The age of anxiety: A multi-dimensional perspective on age and anxiety across the adult lifespan

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Abstract

In recent years, a growing body of research has begun to address the question of how anxiety presents in older as compared to younger adults. Despite the theoretical and treatment advances that have resulted, the field is lacking insight into how anxiety is experienced and expressed across the entire adult lifespan. Moreover, the small research body that has considered anxiety on an age continuum has been somewhat limited by not considering subjective or implicit age as elements of the age concept that may influence its relationship to anxiety. Given the high lifetime prevalence rate of anxiety problems, as well as our aging population, it is important to address these limitations. This dissertation, which is divided into three sub-studies, tests how the structures of anxiety (Study 1) and age (Study 2) differ across the adult lifespan and between genders, as well as whether the relationship between chronological age and anxiety is moderated by subjective age perception and/or implicit age (Study 3). Online volunteer participants (N = 1350) completed three measures of anxiety to assess anxious cognitions, feelings (somatic feelings and subjective distress), and behaviors, in addition to three measures of age (chronological, subjective, and implicit). Participants also completed brief health and memory functioning questionnaires.

Contrary to predictions, results of Study 1 supported age-invariance in anxiety with slight gender differences only evident during early adulthood (ages 25-44). Means on the anxiety measures generally demonstrated a linear decline with age. Results of Study 2 indicated that the construct of subjective age differed in emerging adulthood (ages 18-24) relative to the rest of adulthood, such that social

age loaded especially strongly onto the latent subjective age factor in emerging adulthood (with lower, more moderate loadings for mental and look age), whereas all domains of subjective age (mental, social, physical, and look) loaded fairly comparably during the rest of adulthood. As hypothesized, emerging adults reported feeling older than their chronological age across most domains, whereas the opposite was true for participants age twenty-five and older. Regarding implicit age, all age groups demonstrated a bias to self-identify with young-related (relative to old-related) words, with the exception of older adults for whom no bias was evident,. Lastly and unexpectedly, in Study 3, neither subjective nor implicit age correlated with anxiety or moderated the relationship between chronological age and anxiety. Overall, findings support prior reports of an age-associated decline in anxiety and raise the question of what variables may account for the relationship between chronological age and anxiety, given perceived age does not appear central to this relationship.

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Introduction

Prompted by a rapidly aging population, recent years have seen a growing body of research on anxiety in older adulthood. Though this research has advanced our theoretical understanding and informed our treatment approaches, the oft-used extreme group designs comparing older to younger adults have failed to capture the structure of anxiety among individuals in these age groups. Moreover, the little research that has explored anxiety along an age continuum has been limited by not considering different aspects or components of the age concept that may influence its relationship to anxiety. Specifically, the majority of prior work has considered only the chronological aspect of age, ignoring other components (e.g., subjective age) that are strong predictors of physical and psychological health and functioning (e.g., Bowling, See-Tai, Ebrahim, Gabriel, & Solanki, 2005). Given an increasingly aged population, as well as the high lifetime prevalence rate of anxiety problems (National Comorbidity Survey Replication; Kessler, Berglund, Demler, Jin, Merikangas, & Walters, 2005), this dissertation examines how the expression of anxiety differs across the adult lifespan, as well as the role that explicit and implicit self-perceptions of age may play in its expression. Here, expression refers to the structure of the construct (e.g., variability in strength of the loadings of different components of anxiety onto a latent anxiety factor). The first two studies examine how the structure of anxiety (Study 1) and age (Study 2) differ across the adult lifespan and between genders. Study 3 builds on the findings of Study 1 and 2 to test the relationship between self-perceptions of age and anxiety, as well as whether these perceptions moderate the relationship between chronological age and anxiety.

Anxiety in Older Adults

Many studies have reported that anxiety disorders are less prevalent in older as compared to younger adults (e.g., Alonso et al., 2004; Flint, 1994; Regier et al., 1988; Wells et al., 2006; see Jorm, 2000 for a review). In line with these findings, results from the National Comorbidity Survey Replication pointed to a gradual rise in lifetime anxiety disorder prevalence ratings that peaked at 35.1% in individuals aged 30 to 44, before declining slightly in middle adulthood and steeply in those 60 and above (to 15.3%; Kessler et al., 2005). Yet, anxiety disorders still remain somewhat common among older individuals, especially women (Byers, Yaffee, Covinsky, Friedman, & Bruce, 2010). Current best estimates predict that between 2.3-14.2% of older adults suffer from an anxiety disorder (Wolitzky-Taylor, Castriotta, Lenze, Stanley, & Craske, 2010), with a higher prevalence rate among those in poor physical health (e.g., Tolin, Robinson, Gaztambide, & Blank, 2005). Notably, however, disorder prevalence rates are obscured by older adults' decreased tendency to report psychological symptoms (Bryant, 2010), their medical comorbidities, and their higher rates of impairment in activities of daily living (Ayers, Sorrell, Thorp, & Wetherell, 2007), as well as by measurement issues (e.g., strict diagnostic criteria unsuited to an older population, and use of measures that have not been validated in an older adult sample; Bliwise, McCall, & Swan, 1987, see Fuentes & Cox, 1997).

Despite this somewhat ambiguous picture regarding diagnostic rates, what remains clear is that subdiagnostic anxiety symptoms are quite prevalent and problematic in the older adult population (Bliwise et al., 1987; Hinrichsen, 1990;

Regier et al., 1988), affecting slightly more than half of older adults in some studies (e.g., Schaub & Linden's, 2000, German sample aged 70+). In fact, such symptoms may increase in advanced age. In a large, cross-sectional community sample, Teachman (2006) found a curvilinear relationship between chronological age and negative affect (a combined measure of depression and anxiety symptoms and neuroticism). Specifically, Teachman reported that negative affect increased during early adulthood, peaking in the mid-30s, after which it declined steadily until a final uptick in the mid-70s. In addition to being highly aversive, anxiety symptoms are associated with a host of negative consequences, such as physical complications, a decreased sense of wellbeing, overutilization of medical services, substance abuse, and even suicide (see Ayers et al., 2007). Understanding the manifestation of these symptoms from a lifespan perspective is necessary to enable sound and speedy detection by various healthcare providers.

Structure of Anxiety

According to Lang and colleagues, fear can be expressed through multiple response systems that may be desynchronous (Bradley & Lang, 2000; Lang, 1978; Lang, Cuthbert, & Bradley, 1998). In keeping with Lang and colleagues' models, Study 1 examines the structure of anxiety through cognitive, feeling (somatic feelings and subjective distress), and behavioral response domains. This notion of desynchrony among response domains has been discussed in the depression literature for over two decades. For example, the diagnostic criteria for major depression include both cognitive (e.g., thoughts of worthlessness, recurrent thoughts of death or suicide) and somatic (e.g., fatigue, insomnia, or hypersomnia)

symptoms (American Psychiatric Association, 1994). However, evidence suggests that symptom presentation may be influenced by age. McNeil and Harsany (1989) reviewed evidence suggesting that depression often presents differently in older adults, for whom somatic symptoms are more frequently endorsed relative to younger adults. This presentation, characterized by physical symptoms and withdrawal, has been termed "depression without sadness" (Gallo, Rabins, Lyketsos, Tien, & Anthony, 1997) or "depletion syndrome" (Newmann, Engel, & Jensen, 1991).

Similar to depression, anxiety has been hypothesized to present with more of a somatic component in older adults (McDonald, 1973; Sallis & Lichstein, 1982; Turnbull, 1989). Whereas anxiety in Western cultures is often characterized by "impaired concentration, memory difficulties, and other cognitive symptoms that are impairing and distressing" (Washington, Norton, & Temple, 2008), its presentation in older adults may more often be marked by "a strong somatic component, lack of worry, and possible agoraphobic tendencies" (Fuentes & Cox, 1997, p. 275). The bodily changes that accompany aging may be partly responsible for the increased focus on somatic symptoms in older adults. Physiological stress reactivity has been shown to increase in older adulthood due to changes in the sympathetic nervous system that lead to an increase in norepinephrine levels and/or to hormonal changes in women (Saab, Matthews, Stoney, & McDonald, 1989). Moreover, relative to their younger counterparts, older adults experience a greater increase in catecholamines (norepinephrine, epinephrine, and dopamine) in response to a stressor and take longer to return to baseline levels (McNeilly & Anderson, 1997).

The small literature on anxiety treatments in older adults points to the importance of targeting this exacerbated somatic component. Cognitive behavioral therapy protocols that have been developed for use in younger adults have been shown to be less effective in older adults (Stanley et al., 2003; Stanley, Beck, & Glassco, 1996; Wetherell, Le Roux, & Gatz, 2003; Wetherell, Sorrell, Thorp, & Patterson, 2005), perhaps owing to older adults' higher rates of cognitive dysfunction (Mohlman, 2005; Mohlman & Gorman, 2005). Rather, relaxation training, which targets somatic symptoms, has been shown to be especially effective in older adults (Welden & Yesavage, 1982).

In addition to somatic symptoms, behavioral avoidance may also play a larger role in older adults' expression of anxiety, relative to other age groups. According to the model of Selection, Optimization, and Compensation (SOC; Baltes & Baltes, 1990), successful aging is marked by the selection of fewer and more meaningful activities and goals on which to focus one's resources. Given the normalcy of such "niche-picking" behavior, as well as common physical limitations (e.g., hypertension, arthritis) that may make certain activities relatively riskier, avoidance may be a prominent means through which anxiety is expressed in older individuals that may go unnoticed as a symptom (Green, Magee, Steiner, & Teachman, 2014). To summarize, in light of this previous research, cognitive and subjective distress symptoms were hypothesized to play a relatively more prominent role in the expression of anxiety (i.e., load highly onto an anxiety latent factor) for younger and middle aged adults, whereas somatic and behavioral

symptoms were expected to be relatively more important for older adults' expression of anxiety.

Gender differences in anxiety. Women are more likely than men to develop an anxiety disorder throughout the lifespan (McLean, Asnaani, Litz, & Hofmann, 2011). For example, results from a national survey of over 8,000 individuals aged 15 to 54 revealed women to be about twice as likely to be diagnosed with GAD in comparison to men (Wittchen, Zhao, Kessler, & Eaton, 1994). Turning specifically to middle and older age, women have a greater chance of struggling with anxiety and suffering a more chronic course than men (de Beurs, Beekman, Deeg, & Van Dyck, 2000). Cross-sectional research suggests that this gender difference is most prominent within the 20s age group, during which time it is hypothesized that career and relationship stressors, among others, may more negatively impact women (de Goede, Spruijt, Iedema, & Meeus, 1999). Study 1 tests whether the structure of anxiety is similar between genders and, if so, whether there are variable gender differences across age groups. This is a necessary step in order to examine the larger question of the relationship between age and anxiety in Study 3 (i.e., if anxiety has a different structure at different points in the lifespan or for either gender, these differences would need to be taken into account in Study 3).

Structure of Age

Though evidence from the depression and anxiety literatures highlights the importance of considering chronological age in relation to symptom presentation,

the clinical implications of subjective age[1], or how old one perceives oneself to be (Hendricks, 1995), may be just as important, if not more so. Study 2 tests how individuals' explicit (i.e., subjective age) and implicit age self-concepts relate to their expression of anxiety.

Subjective age. Over two decades ago, Shiffman and Sherman (1991) remarked, "Age is revealing itself to be more a state of mind than a physical state" (p. 188). Research supports this perception of age as somewhat malleable, even cross-culturally (Barak, 2009). On average, the teen and emerging adulthood years are associated with feeling slightly older than one's chronological age, whereas the rest of adulthood (i.e., after approximately the mid-twenties) is a time during which feeling younger is the norm (e.g., Montepare & Lachman, 1989; Öberg & Tornstam, 2001; Teuscher, 2009; Underhill & Cadwell, 1983).

A number of studies with older samples have examined subjective age, defined as the age individuals perceive themselves to be (Hendricks, 1995), and its different domains, such as how old a person feels physically versus mentally (e.g., Hubley & Russell, 2009). However, no study to our knowledge has examined whether the domains comprising subjective age vary across the adult lifespan and between genders. This is an important question because of subjective age's demonstrated predictive power. In comparison to chronological age, subjective age has sometimes been shown to be more predictive than chronological age of life satisfaction (Sherman, Schiffman, & Dillon, 1988), self-respect, self-efficacy (Barak & Rahtz, 1989), and of older adults' physical and psychological health and functioning

[1] Previous research has also termed this "cognitive age" (e.g., Barak & Schiffman, 1981).

(Bowling et al., 2005; Hubley & Russell). In fact, longitudinal research has demonstrated that maintaining a younger subjective age is associated with lower mortality risk across a 12- to 16-year-period in adults age 70 to 100 (Kotter-Grühn, Kleinspehn-Ammerlahn, Gerstorf, & Smith, 2009). Moreover, feeling older than one's years has been associated with having a more pessimistic view of cognitive aging for women aged 55 and older (Schafer & Shippee, 2010). Though the majority of these findings are correlational, there is some causal evidence linking older subjective age to negative outcomes. For example, individuals in middle-to-older adulthood who have undergone an experimental manipulation to make them feel older (i.e., being asked to read material written in small, italicized, low-contrast font without explanation) have been shown to be more susceptible to negative ageist stereotypes (Eibach, Mock, & Courtney, 2010). Thus, establishing whether the structure of subjective age is comparable across different groups is critical to understanding whether certain subjective age domains are more closely tied to these significant outcomes across different subpopulations.

***Measurement and change patterns in subjective age*.** Kastenbaum and colleagues' "ages-of-me" model (Kastenbaum, Derbin, Sabatini, & Artt, 1972) has provided the basis for much of the research on subjective age. The model outlines a series of domain-specific estimates that contribute to a person's overall subjective age. Working from this model, Barak (1979, as cited in Barak, 1987) first developed a measurement scale in which participants selected the age decade (e.g., twenties, thirties) that best captured how old they felt (psychological age) and looked (biological age), as well as the ages they associated with their activities (social age)

and interests. Multiple studies have used an average of these (or similar) domains (Barak & Schiffman, 1981; Hubley & Russell, 2009; Montepare & Lachman, 1989; Stephens, 1991; see Teuscher, 2009) where subjective age has been shown to have high internal stability (Barak, 1979). More recently, Hubley and Russell reported a one-factor solution for subjective age in a sample of older women using a measure that included participants' physical, mental (i.e., thinking and reasoning skills), social (e.g., in relationships), and look (appearance) ages. However, no studies to date have directly compared the contribution of different domains to the subjective age construct across age groups and genders, leaving open the question of whether individuals are drawing from the same information when reflecting on their subjective age.

Nevertheless, based on this multi-domain approach to measuring subjective age, as well as on other simplified single-item measures, subjective age has shown some rather predictable patterns across different age groups. In a large community sample, Rubin and Berntsen (2006) reported that prior to the age of 25, participants, on average, reported feeling older than their chronological ages, though the opposite was true after 25. Though studies differ regarding the exact crossover point at which people begin to report feeling younger (Galambos, Turner, & Tilton-Weaver, 2005; cf. Montepare & Lachman, 1989), they usually agree that a shift occurs somewhere in the early to mid-twenties, a period often marked by important transitions, such as leaving home and getting a job, that are linked to increased maturity and responsibility (Settersten, 2011). Individuals older than this crossover point generally report feeling younger, although there appears to be a

"capping out" of sorts in terms of *how much* younger. Rubin and Berntsen reported that after the age of 40, North Americans felt, on average, 20% younger than their chronological age. This figure is in keeping with the finding that, across studies, older adults generally report feeling 12 to 15 years younger than their chronological age (see Hubley & Hultsch, 1994). Notably, however, as is true in younger adults (Montepare, 1991), the size of the discrepancy may be contingent on the subjective aging dimension that is assessed (e.g., there may be a larger discrepancy between chronological age and how old individuals believe they act vs. the discrepancy between chronological age and how old they feel they look; Kastenbaum et al., 1972).

Domain-based differences in subjective age.

Physical. Not surprisingly, research points to a significant relationship between self-reported good physical health and feeling younger in old age, independent of sociodemographic variables (Demakakos, Gjonca, & Nazroo, 2007). Further, poor health has been shown to be a strong predictor of feeling older than one's years (Barrett, 2003; Bowling et al., 2005; Westerhof, Barrett, & Steverink, 2003), and slightly more so among adults over 70 than among those aged 55-69 (Hubley & Russell, 2009). We therefore hypothesize that how old one feels physically will contribute more to the subjective age construct in older adulthood (i.e., 65 and older) than in younger age groups.

Mental. Given that lower cognitive functioning has been associated with feeling older among individuals age 65 and above (Uotinen, Rantanen, & Suutama, 2005), we hypothesize that mental age, or one's perception of one's thinking and

reasoning skills, will be an especially important component of subjective age among older adults (65 and older) and, to a lesser extent, among those in middle adulthood (45-64). Because younger adults, in general, are not expected to have experienced pronounced difficulties in their thinking and reasoning skills (so there may be less variability in how they perceive their mental age), mental age is not expected to be as influential to younger adults' subjective age construct.

Social. Normative social transitions across the adult lifespan are expected to be salient to subjective age. Prior research on subjective age during emerging adulthood has found subjective age to be tied to "psychosocial maturity" (Greenberger, Josselson, Knerr, & Knerr, 1975), a construct that seems to most closely map onto social age, as it is defined by "(1) the capacity to function effectively on one's own…(2) the capacity to interact adequately with others…and (3) the capacity to contribute to social cohesion" (p. 128). In line with this notion, Arnett (2003) reported that "establish[ing] equal relationships with parents" was viewed by a sample of 18- to 29-year-olds of diverse ethnicities as most necessary to being considered an adult. Therefore, shifts in relationships with others (e.g., parents, teachers, boss) may shape young peoples' views of whether they have reached adult status and likely, also, their subjective age.

Outside of emerging adulthood, social transitions likely continue to be salient to subjective age. For example, though it has not been the subject of as much research, key relational shifts that often occur during young adulthood, such as getting married, becoming a parent, or seeing one's parents grow older may shape subjective age. Similarly, the transition to becoming an "empty nester" (Lachman,

2004) or a grandparent (Kaufman & Elder, 2003) during middle adulthood may hold comparable sway in determining subjective age. Lastly, transitions that may occur in older adulthood, such as widowhood and enhanced dependency, are likely to impact subjective age, especially given the increased focus on relationships during this life period (see Socioemotional Selectivity Theory; Carstensen, Isaacowitz, & Charles, 1999). Thus, social age is expected to be a strong contributor to subjective age throughout the adult lifespan.

Look. We expect that the extent looks contribute to subjective age may vary as a function of the interaction between age and gender (rather than by age alone, as outlined in the other domains). Prior evidence for gender differences in subjective age has been mixed (see Infurna, Gerstorf, Robertson, Berg, & Zarit, 2010). Whereas some studies have found that middle aged and older women have younger subjective ages than their same-aged male counterparts (e.g., Barak & Stern, 1986; Montepare & Lachman, 1989), most studies have not found a gender difference in mean subjective age (e.g., Henderson, Goldsmith, & Flynn, 1995; Montepare, 1991). However, these gender evaluations have typically not considered the interacting role of chronological age, despite theoretical and empirical reasons to expect women's feelings about their looks to change with age. For instance, feminist theories emphasize women's physical looks as the basis upon which they gain status (e.g., Sontag, 1972; but see Wilcox, 1997), and, in keeping with this emphasis, young women have been shown to be more concerned than young men about the toll that aging will take on their looks (Gupta & Schork, 1993; McConatha, Schnell, Volkwein, Riley, & Leach, 2003). This would lead to the expectation that young women's

overall subjective age may be especially influenced by their perceived look age. Further, though women tend to be dissatisfied with their bodies across the adult lifespan, this dissatisfaction is lower among women in middle and older adulthood, compared to younger adulthood (Franzoi & Koehler, 1998; Hetherington & Burnett, 1994; Öberg & Tornstam, 1999; Reboussin et al., 2000). This reduced negative evaluation of one's appearance with increasing age may be associated with a diminished role of looks in determining overall subjective age for middle aged and older women. This leads to the hypothesis that subjective looks may explain more variance in younger women's overall subjective age, especially during emerging adulthood (18-24), relative to other age and gender groups.

Subjective age and anxiety. Given Taylor and Brown's (1988, 1994) work on the psychologically protective nature of positive illusions, it is not surprising that subjective age has sometimes been shown to be a better predictor of physical and psychological health and functioning than chronological age (Bowling et al., 2005; Hubley & Russell, 2009). As Barrett (2005) noted, "Maintaining a younger — and more age-discrepant — identity as one ages…requires a high degree of perceived control over critical life domains" (p. 178). While a causal connection cannot be made, given the associations between a relatively younger subjective age and more positive psychological and physical health outcomes, as well as between anxiety and poorer perceived health in old age (de Beurs, van Balkom, Van Dyck, & Lange, 1999), feeling younger than one's age may correlate with decreased anxious symptoms, starting in one's mid-twenties when feeling younger is developmentally normative.

Further, subjective age may moderate the relationship between chronological age and anxiety. In the case of a linear relationship between chronological age and anxiety, a steeper decline in anxiety symptom levels with rising chronological age may be observed among individuals who report a relatively younger subjective age from the mid-twenties on, whereas a less steep decline may be observed among individuals who report feeling older during this time period. This is expected because of prior work showing psychological benefits of feeling younger than one's chronological age (from the mid-twenties onward). If, similar to the findings of Teachman (2006), a curvilinear relationship emerged between chronological age and anxiety, then, relative to those who feel older, those who feel younger may evidence a steeper decline in anxiety symptoms throughout most of adulthood and a less steep increase in anxiety symptoms during old-old age. In other words, because of the benefits of feeling younger than one's chronological age, a younger subjective age is expected to enhance the protective effects of chronological age on anxiety throughout most of adulthood and diminish the risk conferred by chronological age on anxiety in old-old age.

Implicit age. Unlike subjective age, implicit age (one's automatic age self-concept that is less consciously controlled) has not received much research attention. However, evidence supports the existence of "age schemas," or self-concept associations organized around age that vary in strength among individuals (Montepare & Clements, 2001). Conceptually similar to schemas, implicit associations are thought to represent automatic (i.e., relatively uncontrollable) interconnections stored in memory (Teachman & Woody, 2004). Notably, one prior

study has measured implicit age in a sample of "young" (18-29), "young-old" (55-74), and "old-old" (75+) participants (Hummert, Garstka, O'Brien, Greenwald, & Mellott, 2002) and found all age groups to more strongly associate the self with "young" relative to "old." Study 2 assesses the strength of these interconnections between the self (versus others) and the concepts of "young" relative to "old."

