# Experiences with Intrusive Thoughts in Younger and Older Adults

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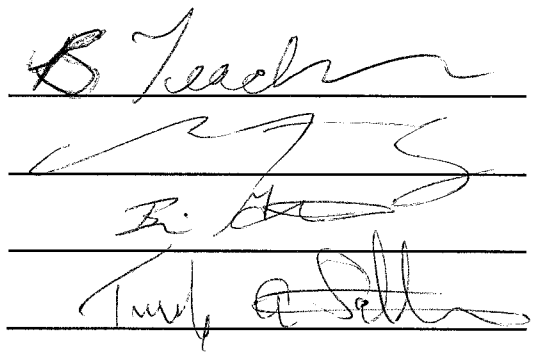

## Abstract

Intrusive thoughts are common obstacles to well-being in younger adults, but they are not well understood in older adults. Leading theories of intrusive thoughts suggest that the meaning one assigns to an intrusive thought will play a large role in determining one's emotional response to that thought. The two current studies incorporated a lifespan perspective into theories of intrusive thoughts to examine age-related differences in the initial experience and recurrence of intrusive thoughts, the distress following these recurrences, and the meanings assigned to these recurrences. In study one, younger (*N* = 51) and older (*N* = 49) adults were randomly assigned to suppress (i.e., keep out of mind) or monitor an intrusive thought. In study two, we extended younger (*N* = 35) and older (*N* = 36) adults' time engaging with intrusive thoughts by asking participants to suppress and then monitor a series of three intrusive thoughts. We also attempted to manipulate the meanings assigned to the thoughts' return in line with concerns expected to be threatening to older and younger adults, respectively.

Across studies, the age groups did not differ in their actual difficulties with the recurrence of intrusive thoughts, but older adults tended to perceive greater difficulty keeping those same thoughts out of mind. With regard to distress, in both studies older adults experienced steadier levels of positive affect than younger adults when engaging with intrusive thoughts. However, older adults also appeared to experience slower decline of negative affect than younger adults. In terms of the meanings assigned to recurrences of intrusive thoughts, older adults were prone to interpreting the recurrence of intrusive thoughts as a sign of cognitive decline across studies. Finally, the substantial effort older adults put into keeping intrusive thoughts out of mind appeared to be an important age-related risk factor for negative emotional consequences after intrusive thoughts.

Together, these studies highlight potential risk and protective factors in older adults for experiencing emotion dysregulation after intrusive thoughts. The evidence from the two studies demonstrates that an individual's reactions to intrusive thoughts must be considered within an 'age context' that takes into account age-relevant concerns.

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## Introduction

Intrusive thoughts are unpleasant but familiar visitors to the minds of most adults. From nagging worries about one's health to jarring thoughts about a partner being in a car accident, these thoughts encompass a broad range of life concerns. Intrusive thoughts are common for both younger and older adults, although there is considerably less research about these thoughts in older adults (Calamari, Janeck, & Deer, 2002). Studying intrusive thoughts in older adults is important in order to understand age-related risks and protective factors for experiencing distress following intrusive thoughts.

When intrusive thoughts increase distress for older adults, there may be significant consequences. In older adults, increases in anxiety or negative affect have been associated with health outcomes such as increased risk of heart disease (Mroczek & Spiro, 2007), early signs of Alzheimer's disease (Wilson et al., 2007), and early death (Shibeshi, Young-Xu, & Blatt, 2007). Further, anxiety is a major problem among older adults, with some researchers finding that over 50% of older adults suffer from significant symptoms of anxiety (Schaub & Linden, 2000). Because intrusive thoughts are central to anxiety problems (Clark & Rhyno, 2005), understanding the contributions of intrusive thoughts to anxiety in older adults is likely critical for promoting healthy aging. Unfortunately, existing cognitive therapies for intrusive thought problems have been less effective for older (versus younger) adults (Ayers, Sorrell, Thorp, & Wetherell, 2007), so there is a need for a better understanding of lifespan influences on intrusive thoughts and anxiety.

