2	3	4	5	6
37. I have a better memory than the average elderly adult	1	2	3	4	5	6
38. I am friendlier than the average middle-aged adult	1	2	3	4	5	6
39. I am friendlier than the average young adult	1	2	3	4	5	6
40. I am more creative than the average elderly adult	1	2	3	4	5	6
41. I have a better attention span than the average young adult	1	2	3	4	5	6
42. I am more successful than the average middle-aged adult	1	2	3	4	5	6
43. I am more intelligent than the average young adult	1	2	3	4	5	6
44. I am wiser than the average elderly adult	1	2	3	4	5	6
45. I have a better attention span than the average elderly adult	1	2	3	4	5	6
46. I am better at recognizing previously studied words than the average elderly adult.	1	2	3	4	5	6
47. I am healthier than the average middle-aged adult	1	2	3	4	5	6
48. I am more generous than the average middle-aged adult	1	2	3	4	5	6
49. I have more friends than the average middle-aged adult	1	2	3	4	5	6
50. I have faster reflexes than the average young adult	1	2	3	4	5	6
51. I am better at recognizing previously studied words than the average young adult.	1	2	3	4	5	6
52. I have higher moral standards than the average young adult	1	2	3	4	5	6
53. I have higher moral standards than the average middle-aged adult	1	2	3	4	5	6
54. I have a bigger vocabulary than the average middle-aged adult	1	2	3	4	5	6
55. I am more compassionate than the average young adult	1	2	3	4	5	6
56. I have better general logical reasoning ability than the average elderly adult.	1	2	3	4	5	6
57. I have more friends than the average young adult	1	2	3	4	5	6
58. I am healthier than the average elderly adult	1	2	3	4	5	6
59. I will live longer than the average elderly adult	1	2	3	4	5	6

	SD	D	SLD	SLA	A	SA
60. I can identify grammatically correct standard English better than the average elderly adult.	1	2	3	4	5	6
61. I am more intelligent than the average elderly adult	1	2	3	4	5	6
62. I am more forgiving than the average young adult	1	2	3	4	5	6
63. I am more compassionate than the average elderly adult	1	2	3	4	5	6
64. I have higher moral standards than the average elderly adult	1	2	3	4	5	6
65. I am physically stronger than the average young adult	1	2	3	4	5	6
66. I process symbolic information faster than the average elderly adult	1	2	3	4	5	6
67. I am more considerate than the average middle-aged adult	1	2	3	4	5	6
68. I am physically stronger than the average middle-aged adult	1	2	3	4	5	6
69. I am healthier than the average young adult	1	2	3	4	5	6
70. I am better at recognizing previously studied words than the average middle-aged adult.	1	2	3	4	5	6
71. I am wiser than the average middle-aged adult	1	2	3	4	5	6
72. I am more forgiving than the average middle-aged adult	1	2	3	4	5	6
73. I can identify grammatically correct standard English better than the average middle-aged adult.	1	2	3	4	5	6
74. I am more successful than the average elderly adult	1	2	3	4	5	6
75. I am wiser than the average young adult	1	2	3	4	5	6
76. I am a more attractive than the average young adult	1	2	3	4	5	6
77. I have a better memory than the average young adult	1	2	3	4	5	6
78. I have faster reflexes than the average middle-aged adult	1	2	3	4	5	6
79. I have more friends than the average elderly adult	1	2	3	4	5	6
80. I am more creative than the average middle-aged adult	1	2	3	4	5	6
81. I am happier than the average elderly adult	1	2	3	4	5	6

Appendix E

DOMAIN IMPORTANCE SCALE

Please circle a number that corresponds to how important you feel the following domains are to your self-esteem, where 1 = Least Important (LI), 3 = Moderately Important (MDI), and 5 = Most Important (MI).

		LI		MDI		MI
1.	Driving	1	2	3	4	5
2.	Longevity	1	2	3	4	5
3.	Attractiveness	1	2	3	4	5
4.	Intelligence	1	2	3	4	5
5.	Health	1	2	3	4	5
6.	Memory	1	2	3	4	5
7.	Friendliness	1	2	3	4	5
8.	Generativity	1	2	3	4	5
9.	Physical strength	1	2	3	4	5
10.	Forgiveness	1	2	3	4	5
11.	Success	1	2	3	4	5
12.	Reflex ability	1	2	3	4	5
13.	Compassion	1	2	3	4	5
14.	Having a large social network	1	2	3	4	5
15.	Morality	1	2	3	4	5
16.	Creativity	1	2	3	4	5
17.	Responsibility	1	2	3	4	5
18.	Happiness	1	2	3	4	5
19.	Being considerate	1	2	3	4	5
20.	Wisdom	1	2	3	4	5
21.	Attention span	1	2	3	4	5
22.	Vocabulary	1	2	3	4	5
23.	Processing speed	1	2	3	4	5
24.	Recalling words	1	2	3	4	5
25.	Recognizing words	1	2	3	4	5
26.	Grammar	1	2	3	4	5
27.	Logical reasoning	1	2	3	4	5