Like subjective age, a term we use in keeping with the literature, a person's implicit age-self concept is also subjective in nature. How then might the two aging measures differ? Most noticeably, the former is designed to be a less controllable measure and, therefore, would likely elicit less response bias than the explicit measure of subjective age. Further, the implicit measure asks participants to consider their age self-concept relative to that of others, whereas the subjective age measure assesses felt age relative to chronological age. Though an individual may view him or herself as somewhat older than the calendar would reveal, that does not necessarily mean that he or she self-identifies with "old" more strongly than with "young" (and vice versa). Indeed, the measurement of subjective age provides a concrete marker (i.e., an actual number), whereas the measurement of implicit age provides an individual's abstract sense of whether he or she is old or young relative to others, with no age markers given.

Implicit age and anxiety. It is important to explore implicit age in relation to anxiety, given research that has shown a connection between implicit self-concept and anxiety symptoms (e.g., Reich, Below, & Goldman, 2010; Teachman, Smith-Janik, & Saporito, 2007; Teachman & Woody, 2003). Individuals with social anxiety or panic disorder demonstrate relatively more negative implicit associations tied to the

self than do nonanxious control participants (see Roefs et al., 2011, for a review). Additionally, in an unselected undergraduate sample, implicit (but not explicit) self-esteem predicted observer-ratings (but not self-ratings) of anxiety during a speech task (Spalding & Hardin, 1999). Given the established ties between subjective age and psychological wellbeing, as well as the youth-oriented culture of the United States (Westerhof & Barrett, 2005; Westerhof et al., 2003), having a relatively stronger, implicit "young" age self-concept may predict decreased anxiety for all age groups. Notably, though having a relatively older subjective age is normative during the early twenties, given that the subjective age discrepancy is typically relatively small at this stage of life (i.e., the age of 25 has been shown to be the "crossover point"; see Rubin & Berntsen, 2006, p. 780), presumably, it would not be normative for these individuals to implicitly view themselves as *old* (relative to *young*).

Further, like subjective age, implicit age may moderate the relationship between chronological age and anxiety. In the case of a linear relationship between chronological age and anxiety symptoms, a steeper decline in anxiety with increasing chronological age may be observed among individuals who more strongly self-identify with young-related, relative to old-related, words. As with subjective age, in the case of a curvilinear relationship between chronological age and anxiety, individuals who more strongly self-identify with young-related words may not only demonstrate a steeper decline in anxiety symptoms across adulthood but also a less steep increase in symptoms during older adulthood, relative to those who more strongly self-identify with old-related words.

Gender differences in mean subjective and implicit age. The evidence for a gender difference in subjective age is mixed (see Infurna et al., 2010). Whereas some studies have found that middle aged and older women have younger subjective ages than do their male counterparts (e.g., Barak & Stern, 1986; Montepare & Lachman, 1989), most have not found a gender difference in older or younger adults (Henderson et al., 1995; Rubin & Berntsen, 2006; Montepare, 1991). Given that this is the first study to explore potential gender differences in implicit age, there is little prior work to guide hypotheses. Thus, it is unclear whether a gender difference will emerge in subjective or implicit age. In addition to testing for mean gender differences across age groups for implicit age, Study 2 also tests whether subjective age is a similar construct between men and women and, if so, whether there are mean gender differences in subjective age across age groups.

Overview and Hypotheses

Study 1. Study 1 examines how the structure of anxiety differs across the adult lifespan and between genders through the testing of measurement invariance for a latent anxiety factor. Further, this study assesses the relationship within and across four anxiety indicators (i.e., thoughts, subjective distress, somatic sensations, and behavior) as they relate to chronological age and gender.

Age- and gender-based differences in anxiety's structure. Cognitive symptoms and subjective feelings of distress are expected to play a relatively more prominent role in the expression of anxiety during emerging, early, and mid-adulthood (i.e., in individuals ages 18-64), and somatic and behavioral symptoms are predicted to play a relatively more prominent role in older adults' (i.e., those

65+) expression of anxiety. Further, whereas all four anxiety components are hypothesized to load relatively equally onto a single anxiety factor for individuals in emerging, early, and mid-adulthood, we expect the thought component to load less highly onto an anxiety factor in older age.

We do not have hypotheses for gender-based structural differences, though we will test for these as an exploratory set of analyses.

Age- and gender-based differences in mean symptom levels of anxiety. Two competing hypotheses for the relationship between anxiety indicators and chronological age will be tested. Anxiety symptoms may linearly decline with chronological age, as has been observed in some studies (e.g., Henderson et al., 1998). Alternatively, a curvilinear pattern may emerge, such that symptoms could be highest in emerging adulthood, decline throughout early and middle adulthood, and then rise again in the older age group (e.g., Teachman, 2006). In the curvilinear scenario, we would predict a greater increase in the somatic and behavioral indicators than in the cognitive indicator in older age. Regarding gender, we hypothesize that women will report higher anxiety means across the adult lifespan.

Lastly, as an exploratory analysis, the interaction between age and gender in predicting anxiety symptom levels will be tested. In a large, representative community sample, Leach and colleagues reported that the gender gap in anxiety levels was highest for women in their early- to mid-twenties (Leach, Christensen, Mackinnon, Windsor, & Butterworth, 2008), a time during which career and relationship stressors, among others, may contribute to more anxiety in women (de Goede et al., 1999).

Study 2. Study 2 examines how the structure of age measured explicitly and implicitly differs across the adult lifespan and between genders. This is done in preparation for Study 3, which tests perceived age-related moderators of the relationship between chronological age and anxiety. As with anxiety in Study 1, subjective age will be characterized using a multi-dimensional framework (i.e., social-, mental-, physical-, and look-age).

Age- and gender-based differences in subjective age's structure. The four subjective age indicators are hypothesized to load onto a single factor in older age, in keeping with Hubley and Russell (2009). We will test whether a one-factor solution can also be applied across the rest of the adult lifespan and between genders. Given the literature's mixed results on gender differences in subjective age, age may interact with gender, particularly during older age (e.g., look-age may play a greater role in subjective age for older women than for older men).

For emerging adults (18-24), it is hypothesized that social-age will load strongly onto overall subjective age across genders and that look-age will be a particularly important component of young women's overall subjective age. Similarly, among 25-44 year-olds, social-age is predicted to be a large component of subjective age, given changing familial roles often assumed during this time period. In middle age (45-64) and through older age (65+), it is hypothesized that social-age will continue to play an important role in determining subjective age, though physical- and mental-age will also be increasingly central features. Among middle aged and older women (45+), look-age is hypothesized to not load as highly onto a

subjective age factor in comparison to women in emerging and early adulthood (18-44).

Age- and gender-based differences in mean subjective and implicit age. Based on the work of Rubin and Berntsen (2006), individuals younger than 25 are hypothesized to report feeling older than their chronological age across the four subjective age domains, whereas the opposite is hypothesized for individuals age 25 and above. Regarding implicit age, given that the majority of individuals, on average, report not feeling old, all age groups are expected to display a bias to associate the self more strongly with young-related words relative to old-related words.

Study 3. Study 3 examines the relationship between anxiety and both subjective and implicit age, and tests whether the relationship between chronological age and anxiety is moderated by either subjective or implicit age.

Subjective age and anxiety. Based on the established connection between psychological and physical wellness indicators and feeling younger than one's years, a younger subjective age is predicted to be associated with decreased anxiety starting after the age of 25 and heightened anxiety in emerging adulthood (18-24). These hypotheses are in line with expected subjective age norms for those age groups (i.e., it is normative to report feeling older than one's age during emerging adulthood and younger than one's age thereafter). Though there is no direct evidence that deviating from such norms would predict higher anxiety levels, it is plausible that, for example, being 20 and feeling 15 or being 72 and feeling 90 — a twenty-five percent discrepancy in the non-normative direction in both cases — would be correlated with predictors of heightened anxiety symptoms such as

inhibited social skills in younger adults (Thompson & Rapee, 2002) or poor health in older adults (Himmelfarb & Murrell, 1984). In other words, the deviations in subjective age may reflect other problems in functioning that are predictive of anxiety. Additionally, the anticipated, normative decline in anxiety from early adulthood through older age is hypothesized to be more exaggerated among individuals who report feeling younger than their chronological age, given the established association between feeling younger and increased wellness. Conversely, among those who report feeling older than their chronological age, heightened anxiety symptoms are expected after age 25. Moreover, for these individuals, the anticipated age-related decline in anxiety from early adulthood though older age is hypothesized to be less steep.

Implicit age and anxiety. Regarding implicit age, having a relatively stronger *me-young* bias is predicted to correlate with decreased anxiety across adulthood, given the positive outcomes typically associated with having a young self-concept. Further, the normative decline in anxiety from early adulthood through older age is hypothesized to be steeper among those who have a relatively stronger *me-young* bias (for the same reasons as outlined for subjective age). On the other hand, among individuals who have a relatively weaker *me-young* bias, heightened anxiety symptoms are anticipated across adulthood. Further, the expected decrease in anxiety from early adulthood through older age is hypothesized to be less exaggerated for those with a relatively weaker *me-young* bias.

Through these analyses, this dissertation will achieve the overarching goal of examining age- and gender-based differences in anxiety's structure that, along with

subjective age and implicit age, could help explain differences in how anxiety is experienced across the adult lifespan and between genders.

Study 1: How Does the Structure of Anxiety Differ Across the Adult Lifespan and Between Genders?

The current study takes a multi-dimensional approach to the assessment of anxiety, measuring participants' cognitive, subjective, somatic, and behavioral anxiety symptoms. This approach was selected in keeping with the work of Lang and colleagues, which shows evidence for desynchrony among response domains (Bradley & Lang, 2000; Lang, 1978; Lang, Cuthbert, & Bradley, 1998). The study's goals were two-fold. First, we aimed to test for measurement invariance in anxiety across adult age groups and between genders. This test was deemed necessary given results in the depression literature suggesting that symptom presentation may be related to age (e.g., McNeil & Harsany, 1989), and was a required step to prepare for Study 3 in which we examine moderators of the relationship between chronological age and anxiety. If the structure of anxiety substantially differs across age and/or gender groupings, then use of an identical anxiety model in the moderation analyses would be ill advised. Second, we aimed to compare mean levels of anxiety symptoms across age and gender groupings.

Methods

Participants

Participants (N = 1350; 67.3% women) were US citizens aged 18 and older who visited the publicly accessible Project Implicit website (http://implicit.harvard.edu) between June 3, 2010 and September 23, 2010. Upon

visiting the site and completing a demographics questionnaire, individuals were randomly assigned to one of the site's studies. They were only eligible to complete the current study once. To account for the smaller number of older (compared to younger) adult visitors to the Project Implicit website, age was used to weight recruitment to the current study (e.g., individuals aged 35-44 were more likely to be assigned to the current study than those aged 25-34, and less likely than those aged 45-54). The number of participants in each age decade bin was checked weekly, and recruitment was closed for a given age bin once approximately 220 participants in that age range had consented. Note that more age bins were created than used in analyses to ensure approximately equal distribution across all ages. Further, to recruit additional older adults, residents of a mid-Atlantic retirement community with public (and functioning) email addresses (N = 66 emailed; N = 29 consented) were sent an email inviting them to participate by following an Internet link to the study.[2] Participants for the combined final sample reported ages ranging from 18 to 91 years (M = 42.95, SD = 16.45). It should be noted that while Project Implicit samples are not representative of any specific population, they are usually more diverse than typical samples obtained at a single site (Nosek et al., 2007), pointing to the value of online recruitment. Relatedly, a recent study indicated that 53% of Americans aged 65 and older are online (and 70% of these use the Internet on a daily basis), suggesting that online older adult samples may be less biased than they

[2] The results of chi-square tests comparing the Project Implicit age 65+ sample to the retirement community sample revealed no significant differences in gender, race, ethnicity, or education.

were among past cohorts (Zickuhr & Madden, 2012). See Table 1 for sample demographic characteristics and comparisons across age groups.

Materials

In addition to reporting demographic information including chronological age, participants completed the following questionnaires (see Appendix A).

Anxiety measures.

Anxious cognitions. Participants completed selected items from the Brief Bodily Sensations Interpretation Questionnaire (BBSIQ; Clark et al., 1997). Participants read three ambiguous scenarios: (1) a socially-relevant scenario selected to be particularly relevant to the concerns of younger adults (see Teachman & Gordon, 2009), (2) a physically-relevant scenario selected to be relevant to the concerns of older adults (see Teachman & Gordon), and (3) a general scenario that was not expected to be preferentially relevant to either age group (a general scenario). For example, the socially-relevant scenario read, "You have visitors over for dinner and they leave sooner than you expected. Why?" Using a 9-point scale (0 = *Not at all likely*, 8 = *Extremely likely*), participants rated the likelihood of each of three proposed explanations for the ambiguous scenario, one of which was always negative (e.g., "They did not enjoy the visit and were bored with your company") and two of which were either neutral or positive (e.g., "They did not wish to outstay their welcome"). Likelihood ratings for the three negative explanations (one per scenario) were averaged as a measure of anxious cognitions.

Though the BBSIQ in its complete form has established strong psychometric properties (e.g., Clark et al., 1997) and has been used previously with older adults

(Teachman & Gordon, 2009), we conducted pilot testing on our selected three scenarios to ensure that they measured the appropriate domains (i.e., social, physical, general). Twenty-two individuals who were blind to hypotheses rated each scenario's physical-, social-, and age-relevance (1 = *Not very relevant*, 5 = *Very relevant*), in addition to the valence of each proposed explanation for the scenarios (1 = *Very negative*, 5 = *Very positive*). As expected, there was a difference in the physical relevance ratings of the scenarios ($F_{(2,20)} = 58.68$, $p < .001$, $\eta_p^2 = .85$). Follow-up pairwise comparisons revealed that the physical scenario was rated more physically relevant than the general ($p < .001$) or social ($p < .001$) scenario). Also as expected, the scenarios differed in social relevance ($F_{(2,20)} = 70.18$, $p < .001$, $\eta_p^2 = .88$), with the social scenario being rated more socially relevant that the general ($p < .001$) or physical ($p < .001$) scenario. Furthermore, the rated age-relevance of the scenarios did not differ ($p = .805$), an important finding, given that we did not intend for the scenarios to be read as *explicitly* targeted for specific age groups. Regarding the valence of the proposed explanations, for each scenario, a difference in valence negativity was found (social: $F_{(2, 20)} = 79.88$, $p < .001$, $\eta_p^2 = .89$; physical: $F_{(2,20)} = 15.80$, $p < .001$, $\eta_p^2 = .61$; general: $F_{(2,20)} = 81.75$, $p < .001$, $\eta_p^2 = .89$). These differences were in the expected direction, in that the negative explanations were consistently rated as more negative than either of the two neutral explanations (all ps $< .01$).

Reliability was calculated for the negative explanations for the three scenarios and was found to be low in the current study (Cronbach's alpha = .44), which may have been partly due to the small number of items and the

heterogeneous nature of the domains assessed. Further, there may have been age group differences in the perceived likelihood of the negative explanations based on the different domains (e.g., social vs. physical; see Teachman & Gordon, 2009).

Feelings: subjective distress and somatic. Participants completed the 7-item anxiety subscale of the short version of the Depression, Anxiety, Stress Scales (DASS21-Anxiety; Lovibond & Lovibond, 1995). This measure is comprised of three items assessing subjective distress (e.g., "I felt I was close to panic") and four items assessing somatic correlates of anxiety (e.g., dryness of the mouth, trembling) over the past week. These item groupings will be considered separately for all analyses given hypothesized age-based differences in loadings for subjective distress and somatic feelings. Participants responded to each item using a 4-point scale (0 = *Did not apply to me at* all, 3 = *Applied to me very much, or most of the time*). The 7-item subscale has been found to have good psychometric properties in diagnosed (Antony, Bieling, Cox, Enns, & Swinson, 1998; Brown, Chropita, Korotitsch, & Barlow, 1997; Clara, Cox, & Enns, 2001) and community-dwelling (Crawford & Henry, 2003) adults, as well as in older anxiety-treatment seeking adult samples (Gloster et al., 2008; Cronbach's alpha in current study for subjective distress items = .50; Cronbach's alpha in current study for somatic items = .52).

Behavioral avoidance. Participants responded to two items modeled off of questions in the Anxiety Disorder Interview Schedule-IV (ADIS-IV; Brown, Di Nardo, & Barlow, 1994). Using a 5-point scale (0 = *Never avoid*, 4 = *Always avoid*), participants reported how often they "avoid doing certain things or entering situations because those situations may elicit feelings of fear, anxiety or panic."

Additionally, participants reported the degree to which this avoidance has interfered with their life on a 5-point scale (0= *No interference,* 4 = *Severe interference*; Cronbach's alpha in current study = .68).

Procedure

After being randomly assigned to this study, participants saw a consent form (see Appendix A) that informed them they would be completing "brief questionnaires in which you describe yourself, your feelings and the ways in which you think and respond to your surroundings." There was no mention of age or anxiety.[3] Next, participants completed a demographics questionnaire common to all Project Implicit studies before completing the three anxiety questionnaires (abbreviated BBSIQ, behavioral avoidance questions, and DASS21-Anxiety) in random order, followed by subjective age measures and an age-relevant Implicit Association Test (IAT; see Study 2). Finally, participants completed brief health and memory functioning questionnaires in random order (see Study 3) before being debriefed and presented with their IAT feedback, which described the relative strength of their implicit age association.

Results

Age Group Divisions and Descriptive Statistics

[3] Participants who consented went on to view an instructional manipulation check (IMC) given to test whether they were reading materials very closely (Oppenheimer, Meyvis, & Davidenko, 2009). Less than half (45.8%, $N = 584$) of participants passed the IMC, a slightly lower percentage than that reported by previous Internet studies (Magee, Smyth, & Teachman, 2012; Oppenheimer et al.). However, this is a particularly rigorous test, and in prior studies, passing or failing did not moderate the reported effects (Magee et al.; Menatti, Smyth, Teachman, & Nosek, in press). We will examine whether IMC status moderates mean levels of anxiety and Subjective Age Percent Discrepancy in the current study.

Visual inspection of graphs plotting chronological age by each anxiety measure revealed a continuous pattern that did not imply data-driven age groupings. Therefore, to test measurement invariance of anxiety across age groups, the sample was divided into four age groups, reflecting emerging adulthood (18-24), early adulthood (25-44), mid-adulthood (45-64), and older adulthood (65+). Though age divisions are, by their nature, somewhat arbitrary, these groupings were selected based on previous age-related findings in anxiety (e.g., Teachman, 2006) and subjective aging research, as well as on social norms and research designs, given the need for consistency across studies within the dissertation. Largely in keeping with Arnett's (2000) definition, emerging adulthood was defined as the years spanning 18 to 24. This age range encompasses the continuation of higher education for many (especially in our sample), as well as a time during which, on average, individuals think of themselves as older than their age (e.g., Rubin & Berntsen, 2006), distinguishing this group from the rest of adulthood. Early adulthood was defined as ranging from age 25 to 44, the period of time that often encompasses major life transitions, such as career development, marriage, and the starting of a family. Middle adulthood was characterized as extending from 45 to 64, largely in keeping with Toothman and Barrett's (2011) finding, based on the nationally representative National Survey of Midlife Development in the United States (MIDUS), that individuals view middle age as spanning from the mid-40s to the early 60s. Lastly, 65 was selected as the beginning of older adulthood, given its frequent use in both research and policy (e.g., retirement age for some individuals, Medicare eligibility; Bowling, See-Tai, Ebrahim, Gabriel, & Solanki, 2005). See Table

2 for a correlation matrix and descriptive statistics for each of the four anxiety indicators, subdivided by age and gender.

Testing Measurement Invariance of Anxiety: Modeling Procedure and Evaluation Criteria

Measurement invariance of anxiety was assessed for age and gender groupings. Analyses were performed using Amos Graphics version 20 (Arbuckle, 2011). Maximum likelihood estimation was used, and invariance tests were performed on increasingly restrictive nested models, in keeping with Jöreskog's (1971, 1993) method for assessing comparability of factor structures. Measurement invariance was examined by first testing configural, and then metric invariance across the groups (see Byrne, 2004). Configural invariance is satisfied if the groups have a similar basic model structure (i.e., the same indicators load on the same latent constructs), as determined by confirmatory factor analyses within each group (Milfont & Fischer, 2010). Metric invariance is a stricter criterion that requires the strength of individual factor loadings onto their latent construct to be the same across groups (Milfont & Fischer). Evidence of measurement invariance would indicate that the meaning of the latent variable is the same across groups (Steenkamp & Baumgartner, 1998). We did not test for invariance of error variances, given that this is often regarded as an overly restrictive test (Bentler, 2004; Byrne) and was not central to the current questions.[4]

[4] Notably, though the proposed analytic plan had included invariance testing for a second order anxiety factor model, convergence issues necessitated the use of a first order model instead (see Appendix B for further detail).

Absolute model fit was assessed with the comparative fit index (CFI; Bentler, 1990) and the root mean square error of approximation (RMSEA; Steiger & Lind, 1980). These goodness-of-fit indices were selected because they are relatively independent of sample size (Hong, Malik, & Lee, 2003). CFI values of about 0.95 indicate acceptable fit, with higher numbers indicating better fit (Hu & Bentler, 1999). RMSEA values less than 0.08 indicate good fit, with lower numbers indicating better fit (Browne & Cudeck, 1993). We do not reference the CFI in the multi-group comparisons, given that CFI values decrease as models become more restrictive, resulting in biased model comparisons (Hong et al.). Thus, within these multi-group analyses, we evaluated change in the χ^2 statistic to compare across models, as well as changes in RMSEA.

Gender invariance. Given that our primary question concerned age-invariance, we first tested whether the genders could be combined within a given age group.

We checked whether a one-factor model of anxiety was appropriate for both genders, meaning that the model fit well with all four anxiety indicators loading onto a single factor. Specifically, we constructed a one-factor model of anxiety comprised of the four previously described indicators, and tested this model's fit for both genders in a multi-group factor analysis in an SEM framework. The model was found to have excellent fit, $\chi^2(4, N = 1347) = 3.76$, CFI = 1.00, RMSEA = .000, suggesting that the same one-factor solution was appropriate for both genders.