Given the prevalence of intrusive thoughts, a primary question facing anxiety researchers is determining why intrusive thoughts vex some people while not bothering others. On the one hand, intrusive thoughts are implicated in many clinical disorders across the lifespan (Clark, 2005). At the same time, intrusive thoughts do not always have negative consequences, and are frequently experienced by healthy people. To

resolve this apparent discrepancy, cognitive theories of intrusive thoughts (Rachman, 1997; Salkovskis, 1998) propose that there are a wide range of meanings that a person can ascribe to an intrusive thought, with drastically different consequences. In other words, it is the meaning ascribed to an intrusive thought that causes these thoughts to become either recurrent and extremely distressing, or infrequent and minimally upsetting. For example, a person who interprets a thought of a close friend being in a car accident as a sign of his or her moral failure (e.g., "If I'm having this thought, maybe I secretly *do* want my friend to be in a car accident!") is likely to feel distressed and preoccupied with the thought. In contrast, someone ascribing a more innocuous meaning (e.g., "That thought was weird, but it doesn't mean anything about me") is unlikely to develop difficulties.

While most research on intrusive thoughts has focused on the meanings younger adults assign to intrusive thoughts (Calamari et al., 2002), older adults may assign fundamentally different types of meanings. The goals that are most accessible and valued by older adults may lead them to appraise intrusive thoughts through a different lens than younger adults. For example, an older adult who greatly values maintaining her cognitive functioning may see recurrent intrusive thoughts as a scary sign of cognitive decline (Calamari et al., 2002). Indeed, research suggests that such concerns about cognitive decline are likely to be prominent in the fears of older adults (Dark-Freudeman, West, & Viverito, 2006). This is rather distinct from the typical younger adult-relevant fears focused on moral failure (Dark-Freudeman et al., 2006). These fears often include concerns that one is not becoming a good person, is dangerous to the self or others, is secretly evil, or unknowingly wishes to act in ways contrary to his or her values (Ferrier & Brewin, 2005). While both younger and older adults' typical fears are examples of negative meanings given to intrusive thoughts, these meanings must be understood within the appropriate age context. The current studies incorporated a

lifespan perspective into existing theories of intrusive thoughts in order to examine age-related differences in the initial experience and recurrence of intrusive thoughts, the distress following these recurrences, and the meanings assigned to these recurrences. It was expected that older adults would be relatively prone to interpreting recurrences of intrusive thoughts as a sign of cognitive decline, whereas younger adults would be more prone to ascribing recurrences of intrusive thoughts to moral failure or emotional dysfunction.

In study one, we investigated the rate and perception of intrusive thought recurrences and subsequent distress that occurs when younger and older adults are asked to suppress (i.e., keep out of mind) an intrusive thought. We expected to see a striking divergence whereby psychologically healthy older adults (i.e., those not suffering from high levels of emotion dysregulation, such as anxiety disorders) would initially experience *more* difficulty controlling intrusive thoughts during thought suppression than younger adults, but would feel *less* distressed by these thoughts (see Figure 1 for the proposed model). We also asked participants about their everyday intrusive thoughts in order to learn what types of intrusive thoughts older adults experience, how frequently the thoughts occur, and how distressing people find these thoughts. For older adults, we expected that they would report less distress due to intrusive thoughts in their everyday lives than younger adults. We also measured age-relevant meanings assigned to recurrences of intrusive thoughts to test the idea that older adults would, on average, assign fewer negative meanings to recurrences of their intrusive thoughts, except in the older-adult-relevant domain of cognitive decline. For younger adults, we expected that they would endorse more negative meanings about recurrences of their intrusive thoughts, particularly in the domains of moral failure and emotional dysfunction. This study offered an initial, relatively descriptive glimpse into age differences in the way individuals experience intrusive thoughts.

In study two, we focused more specifically on age differences in the meanings given to recurrences of intrusive thoughts, testing the relationship between assigned meanings and distress after intrusive thoughts. We also examined responses to intrusive thoughts over repeated trials to provide a more comprehensive look at age differences in responding to intrusive thoughts. We first measured the meanings participants gave to recurrences of an intrusive thought when they were given instructions that did not emphasize any particular meaning. Next, we tried to manipulate the meaning given to recurrences of a second intrusive thought by inducing the same participants to believe that recurrences of this intrusive thought were a sign of declining cognitive functioning. Finally, we attempted to induce participants to believe that recurrences of a third intrusive thought were a sign of poor moral and emotional growth. When participants were given instructions not emphasizing any particular meaning, we expected that older adults would ascribe fewer negative meanings to recurrences of intrusive thoughts (except for cognitive decline ones), and feel less distress than younger adults (akin to the predictions for study one). However, when participants were induced to ascribe intrusive thought recurrences to declining cognitive functioning (an older-adult relevant meaning), we expected that older adults would appear like younger adults in their emotional reaction to intrusive thoughts. Finally, when participants were induced to ascribe intrusive thought recurrences to poor moral and emotional functioning (a younger-adult relevant meaning), we expected that younger adults would experience even greater distress compared to older adults than when receiving instructions not emphasizing any particular meaning.