Appendix F

Memory Tasks

<u>RECALL TASK</u>

This questionnaire asks you to rate how certain you are that you can **<u>recall</u>** words from memory after studying them for a short period of 3 minutes. You will study 30 words such as **"jacket,"** **"bicycle,"** and **"tulip."**

If you believe you **cannot** recall the words, circle **NO**.

If you believe you **can** recall the words, circle **YES,** and a percentage to indicate how sure you are. The range for certainty is 10% **(barely certain)** to 100% **(completely certain).**

If I studied a set of **30** words for 3 minutes, I could recall **<u>1-5</u>** of the words, if tested for recall immediately after studying the set.

No	Yes		10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

If I studied a set of **30** words for 3 minutes, I could recall **<u>6-10</u>** of the words, if tested for recall immediately after studying the set.

No	Yes		10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

If I studied a set of **30** words for 3 minutes, I could recall **<u>11-15</u>** of the words, if tested for recall immediately after studying the set.

No	Yes		10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

If I studied a set of **30** words for 3 minutes, I could recall **<u>16-20</u>** of the words, if tested for recall immediately after studying the set.

No	Yes		10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

If I studied a set of **30** words for 3 minutes, I could recall **<u>21-25</u>** of the words, if tested for recall immediately after studying the set.

No	Yes		10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

If I studied a set of **30** words for 3 minutes, I could recall **<u>26-30</u>** of the words, if tested for recall immediately after studying the set.

No	Yes		10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

<u>RECALL TASK</u>

Please make a prediction and write it on the line below. How many words out of 30 words do you think you can recall after studying a word list for 3 minutes?

Number of words I think I can remember: __________

RECALL TASK

1. Please compare your general ability to recall a list of words with that of other participants by providing your percentile ranking.

   My percentile ranking: ________

2. Please estimate how your score on the test compares with that of other participants by providing your percentile ranking.

   My percentile ranking: ________

3. Please estimate how many words (out of 30) you think you recalled.

   Number of correct answers: ________

RECOGNITION TASK

1. Please compare your general ability to recognize a list of words with that of other participants by providing your percentile ranking.

   My percentile ranking: ________

2. Please estimate how your score on the test compares with that of other participants by providing your percentile ranking.

   My percentile ranking: ________

3. Please estimate how many words (out of 30) you think you recognized.

   Number of correct answers: ________

Appendix G

Intelligence tasks

VOCABULARY TASK

This questionnaire asks you to rate your knowledge of word meanings. You will be given 18 words each with 5 synonyms. You will have 4 minutes to complete the task. Please rate how certain you are that you can pick the best synonym for each word.

If you believe you **cannot** pick the best synonym, circle **NO**.

If you believe you **can** pick the best synonym, circle **YES,** and a percentage to indicate how sure you are. The range for certainty is 10% **(barely certain)** to 100% **(completely certain).**

From a list of **18** vocabulary words, I can pick the best synonym for **1-3** words on the list.

No	Yes		10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

From a list of **18** vocabulary words, I can pick the best synonym for **4-6** words on the list.

No	Yes		10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

From a list of **18** vocabulary words, I can pick the best synonym for **7-9** words on the list.

No	Yes		10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

From a list of **18** vocabulary words, I can pick the best synonym for **10-12** words on the list.

No	Yes		10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

From a list of **18** vocabulary words, I can pick the best synonym for **13-15** words on the list.

No	Yes		10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

From a list of **18** vocabulary words, I can pick the best synonym for **16-18** words on the list.

No	Yes		10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

<u>Vocabulary Task</u>

Please make a prediction and write it on the line below. How many items on the 18-item vocabulary task do you think you will correctly define in 4 minutes?

Number of items I think I will get correct: __________

<u>VOCABULARY TASK</u>

This is a test of your knowledge of word meanings. Look at the sample below. One of the five numbered words has the same meaning or nearly the same meaning as the word above the list. Circle the number that is most similar to the word.

Jovial

1. Refreshing
2. Scare
3. Thickset
4. Wise
5. Jolly

The answer to the sample is number 5 and has been circled.