Test of metric invariance. Next, using a multi-group analysis, this one-factor baseline model in which all factor loadings were freely estimated (Model 1) was

compared to a second model (Model 2) that was identical with the exception that factor loadings were constrained to be equal between genders (e.g., the loading for the somatic indicator on the latent factor was set equal for men and women). This comparison resulted in a change in χ^2 from 3.76 to 13.22 and a gain of 3 degrees of freedom. A χ^2 difference test between the nested models indicated a significant loss of fit in Model 2 (p = .024), suggesting metric variance. Further evidence for poorer fit in Model 2 was an increase in RMSEA from .000 in Model 1 to .026 in Model 2.

Follow-up analyses were next conducted comparing Model 1 to Model 2 for men and women within each of the four age groups to determine whether any age groups demonstrated metric invariance (e.g., the loading for the subjective distress indicator on the latent factor was set equal for 18-24-year-old men and 18-24-year-old women). Results supported metric invariance across gender for the two older age groups (i.e., 45-64 and 65+), so for the subsequent age-invariance analyses, a single model that included both genders was estimated for each of these age groups. Though the 18-24-year-old group also demonstrated metric invariance, based on the results of a χ^2 difference test and improved RMSEA, combining men and women within this age group resulted in a Heywood case (i.e., a standardized loading greater than one and a negative error variance). Therefore, though the loading pattern was very similar, for all subsequent age invariance comparisons, gender was separated within this 18-24-year-old group. Lastly, and in contrast to the other three age groups, among 25-44-year-olds, men and women differed, such that somatic feelings had a higher loading for women than for men, and behavioral

avoidance had a higher loading for men than for women. Loadings for anxious cognitions and subjective distress were similar between the genders.

In summary, the gender invariance tests found evidence for invariance for all age groups except early adulthood (i.e., 25-44 year-olds), who demonstrated dissimilar loadings for subjective distress and behavioral avoidance.

Age invariance. Prior to testing metric invariance across age groups, we first checked whether a 1-factor model of anxiety was appropriate (akin to the analysis for gender). Specifically, the fit of a one-factor model was tested in a multi-group analysis that included six groups, divided by age, and gender as necessary based on the gender invariance analyses: (1) 18-24-year-old women, (2) 18-24-year-old men, (3) 25-44-year-old women, (4) 25-44-year-old men, (5) 45-64-year-olds, and (6) 65+ year-olds. The results revealed excellent model fit, $\chi^2(13, N = 1347) = 10.02$, CFI = 1.00, RMSEA = .000, suggesting that the one-factor solution was appropriate across age groups.

Test of metric invariance. This baseline, one-factor model with freely estimated factor loadings (Model 1) was then compared to Model 2, which differed only in that factor loadings for each anxiety indicator were constrained to be equal across the six groups (e.g., the behavioral avoidance loading on the latent overall anxiety factor was equal for 18-24-year-old women, 18-24-year-old men, 25-44-year-old women, etc.). Chi-square values increased from 10.02 in Model 1 to 33.98 in Model 2 with a gain of 15 degrees of freedom. Though the RMSEA increased from .000 to .013 in Model 2, a χ^2 difference test did not indicate a significant loss of fit for the more parsimonious Model 2. This suggests mostly comparable loadings across

the six groups. Nonetheless, for the sake of thoroughness, we conducted 15 follow-up tests, contrasting two groups at a time, testing each possible group comparison among the six groups. In each case, the baseline model (Model 1), in which all factor loadings were freely estimated, was compared to the same model but with factor loadings constrained to be equal between the two groups (Model 2; see Table 3). Across the 15 tests, the only significant metric variant finding was the (previously reported) gender difference between 25-44-year-old women and men. This suggests that across age groups, the factor structure of anxiety is very similar.

To attain final factor loadings for anxiety based on the results from gender and age invariance testing, a multi-group analysis was then conducted on a three-group model consisting of the following groups: (1) 25-44-year-old women, (2) 25-44-year-old men, and (3) all other participants. See Table 4 for parameter estimates. This three-group model was chosen to account for the gender differences within the 25-44-year-old group, despite there being evidence for metric invariance across all four age groups. Model fit was excellent (CFI = 1.00; RMSEA = .000). Findings suggested that, overall, the structure of anxiety is quite similar across the adult lifespan and between genders. For all three groups, subjective distress consistently had the highest loading and cognitions the lowest loading onto the latent anxiety factor. Whereas somatic feelings and behavioral avoidance had comparable loadings for most of the sample, 25-44-year-old women had higher loadings for somatic feelings relative to 25-44-year-old men, and 25-44-year-old men had higher loadings for behavioral avoidance, relative to 25-44-year-old women.

Mean Level Analyses of Anxiety Indicators

To determine whether mean anxiety scores differed among the eight age and gender groups, the means for each of the four anxiety response indicators were calculated. A multivariate ANOVA was conducted with the four anxiety response indicators as dependent variables and age group (with four levels) and gender as fixed factors. Results revealed main effects of age group ($F_{(12, 3513)} = 4.755$, $p < .001$, $\eta_p^2 = .02$) and gender ($F_{(4,1169)} = 2.67$, $p < .05$, $\eta_p^2 = .01$), as well as a significant age group x gender interaction ($F_{(12, 3513)} = 1.77$, $p < .05$, $\eta_p^2 = .01$). Given this interaction, we then examined age group and gender mean differences for each of the four anxiety indicators.[5]

Cognitions. Results of a univariate ANOVA with mean BBSIQ score as the dependent variable and age group and gender as fixed factors revealed a main effect of age group ($F_{(3, 1194)} = 3.27$, $p < .05$, $\eta_p^2 = .01$). Individuals age 18-24 reported the highest anxiety level ($M = 1.95$, $SD = 1.38$), which was not significantly different from that reported by 25-44 year-olds ($M = 1.73$, $SD = 1.39$), but differed from that reported by those age 45-64 ($M = 1.61$, $SD = 1.29$) and 65+ ($M = 1.47$, $SD = 1.14$), $ps < .05$. Those age 45-64 and 65+ were not significantly different from each other, $p = .418$. There was no main effect of gender or gender x age interaction, $ps > .10$. These findings suggest that anxious cognitions are lower among middle aged and older adults than they are among emerging and early adults.

Subjective distress. A univariate ANOVA was conducted with mean subjective distress as the dependent variable and age group and gender as fixed

[5] This analysis was also run with IMC status (pass or fail) entered as a fixed factor. Though there was still a main effect of age group ($p < .001$, $\eta_p^2 = .02$), the main effect for gender became a trend ($p < .10$, $\eta_p^2 = .01$), as did the age group x gender interaction ($p < .10$, $\eta_p^2 = .01$).

factors. There were main effects of gender ($F_{(1, 1201)} = 10.39$, $p < .01$, $\eta_p^2 = .01$) and age ($F_{(3, 1201)} = 13.95$, $p < .001$, $\eta_p^2 = .03$), which were subsumed by a gender x age interaction ($F_{(3, 1201)} = 4.21$, $p < .01$, $\eta_p^2 = .01$).

To determine the source of the interaction, four independent samples *t*-tests were run, comparing mean subjective distress for women and men within each age group. Among those ages 18-24, as expected, women ($M = .53$, $SD = .57$) reported significantly more subjective distress than men ($M = .24$, $SD = .34$), $p < .001$, $d = .68$. Surprisingly, there were no gender differences in the other age groups. As a second means of probing the interaction, two univariate ANOVAs were conducted (one for each gender), comparing subjective distress across the four age groups. Among the women, subjective distress significantly differed across age groups, lessening with increasing age (18-24: $M = .53$, $SD = .57$; 25-44: $M = .37$, $SD = .50$; 45-64: $M = .26$, $SD = .43$; 65+: $M = .10$, $SD = .21$), all age group comparisons *p*s $< .01$. Conversely, among the men, the greatest subjective distress was reported among the 25-44 year olds ($M = .31$, $SD = .46$), which did not significantly differ from that reported by the 18-24 year olds ($M = .24$, $SD = .34$), but did differ from that reported by those 45-64 ($M = .20$, $SD = .36$) and those 65+ ($M = .13$, $SD = .29$), *p*s $< .05$. No other significant age differences were found among the men. Together, these findings suggest that, similar to anxious cognitions, subjective distress levels are lower among middle aged and older adults, relative to emerging and early adults. Further, with the exception of emerging adulthood during which women report more subjective distress, men and women do not significantly differ in their levels of reported subjective distress.

Somatic feelings. Results of a univariate ANOVA with mean somatic feelings as the dependent variable and age group and gender as fixed factors revealed a main effect of age group ($F_{(3, 1203)} = 9.06$, $p < .001$, $\eta_p^2 = .02$). Somatic anxiety decreased across age groups (18-24: $M = .48$, $SD = .40$; 25-44: $M = .40$, $SD = .39$; 45-64: $M = .33$, $SD = .36$; 65+: $M = .28$, $SD = .34$), with all age groups significantly different from one another ($ps < .05$), with the exception of the 45-64 and 65+ groups, which did not significantly differ from each other. There was no main effect of gender or age group x gender interaction, $ps > .10$. This suggests a similar pattern to that demonstrated for anxious cognitions and subjective distress of fewer anxiety-related somatic sensations in middle aged and older adults, relative to emerging and early adults.

Behavioral avoidance. Lastly, a univariate ANOVA was conducted with mean behavioral avoidance as the dependent variable and age group and gender as fixed factors. There was no main effect for age group or gender and no age group x gender interaction (all $ps > .05$).

Together, the mean level analyses found a general pattern of decline in anxiety indicators with successive age group, with consistent differences appearing between emerging/early adulthood and middle/older adulthood. The exception to this pattern was behavioral avoidance, which did not change with age.

Mean level analyses of anxiety indicators examining old-old adults separately. Given our hypothesis concerning a curvilinear relationship between age and anxiety, we repeated all mean level analyses with five age groups: emerging, early, and middle adulthood, as before, but dividing young-old (i.e., 65-74) from old-old (75+) adults. Results of a multivariate ANOVA with the four anxiety response

indicators as dependent variables and age group (with five levels) and gender as fixed factors revealed only a main effect of age group ($F_{(16, 4680)} = 3.68$, $p < .011$, $\eta_p^2 = .01$). Post hoc comparisons within each anxiety domain revealed no significant differences between means for young-old and old-old adults, suggesting that a linear pattern best fit the data.

Discussion

This study tested whether the structure and mean levels of anxiety are similar across the adult lifespan and between genders. Within a multi-group structural equation modeling framework, we tested measurement invariance for a latent anxiety construct comprised of four indicators: anxious cognitions, subjective distress, somatic sensations associated with anxiety, and behavioral avoidance. Contrary to predictions, anxiety was shown to have a similar structure across all age groups. Consistently, most of the variance in the latent anxiety construct was accounted for by subjective distress, which included items related to worrying about panic, feeling close to panic, and feeling scared without reason. Anxious cognitions (i.e., a negative interpretative bias) consistently explained the smallest portion of variance in the overall anxiety latent factor. Somatic sensations (e.g., dryness of the mouth, breathing difficulty without physical exertion, trembling) and avoidance had medium-sized loadings across all groups.

Despite age-based structural consistency with the other age groups, men and women in early adulthood (25-44) differed from each other on the strength of the factor loadings for anxious somatic sensations and avoidance, though differences were relatively small. Among women in early adulthood, anxiety had a larger

somatic component than it did among men, and this somatic component had a higher loading in women than did anxious avoidance. The reverse was true among men in early adulthood, for whom anxious avoidance loaded higher than it did among women and higher than somatic sensations.

We also tested mean level differences by age group and gender for each anxiety indicator. In line with the first of our two competing hypotheses, in general, a linear decline with age was observed for anxious cognitions, subjective distress, and somatic feelings. However, contrary to predictions, behavioral avoidance did not demonstrate age differences. Further, the anticipated gender difference of women reporting more anxiety symptoms than men was found only for subjective distress among emerging adults (18-24).

Similarities in the Structure of Anxiety

Cognitions. Anxiety-related cognitions demonstrated a significant, albeit small, loading onto a latent anxiety factor in most cases. It is surprising that a negative interpretation bias did not account for a larger portion of the variance in anxiety across emerging, early, and middle-adulthood. Over thirty years of research have supported the idea, first proposed by Beck (1976), that anxious individuals are more likely than their non-anxious peers to interpret ambiguous information in a negative or threatening way (see Mathews & Mackintosh, 2000). This finding is robust and evident across diverse methodologies (e.g., Eysenck, MacLeod, & Mathews, 1987; Mathews, Richards, & Eysenck, 1989; Richards & French, 1992). Further, evidence from the burgeoning cognitive bias modification literature points

to the positive impact of shifting these biases on anxiety symptoms and emotional vulnerability in the face of a stressor (see Hallion & Ruscio, 2011).

One reason for the relatively small loading of cognitions on the anxiety factor in this case may follow from our selected cognitive bias measure. Given the time constraints of this Internet-based study, we selected three items from the BBSIQ that, together, sampled a socially-relevant, physically-relevant, and general-threat-relevant domain. Though we chose the first two items in accordance with concerns frequently reported by younger and older adults, respectively, a measure including more scenarios may have more comprehensively assessed interpretation biases. Further, pilot testing revealed low internal reliability for the 3-item measure, which itself was not a validated subscale. Together, these issues may have attenuated the variability accounted for in the latent anxiety factor by anxious cognitions.

Nevertheless, from a theoretical perspective, our results suggest that anxious thoughts play a relatively small and constant role across age groups. When hypothesizing differences in loading patterns between younger and older adults, we had drawn from the depression literature's mean-based findings of decreased cognitive symptoms (e.g., worrying: Christensen et al., 1999; worthlessness and guilt: Gallo, Anthony, & Muthén, 1994) and increased somatic symptoms (e.g., fatigue, psychomotor retardation; Christensen et al.) in older adults, relative to younger adults. This seemed to be a valid starting point, based on commonalities between mood disorders (e.g., high comorbidity between anxiety and depression in older adults; Lenze et al., 2000). However, our results point to differences between mean-based and structural findings. In other words, though anxious cognitions do

appear to decline with increasing chronological age, these mean differences do not seem to translate into differences in the composition of the anxiety construct itself.

Subjective distress. In contrast to anxious cognitions, subjective distress accounted for a very large portion of the variance in the latent anxiety factor across the adult lifespan. Though we had hypothesized that this would be the case for the younger three age groups (18-64), we found the same pattern among the older adults (65+) as well. These findings suggest that, within our unselected sample, anxiety is best captured by feelings of panic and fear. Our hypothesis that subjective distress would have a relatively smaller loading onto the anxiety construct among older adults was based on mean findings in the depression literature of decreased reported subjective distress among older adults (i.e., "depression without sadness"), which we had thought may reflect developmentally-related differences in depression or cohort-related differences in the stigma associated with reporting such symptoms. Our finding of a consistently important role for subjective distress across all age groups, however, is in keeping with the work of Feldman Barrett and colleagues who argue for the centrality of subjective feelings, regardless of age, within the context of the study of emotion (Feldman Barrett, Mesquita, Ochsner, & Gross, 2007). The authors state that "the question 'What is the experience of emotion?' is really the question 'What do people feel when they feel an emotion?'" (p. 376), and they hold that self-reported mental state, best captured in the current study by subjective distress, is "the most direct way to measure the contents of a mental representation of emotion" (p. 376).

Somatic feelings. Given research reporting that depression has a more somatic manifestation among older adults, we had hypothesized that anxiety may, similarly, present with more of a somatic component among older adults than among other age groups. Contrary to predictions, however, somatic sensations (e.g., trembling, awareness of the action of one's heart without physical exertion) had a similar, medium sized loading onto a latent anxiety factor across all age groups. Though early adulthood (25-44) did not differ from other age groups on this variable, there was a gender difference in the role of somatic feelings within early adulthood. Namely, somatic sensations accounted for more variance in anxiety among the women than among the men.

Why might somatic sensations account for more variance in anxiety among women in early adulthood than among men? One possibility is that hormonal changes that may occur during early adulthood may contribute to somatic sensations' relatively greater centrality to women's experience of anxiety. For example, hormonal and other bodily changes associated with menstruation and pregnancy commonly occur during this age range, potentially making somatic symptoms a more normative component of the anxiety construct among women. Indeed, in a sample of almost 200 pregnant women, meeting screening criteria for a depressive or anxiety disorder was associated with a heightening of typical somatic symptoms associated with pregnancy (e.g., headaches, dizziness, pounding heart; Kelly, Russo, & Katon, 2001). Further, among women seeking treatment for premenstrual syndrome, of which anxiety can be a large component, approximately 40% met criteria for a mood or anxiety disorder or both, suggesting a high degree of

overlap between the two (Bailey & Cohen, 1999). Therefore, somatic symptoms may explain a greater portion of variance in women's anxiety during early adulthood, as compared to their male peers, given other commonly occurring life events during this time that may make somatic symptoms more normative among the general population of women.

Behavioral avoidance. Based on the model of Selection, Optimization, and Compensation (SOC; Baltes & Baltes, 1990), we had hypothesized that behavioral avoidance would explain a larger portion of the variance in anxiety for older adults than for other age groups. Moreover, given that healthy aging is associated with opting out of activities that are poorly matched to one's changing resources (e.g., physical or cognitive abilities), we also expected behavioral avoidance to occur more often in older adults, which it did not (see below). In actuality, behavioral avoidance explained a medium-sized portion of the variance across all age groups. Perhaps this occurred because avoidance is so central to multiple forms of anxiety pathology (see Lovibond, 2006) that it remains a substantial component of anxiety, regardless of age.

As with somatic feelings, a gender difference was again found in early adulthood (25-44), such that avoidance had a higher loading for men than for women (though the difference was not as large as that seen for somatic feelings). One possibility is that women may be more likely to endorse behavioral avoidance items for reasons that are not as related to anxiety (e.g., it could be tied to gender differences in assertiveness; e.g., Eagly, Karau, Miner, & Johnson, 1994).

Notably, the relatively large discrepancies between the amount of variance accounted for by the different components of anxiety (i.e., differences in the strength of the loadings), suggesting relatively minimal overlapping variance in the indicators, raises the question of whether anxiety is better conceptualized with an emergent variable model, as opposed to the latent variable approach taken in the current study. Emergent variable models, as described by Coan (2010), better account for a lack of coherence among indicators of a construct, such as anxiety, as emotions are presumed to emerge rather than result from measured indicators of emotion (e.g., physiological, behavioral). In other words, whereas a latent variable model presupposes the existence of an anxiety construct that depends upon covariation among multiple indicators affected by an associated executive network, an emergent variable model maintains that it is the interactions among such indicators that produce the experience of an emotion. Though the lack of coherence between cognitive and subjective distress indicators in the current study could be taken as evidence for an emergent model of anxiety, certainly methodological considerations, as highlighted above, must also be taken into account, before discounting the latent approach.

Age- and Gender-based Differences in Mean Levels of Anxiety Symptoms

In line with the first of our competing hypotheses, means on three of the four anxiety indicators generally declined across the four age groups. This pattern was evident for anxious cognitions, subjective distress, and somatic feelings, though in some cases, differences between two sequential age groups did not reach significance. Interestingly, there was no evidence to support the second of our

competing hypotheses, that is, a curvilinear relationship between anxiety symptoms and age. Given that Teachman's (2006) curvilinear findings were based on an aggregate measure of negative affect that included depression and neuroticism in addition to anxiety, it may be that this curvilinear relationship is less driven by anxiety than by symptoms of depression and/or neuroticism.

Unexpectedly, symptoms of behavioral avoidance did not significantly vary by age group. In the current study, we assessed anxious avoidance by asking individuals (1) the extent to which they avoid activities or situations because they may experience fear, anxiety, or panic, and (2) the extent to which this avoidance has interfered in their life. According to the SOC model, it is likely that within a largely healthy sample, older adults may opt-out of certain activities to which their resources are not well matched and which, therefore, could make them anxious. Given that the typical decline in anxiety symptoms was not evident for this domain, older adults may endorse adaptive avoidance as anxious avoidance (thereby inflating the older adults' mean). Indeed, the issue of teasing apart anxious avoidance from adaptive situation selection highlights the importance of enhanced communication between the psychopathology literature that mostly draws from studies of younger and middle-aged adults and the healthy aging literature (see Green, Magee, Steiner, & Teachman, 2014).

Though age-based differences in anxiety indicators were common, gender differences were rare. The only anxiety indicator for which there was a gender difference (women reporting more symptoms than men) was subjective distress, and this was only true for emerging adults (18-24). This was contrary to our

prediction that women would report higher anxiety means across all symptom domains, based on findings of higher lifetime anxiety disorder prevalence rates among women. One possibility for the largely null gender findings may lie in the distinction between disorder prevalence rates and symptom prevalence rates. Though there is a dearth of research on gender differences in treatment seeking for anxiety disorders, women may be more likely to seek treatment for certain anxiety disorders (Shear, Cloitre, Pine, & Ross, 2005; for a counterexample in the social anxiety literature, see Weinstock, 1999) and, therefore, to receive a diagnosis. Examining anxiety symptoms in an unselected sample may lead to less gender-biased results.

Limitations and Conclusion

This study had a number of limitations that should be considered alongside the results. First, the cross-sectional nature of these data limits our ability to draw developmental conclusions. Though we did not find age differences in the structure of anxiety, it is possible that the similarities are due to a general environmental influence (e.g., current conceptualizations of anxiety promulgated in popular media and advertisements). Second, though the current sample included a relatively large number of "old-old" individuals (75+; n = 43), this sub-sample was not large enough to make up its own age group. Therefore, we were unable to compare the structure of anxiety between the "young-old" and the "old-old," which, based on research reporting an increase in symptoms among the old-old (e.g., Teachman, 2006), could have produced disparate findings. However, as an exploratory analysis, we repeated all mean level analyses dividing the older adult group into "young-old" (65-74) and

"old-old" (75+) and found no evidence for a curvilinear relationship. Third, our sample was unselected, so replication of these findings with clinically anxious participants will be important. Fourth, as previously mentioned, the study's measure of anxious cognitions may not have been comprehensive enough to reliably assess the construct. It is possible that anxious cognitions would have accounted for a larger portion of the variability in anxiety had the full, validated BBSIQ or an alternate measure of cognitions been used.