Through these two studies, we hoped to demonstrate age-related differences in the experience of intrusive thoughts and their resulting distress. Further, we aimed to show that the meanings ascribed to intrusive thoughts are crucial for determining the future recurrence and distress associated with intrusive thoughts for both younger and

older adults. We tested the idea that older adults do not generally ascribe negative meanings to intrusive thoughts, and so do not experience great distress. However, we predicted that older adults are at risk for emotional difficulties when assigning meanings that threaten their valued age-relevant goals, and we attempted to demonstrate this vulnerability by threatening a common goal of older adults - maintaining cognitive functioning. Similarly, we also examined younger adults' risk by threatening their valued age-relevant goal of successful moral and emotional development.

Age Differences in Difficulty Controlling Intrusive Thoughts

When intrusive thoughts are initially encountered, younger and older adults often engage in strategies designed to resist the thoughts. Among these strategies, thought suppression seems to be a common response in both age groups (Krause, 2007; Wegner & Zanakos, 1994). During thought suppression, it is believed that individuals consciously attempt to stop thinking about unwanted thoughts while automatically monitoring for further thought intrusions (Wegner, 1994). As one might expect, persons attempting to suppress thoughts often ironically end up thinking more about those thoughts (Wegner & Zanakos, 1994). In our own research, we found that approximately 95% of people experienced at least one recurrence of an intrusive thought when attempting to suppress these thoughts (Magee & Teachman, 2007). In the current studies, we asked younger and older adults to suppress intrusive thoughts in order to examine their ability to control intrusive thoughts and their affective reactions to the nearly inevitable recurrence of intrusive thoughts during suppression attempts.

In thinking about age differences in the link between intrusive thoughts and anxiety, one issue to consider is that older adults may initially experience more difficulty trying to control thoughts compared to younger adults (see initial portion of Figure 1 model). Specifically, the aspects of executive functioning needed to keep unwanted thoughts out of mind may be relatively impaired in older adults. This notion stems from

Hasher and Zacks (1988), who originally proposed that inhibition, an aspect of executive functioning, may be impaired in older adults. Their theory suggested that inhibition serves attentional goals by suppressing goal-interfering information, or possibly by preventing the return of attention to previously rejected items (Zacks, Radvansky, & Hasher, 1996). Applying this theory to thought suppression, inhibition might be viewed as preventing the return of attention to thoughts that are rejected as unwanted.

In the years since Hasher and Zacks' proposal, age differences in inhibition have been shown to have substantial overlap with age differences in other major cognitive abilities (Salthouse, Atkinson, & Berish, 2003), leading to questions about the utility of studying inhibition as an independent construct from executive functioning. Evaluating these larger questions concerning the scope or independence of an inhibition deficit among younger and older adults is critical, but beyond the reach of the current studies. Instead, we formulated our hypotheses by integrating the findings on the particular processes that are related to thought suppression.

Three areas of the inhibition literature support the idea that the specific executive functioning processes involved in thought suppression are relatively impaired in older (versus younger) adults. First, there is some suggestion that older adults may more consistently exhibit inhibition deficits in situations involving more controlled processing (Maylor, Schlaghecken, & Watson, 2005; McDowd, 1997). For example, older adults generally show impairment on visual search tasks in which controlled processing guides the inhibition of visible information, but not on tasks involving the inhibition of stimuli that are no longer consciously visible (which requires more automatic processing).[1] This type of inhibition deficit seems to map well onto thought suppression, a task in which a

[1] While this characterization generally holds true, there are further divisions that can be made to distinguish among the more automatic types of inhibition (see Maylor et al., 2005).

controlled process is believed to largely determine success at inhibiting a consciously available thought or image (Wegner, 1994).