It is to your advantage not to guess and only answer the questions that you know or the ones you are able to eliminate one or more answers choices as wrong.

Sample of first five items of Vocabulary Task.

1. handicraft
    1- cunning
    2- fast boat
    3- utility
    4- manual skill
    5- guild

2. resistant
    1- confusing
    2- conjunctive
    3- systematic
    4- assisting
    5- opposing

3. ejection
    1- restoration
    2- expulsion
    3- reformation
    4- bisection
    5- exposition

4. yawl
    1- tropical storm
    2- foghorn
    3- carouse
    4- sailboat
    5- turn

5. listless
    1- aggressive
    2- adaptable
    3- indifferent
    4- sorrowful
    5- ugly

VOCABULARY TASK

1. Please compare your general ability to identify synonyms of common English words with that of other participants by providing your percentile ranking.

   My percentile ranking: ________

2. Please estimate how your score on the test compares with that of other participants by providing your percentile ranking.

   My percentile ranking: ________

3. Please estimate how many test questions (out of 18) you think you answered correctly.

   Number of correct answers: ________

DIGIT SYMBOL TASK

This task will provide you with a key featuring 9 different symbol-number pairings; each symbol will correspond to a number, displayed in a box below the symbol (e.g., the square symbol corresponds to the number 4). Below the key are 93 symbols. The boxes below each symbol are empty. You must fill each box with the symbol's matching number. You will have 90 seconds to complete as many boxes as you can. Please rate how certain you are that you can complete the symbols.

If you believe you **cannot** complete the symbols, circle **NO**.

If you believe you **can** complete the symbols, circle **YES,** and a percentage to indicate how sure you are. The range for certainty is 10% **(barely certain)** to 100% **(completely certain)**.

On a **93-item** digit-symbol test, I can fill in **1-10** symbols in the blank boxes in 90 seconds.

No	Yes	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

On a **93-item** digit-symbol test, I can fill in **11-20** symbols in the blank boxes in 90 seconds.

No	Yes	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

On a **93-item** digit-symbol test, I can fill in **21-30** symbols in the blank boxes in 90 seconds.

No	Yes	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

On a **93-item** digit-symbol test, I can fill in **31-40** symbols in the blank boxes in 90 seconds.

No	Yes	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

On a **93-item** digit-symbol test, I can fill in **41-50** symbols in the blank boxes in 90 seconds.

No	Yes	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

On a **93-item** digit-symbol test, I can fill in **51-60** symbols in the blank boxes in 90 seconds.

No	Yes	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

On a **93-item** digit-symbol test, I can fill in **61-70** symbols in the blank boxes in 90 seconds.

No	Yes	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

On a **93-item** digit-symbol test, I can fill in **71-80** symbols in the blank boxes in 90 seconds.

No	Yes	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

On a **93-item** digit-symbol test, I can fill in **81-90** symbols in the blank boxes in 90 seconds.

No	Yes	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

On a **93-item** digit-symbol test, I can fill in **all 93** symbols in the blank boxes in 90 seconds.

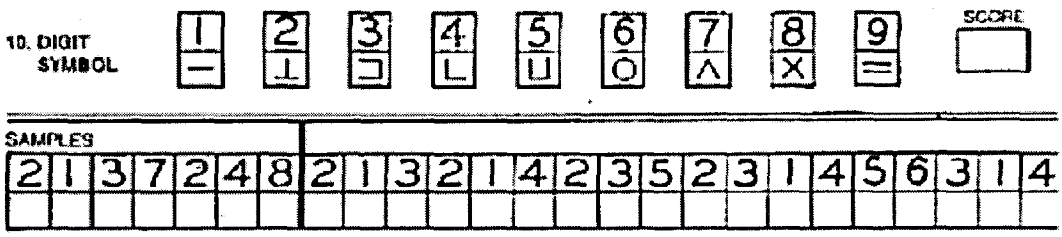
No	Yes	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

Digit Symbol Task

Please make a prediction and write it on the line below. Out of 93 items, how many symbols do you think you can complete in 90 seconds?

Number of symbols I think I can complete: __________

Sample of key and first row of Digit Symbol Task.



DIGIT SYMBOL TASK

1. Please compare your general ability to process symbolic information with that of other participants by providing your percentile ranking.

   My percentile ranking: ________

2. Please *estimate* how your score on the test compares with that of other participants by providing your percentile ranking.

   My percentile ranking: ________

3. Please estimate how many symbols (out of 93) you think you completed correctly.

   Number of correct answers: ________