Nevertheless, these results are interesting from a theoretical and clinical perspective. To our knowledge, this is the first study to test whether multiple indicators of anxiety comprise a similar construct between genders and across the adult lifespan. Overall, our findings suggest great similarities in the construct, with the most variability in anxiety explained by subjective feelings and the least by anxious cognitions. Anxious somatic sensations and behavioral avoidance had moderate loadings, though the strength of these loadings differed between women and men in early adulthood. Clinically, these findings give further credence to the importance of conducting a multi-modal assessment of anxiety.

Study 2: How Does the Structure of Age Differ Across the Adult Lifespan and Between Genders?

The current study examines whether subjective age is a similar construct across the adult lifespan and between genders, as well as whether there are mean differences in felt age, as measured explicitly and implicitly. This study was done in preparation for Study 3, which considers how felt age relates to anxiety and whether it moderates the relationship between chronological age and anxiety.

Interest in these questions follows from prior work demonstrating the predictive power of subjective age in relation to life satisfaction (Sherman, Schiffman, & Dillon, 1988), self-respect, self-efficacy (Barak & Rahtz, 1989), and physical and psychological health and functioning in older adults (Bowling, See-Tai, Ebrahim, Gabriel, & Solanki, 2005; Hubley & Russell, 2009).

Regarding the explicit measurement of subjective age, based on previous findings (e.g., Hubley & Russell, 2009), we assessed participants' subjective ages across four domains: (1) mental, (2) physical, (3) social, and (4) look (i.e., appearance). Similar to Study 1, we tested the measurement invariance of a latent subjective age factor composed of these indicators across age and gender groups, as well as mean differences in each of these indicators among groupings. Testing for measurement invariance was necessary so that subjective age could be used as a moderator of the relationship between chronological age and anxiety in Study 3. For example, were subjective age to have a different structure based on one's age or gender, then it would not be justified to use the same subjective age model for the whole sample in the moderation analyses.

Recall that we hypothesized that for emerging adults (18-24), social-age would be related to overall subjective age for both genders and that look-age would be a particularly important component of young women's overall subjective age. Similarly, among the 25-44 year-olds, we predicted that social-age would be important in determining subjective age, given changing familial roles often assumed during this time period. In middle age (45-64) and through older age (65+), it was hypothesized that social-age would continue to play an important role

in determining subjective age, though physical- and mental-age would also be increasingly central features. Among women 45+, look-age was hypothesized to not load as highly as before onto a subjective age factor. Regarding mean levels of subjective age, we predicted that participants younger than 25 would report feeling older than their chronological age across domains and that the opposite would be true for individuals age 25 and older.

The current study also measured implicit age, defined by how strongly a participant associates the self versus others with young-related words, relative to old-related words. While this is also a measure of subjective age, it is thought to differ from the explicit measure in that (1) it is less controllable and, therefore, less likely to elicit a response bias, and (2) it measures one's age concept more abstractly (i.e., "old" or "young" vs. an actual number in the explicit measure) and relative to "others" (vs. the inherent self-relativeness of the explicit measure). Further, unlike the explicit subjective age measure, our measure of implicit age was not comprised of multiple domains and, as such, did not require measurement invariance testing prior to its eventual use in Study 3. We hypothesized that all age groups would associate the self more strongly with young-related words relative to old-related words, in keeping with Hummert and colleagues' findings (Hummert, Garstka, O'Brien, Greenwald, & Mellott, 2002).

Methods

Participants

Participants were the same as described in Study 1.

Materials

Chronological age. Participants reported their chronological age using a dropdown menu with boxes for birth year (options ranging from 1905-2002) and birth month.

Subjective age and Subjective Age Percent Discrepancy. Using a dropdown menu that ranged from 7 to 110+, participants selected the age in years that they felt across a variety of domains. Specifically, participants reported how old they: 1) thought they looked, 2) felt socially (e.g., in relationships), 3) felt physically, and 4) felt mentally (e.g., thinking and reasoning skills). This measure was a modified version of that used by Hubley and Russell (2009) who assessed subjective age across the same domains using verbal descriptions (e.g., much younger than chronological age, much older than chronological age) versus specifying a number. The exact numbers were obtained in this study to allow calculation of a more precise chronological versus subjective age discrepancy. When measuring the discrepancy between an individual's chronological and subjective age, it is important to keep in mind that a subjective age discrepancy of five years, for example, may have different implications for a 20-year-old than it would for a 75-year-old. To account for this, a Subjective Age Percent Discrepancy (SAPD) score was calculated, which corresponded to the discrepancy between a participant's subjective and chronological age expressed as a percent of his or her chronological age (see Eibach, Mock, & Courtney, 2010). In other words, for each of the four subjective age domains, a participant's chronological age was subtracted from his or her domain-specific subjective age, and the difference was divided by his or her chronological age. For example, if a 30-year-old participant reported a mental

subjective age of 25, then her Mental-SAPD would be (25 – 30) / 30 = -.17. The negative sign indicates she feels mentally younger than her chronological age, and the discrepancy between her subjective mental age and her chronological age would be 17% of her chronological age.

Implicit age. Participants completed an Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998), a computerized reaction time test to measure the relative strength of participants' implicit associations about the self or others with young-related and old-related concepts. This measure is based on the premise that the relative strength of an individual's implicit associations between target concepts is reflected by his or her speed in classifying word stimuli into superordinate categories. In keeping with previous research involving the IAT in which attitudes toward the self are compared to attitudes toward others (e.g., de Jong, 2002; Greenwald & Farnham, 2000; Hummert et al., 2002), the current study used the target categories "Me" and "Not me" and the descriptive attribute categories "Young" and "Old." Stimuli used for the target categories included, "I," "Myself," "Self," and "Other," "Them," "They." The descriptor stimuli were "Younger," "Youthful," "Junior," and "Aging," "Older," and "Senior."

The IAT was divided into seven blocks, three of which provided familiarization and practice with categorizing stimuli and were not analyzed. During the four critical IAT blocks (block numbers 3, 4, 6, and 7), a target category and a descriptive attribute category appeared in one upper corner of the screen (e.g., "Old or Me"), and the other category pairing (in this case, "Young or Not me") appeared in the adjacent upper corner. Participants then saw a word that belonged to one of the

four categories (either the target or descriptor categories) in the middle of the screen and used one computer key to sort the stimulus into the appropriate pairing (e.g., "Senior" would be categorized into the "Old or Me" categories). A second computer key was used to categorize stimuli belonging to either of the other two categories (e.g., "Young or Not me"). After completing two identical critical blocks with 20 and 40 trials, respectively, participants then completed two more critical blocks in which the pairings were switched such that "Old or Not me" words were to be categorized together using the same key and "Young or Me" words were to be categorized together using the other key. As before, the first of these blocks included 20 trials, and the second included 40 trials. The difference in reaction time between category groupings provided a relative measure of the strength of the association between concepts (i.e., the *D* score; higher numbers correspond to relatively stronger *me-young* associations). The order of the category pairings was counterbalanced. Split-half reliability (the two 20-trial blocks vs. the two 40-trial blocks) was acceptable (r = .68)

Procedure

Please see Study 1.

Results

Age Group Divisions and Descriptive Statistics

To test measurement invariance of SAPD across age groups, the sample was divided into the same four age groups described in Study 1, reflecting emerging adulthood (18-24), early adulthood (25-44), mid-adulthood (45-64), and older adulthood (65+). As before, visual inspection of chronological age by each domain's

subjective age plots and by implicit age revealed a continuous pattern that did not imply data-driven age groupings.

A correlation matrix and descriptive statistics for each of the four subjective age indicators and implicit age, subdivided by age groupings, is provided in Table 5. See Figure 1 for a depiction of Subjective Age Percent Discrepancy for each domain collapsed across age groups.

Subjective Age Invariance: Modeling Procedure and Evaluation Criteria

Measurement invariance of SAPD was assessed for age and gender groupings using the same strategy as outlined in Study 1.

Gender invariance. We first tested gender invariance to determine whether age groups needed to be separated by gender for the primary age-based analyses. Based on prior research reporting a one-factor solution for subjective age, we used a one-factor model for both genders. To check the appropriateness of this approach for these data, we conducted a multi-group factor analysis in an SEM framework testing the fit of this baseline model and found adequate fit, $\chi^2(4, N=1347) = 33.42$, CFI = .949, RMSEA = .074.

Test of metric invariance. In a multi-group analysis, a baseline one-factor model (Model 1) was constructed in which all factor loadings were freely estimated. A comparison model (Model 2), identical to Model 1 with the exception that all factor loadings were constrained to be equal between genders, was then estimated, resulting in a change in χ^2 from 33.42 to 46.50 and a gain of 4 degrees of freedom. Given that Model 2 was nested within Model 1, a χ^2 difference test was performed, which revealed that constraining the factor loadings led to a significant loss of

model fit (p = .011), suggesting metric variance. The RMSEA did improve slightly in Model 2 (changed from .074 to .060), indicating improved fit. Follow-up analyses were performed comparing women and men within each of the four age groups to identify any potentially metric invariant age group comparisons. Results supported metric invariance across gender among the 18-24, 45-64, and 65+ age groups, but a χ^2 difference test indicated a significant difference in the factor loadings for women and men age 25-44 (p = .003). However, subsequent review indicated that the loading pattern was very similar between genders for the age 25-44 group. For both genders, Social-SAPD had the highest loading (.65 and .67, respectively), followed by Mental-SAPD (men = .60, women = .64), Physical-SAPD (men = .54, women = .48), and Look-SAPD (men = .47, women = .46). The finding of a significant likelihood ratio test in the context of similar factor loadings is not surprising, given that the likelihood ratio test is highly sensitive to sample size (Bentler, 1990). Therefore, we decided not to subdivide this age group by gender in future analyses, following Bryne (2001).

Age invariance. Given prior findings (e.g., Hubley & Russell, 2009), a one-factor model was estimated in which Mental-, Physical-, Social-, and Look-SAPD all loaded onto one general SAPD factor. The results of a multi-group analysis across the four age groups indicated good model fit, $\chi^2(8, N = 1350) = 20.39$, CFI = .963, RMSEA = .034.

Test of metric invariance. In a multi-group analysis, a baseline model (Model 1) was first estimated for each age group using the one-factor model with the four SAPD domain indicators. All parameters were freely estimated. Next, a

comparison model (Model 2) was constructed in which the factor loadings were constrained to be equal across the four age groups (i.e., the Social-SAPD loading for age 18-24 was constrained equal to the Social-SAPD loading for ages 25-44, 45-64, etc.), and fit indices were compared to those derived from Model 1. In Model 2, the χ^2 value increased from 20.39 to 54.13, and 12 degrees of freedom were gained. A χ^2 difference test suggested metric variance (p = .001), and the ordering of the loading pattern was dissimilar across age groups (though the RMSEA reflected only a very slight decrease in model fit in Model 2 from .034 to .036). We conclude from this analysis that the factor-loading pattern for SAPD differs across age groups.

To determine which of the age groups had distinct factor-loading patterns, six follow-up, multi-group analyses were performed, comparing each of the four age groups to one another. For each age group comparison, a baseline model (Model 1) in which domain loadings were allowed to vary across all age groups was compared to a metric invariant model (Model 2). A χ^2 difference test was performed for each of the six comparisons, and changes in RMSEA were examined (see Table 6). Results of a χ^2 difference test revealed metric variance for the 18-24 year-old age group in comparison with each of the other three age groupings. In line with this finding, the RMSEA indicated poorer model fit in Model 2 for each of these comparisons. On the contrary, all other age groupings (i.e., 25-44, 45-64, and 65+) were found to have metric invariance. In other words, factor loadings could be constrained to be equal

across each of these three older age groups without a significant loss of fit in the model. In fact, the RMSEA improved in Model 2 for these three comparisons.[6]

Given these findings, a multi-group analysis was conducted comparing two age groups: (1) ages 18-24, and (2) ages 25 and above (aggregate of the 25-44, 45-64, and 65+ groups). See Table 7 for parameter estimates. Model fit was adequate, $\chi^2(4, N = 1350) = 35.39$, CFI = .924, RMSEA = .076. In the emerging adult (18-24) group, findings indicated that Social-SAPD had a large loading, followed by moderate-sized loadings for Mental-SAPD and Look-SAPD, and a non-significant loading for Physical-SAPD. The loading pattern was very different in the second group (ages 25 and above), for which there were relatively equal, large loadings across all indicators.

Mean Level Analyses of Subjective Age Domains

Mean SAPD was computed for each domain within each age group. To understand the significance of the discrepancies, one-sample *t*-tests were conducted comparing these means to 0, which would indicate no significant difference between subjective and chronological age. On average, individuals ages 18-24 reported feeling slightly, albeit significantly, older than their chronological age across the social (d = .46), mental (d = 1.79), and physical (d = .31) domains, but younger in the look domain (d = -.80), ps < .05. In contrast, individuals in the other three groups, in

[6] The general pattern of a different SAPD structure in younger adults versus older adults was robust even when dividing the 25-44 age group into two groups (i.e., 25-34 and 35-44). Individuals age 18-34 had a similar SAPD structure, which differed from individuals 35 and older. Therefore, though the current study used 25 as a theoretically-derived "cut-point," the finding of differences in the structure for younger adults, relative to middle aged and older adults is robust across different age divisions.

general, reported feeling younger than their chronological ages across domains (*p*s < .001 for 10/12 tests). See Figure 2.

To determine whether mean SAPD varied by age groupings and gender across domains, we performed a repeated measures ANOVA with a within-subjects factor of subjective age domain (mental, physical, social, look), and between subjects factors of age group (18-24, 25-44, 45-64, and 65+) and gender. There were main effects of domain ($F_{(3, 1097)} = 23.20$, $p < .001$, $\eta_p^2 = .06$) and age group ($F_{(3, 1099)} = 161.61$, $p < .001$, $\eta_p^2 = .31$), which were subsumed by a significant SAPD domain by age group interaction ($F_{(9, 3297)} = 36.48$, $p < .001$, $\eta_p^2 = .09$). There were no significant main or interactive effects for gender (all *p*s > .10).[7]

To uncover the source of the domain by age interaction, four repeated measures ANOVAs were conducted (one per age group) with domain as a within subjects factor (see Figure 2). Results indicated a main effect of domain for each age group (all *p*s < .001). The two younger age groups (i.e., those 18-44) reported feeling oldest in the mental domain (though, in the 25-44 group, Mental-SAPD was not significantly different from 0), and youngest in the look domain. Individuals in the two older age groups (i.e., those 45 and older) reported the largest discrepancies (feeing younger than their chronological age) for Mental- and Social-SAPD. They reported the smallest discrepancies, though still in the younger direction, for Look- and Physical-SAPD. Overall, as expected, whereas 18-24 year-olds reported feeling

[7] When this repeated measures ANOVA was run with IMC status (pass, fail) as a third between-subjects factor, the pattern of results did not change. IMC status did not moderate results.

slightly older in most domains (with the exception of Look-SAPD), all other age groups reported feeling slightly younger or their chronological age across domains.

As a second means of probing the domain by age interaction, four univariate ANOVAs were conducted (one per domain) comparing across the four age groups. There was the expected main effect of age across each domain (all *p*s < .001; η^2_p for Social-SAPD = .17; η^2_p for Physical-SAPD = .10; η^2_p for Mental-SAPD = .33; η^2_p for Look-SAPD = .04), such that individuals reported feeing increasingly younger from the youngest to oldest age group. The one exception to this pattern was for Look-SAPD, for which there was no difference between participants in the three older age groups, all of whom reported looking approximately 13% younger than their chronological ages.

Mean Level Analyses of Implicit Age

Mean implicit age was computed within each age group. As with SAPD, one-sample *t*-tests were run comparing each mean to 0. Means significantly larger than 0 would indicate a relatively stronger *me-young* bias, whereas means significantly smaller than 0 would indicate a relatively stronger *self-old* bias. On average, individuals in emerging ($t(175) = 18.47$, $p < .001$), Cohen's $d = 2.79$), early ($t(347) = 28.11$, $p < .001$, Cohen's $d = 3.02$), and middle ($t(387) = 9.90$, $p < .001$, Cohen's $d = 1.01$) adulthood reported significantly stronger *me-young* associations. However, older adults (65+) did not report a significant bias in either direction ($p > .05$).

Next, to determine whether mean implicit age varied across age and gender groupings, we conducted a univariate ANOVA with IAT *D* score as the dependent variable and age group and gender as fixed factors. There was a main effect of age

group ($F_{(3, 1014)} = 38.80$, $p < .001$, $\eta_p^2 = .10$), with those in emerging and early adulthood (18-44) reporting similarly strong *me-young* associations, followed by weaker *me-young* associations in middle adulthood (45-64), and the weakest *me-young* association (indeed, no significant *me-young* bias) in the older adulthood (65+). There was no main effect of gender and no age group by gender interaction.[8]

Creation of Implicit Age Factor Score

To reduce measurement error in the implicit age score, we created a latent implicit age variable comprised of four equal parcels (each reflecting a *D* score) to be used in Study 3. To form these parcels, participants' responses to the 60 critical trials in each critical category pairing (i.e., block numbers 3 and 4 are one pairing, and block numbers 6 and 7 are the second pairing) were divided into four subsets of 15 trials each. The resultant one-factor implicit age model had adequate fit, $\chi^2(2, N = 1350) = 21.46$, CFI = .989, RMSEA = .085.

Discussion

The current study examined an explicit and an implicit measure of subjective age across the adult lifespan and between genders and tested for measurement invariance in the explicit measure. Using multi-group structural equation modeling, we examined the loadings of four subjective age domains (i.e., mental, physical, social, and look), expressed as a percentage of an individual's chronological age (SAPD), onto a single latent factor. Results indicated the structure of SAPD did not vary by gender, but was different for 18-24 year-olds in comparison to the rest of

[8] When this analysis was re-run with IMC status (pass, fail) as a third fixed factor, the pattern of results did not change. IMC status did not moderate results.

the sample, such that all four domains had moderate to large loadings onto a latent SAPD factor in the 25 and older group, whereas, for individuals age 18-24, Social-SAPD had the largest loading by far, with moderate loadings for Mental-SAPD and Look-SAPD. We also tested for age, gender, and domain-based mean level differences in SAPD. As expected, in general, adults under age 25 felt older than their chronological age (with the exception of reporting that they looked younger), while those over age 25 tended to feel younger. Further, in most cases, as chronological age increased, participants' SAPD increased. Finally, individuals in middle and older age tended to report the largest discrepancies in the mental and social domains, on average, reporting mental ages that were 18-19% younger and social ages that were 29-30% younger than their chronological ages. It is important to remember that these results reflect *relative* not absolute differences between the age groups. In other words, though a 60-year-old may feel that he is 30 percent younger than his chronological age in the social domain (i.e., 42 years old), this does not mean that he feels socially younger than a 30-year-old at an absolute level, who may only feel 10% younger than his age (i.e., 27 years old).

Results for implicit age were mostly in keeping with hypotheses, as all but the older adults demonstrated a relative bias to associate the self more strongly with young related words. This *me-young* bias was not present, on average, in the older adult group, for whom no significant bias was evident. The difference in findings reported in the current study versus those reported in Hummert et al. (2002), who found a significant bias to associate the self with young across all age groups, may have been partly due to stimuli differences. Whereas the current study

used only words as stimuli, Hummert and colleagues had participants categorize images of older and younger adults using the categories "self/other" and "old/young." It is possible that their images of older adults were viewed as more negative than the old-related words used in the current study (i.e., "aging," "older," "senior"), which could have produced their finding of a significant response bias in the *self-young* direction among older adults.

Subjective Age in Emerging Adulthood vs. Other Stages of Adulthood

Emerging adulthood. In line with hypotheses, we found that the structure of SAPD varied based on age group. Specifically, emerging adults (18-24) had a different SAPD structure in comparison to the three other age groups (25+), which did not differ from each other. For the emerging adults, as expected, Social-SAPD loaded highly onto the latent factor. These findings are in keeping with prior research that has found psychosocial maturity, a construct defined by adaptive functioning and socioemotional competence, to correlate with subjective age in emerging adulthood. Mental- and Look-SAPD had much smaller (though still moderately-sized) factor loadings, whereas Physical-SAPD did not load significantly onto the SAPD factor. These results indicate that during emerging adulthood, one's subjective age is primarily based on an individual's sense of his or her social age, with a relatively smaller contribution from one's mental and look age.

Contrary to predictions, there was no gender difference in the role of Look-SAPD. This is somewhat surprising, given prior theories linking looks to status among women (e.g., Sontag, 1972) and research indicating that younger women are more concerned than their male counterparts about the effects of aging on their

looks (Gupta & Schork, 1993; McConatha, Schnell, Volkwein, Riley, & Leach, 2003). We did not assess whether women had this particular concern in our sample, which will be important in future research assessing subjective age. Perhaps apprehension about the future effects of aging among young women is not expressed as an emphasis on looks in determining subjective age, or perhaps the gender difference that was evident in the 1990s and early 2000s is less evident today.

Early adulthood and older. There were no significant differences in the factor loadings for SAPD domains for the other three age groups or between genders. As expected, for individuals age 25 and older, Social-SAPD continued to load highly onto the latent SAPD factor. Theory from the aging literature supports the continued importance of social relationships to the subjective age construct for men and women across the adult lifespan. For instance, Socioemotional Selectivity Theory (Carstensen, Isaacowitz, & Charles, 1999) holds that when time is perceived as more limited (as is often the case in older age), individuals are more likely to shift from prioritizing future-oriented goals to prioritizing those that are present-oriented and emotion-related, such as spending more time with loved ones. Therefore, given the important role of close relationships throughout older adulthood, it is not surprising that social-age would continue to be a prominent component of subjective age for all age groups.

As hypothesized, Mental-SAPD also had a high factor loading, pointing to the importance of mental age to the subjective age construct from the mid-20s onward. Concerns about cognitive decline are common among middle aged to older adults and seen as pertinent to aging. In fact, among a sample of community-based adults

age 53 to 87, approximately half reported cognitive or memory-specific concerns when asked to think about their future "possible selves" in the cognitive domain (Dark-Freudeman, West, & Viverito, 2006). Of those who listed such concerns, all named this as their "most dreaded feared self" (Dark-Freudeman et al., p. 90). In a community sample of younger and older adults, both age groups reported that the thought of losing one's memory and forgetting friends and family is highly relevant to older adults and highly distressing (Beadel, Green, Hosseinbor, & Teachman, 2013). The prevalence and relevance of cognitive concerns from middle age onward suggests that perceived cognitive age is likely to remain important across the adult lifespan, leading to its large contribution to the subjective age construct.

This early adulthood and older model of SAPD also differed from that found in emerging adulthood on the basis of the moderate to large factor loadings for Physical- and Look-SAPD. The increased role of Physical-SAPD in older age groups, relative to that in emerging adulthood was anticipated (though was not expected to appear until middle age), based on prior findings of a significant relationship between physical health and subjective age (e.g., Barrett, 2003; Bowling et al., 2005; Westerhof, Barrett, & Steverink, 2003). Look-SAPD also explained a comparably large portion of the variance in SAPD for those in early adulthood and older. Though not specifically hypothesized, this was not surprising, given age-related differences in the relationship between physical- and look-age; namely, they were not correlated for the youngest age group (literally $r = .00$; see Table 5), but their correlation grew from small to moderate as chronological age increased (e.g., $r = .45$

for age 65+), indicating that the constructs may be viewed as more similar with age and, therefore, have similarly-sized loadings.

One might speculate that the relatively more balanced domain contributions to the subjective age construct (i.e., fairly comparable loadings across domains) throughout the majority of adulthood may partly explain the well-documented phenomenon of feeling younger than one's years after emerging adulthood. For example, whereas a recent college graduate may reflect on her newfound autonomy and serious romantic relationship in deciding her overall subjective age, a 60-year-old man, though he may look older than his age, may choose to reflect on his career success in a cognitively demanding field, active social life, and physical fitness when determining how old he feels. Therefore, throughout adulthood, individuals may be able to continue feeling relatively younger than their age by casting a wider net across domains, so to speak, when conceptualizing their subjective age. Certainly, such *post hoc* ideas are speculative, and this finding requires replication.

Age-based Differences in Mean Subjective Age

Emerging adulthood. As hypothesized, those in emerging adulthood (18-24) reported SAPDs indicating they felt older than their chronological age across mental, physical, and social domains, and younger than their chronological age in the look domain. Notably, the largest subjective age discrepancy (in the direction of feeling older) was in the mental domain (on average, 24% older than their chronological age). This is striking in comparison to their report of feeling only 6% older socially and 3% older physically. These findings may be due to the highly educated nature of an online sample who volunteer to participate in research. Social

comparison may result in their feeling more cognitively mature or capable than their same-aged peers, leading to a more discrepant mental-age.

Early adulthood and older. Generally in line with hypotheses, those age 25 and above reported feeling significantly younger across most domains, especially in the social domain. Moreover, for all but the look domain, the discrepancy between chronological and subjective ages grew larger with each successive age group (e.g., whereas 45-64 year-olds feel 19% younger than their age in the social domain, 65+ year-olds feel 29% younger than their age in the social domain). This is in keeping with the finding of Montepare and Lachman (1989) that discrepancies between subjective and chronological age increased with age (when averaging across subjective age domains), and the current findings add further nuance by showing that this pattern does not hold in the look domain, where the discrepancy is similar across age groups after emerging adulthood.

The finding that individuals age 25 and older, on average, reported looking only 12-13% younger than their age is curious, in light of larger discrepancies across other domains, especially given the United States' youth-oriented culture (Westerhof & Barrett, 2005). Here, the study's cross-sectional nature may be particularly important to interpreting the findings. Although speculative, given developments in skin-care (e.g., use of sunscreen, anti-aging creams), as well as an emphasis on exercise throughout older adulthood, it may be that today's older adults do not objectively look as old as their grandparents did. Therefore, different cohorts may associate a given age with objectively older or younger looks, which would cause variations in scale use across age groups.

Age-based Differences in Mean Implicit Age

In line with hypotheses, most of the sample reported relatively stronger *me-young* associations, on average. However, contrary to expectations, older adults (65+) did not exhibit a youth-oriented bias and, in fact, showed no implicit age bias at all, on average. These older adult results are surprising, especially in light of previously reported findings from a large Swedish sample that the majority of 84-90-year-olds report not feeling old (Infurna, Gerstorf, Robertson, Berg, & Zarit, 2010), as well as the consistently reported finding that most older adults report subjective ages that are relatively youthful (e.g., Montepare & Lachman, 1989; Rubin & Berntsen, 2006). Further, in the current study, older adults reported explicit subjective ages ranging from 13 to 30% younger than their chronological ages across domains, on average. Given that the average older adult in our study was 71 years old, this would equate to subjective ages that range from 50 (mental-age) to 62 (look-age). What, then, accounts for the difference between subjective reports of relative youthfulness and no significant implicit age bias among older adults? One possibility is that the young category descriptors used in the IAT were too young for older adults to identify with. Though a 71-year-old may feel 30% younger than his or her age (i.e., 50) in the mental age domain, that does not necessarily equate to feeling "youthful" or "junior" in comparison to others, as the descriptors are labeled. Future research using this new measure may choose to incorporate different descriptors that are less overtly associated with youth (e.g., "lively").

Limitations and Conclusion

These findings should be interpreted in light of the study's limitations. Most notably, these data are cross-sectional, which means cohort effects may also explain the findings. Nevertheless, there is some evidence for concordance in cross-sectional and longitudinal data in this area. Markides and Ray (1988) reported that the same factors (e.g., health, older chronological age) were associated with transitioning from feeling young or middle-aged to feeling old in their 8-year longitudinal study as has been reported in cross-sectional studies. Second, the study was based on self-reported subjective age, and so it is possible that social desirability differentially influenced what participants felt was acceptable to report at different ages. However, the variable age findings across domains argue against a simple social desirability explanation, and the web-based administration provided considerable privacy for participants. Third, given that this study was conducted online, we were unable to verify the ages of our participants. Nevertheless, data suggest that participants may be more likely to be truthful online, based on their reported increased comfort with disclosing clinical information (Shapiro, Chandler, & Mueller, 2013). Fourth, we were unable to test whether cultural or ethnic diversity moderated these results, given the relative homogeneity of the sample. As Arnett and Galambos (2003) argue, these factors may differentially shape how young adults view the transition to adulthood. Arnett (2003) found in a sample of emerging adults that African Americans and Latinos were more likely to consider themselves adults than were Asian Americans or Caucasians, which was partly explained by the higher percentage of parents in the African American and Latino samples. Fifth, the relatively smaller number of older adults in the study precluded

sub-group analyses within the older adult sample, which could have, for example, revealed differences in the composition of subjective age among the so-called "old-old" (i.e., ages 75+). Last, our models do not account for how different subjective age domains could influence each other. It will be interesting in future work to consider the interactions and dependencies between the domains (e.g., what are the implications of feeling young socially on one's physical subjective age?).

Despite these limitations, this study is the first to our knowledge to examine whether the structure of subjective age is the same across age groups and between genders. Results indicated that, though the structure does not vary based on gender, it does vary based on age. Most notably, for emerging adulthood, it seems that individuals rely most heavily on their social age when determining how old they feel, whereas other domains are taken into greater consideration after this developmental period. This gives individuals the chance to draw on multiple pieces of information as they age chronologically when determining how old they feel, potentially allowing for greater flexibility in the construct and increased possibilities for feeling "forever young(er)."

Study 3: Does Subjective Age Perception or Implicit Age Moderate the Relationship Between Chronological Age and Anxiety?

The current study builds on the two prior studies to answer three questions: (1) What is the relationship between anxiety and subjective age, (2) What is the relationship between anxiety and implicit age, and (3) Is the relationship between chronological age and anxiety moderated by subjective and/or implicit age?

As a reminder, the results of Study 1 indicated a generally negative, linear relationship between age and anxious cognitions, subjective distress, and somatic feelings. Further, the results of Study 2 were in keeping with prior work on subjective age (e.g., Rubin & Berntsen, 2006) in demonstrating that emerging adults (18-24) reported feeling slightly older than their age across all but the look-age domain and that all other age groups reported feeling younger than their age. Finally, largely in keeping with hypotheses, all age groups with the exception of older adults (who demonstrated no significant bias) showed an implicit bias to associate the self more strongly with young-related words relative to old-related words.

Regarding the question of the relationship between anxiety and subjective age, in line with prior work on the protective nature of positive illusions (Taylor & Brown, 1988, 1994), feeling younger than one's chronological age has been found to predict better psychological health, as measured by reports of life satisfaction (Sherman, Schiffman, & Dillon, 1988), self-respect, and self-efficacy (Barak & Rahtz, 1989). (Note, this positive illusion connection assumes in part that being younger is positive, which is clearly not always the case.) Moreover, feeling younger during older adulthood is a positive indicator of better physical health and functioning (Bowling, See-Tai, Ebrahim, Gabriel, & Solanki, 2005; Hubley & Russell, 2009), better perceived health (de Beurs et al., 1999), and lower mortality across a 12- to 16-year-period (Kotter-Grühn, Kleinspehn-Ammerlahn, Gerstorf, & Smith, 2009). Conversely, feeling relatively older correlates with having a more pessimistic view of cognitive aging (Schafer & Schippee, 2010). Barrett (2005) points to one's

perceived control over important life domains as key to feeling younger with increasing age, and it is likely that this third variable is also partly responsible for decreased anxiety in older age.

Therefore, given the relationship between anxiety and many of the psychological and physical variables that have previously been linked to subjective age, we hypothesized that feeling relatively younger than one's chronological age would be associated with lowered anxiety in early (25-44), middle (45-64), and older (65+) adulthood, whereas feeling older than one's chronological age would be correlated with heightened anxiety in these age groups. On the other hand, during emerging adulthood (18-24), a time in which it is developmentally normative to feel older (e.g., Rubin & Berntsen, 2006, as well as our sample), we hypothesized the opposite relationship (i.e., feeling younger associated with *more* anxiety). As noted previously, though there is no direct evidence linking developmentally normative subjective age to anxiety symptoms, it is plausible that feeling younger during emerging adulthood may be associated with anxiety correlates such as inhibited social skills (Thompson & Rapee, 2002), and, therefore, predict increased anxiety symptoms.

A participant's implicit age may also correlate with his or her anxiety symptom levels, though implicit age has received far less research attention than explicit subjective age. If we assume that explicit subjective age and implicit age are capturing partly overlapping constructs (though see Table 5 for modest correlations in our data set), then it is plausible that they will show some comparable relations to anxiety (this assumes the literature showing positive outcomes tied to younger

subjective age may also inform predictions for implicit age). Further, in the anxiety domain, previous work on implicit self-concepts has shown that anxious individuals have more negative self-associations than nonanxious individuals (see Roefs et al., 2011, for a review), though this work did not consider age. Moreover, it seems plausible that identifying with *old* will be a more negative self-association given the United States' youth-oriented culture (Westerhof & Barrett, 2005; Westerhof et al., 2003). Thus, while the evidence contributing to the prediction of the implicit age-anxiety link is indirect, taken together, it points to younger implicit age self-concept being associated with less anxiety.

Notably, we hypothesized that having a relatively stronger *me-young* bias would be associated with less anxiety across all four age groups. This differs from the hypothesis for the relationship between subjective age and anxiety in emerging adulthood (18-24). This is because, though having a relatively older subjective age during emerging adulthood is normative, it would, presumably, not be normative to view oneself as *old* relative to *young* during this age span. Though, as with subjective age, there is no direct link between developmentally non-normative implicit age patterns and anxiety, it is plausible that more strongly identifying with old-related words (e.g., aging, older, senior) than with young-related words (e.g., younger, youthful, junior) during one's youth may be associated with a poor sense of belonging, which is correlated with higher anxiety levels (e.g., Hagerty, Williams, Coyne, & Early, 1996).

Finally, there is reason to suspect that one's subjective or implicit age could moderate the relationship between chronological age and anxiety. Given that feeling

relatively younger predicts better physical and psychological health outcomes, it may be that the age-related decline in anxiety symptoms noted in Study 2 is even steeper among those who report a relatively younger subjective age from early adulthood onward (25+) and/or a relatively stronger *me-young* bias across the adult lifespan. Having a sense that one is younger than one's years, despite undergoing the trials of aging, may be indicative of a "high degree of perceived control over critical life domains," as Barrett (2005, p. 178) wrote, and thereby be found in an individual who reports less anxiety than would otherwise be expected based on his or her chronological age group. On the contrary, a less steep decline may be observed among those who feel older than their chronological age after age 25 and/or have a weaker *me-young* bias.

In addition to the measures of chronological age, Subjective Age Percent Discrepancy (SAPD), implicit age, and anxiety as described in Studies 1 and 2, the current study also included measures of health and memory functioning. Though the primary aims of this dissertation are not related to physical health or memory functioning, these measures were included given that previous research has documented a strong relationship between health and subjective age (e.g., Bowling et al., 2005; Hubley & Russell, 2009). A large correlation between SAPD and either of these health measures within an age or gender grouping would argue for taking those participants' health scores into account when determining any potential moderating role of SAPD in the relationship between age and anxiety.

Methods

Participants

Participants were the same as described in Study 1.

Materials

Health. Participants completed a brief questionnaire to broadly assess their physical health difficulties (Mulsant, Ganguli, & Seaberg, 1997). Using a dropdown menu ranging from none to 10+, they recorded the number of prescription medications related to physical health difficulties that they were taking. Among older adults, this measure correlates with number of recent physician visits and hospitalizations (Lassila et al., 1996). They also provided a subjective rating of their overall health in comparison to their same-aged peers on a 4-point scale (1 = *Excellent*, 4 = *Poor*; Thomas, Kelman, Kennedy, Ahn, & Yang, 1992).

Memory functioning. Participants provided subjective ratings pertaining to their memory functioning, using the 3-item subscale of the *Memory Functioning Questionnaire* (Gilewski, Zellinski, & Schaie, 1990). They rated their memory relative to the average individual's memory (1 = *Very poor*, 7 = *Very good*), relative to the best it has ever been (1 = *Much worse,* 7 = *Much better*), and in terms of the kinds of memory problems they have (1 = *Major problems*, 7 = *No problems*; Cronbach's alpha = .72).

Procedure

Please see Study 1.

Results

Creation of Factor Scores

Prior to computing correlations among anxiety, SAPD, and implicit age, regression-based factor scores were created for each of these three latent variables

according to the final age and gender groupings determined in Studies 1 and 2. This approach was selected to allow group differences in loading patterns to be reflected in variables that could be used in subsequent moderation analyses. For example, a given's participant's anxiety factor score (which was comprised of the sum of his or her z-score-transformed means on the cognitive, subjective distress, somatic sensations, and behavioral avoidance measures, each multiplied by its respective factor score weight) was computed in one of three ways, based on his or her age/gender grouping. Different factor score weights were used corresponding to 25-44-year-old women, 25-44-year-old men, and all other participants combined (see Study 1), and higher factor scores corresponded to *higher* anxiety levels across most indicators.

The SAPD factor score was computed in two ways, one for those ages 18-24 and one for those ages 25+ (see Study 2). Notably, higher values on the SAPD factor score corresponded to feeling older across most indicators.

The four indicators for the implicit age latent variable were created from sequentially ordered parcels of IAT trials (i.e., critical response trials were divided into four subsets of 15 trials each, with the first quarter of trials corresponding to the first parcel, etc.). The implicit age factor score was computed in the same way for all participants with higher values corresponding to relatively stronger *me-young* associations. We did not test for age invariance in the IAT construct because the parcels were not thought to have independent theoretical meaning; however, we recognize that the sequential ordering of the parcels may introduce a confound with potentially age-related fatigue effects.

Relationship Between Anxiety and Subjective Age

To determine the relationship between anxiety and subjective age within the five age/gender groupings determined in Study 1 (i.e., 18-24, 25-44 men, 25-44 women, 45-64, and 65+) we ran bivariate correlations between each anxiety indicator and the SAPD factor score. Further, to arrive at an overall picture of how anxiety related to subjective age, we correlated the overall anxiety factor score with the SAPD factor score for each of these groupings. See Table 8. In general, anxiety did not significantly correlate with the SAPD factor score. The main exception to this was among middle aged adults (45-64), for whom feeling relatively older corresponded to higher subjective distress, anxious somatic sensations, and overall anxiety (though magnitudes of the correlations were small). Also, among emerging adults (18-24), feeling relatively younger was associated with a slight increase in behavioral avoidance. Overall, these results suggest that anxiety and subjective age are not strongly related, and that no single indicator of anxiety stands out as more strongly related to subjective age than another.

Relationship Between Anxiety and Implicit Age

To determine the relationship between implicit age and anxiety, a bivariate correlation was run between the implicit age factor score, each anxiety indicator, and the anxiety factor score for each of the five age/gender groupings described above. See Table 9. Implicit age was not significantly related to anxiety, with the sole exception of 25-44-year-old men demonstrating a small correlation between having a relatively stronger *me-young* bias and reporting increased behavioral avoidance.

These results generally suggest no relationship between one's implicit age identity and anxiety symptoms.

Subjective and Implicit Age as Possible Moderators of the Chronological Age/Anxiety Relationship

Relationships among subjective age, implicit age, physical, and cognitive health. Prior to running the moderation analyses, we first examined correlations between the SAPD factor score, implicit age, and physical, as well as cognitive health (i.e., memory functioning) across gender and age groupings. This was necessary, given that previous research has documented a strong relationship between health and subjective age (e.g., Bowling et al., 2005; Hubley & Russell, 2009). Large correlations between health measures and SAPD and/or implicit age would suggest that health should be taken into account in the moderation models to draw cleaner conclusions about the unique role of subjective or implicit age. As reported in Table 10, most health measures were not significantly related to SAPD or to implicit age, and any significant correlations were small to moderate in magnitude (though there was a modest but fairly reliably relationship between subjective age and comparative subjective health). Notably, results were similar when health measures were correlated with a subjective age difference score and with the square of this difference score, pointing to the robustness of the (mostly null) findings. Therefore, it was not deemed necessary to include physical or cognitive health in the following models.

Does subjective age moderate the chronological age/anxiety relationship? Before modeling the relationship between chronological age and

anxiety with the SAPD moderator, we first plotted the relationship between anxiety symptom measures and chronological age to check for non-linear relationships with age that would need to be specified in the moderation models. Given that there was no evidence for non-linearity, chronological age was only included as a linear term in all models.

Next, we considered how to model the different components of anxiety in the moderation analyses. Importantly, the results of Study 1 indicated that the latent anxiety construct was quite similar across age groups and that, indeed, the only evidence for structural variance was found between men and women in early adulthood (25-44). Therefore, given these minimal differences, to attain factor loadings for each anxiety indicator, we first ran the analysis using the same four-indicator anxiety model across all age and gender groups.

A centered, continuous chronological age variable, the SAPD factor score, and the interaction between these two variables were regressed onto the latent anxiety variable. Though age groupings (and not a continuous age variable) were used in the prior studies, that approach was used for purposes of model comparison across age and gender divisions. Given that the question of moderation did not require further model comparison across subsets of our sample, the decision was made to use a continuous age variable. See Figure 3. Model fit was excellent, $\chi^2(11, N = 1350) = 19.31$, CFI = .987, RMSEA = .024, and standardized factor loadings for the four anxiety indicators were each significant and comparable in magnitude to Study 1's results, which were based on age group as a categorical variable. As expected based on prior means analyses in Study 1, there was a significant, negative relationship

between chronological age and the latent anxiety factor ($p < .001$), such that anxiety decreased with increasing age. However, neither subjective age nor the age by SAPD interaction significantly predicted anxiety, indicating that SAPD did not moderate the relationship between chronological age and anxiety.[9]

Though anxiety was found to be structurally age-invariant in Study 1, given the observed gender difference (i.e., 25-44 women different from 25-44 men), we re-ran this analysis substituting the overall anxiety factor score for the latent anxiety model (where the lower-order anxiety indicators were each modeled). The factor score accounts for differences in the factor loadings for anxiety that were evident in Study 1 (i.e., 25-44 women vs. 25-44 men vs. all other participants). Though fit statistics were unable to be calculated due to the model being saturated, results were largely the same as in the first moderation analysis. Again, there was a significant, negative relationship between chronological age and anxiety ($p < .001$), and no evidence for a relationship between SAPD and anxiety or for an SAPD by age interaction term and anxiety. [10]

Does implicit age moderate the chronological age/anxiety relationship?

Analyses identical to those conducted for SAPD were carried out to test for moderation by implicit age. See Figure 4. We first tested whether a centered

[9] Identical analyses were also run using the following variables in place of the SAPD factor score: (1) subjective age difference score (i.e., mean of four subjective ages minus chronological age), (2) the square of this difference score, or (3) the mean subjective age score centered at 25. Results were similar across models.

[10] Again, identical analyses were run using the three alternative subjective age variables listed in footnote 9 in place of the SAPD factor score. Results were generally similar, though there was evidence for moderation when the square of the subjective age difference score was used in place of the SAPD factor score (standardized regression weight = .30, $p < .001$).

chronological age variable, an implicit age factor score, or the interaction between these two variables predicted a latent anxiety variable. Model fit was excellent, $\chi^2(11, N = 1350) = 18.54$, CFI = .988, RMSEA = .023, and factor loadings for the four anxiety indicators were significant and in keeping with results reported in Study 2. Again, a negative relationship was found between chronological age and the latent anxiety construct ($p < .001$). However, neither implicit age nor the implicit age by chronological age interaction term significantly predicted anxiety, indicating a lack of moderation.

We next re-ran this analysis, substituting the anxiety factor score for the latent anxiety model, to take into account the gender-based differences in factor loadings. Results were in keeping with those found when an anxiety model was estimated, with no evidence for moderation by implicit age.

Discussion

The current study examined the relationship between anxiety and felt age as measured explicitly (i.e., subjective age) and implicitly across the adult lifespan and between genders. Additionally, the study tested whether either the explicit or implicit measure of felt age moderated the relationship between chronological age and anxiety. In keeping with the findings of Study 1 that showed a slight gender difference in the latent anxiety factor between men and women in early adulthood, correlations between anxiety and felt age measures were examined within five groupings: 18-24 year-olds, 25-44 year-old men, 25-44 year-old women, 45-64 year-olds, and 65+ year-olds. Contrary to expectations, in general, neither subjective age nor implicit age consistently correlated with anxiety measures. However, the

exceptions to this pattern, though infrequent and small in magnitude, were in the expected direction for subjective age. Specifically, among those in middle age (45-64), having a relatively older subjective age correlated with more subjective distress and anxious somatic sensations, as well as with higher overall anxiety, as indexed by the anxiety factor score. During emerging adulthood (18-24), having a younger subjective age was associated with a slight increase in behavioral avoidance. Turning to implicit age, the only significant correlation, contrary to hypotheses, was between having a relatively stronger *me-young* bias and reporting increased behavioral avoidance among men in early adulthood (25-44). Unexpectedly, neither subjective nor implicit age moderated the relationship between chronological age and anxiety.

Relationship Between Felt Age and Anxiety

The finding that, for the most part, neither measure of felt age correlated with anxiety symptom level is surprising, given prior findings relating lower subjective age to better psychological health, increased self-respect and self-efficacy, and better physical health and functioning (Barak & Rahtz, 1989; Bowling et al., 2005; Hubley & Russell, 2009). In discussing Americans' younger subjective ages relative to Germans' subjective ages, Westerhof and colleagues speculate that America's focus on individualism, which ties one's social worth to one's earning power or autonomy, as well as America's lack of a forced retirement age, may contribute to its citizens' younger age identity, particularly in older age (Westerhof & Barrett, 2005). Given this cultural background, which may contribute to a sense that feeling older than one's chronological age is non-normative, older felt age was

hypothesized to be a "red flag" of sorts, potentially signaling difficulties in other life areas or conditions, such as poor health, that could be associated with increased anxiety levels.

One speculation about the reason for the largely null felt age-anxiety results concerns the potentially restricted range of the subjective age variable. Given that the majority of our participants in early adulthood and older reported feeling younger than their chronological age (see Table 11), the variability in subjective age mainly just reflects variability in the extent of feeling younger. Perhaps feeling younger, regardless of the extent of the discrepancy, is a wellness indicator (i.e., it predicts positive outcomes, like life satisfaction, but not negative outcomes), which would result in a greatly weakened relationship between subjective age and anxiety. Given this possibility, as an exploratory *post hoc* analysis, we examined the correlation between mean subjective age and anxiety indicators for only those participants in early adulthood and beyond who, on average (i.e., averaging across the subjective age domains), reported feeling older than their chronological age. As noted in Table 11, in most cases, correlations between mean subjective age and anxiety symptoms were still small and mostly non-significant. Moreover, the variability in SAPD factor scores was comparable between those who reported feeing older versus younger within each of the SAPD domains. Therefore, it does not appear that our findings are due to issues of constrained variance. Rather, it is perhaps the case that subjective age, while predictive of positive physical and psychological outcomes, does not necessarily correlate with negative outcomes, such as anxiety.

Notably, prior research has found that feeling older is correlated with negative outcomes such as increased negative affect (Westerhof & Barrett, 2005) and lower life satisfaction (Teuscher, 2009), but these relationships only appear to hold when attitudes toward aging are negative (Mock & Eibach, 2011). Given that we did not assess attitudes toward aging, we are unable to test this moderation question. It will be important in future work to consider a broader range of positive and negative outcomes, in addition to attitudes toward aging, to determine whether the prediction by subjective age differs on this dimension.

Issues of variability, however, may have obscured the relationship between implicit age and anxiety. Indeed the majority of participants reported a relatively stronger *me-young* bias. Very few participants (i.e., 1.4% of the sample, ranging from 53-79 years old) had a significantly stronger *me-old* bias, which we had hypothesized would be associated with anxiety symptoms.

Subjective age. Despite the relative lack of correlations between subjective age and anxiety in general, the age groups that did demonstrate a relationship were middle adulthood, which marks a broad period of transition between adulthood and older age, and emerging adulthood, which corresponds to the transition between adolescence and adulthood. During middle adulthood, one could speculate that menopausal status may partly explain the relationship between feeling older and endorsing more frequent anxiety-linked somatic sensations during middle adulthood in women, who constituted 68.9% of the middle aged sample. Menopausal women in middle adulthood may not only feel older than their age but also experience more somatic sensations that could be associated with menopause

and/or anxiety (e.g., dry mouth: Wardrop, Hailes, Burger, & Reade, 1989). Indeed, an exploratory, follow-up analysis among middle-aged adults in the current sample showed a significant (albeit small) correlation between feeling older (averaging across all subjective age domains) and reporting more anxiety-linked somatic symptoms, but only in women ($r = .18$, $p < .01$; men: $r = .01$). Notably, other factors that are relatively common in middle age, including a sedentary lifestyle (Mortensen, Siegler, Barefoot, Grønbæk, & Sørensen, 2006) and being overweight (Whitmer, Gunderson, Barrett-Connor, Quesenberry, & Yaffe, 2005), are also strongly associated with somatic symptoms such as breathing difficulties, regardless of menopausal status (Moilanen et al., 2010), and may also predict feeling relatively older than one's age.

During emerging adulthood, feeling younger than one's age was associated with increased behavioral avoidance. It is interesting that only behavioral avoidance, which was operationalized by the degree of avoidance participants reportedly engaged in due to fear of panicking, as well as the degree to which this avoidance had impacted their lives, correlated with feeling younger during this age group. Though speculative, this finding may be a result of cohort effects, given "helicopter parenting" has been identified as a phenomenon that is especially prominent among Baby Boomer parents (Fingerman, Pillemer, Silverstein, & Suitor, 2012). These are the parents whose children are now emerging adults. Helicopter parenting is defined by an overly involved and developmentally inappropriate style of parenting in which parents stand ready to come to their children's aid at the first sign of difficulty (Segrin, Woszidlo, Givertz, Bauer, & Murphy, 2012). This parenting

style is related to dependent personality traits and neuroticism, as well as lower self-efficacy and poor emotion regulation in young adults, as their growth in autonomy and confidence in goal achievement and problem solving is stymied (see Segrin et al.). Emerging adults parented in this way may, understandably, feel younger than their age, which itself is developmentally non-normative, and be more prone to avoid situations out of fear that they might not be able to cope. Future research that directly assesses correlations between anxiety symptom levels and participants' experience of their parents' parenting styles across different age groups would be helpful for understanding the current study's finding. Notably, however, our study's sample size is relatively large and this effect was small, so results should not be over-interpreted.

Implicit age. Turning to implicit age, the only significant correlation with anxiety was found among men in early adulthood (25-44) for whom having a relatively stronger *me-young* bias was associated with increased behavioral avoidance. Interestingly, this finding parallels that for subjective age among emerging adults (18-24) and men in early adulthood (25-44; though that correlation did not reach significance). The relationship between self-identifying with youthfulness and reporting anxiety-linked behavioral avoidance for men but not women may reflect gender-based differences in the meaning of the implicit age construct. For example, strongly self-identifying with youthfulness may be indicative of higher risk aversion in men, but more indicative of being carefree or confident in women. Certainly, such *post hoc* reasoning is speculative and would require investigation.

Differences between felt age measures. Though neither measure of felt age was consistently correlated with the anxiety measures, relatively fewer reliable relationships were found between implicit age and anxiety measures than between subjective age and anxiety measures. While this is perhaps not surprising, given that this is the first time this implicit age measure has been used, it is also possible that explicit age measurements are more predictive of self-reported anxiety responses. This would be in keeping with dual-process models of attitude-behavior relations (e.g., Strack & Deutsch, 2004), which hold that explicit measures have greater predictive validity when cognitive control resources are high (as would presumably be the case when completing self-report questionnaires on anxiety symptoms), and implicit measures have greater predictive validity when such resources are low. Therefore, though one might expect explicitly-reported subjective age to be more predictive of anxiety as it was operationalized in the current study, implicit age might be more predictive of *in vivo* anxious avoidance or physiological reactivity, for example, which would likely be associated with increased state anxiety and, therefore, depleted cognitive control resources (see Kidorf & Lang, 1999; Polivy, Herman, & McFarlane, 1994).

Lack of Moderation of Chronological Age/Anxiety Relationship

Contrary to expectations, neither measure of felt age moderated the relationship between chronological age and anxiety. This was true regardless of how anxiety was calculated, either as a latent construct that was identical across participants or as a factor score computed differently for 25-44-year-old men, 25-44-year-old women, and all other participants. Results were also similar (i.e., no

evidence for moderation in five out of six cases) when other measures of subjective age were used in place of the SAPD factor score in the model (see footnotes 9 and 10). However, as expected based on the findings of Study 1, chronological age, unlike subjective or implicit age, emerged as a significant predictor of anxiety, with older age predicting decreased anxiety symptoms. Importantly, this link between chronological age and anxiety does not appear to be due to a reporting bias (i.e., older participants reporting fewer symptoms), because no relationship was found between reported behavioral avoidance and age in Study 1.

It is possible that our study's lack of evidence for moderation by felt age stems in part from the sample's composition. Though more diverse than typical single-site studies (Nosek et al., 2007), the study's sample was highly educated, predominantly Caucasian, and had the resources and interest to participate in this Internet-based study. It is possible that felt age moderates the relationship between age and anxiety under more stressful socioeconomic circumstances than those of our participants. For example, under significant economic hardship, feeling older than one's age in older adulthood may be one means through which perceived vulnerability is expressed, which may increase the relationship between chronological age and anxiety.

It is also possible that we would have found evidence for moderation by felt age had we had longitudinal data. In their 16-year longitudinal sample of 70- to 100-year-olds who participated in the Berlin Aging Study, Kotter-Grühn and colleagues (2009) reported that, even controlling for health and gender, socioeconomic status, and personality variables, individuals who reported an increase in subjective age or

who declined in aging satisfaction over four years were more likely to die in the following twelve years relative to those whose subjective ages or aging satisfaction ratings remained relatively static or decreased. As the authors note, relative stability in subjective age over time may partly reflect high levels of resilience and adaptability to the aging process (see also Sneed and Whitbourne, 2005; Uotinen, Rantanen, Suutama, & Ruoppila, 2006), indicators that may correlate with decreased anxiety. Therefore, it is possible that *change* in felt age may moderate the chronological age-anxiety relationship, despite the null findings with static felt age.

Limitations and Conclusion

Several limitations of this study should be considered when interpreting its findings. First, as noted above, the cross-sectional nature of the data precludes our making developmental conclusions about either the relationship between chronological age and anxiety or the relationship between felt age measures and anxiety. Notably, prior longitudinal work has found that older adults' change in subjective age over a 4-year period from "young" or "middle-aged" to "old" was predictive of health declines (Markides & Boldt, 1983; see also Bowling et al., 2005; Bultena & Powers, 1978), suggesting that a longitudinal study may reveal a stronger relationship between felt age and anxiety, to the extent that anxiety is related to health. Second, this study relied on a new measure of implicit age to explore moderation of the relationship between chronological age and anxiety symptoms. The null moderation findings and the age-based means on the implicit age measure were generally commensurate with our subjective age findings (i.e., participants through middle age, on average, self-identified more strongly with *young* relative to

old), supporting the measure's validity. Further, the implicit age measure demonstrated acceptable reliability (see Study 2). However, further research on this new measure of implicit age would add credence to our findings. Third, the current study measured physical health and memory functioning with self-report questionnaires. Though one might expect a stronger relationship between felt age and subjective health and memory functioning, relative to the relationship between felt age and objective health and memory functioning, using both objective and subjective health measures would bolster confidence in our conclusion that felt age does not simply index health status. Lastly, the relatively small number of older adults in the study precluded our being able to perform sub-group analyses based on health status in this age group, which could have revealed stronger correlations with anxiety measures.

Despite these limitations, the current study is the first to our knowledge to examine felt age — measured explicitly and implicitly — as a moderator of the relationship between chronological age and anxiety. To that end, the study's finding that, within an unselected, Internet-based sample, only one's chronological age and not one's felt age predicts anxiety symptoms supports prior findings of a chronological age-linked decline in anxiety symptoms (e.g., Jorm, 2000; Kessler et al., 2005) and leaves open to further investigation the correlates of chronological age that drive this relationship.

General Discussion

This dissertation investigated the relationship between chronological age and anxiety and whether that relationship is moderated by subjective age

perception and/or implicit age. The results of Study 1 demonstrated that the construct of anxiety was largely similar across the adult lifespan and between genders. Only a slight gender difference was found in early adulthood (25-44), during which time somatic symptoms explained more construct variance than behavioral symptoms for the women (and *vice versa* for the men). Across age groups and between genders, subjective distress consistently accounted for the largest portion of the variance in anxiety, and anxious cognitions accounted for the smallest portion. As hypothesized, mean levels of anxiety symptoms showed a general pattern of linear decline with age, though this was not true for behavioral symptoms, which showed no age-related change.

The results of Study 2 revealed that the construct of subjective age differed in emerging adulthood (18-24) relative to the rest of adulthood. Specifically, whereas subjective age in emerging adulthood tended to draw predominantly from the social age domain, in early adulthood and beyond, all four subjective age domains explained a relatively comparable, moderate to large portion of the construct variance. As hypothesized, on average, emerging adults reported feeling slightly older than their chronological age across domains, whereas those in early adulthood and older reported feeling younger (and ever more so as chronological age increased). The one exception to these patterns was in the domain of look-age. Emerging adults did not report looking older than their age, and discrepancies between chronological and subjective look-age did not significantly increase across the older three age groups. Further, as expected, all age groups reported a

significantly stronger *me-young* (vs. old) implicit age bias, with the exception of older adults (65+) for whom no bias was present.

Lastly, and contrary to predictions, Study 3 demonstrated that, in general, neither measure of felt age correlated with anxiety symptoms. Further, felt age did not moderate the relationship between chronological age and anxiety. This pattern of mostly null findings occurred for both subjective and implicit age.

Taken together, the results of this dissertation bolster our confidence in prior reports of a linear association between rising chronological age and declining anxiety. Two key findings speak to this conclusion. First, at the symptom level, we see a general linear decline across age groups for anxious cognitions, subjective distress, and somatic feelings. This is in keeping with studies reporting a linear decline in anxiety disorder prevalence rates with age (e.g., Kessler et al., 2005), and weakens the argument that disorder prevalence rates are less accurate in older adulthood only due to a chasm between young-adult-based diagnostic criteria and sub-diagnostic symptom levels. In other words, though some older adults may report experiencing multiple symptoms of anxiety, in general, these symptoms, like anxiety diagnoses, appear to decline with age.

Second, at the construct level, our findings show that in an unselected sample, anxiety is age-invariant. This was found to be true across multiple symptom domains. Further, across age groups, subjective distress (i.e., self-reports of worrying, feeling close to panic, and feeling scared) consistently contributed the most variance to the anxiety construct. This result gives methodological credence to

prior studies that have compared mean anxiety levels across age groups, as it supports their implied assumption that they are comparing "apples to apples."

What Does Chronological Age Index That Felt Age Does Not?

One of the most surprising results of this dissertation is that one's felt age, despite previous cited links to positive physical and psychological health outcomes, largely does not correlate with anxiety symptoms. We had assumed that chronological age would correlate with anxiety, in part, due to chronological age's relationship with felt age. And, while felt age, measured both explicitly and implicitly, did show clear chronological-age-based patterns, it was only chronological age that correlated with anxiety. When considering why chronological age is predictive of anxiety symptoms, it is important to bear in mind that there is nothing "special" about chronological age itself. Rather, the question lies in what anxiety-linked developmental process(es) chronological age indexes. If not felt age, what might such processes be?

Thus, while the Discussion sections within each of the three studies focused on implications of the observed chronological age similarities and differences in anxiety, felt age, and their inter-relationships, here we step back and consider other variables to investigate in future work in light of the null felt-age anxiety findings.

Health variables. One possibility is that chronological age may partly reflect one's health status, which has been shown to be inversely correlated with anxiety symptom levels (e.g., Himmelfarb & Murrell, 1984). Given that health typically declines with age, in a representative sample, this reasoning would lead one to suspect a *positive* correlation between anxiety symptoms and age. However, based

on the general healthiness of our online sample and previous counterintuitive findings of an association between age and better self-rated health (Ferraro, 1980; Jylhä, Guralnik, Balfour, & Fried, 2001), it is possible that increasing age would be associated with better perceived health and, therefore, with decreased anxiety in our sample. Nevertheless, in the current study, correlations between chronological age and self-reported physical health and memory functioning variables were small in magnitude. Therefore, ties between decreased anxiety levels and chronological age do not seem likely to be due to the link between chronological age and self-reported physical health or memory functioning.

Processing of emotional information. Change in the processing of emotional information is another developmental process that chronological age could be measuring. The "positivity effect" describes older adults' selective processing of positive over negative material (Carstensen, Mikels, & Mather, 2006), a preference not generally observed in younger adults. For example, in comparison to younger adults, older adults show decreased attention to negative relative to positive or neutral material (e.g., Isaacowitz, Wadlinger, Goren, & Wilson, 2006; Mather & Carstensen, 2003), better memory for positive over negative stimuli (Spaniol, Voss, & Grady, 2008), and lower levels of negative affect and affective reactivity toward stressors in some cases (Mroczek & Kolarz, 1998). Given established ties between the selective processing of negative information and risk for anxiety disorders (e.g., Beck & Clark, 1997; Beck, Emery, & Greenberg, 1985; Williams, Watts, MacLeod, & Mathews, 1997), such positive changes in emotional processing would arguably be expected to produce a linear decline with age in

anxiety symptoms, as seen in the current study. Thus, it would be interesting in future research to examine whether the tendency to exhibit the positivity effect moderates (or perhaps mediates) the chronological age-anxiety link.

Developmental changes in environmental stressors. Chronological age may also index developmental changes in typical exposure to environmental stressors that could be associated with decreased anxiety. Given that we did not assess for the presence of such factors, we are unable to determine their relationship to our findings, though prior work suggests a connection. While concerns related to physical health (Teachman & Gordon, 2009) and memory loss (Beadel, Green, Hosseinbor, & Teachman, 2013) tend to be more relevant to older, relative to younger, adults, in general, older age is a time less plagued by career-related (Henderson et al., 1998; Powers, Wisocki, & Whitbourne, 1992), serious financial (Henderson et al.; Person & Borkovec, 1995, as cited in Wolitzky-Taylor, Castriotta, Lenze, Stanley, & Craske, 2010), or family (Person & Borkovec) concerns. Notably, however, Henderson and colleagues reported that the decreased prominence of these environmental risk factors could not fully account for the age-related decline in anxiety symptoms they reported in their large, unselected, cross-sectional Australian sample. Therefore, it is unlikely that our findings of an age-associated reduction in anxiety symptoms are entirely attributable to such factors. Certainly, a goal of future research would be to determine what correlates of chronological age drive its relationship to anxiety symptoms and diagnoses.

Conclusion and Clinical Implications

Though we found anxiety to be age-invariant in this unselected sample, it does not necessarily follow that the same findings would hold in a clinical sample. Indeed, evidence from the treatment literature speaks to the decreased efficacy of cognitive behavioral treatments for anxiety in older, relative to younger, adults (Stanley et al., 2003; Stanley, Beck, & Glassco, 1996; Wetherelll, Le Roux, & Gatz, 2003; Wetherell, Sorrell, Thorp, & Patterson, 2005) and to the efficacy of relaxation training (Welden & Yesavage, 1982), which targets somatic symptoms. Notably, our findings do not answer the question of whether such age-linked differences in treatment efficacy are due to construct variance within a diagnosed sample or to other aging correlates, such as higher rates of cognitive dysfunction (Mohlman, 2005; Molhman & Gorman, 2005). However, at the symptom level, our results speak to anxiety as a shared experience across the adult lifespan and, one that declines with age. Indeed, as lifespans lengthen, for an increasing number of individuals, the "age of anxiety" may be in the past.

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Table 1

Demographic Characteristics Across Age Groups

	18-24	25-44	45-64	65+
Ethnicity				
Not Hispanic or Latino	82.0%	81.6%	86.0%	90.1%
Hispanic or Latino	11.1%	9.0%	4.5%	0.7%
Unknown	6.9%	9.4%	9.5%	9.2%
Race				
White	70.4%	72.3%	76.0%	91.4%
Black or African American	8.2%	13.4%	14.4%	4.6%
Asian	6.5%	2.2%	1.5%	0.7%
Biracial	9.0%	7.2%	5.1%	2.7%
Other or unknown	5.9%	4.9%	3.0%	0.6%
Highest Level of Education Attained				
Some high school	5.1%	0.6%	0.2%	0.7%
High school graduate	9.0%	3.2%	4.6%	2.6%
Some college	50.0%	30.8%	20.8%	14.5%
Associate's degree	7.7%	7.6%	8.6%	3.9%
Bachelor's degree	17.9%	21.3%	12.8%	9.9%
Some graduate school	8.1%	15.0%	11.9%	9.9%
Master's degree	2.2%	15.8	26.8%	36.9%
Advanced degree	0.0%	5.6%	14.3%	21.7%
Relationship Status				
Single	53.0%	28.0%	26.5%	1.2%
Dating	34.4%	17.6%	8.3%	3.3%
Committed relationship	39.3%	44.0%	31.9%	22.5%
Married/Civil Union/ Dom. Partnership	10.3%	59.6%	67.8%	76.7%
Separated	1.6%	2.8%	4.0%	1.7%
Divorced	0.0%	15.2%	25.2%	23.3%
Widowed	0.0%	0.6%	4.2%	11.7%

Note. Relationship status allowed individuals to select all descriptors that applied to them (e.g., someone could be both married and widowed). Therefore, percentages total over 100.

Table 2

Correlations Among Anxiety Measures, Means, and Standard Deviations

		BBSIQ		DASS-Somatic		DASS- Subjective Distress		Behavioral Avoidance	
		Women	Men	Women	Men	Women	Men	Women	Men
18-24	DASS-Somatic	.20*	.11	-	-				
	DASS-Subjective Distress	.20*	.15	.35**	.32*	-	-		
	Behavioral Avoidance	.02	.13	.17*	-.02	.37*	.42**	-	-
	M	1.98	1.88	.49	.46	.53	.24	1.42	1.15
	SD	1.43	1.25	.39	.42	.57	.34	.70	.69
25-44	DASS-Somatic	.13*	.06	-	-				
	DASS-Subjective Distress	.22**	.18*	.54*	.31**	-	-		
	Behavioral Avoidance	.15*	.10	.24*	.18*	.34**	.52**	-	-
	M	1.80	1.59	.41	.37	.37	.31	1.29	1.26
	SD	1.37	1.42	.39	.40	.50	.46	.81	.88
45-64	DASS-Somatic	.16**	-.02	-	-				
	DASS-Subjective Distress	.13*	.16	.54**	.38**	-	-		
	Behavioral Avoidance	.19**	-.01	.31**	.27**	.43**	.43**	-	-
	M	1.61	1.61	.33	.32	.26	.20	1.32	1.26
	SD	1.32	1.25	.40	.33	.43	.36	.81	.82
65+	DASS-Somatic	.19	.17	-	-				
	DASS-Subjective Distress	.32**	.22	.14	.33**	-	-		
	Behavioral Avoidance	.32**	.17	.13	.07	.32**	.22	-	-
	M	1.30	1.70	.26	.13	.10	.30	1.08	1.13
	SD	1.16	1.08	.28	.29	.21	.39	.71	.75

Note. DASS = Depression, Anxiety, Stress Scales – Anxiety subscale. BBSIQ = Brief Bodily Sensations Interpretation Questionnaire.

Table 3

Age Group Follow-up Model Comparisons

	Baseline Model (Model 1)		Metric Invariance Model (Model 2)			
	χ^2	RMSEA	χ^2	RMSEA	Δdf	Support for Metric Invariance?
18-24 W vs. 18-24 M	5.83	.027	6.56	.000	3	Yes
18-24 W vs. 25-44 W	5.83	.019	7.01	.000	3	Yes
18-24 W vs. 25-44 M	2.96	.000	6.10	.000	3	Yes
18-24 W vs. 45-64	11.50	.045	13.83	.034	3	Yes
18-24 W vs. 65+	9.70	.055	11.16	.035	3	Yes
18-24 M vs. 25-44 W	6.01	.002	7.28	.000	3	Yes
18-24 M vs. 25-44 M	3.14	.000	3.68	.000	3	Yes
18-24 M vs. 45-64	11.68	.041	11.86	.024	3	Yes
18-24 M vs. 65+	9.86	.054	11.04	.032	3	Yes
25-44 W vs. 25-44 M	1.20	.000	9.37	.000	3	No
25-44 W vs. 45-64	2.41	.000	8.31	.015	3	Yes
25-44 W vs. 65+	2.89	.000	10.50	.032	3	Yes
25-44 M vs. 45-64	1.28	.000	5.63	.000	3	Yes
25-44 M vs. 65+	1.78	.000	8.52	.027	3	Yes
45-64 vs. 65+	2.98	.000	10.48	.028	3	Yes

Note. W = Women. M = Men. RMSEA = root mean square error of approximation. Support for metric invariance was not found if $\Delta\chi^2$ on the associated Δdf was significant at $p < .05$.

Table 4

Parameter Estimates for Anxiety Indicators Loadings onto the Latent Anxiety Factor

Parameter	25-44 Women	25-44 Men	18-24 and 45+ Women and men
Anxiety → BBSIQ	.24**	.20	.25***
Anxiety → DASS-Subjective Distress	.88**	.95***	.84***
Anxiety → DASS-Somatic Feelings	.61**	.39**	.52***
Anxiety → Avoidance	.39**	.56**	.47***

Note. Parameter estimates are standardized values. Estimates that are statistically significant at α = .05 are indicated by an asterisk. Estimates that are statistically significant at α = .01 are indicated by two asterisks. Estimates that are statistically significant at α = .001 are indicated by three asterisks. BBSIQ = Brief Bodily Sensations Interpretation Questionnaire; DASS = Depression, Anxiety, Stress Scales.

Table 5

Felt Age Correlations, Means, and Standard Deviations by Age Group

		Mental SAPD	Physical SAPD	Social SAPD	Look SAPD	Implicit Age	*M* (*SD*)
18-24 (*n*=236)	Mental SAPD	-					**.24** (.27)
	Physical SAPD	.11	-				**.03** (.24)
	Social SAPD	.24**	-.07	-			**.06** (.24)
	Look SAPD	.11	.00	.21**	-		**-.06** (.14)
	Implicit Age	-.11	.03	.04	.19*	-	**.52** (.38)
	Chronological Age	-.07	.04	.00	-.16*	-.02	21.22 (1.81)
25-44 (*n*=477)	Mental SAPD	-					.01 (.24)
	Physical SAPD	.17**	-				-.02 (.23)
	Social SAPD	.28**	.23**	-			**-.09** (.26)
	Look SAPD	.18**	.28**	.29**	-		**-.13** (.13)
	Implicit Age	-.02	-.08	.01	-.01	-	**.58** (.39)
	Chronological Age	-.34**	-.22**	-.29**	-.19**	-.05	33.94 (6.20)
45-64 (*n*=483)	Mental SAPD	-					**-.18** (.23)
	Physical SAPD	.22**	-				**-.11** (.21)
	Social SAPD	.22**	.21**	-			**-.19** (.21)
	Look SAPD	.16**	.41**	.28**	-		**-.12** (.11)
	Implicit Age	.02	-.02	-.16**	-.09	-	**.29** (.57)
	Chronological Age	-.20**	-.11*	-.03	-.04	-.25**	53.48 (5.44)
65+ (*n*=154)	Mental SAPD	-					**-.30** (.20)
	Physical SAPD	.34**	-				**-.17** (.15)
	Social SAPD	.28**	.29**	-			**-.29** (.22)
	Look SAPD	.27**	.45**	.34**	-		**-.13** (.08)
	Implicit Age	-.27**	-.17	-.34**	.00	-	.05 (.61)
	Chronological Age	.19*	.22**	.15	.26**	-.02	71.13 (6.18)

Note. SAPD = Subjective Age Percent Discrepancy, corresponds to an individual's subjective age minus his or her chronological age divided by chronological age (positive numbers indicate feeling older than one's chronological age). IAT = Implicit Association Test (numbers reflect IAT *D* score: larger numbers correspond to having a relatively stronger *me-young* bias, 0 = no bias). * = correlations significant at α = .05. ** = correlations significant at α = .01. Felt age means that are **bolded** are significantly different from 0 at α = .05.

Table 6

Age Group Follow-up Model Comparisons

	Baseline Model (Model 1)		Metric Invariance Model (Model 2)			
	χ^2	RMSEA	χ^2	RMSEA	Δdf	Support for Metric Invariance?
18-24 vs. 25-44	8.94	.042	23.39	.052	4	No
18-24 vs. 45-64	14.16	.060	36.62	.071	4	No
18-24 vs. 65+	5.95	.035	17.80	.056	4	No
25-44 vs. 45-64	14.44	.052	23.91	.046	4	Yes
25-44 vs. 65+	6.24	.030	10.24	.021	4	Yes
45-64 vs. 65+	11.45	.054	18.70	.046	4	Yes

Note. RMSEA = root mean square error of approximation. Support for metric invariance was not found if $\Delta\chi^2$ on the associated Δdf was significant at $p < .05$.

Table 7

Parameter Estimates of Models

Parameter	18-24 Estimate	25+ Estimate
SAPD → Mental SAPD	.31*	.52***
SAPD → Physical SAPD	-.06	.57***
SAPD → Social SAPD	.78*	.59***
SAPD → Look SAPD	.28*	.47***

Note. Parameter estimates are standardized values. * = estimates significant at α = .05. *** = estimates significant at α = .001. SAPD = Subjective Age Percent Discrepancy.

Table 8

Correlations Among Anxiety Measures, Anxiety Factor Score, and SAPD Factor Score

	BBSIQ	DASS-Subjective Distress	DASS-Somatic	Behavioral Avoidance	Anxiety Factor Score
SAPD Factor Score					
18-24	-.03	-.05	-.05	-.16*	-.07
25-44 M	-.07	-.16	-.04	-.14	-.16
25-44 W	.02	-.01	.03	.00	.00
45-64	.05	.11*	.16**	.06	.13**
65+	-.07	.06	.05	.09	.07

Note. SAPD = Subjective Age Percent Discrepancy. BBSIQ = Brief Bodily Sensations Interpretation Questionnaire. DASS = Depression, Anxiety, Stress Scales – Anxiety subscale. Higher values on SAPD Factor Score correspond with feeling relatively older across most indicators. Higher values of Anxiety Factor Score correspond with feeling more anxious across most indicators. M = Men. W = Women. * = correlation significant at $\alpha = .05$. ** = correlations significant at $\alpha = .01$.

Table 9

Correlations Among Anxiety Measures, Anxiety Factor Score, and Implicit Age Factor Score

	BBSIQ	DASS-Subjective Distress	DASS-Somatic	Behavioral Avoidance	Anxiety Factor Score
Implicit Age Factor Score					
18-24	.06	.10	-.01	.09	.09
25-44 M	.02	.05	.03	.21*	.06
25-44 W	.08	-.06	-.01	.05	-.04
45-64	.01	-.02	-.04	.01	-.03
65+	.03	.04	.09	.04	.07

Note. BBSIQ = Brief Bodily Sensations Interpretation Questionnaire. DASS = Depression, Anxiety, Stress Scales – Anxiety subscale. Higher values on Implicit Age Factor Score correspond with a stronger *me-young* bias. Higher values of Anxiety Factor Score correspond with feeling more anxious across most indicators. M = Men. W = Women. * = correlation significant at $\alpha = .05$.

Table 10

Correlations Among Physical Health and Memory Measures, Subjective Age, Implicit Age, and Chronological Age

		Number Prescription Medicines (Physical Difficulties)	Comparative Subjective Health	Current Memory Compared to Personal Best Memory	Current Memory Compared to Average	Current Degree of Memory Problems
SAPD Factor Score						
	18-24 W	.01	.31**	.01	.15	.15
	18-24 M	-.21	.08	.16	.31	.16
	25-44 W	-.05	-.08	-.08	-.06	-.09
	25-44 M	-.03	-.29**	-.09	.08	.20*
	45-64 W	.07	-.22**	-.21**	-.10	-.10
	45-64 M	.04	-.30**	-.03	-.01	.01
	65+ W	.29*	-.27*	-.16	-.06	-.11
	65+ M	.33*	-.20	-.25	-.05	-.15
Subjective Age–Chron. Age						
	18-24 W	.14	.00	.10	.12	.17
	18-24 M	-.18	-.17	-.22	-.04	-.16
	25-44 W	-.04	-.13*	-.05	-.04	-.13*
	25-44 M	-.24**	-.17	-.05	.07	.17
	45-64 W	.05	-.20	-.10	-.10	-.07
	45-64 M	-.01	-.32**	.01	.06	.15
	65+ W	.15	-.19	-.13	-.10	-.17
	65+M	.26	-.24	-.17	-.06	-.15
(Subjective Age-Chron. Age)^2						
	18-24 W	-.17	.21	.10	.06	.19
	18-24 M	-.18	.18	.14	.03	.18
	25-44 W	.04	-.02	.01	.00	.05
	25-44 M	.46**	-.14	-.16	-.03	-.06
	45-64 W	.00	.11	.09	.07	.02
	45-64 M	.01	.27**	.02	-.08	-.15
	65+ W	-.17	.21	.10	.06	.19
	65+M	-.18	.18	.14	.03	.18
Implicit Age		-.15**	-.04	.08*	.03	.00
Chronological Age		.47**	.12**	-.22**	.03	.03

Note. SAPD = Subjective Age Percent Discrepancy. Higher values on SAPD Factor Score correspond with feeling relatively older across most indicators. Subjective Age = mean of subjective ages reported across 4 domains. * = correlation significant at $\alpha = .05$. ** = correlation significant at $\alpha = .01$.

Table 11

Correlations Among Mean Subjective Age Percent Discrepancy and Anxiety Indicators Separated by Feeling Older vs. Younger than One's chronological Age

		% of Sample[1]	BBSIQ	DASS-Somatic	DASS-Subjective Distress	Behavioral Avoidance
Mean SAPD						
18-24						
	Feel Younger	24%	-.01	-.30*	-.25	.16
	Feel Older	70%	.26**	.18*	.17*	-.01
25-44						
	Feel Younger	68%	-.11	-.20**	-.04	-.08
	Feel Older	29%	-.03	.26**	.03	.10
45-64						
	Feel Younger	89%	.06	.04	-.05	-.03
	Feel Older	8%	.28	.17	.18	.27
65+						
	Feel Younger	97%	-.06	.11	.14	.10
	Feel Older	2%	-.55	1.00*	--	.06

Note. SAPD = Subjective Age Percent Discrepancy. * = estimates significant at α = .05. ** = estimates significant at α = .01. [1] = Percentages do not sum to 100 because they do not include participants who, on average, feel their chronological age (correlations cannot be computed for these participants because their mean Subjective Age Percent Discrepancy is constant). -- = Correlation cannot be computed because the mean subjective distress score is constant across participants.

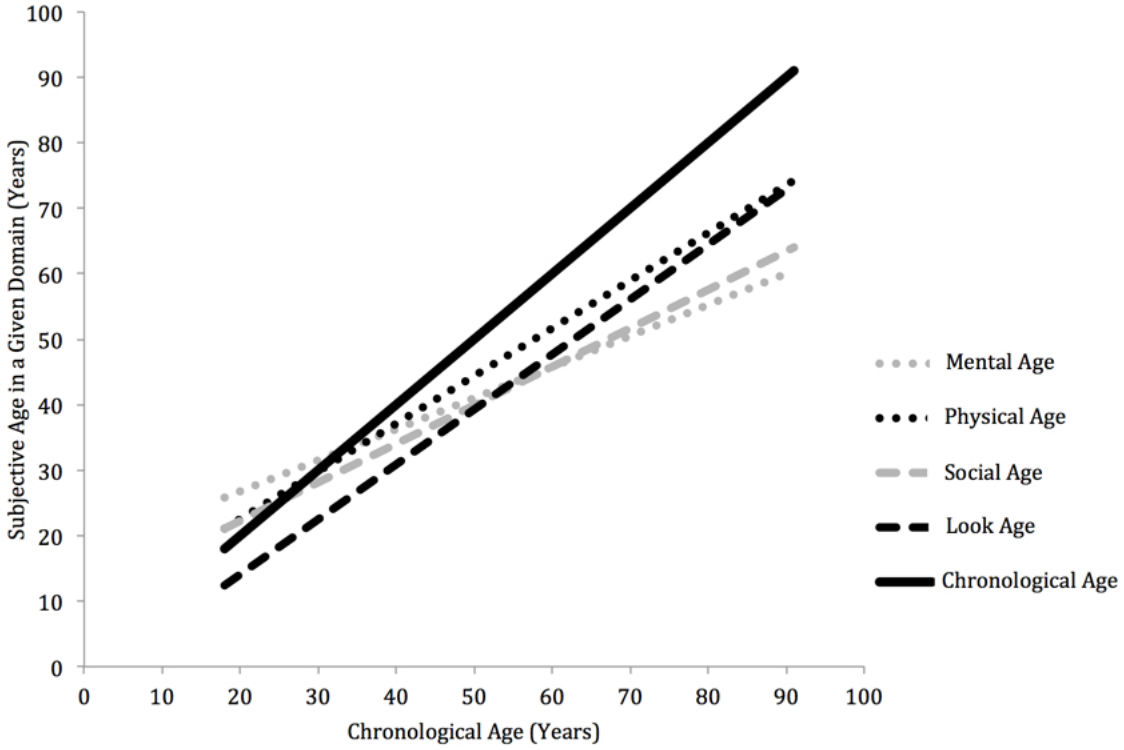


Figure 1. Best-fit linear regression lines for each subjective domain across all age groups. Points below solid black line indicate feeling younger than one's chronological age.

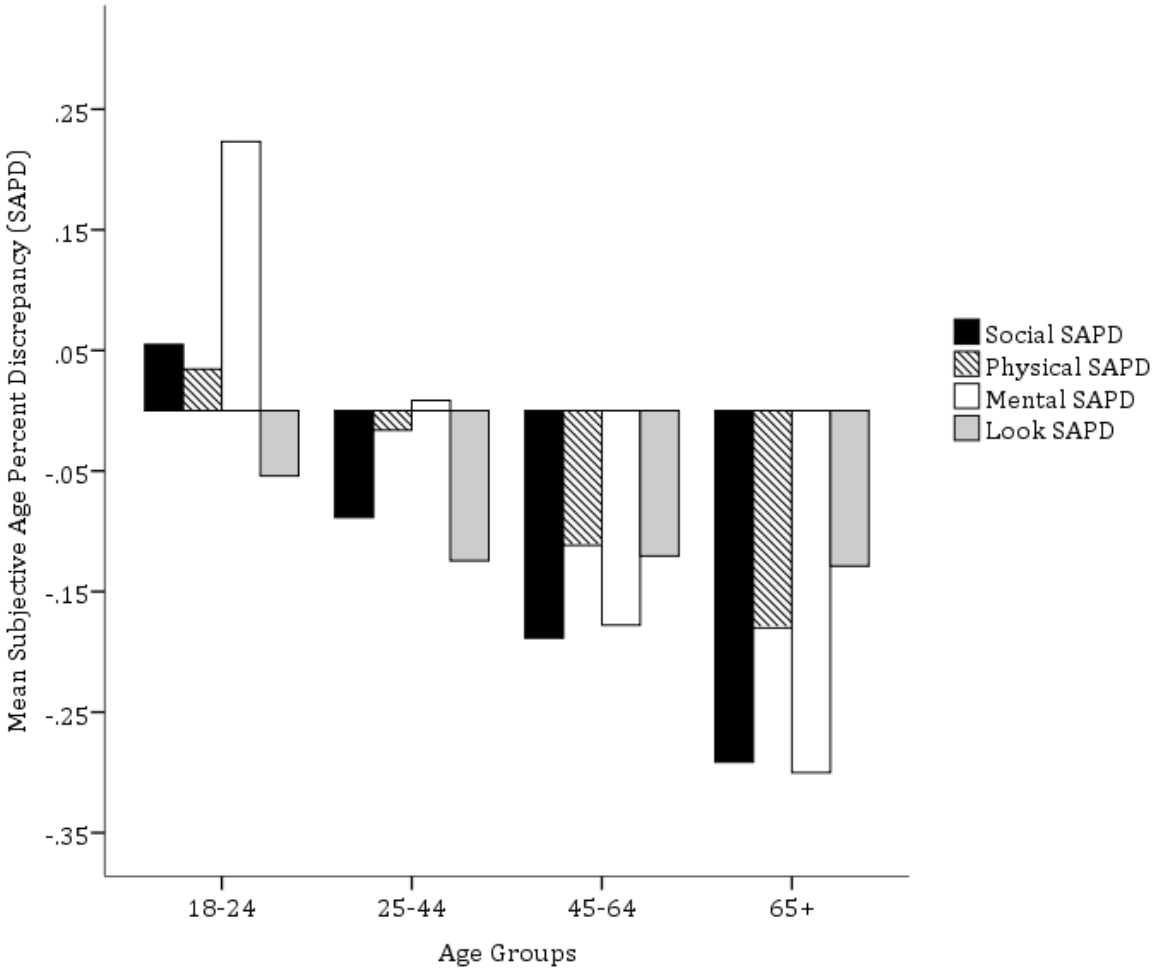
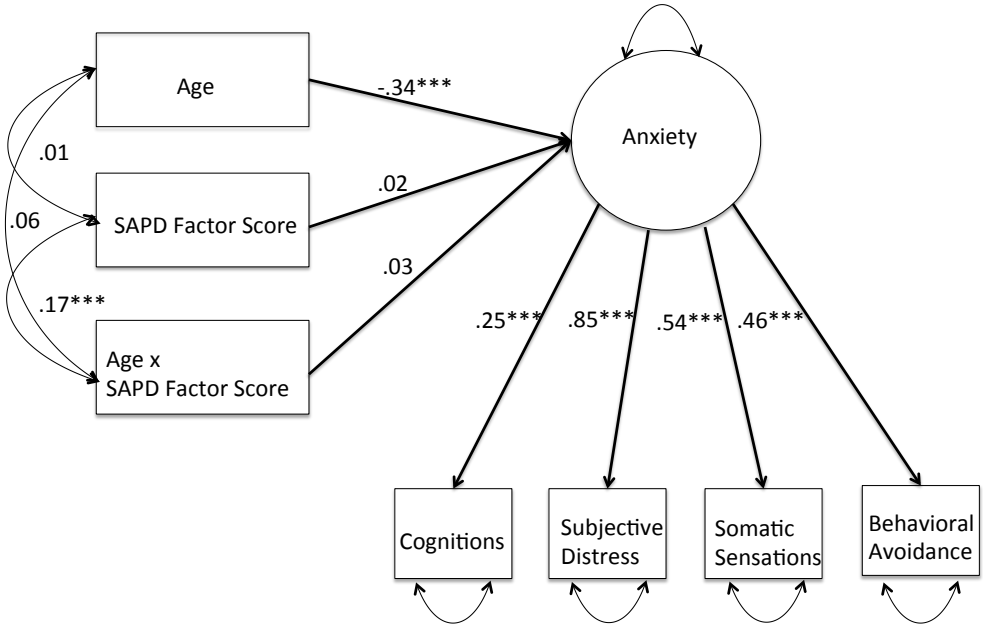


Figure 2. Mean subjective age percent discrepancies for each domain and age group. SAPD = Subjective Age Percent Discrepancy. Positive values indicate feeling older than one's chronological age, and negative values indicate feeling younger than one's chronological age. For example, 18-24 year olds feel 5.57% older socially than their chronological age, while 45-64 year olds feel 18.72% younger socially than their chronological age.

(a)



(b)

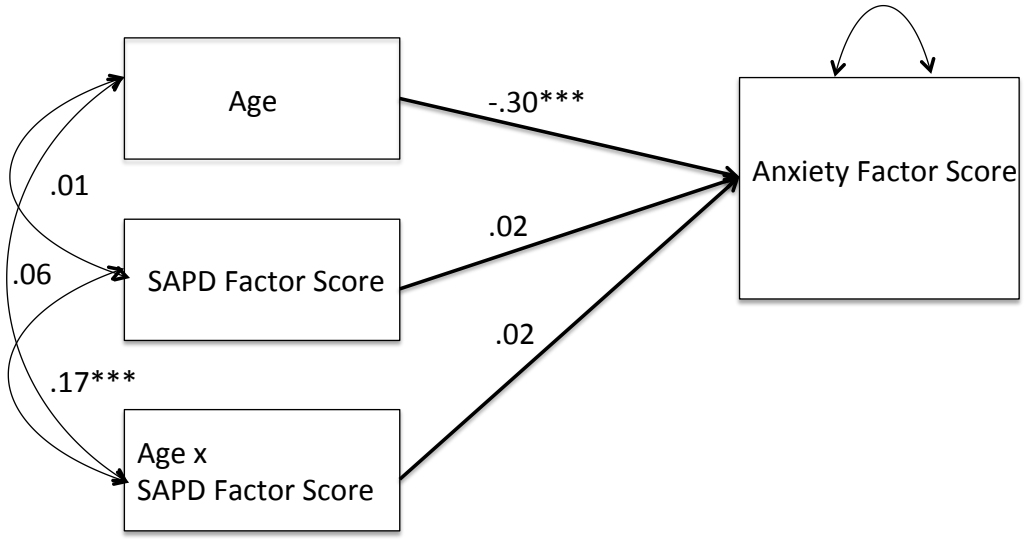
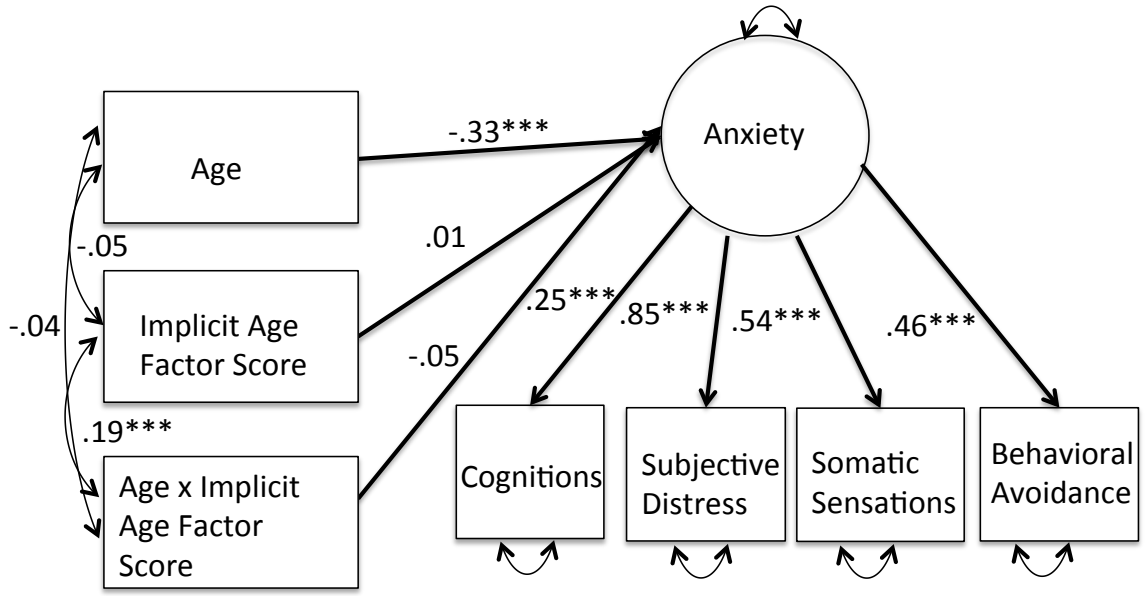


Figure 3. Chronological age, Subjective Age Percent Discrepancy, and their interaction as predictors of anxiety. SAPD = Subjective Age Percent Discrepancy. *** = correlation significant at α = .001.

(a)



(b)

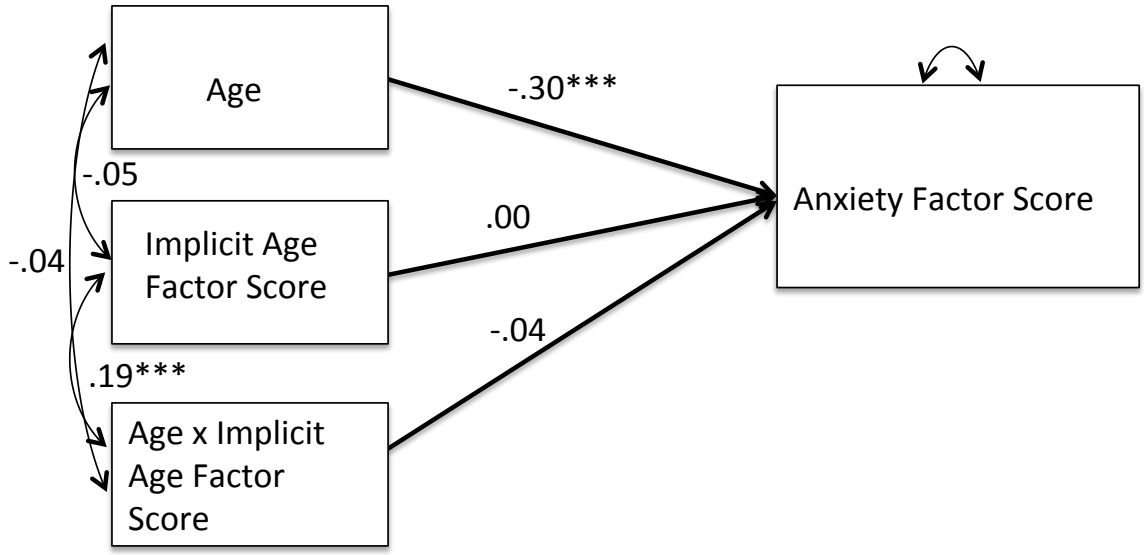


Figure 4. Chronological age, implicit age, and their interaction as predictors of anxiety. SAPD = Subjective Age Percent Discrepancy. *** = correlation significant at $\alpha = .001$.

Appendix A

Recruitment Email

Mailing date: Sept 1, 2010
Sent from Fred Smyth's father, Don Smyth.
Subject line: **Brief, anonymous online study by Don Smyth's son.**

Greetings fellow Broadmead Resident,

My son, Fred, is a research professor of psychology at the University of Virginia and is currently part of a team that is running a short online study which you may find interesting. It is funded by NIH and nearly 1,000 people from around the country have participated so far. To assist the team in increasing the diversity of their study population, I am sending this notice to all Broadmead residents who have publicly listed their emails. I will have no knowledge, however, of whether you decide to take part.

The study has been approved by the University of Virginia's *Institutional Review Board for the Social and Behavioral Sciences*. Your participation would be confidential, since names are not collected, and data will only be reported in the aggregate. Further, Broadmead will not be identified in any publication or presentation of data derived from the study.

It takes about 15 minutes and includes questionnaires on which you describe yourself, your feelings and the ways in which you think and respond to your surroundings.

If you are interested, click on the link below (now or some other time) and you will be given an opportunity to read an "Informed Consent" page which broadly outlines the study's nature. Even if you give your consent and begin the study, you are free to stop participating at any time.

Click on this link (or, if that doesn't work, paste it into your web browser's address space): http://bit.ly/aD1T13

If you would like to contact Fred directly with questions about the study, feel free to email him at fsmyth@virginia.edu.

Best regards,
Don Smyth

Informed Consent Agreement

Welcome to Project Implicit! We hope you will find your visit to be engaging and informative.

This study examines how different ways of describing yourself influence your thoughts, feelings, and behavior. It takes about 15 minutes.

During the study, you will be asked to complete brief questionnaires in which you describe yourself, your feelings and the ways in which you think and respond to your surroundings. **If you would prefer not to do this study, you can click here to be assigned to a new study.**

It is important to note that participation in this study is voluntary, and you may end your participation at any time by closing the study window. Contact Jennifer Simpson, jws5be@virginia.edu, if you have any questions about the study.

Project Implicit's standard privacy policy applies to this study. To view the privacy policy in a separate pop up window, please click here.

Who to contact about your rights in the study:
Tonya Moon, Chairman, Institutional Review Board for the Social and Behavioral Sciences, One Morton Dr Suite 500 University of Virginia, P.O. Box 800392, Charlottesville, VA 22908-0392
Telephone: (434) 924-5999; Email: irbsbshelp@virginia.edu; Website: www.virginia.edu/vprgs/irb

By clicking the 'I agree' button below you are indicating that you have read the informed consent statement above and agree to participate in this study.

Debriefing Form

Thank you for participating.

We are currently investigating ways in which our biological age and our *perception* of our age influence how we experience the thoughts, feelings, and behaviors related to anxiety. Though research has shown that many adults report feeling anxious at some point in their lives, we know relatively little about how adults experience this anxiety across the lifespan. Additionally, we want to know if our perception of our age plays a role in determining whether and how we experience anxiety.

The Implicit Association Test (IAT) you completed, in which you sorted words into the categories 'Old', 'Young', 'Me', and 'Not me', was designed to measure the relative strength of automatic associations among these concepts. We are interested in whether implicit age self-concepts predict individuals' anxiety symptoms. Your results for the IAT are reported below.

Your data suggest a (slight/moderate/strong) association with the self (versus others) as (old, young) compared to (old, young).

The interpretation is described as an 'association with the self with old/young' if you responded faster when (old/young) words and (me/not me) words were classified with the same key than when (old/young) words and (me/not me) words were classified with the same key.

Depending on the magnitude of your result, your automatic associations may bedescribed as 'slight', 'moderate', 'strong', or 'little to no association'. How implicit associations affect our judgments and behaviors is not well understood and may be influenced by a number of variables. As such, the score should serve as an opportunity for self-reflection, not as a definitive assessment of your implicit thoughts or feelings. This and future research will clarify the way in which implicit thinking and feelings affects our perception, judgment, and action.

If you are interested in learning more about anxiety across the lifespan, see:

- Charles, S.T. & Carstensen, L.L. (2007). Emotion regulation and aging. In J.J. Gross (Ed.), Handbook of Emotion Regulation. New York: Guilford Press.

- Teachman, B.A. (2006). Aging and negative affect: The rise and fall and rise of anxiety and depression symptoms. *Psychology and Aging, 21,* 201-107.

If you have any questions about this study, please email Jennifer Simpson at jws5be@virginia.edu

If you have any questions concerning mental health issues in general or feel especially concerned about your own anxiety, please visit our *mental health links* page, which includes information about accessing counseling.

The topic of this task was assigned to you from a list of over a dozen topics. You are welcome to complete as many sessions as you wish, and every session will be a different topic. Some will be topics you have thought about many times, others might be new or unusual topics that you have not considered before. Just return to the login page and enter your email address to start again.

Thank you again for your participation.

Project Implicit Demographics Questionnaire

Please indicate your gender:
Female
Male

Please indicate the year of your birth:
(Participants clicked on appropriate year box. Choices ranged from 1916-2001)

Race:
American Indian/Alaska Native
East Asian
South Asian
Native Hawaiin/Pacific Islander
Black/African origin
White/European origin
More than one race – Black/White
More than one race – Other
Other or Unknown

Please indicate your ethnicity:
Hispanic or Latino
Not Hispanic or Latino
Other

Please indicate the country of your citizenship:
(Participants clicked on the appropriate country box).

Please indicate the country of your residence:
(Participants clicked on the appropriate country box).

Please indicate the postal code of your residence:
(Participants typed their answer into a blank).

Please indicate your highest educational attainment:
Elementary School
Junior High
Some High School
High School Graduate
Some College
Associate's Degree
Bachelor's Degree
Some Graduate School
Master's Degree
M.B.A.
J.D.

M.D.
Ph.D.
Other Advanced Degree

Please indicate the major field of study for your most advanced degree:
Biological Sciences/Life Sciences
Business
Communications
Computer and Informational Sciences
Education
Engineering
Mathematics, Physical Sciences/Technologies
Health Professions or Related Sciences
Humanities/Liberal Arts
Law or Legal Studies
Psychology
Social Sciences or History
Visual or Performing Arts
Other

Please indicate your religious affiliation:
(Participants clicked on the appropriate religious affiliation box).

Please indicate the degree of your religiosity:
Very religious
Moderately religious
Somewhat religious
Not at all religious

Please indicate your political identity:
Strongly liberal
Moderately liberal
Slightly liberal
Neutral (moderate)
Slightly conservative
Moderately conservative
Strongly conservative

Depression, Anxiety, Stress Scales (DASS21-Anxiety)

How much did the statement highlighted below apply to you over the past week? There are no right or wrong answers.

1. I was aware of dryness of my mouth.
2. I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion).
3. I experienced trembling (e.g., in the hands).
4. I was worried about situations in which I might panic and make a fool of myself.
5. I felt I was close to panic.
6. I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat).
7. I felt scared without any good reason.

Did not apply to me at all
Applied to me to some degree, or some of the time
Applied to me to a considerable degree, or a good part of time
Applied to me very much, or most of the time

Decline to answer

Abbreviated Brief Bodily Sensations Interpretation Questionnaire

Explanations of Situations

In this section you will see short descriptions of three situations in which it is not quite clear what is happening. Your task will be to image each situation happening to you and to rate the likelihood of several proposed explanations.

Please rate each of the three explanations below on how likely it is to be true if you found yourself in the situation.

0	1	2	3	4	5	6	7	8
Not at all likely		A little likely		Moderately likely		Very likely		Extremely likely

SITUATION 1 of 3: You have visitors over for dinner and they leave sooner than you expected.

They did not wish to outstay their welcome.
They had another pressing engagement to go to.
They did not enjoy the visit and were bored with your company.

SITUATION 2 of 3: You feel lightheaded and weak. Why?

You are about to faint.
You need to get something to eat.
You didn't get enough sleep last night.

SITUATION 3 of 3: You wake with a jolt in the middle of the night, thinking you heard a noise, but all is quiet. What woke you up?

You were woken by a dream.
A burglar broke into your house.
A door or window rattled in the wind.

Avoidance Measure

Questions about potentially frightening activities or situations: Item 1 of 2

Choose the response that best fits for you.

How often do you avoid doing certain things or entering situation because those situations may elicit feelings of fear, anxiety, or panic?

- Never avoid
- Rarely avoid
- Occasionally avoid
- Usually avoid
- Always avoid
- Decline to answer

Questions about potentially frightening activities or situations: Item 2 of 2

Choose the response that best fits for you.

To what degree has avoidance of these situations interfered with your life (e.g., daily routine, school/job, social activities, relationships)?

- No interference
- Mild interference
- Moderate interference
- Significant interference
- Severe interference
- Decline to answer

Age Survey. A scroll bar in the response box for each question allows you to see all answer options.

What age would you like to be if you could pick out your age right now?

How old do you think that you look?

How old do you feel mentally (e.g., your thinking and reasoning skills)?

How old do you feel physically?

How old do you feel socially (e.g., in relationships)?

How old do you feel overall?

Implicit Association Test

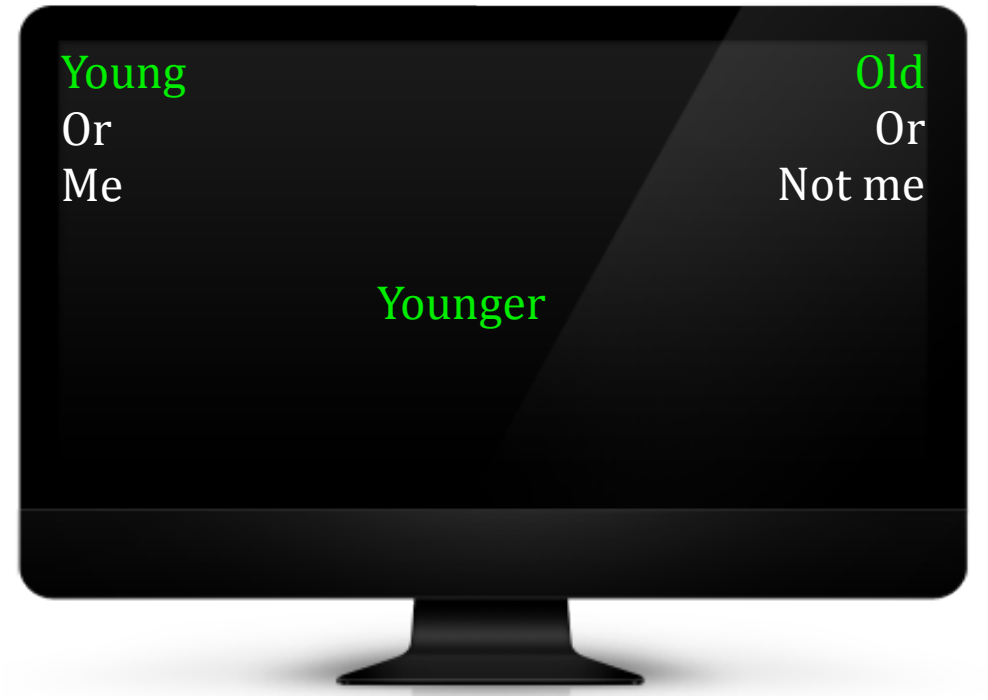
In the next task, you will be presented with a set of words or images to classify into groups. This task requires you to classify items as quickly as you can while making as few mistakes as possible. Going too slow or making too many mistakes will result in an uninterpretable score. This part of the study will take about 5 minutes. The following is a list of category labels and the items that belong to each of those categories.

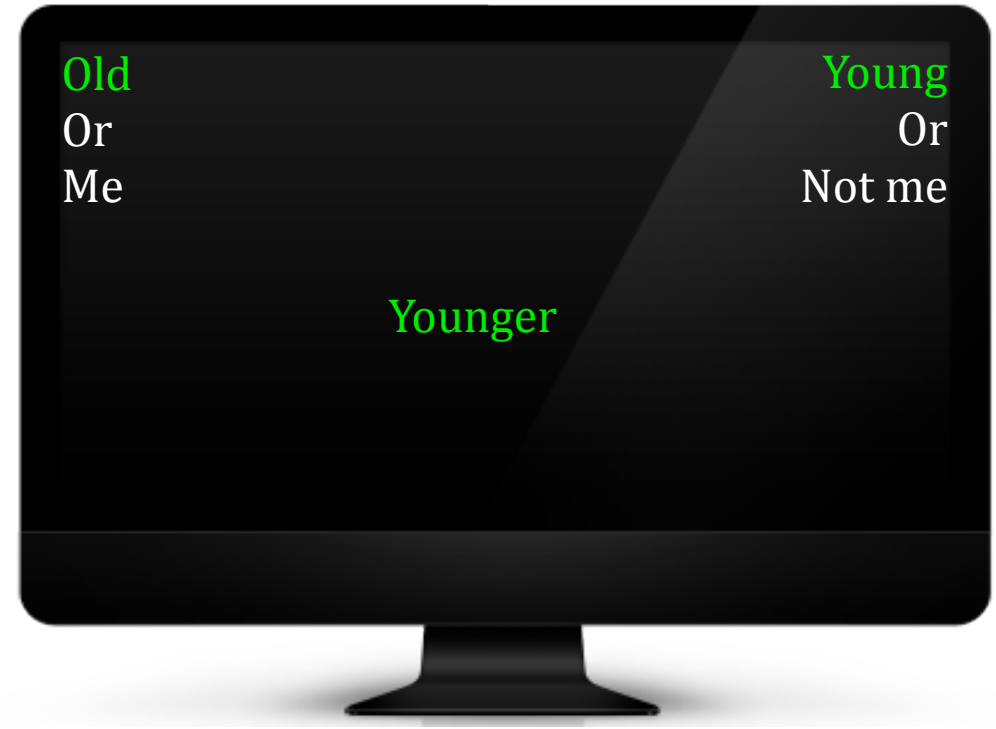
Category	Items
YOUNG	Younger, Youthful, Junior
OLD	Aging, Older, Senior
ME	I, Myself, Self
NOT ME	Other, Them, They

Keep in mind

- Keep your index fingers on the 'e' and 'I' keys to enable rapid response.
- Two labels at the top will tell you which words or images go with each key.
- Each word or image has a correct classification. Most of these are easy.
- The test gives no results if you go slow – Please try to go as fast as possible.
- Expect to make a few mistakes because of going fast. That's OK.
- For best results, avoid distractions and stay focused.

Sample Critical Blocks:





Current Health Survey

How many medications related to physical health difficulties are you taking right now that a doctor prescribed for you?
(None – 10+)

Compared with others of about the same age, how would you describe your overall health? (Excellent, Good, Fair, Poor)

Are you currently struggling with moderate to severe physical health difficulties (e.g., chronic pain, cancer, arthritis, etc.) that have lasted a minimum of several weeks?
(No, Yes).
If yes: To what extent to these difficulties interfere with your daily life?
(No interference, Mild interference, Moderate interference, Significant interference, Severe interference)

Are you currently struggling with moderate to severe emotional difficulties (e.g., depression, panic attacks, anxiety, fighting a lot with family or friends, etc.) that have lasted a minimum of several months?
(No, Yes).
If yes: To what extent to these difficulties interfere with your daily life?
(No interference, Mild interference, Moderate interference, Significant interference, Severe interference)

Perceptions of Memory Questions (1 of 3)

	Very poor			Average			Very good
	1	2	3	4	5	6	7

In general, as compared to the average individual, how would you describe your memory?

Perceptions of Memory Questions (2 of 3)

	Much worse			About the same			Much better
	1	2	3	4	5	6	7

How would you describe your memory, on the whole, compared to the best it has ever been?

Perceptions of Memory Questions (3 of 3)

	Major problems			Some minor problems			No problems
	1	2	3	4	5	6	7

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

Final Demographics Questionnaire

This is the last set of questions.

Which the following describe your relationship status? Choose "Yes" for any that apply:

Single
Dating
Committed Relationship
Married (ceremony only, no official legal recognition)
Married (legally recognized)
Civil Union (legally recognized)
Domestic Partnership (legally recognized)
Separated
Divorced
Widowed

Do you have children? (No/Yes)

Which of the following describe your current living situation? Choose "Yes" for any that apply:

Alone
With Relatives
With Non-Relatives
Adult Foster Care
Nursing Facility
Assisted Living Community
Retirement Community
Other

Some people have one parent (or legal guardian) in their lives, others have two, and some have more. Please use the next two questions to describe how many parents/guardians you consider yourself to have had in your life and how many of these are currently living.

How many parents or legal guardians to [sic] you consider yourself to have (ever) had?
(None – More than four)

How many of your parents or legal guardians are living?
(None – More than four)

Appendix B

The following is a list of statistical approaches that were attempted when testing for measurement invariance in Study 1:

1. First, a second order factor model was constructed with four first order factors (note: four first order factors were needed to obtain fit statistics, as the model was just identified with three first order latent factors; see Chen, Sousa, & West, 2009).
2. This second order factor model would not converge, leading us to attempt a second order factor model with only three first order factors.
3. This new model also demonstrated convergence problems, and so we constructed a first order, one-factor model (4 indicators) to diagnose the problem.
4. The one-factor model also would not converge, due to the 18-24 year-old male group, which demonstrated a Heywood case for the error variance on the subjective distress indicator.
5. In response to the Heywood case, the same multi-group model was run in OpenMx, where a lower bound was set.
6. This resulted in a solution with an error variance of 0 being estimated for the subjective distress indicator.
7. The error variance for this term was, therefore, set to 0 in Amos, which produced an identical solution to the one generated in OpenMx.
8. A non-significant likelihood ratio test led to the eventual combination of th 18-24 year-old male and female groups.