Second, older adults tend to show larger inhibition deficits in situations in which they attempt to inhibit particularly strong response tendencies (Butler & Zacks, 2006). Examples of such response tendencies might include errantly driving home (a well-practiced response) when one intends to drive to the grocery store, or attending to an attention-drawing target despite conscious directions to look at a competing target. During thought suppression, older adults are faced with inhibiting information that is negative and personally-relevant (an intrusive thought). Because there is a strong age-invariant preference for initially attending to threatening information (Mather & Knight, 2006; Rosler et al., 2005), this should be an especially tough response tendency to resist. Therefore, it follows that older adults should have more difficulty than younger adults inhibiting the return of their attention to a negative, personally-relevant intrusive thought.

Third, age-related deficits in inhibitory processes have been linked to deterioration in prefrontal regions of the brain (Braver & Barch, 2002; Hedden & Gabrieli, 2004), and in particular the anterior cingulate cortex (Sharp, Scott, Mehta, & Wise, 2006). Thought suppression performance has also been linked to the anterior cingulate (Wyland, Kelley, Macrae, Gordon, & Heatherton, 2003), suggesting a common neural correlate with specific inhibition processes. While correlational, this imaging evidence is consistent with the overlap of age-related inhibition deficits with thought suppression. These lines of evidence each point to the plausibility of age differences in inhibition influencing thought suppression performance.

Finally, there is some suggestive evidence for likely age differences in thought suppression ability from the literature on other aspects of executive functioning. Specifically, both lower fluid intelligence (Brewin & Beaton, 2002) and increased

demands on working memory (see Wenzlaff & Wegner, 2000) predict decreased thought suppression ability. Given the well-established age differences in favor of younger (relative to older) adults for these aspects of executive functioning (Horn & Cattell, 1967; Salthouse, 1991), we expected that older adults would experience greater difficulty suppressing intrusive thoughts.

Importantly, we expected that older adults' greater difficulty suppressing intrusive thoughts could be reflected in two possible ways: greater actual recurrence of intrusive thoughts, or greater perceived difficulty keeping the intrusive thoughts out of mind. This distinction follows from evidence that older adults often expend increased effort compensating for executive functioning impairment. These compensatory efforts may be at least temporarily effective, so that performance on a primary task is not compromised and impairment is more evident on secondary tasks or perceptions of difficulty (Li, Lindenberger, Freund, & Baltes, 2001). While recurrence of intrusive thoughts and perceived difficulty overlap, they also show distinctions; even when individuals experience similar recurrence of intrusive thoughts, they may experience different levels of perceived difficulty achieving that level of recurrence. This distinction is important because greater perceived difficulty keeping thoughts out of mind has been found to predict future rebound of intrusive thoughts (Forster & Liberman, 2001; Liberman & Forster, 2000). In addition, research has demonstrated that individuals perceiving depletion of cognitive resources may be less successful at general self-regulation, even in the absence of actual depletion (Clarkson, Hirt, Jia, & Alexander, 2009). Thus, older adults may be at risk for negative emotional consequences even if they compensate for age-related declines in executive functioning with strategies that lead to greater perceived difficulty despite showing little difference in intrusive thought recurrence.

One key factor that older adults may use to compensate for executive functioning difficulties is suppression effort. Suppression effort has been predicted to lead to greater subsequent rebound of intrusive thoughts by thought suppress theorists (Wenzlaff & Wegner, 2000), but has not been explored within a lifespan context. If older adults are able to successfully use increased effort to reduce recurrence, then age differences would be most likely to be seen with perceived difficulty keeping thoughts out of mind, rather than actual thought recurrence. Therefore, while we expected that older adults would show both greater intrusive thought recurrence and perceived difficulty than younger adults, we also examined how executive functioning and suppression effort related to these age differences. Specifically, we tested these factors as mediators of the relationship between age group, recurrence of intrusive thoughts, and perceived difficulty keeping thoughts out of mind.

Age Differences in the Link between Intrusive Thoughts and Distress

It is tempting to view the possibility of more difficult suppression of intrusive thoughts as problematic for older adults; after all, experiencing more thoughts about topics such as one's close friend being in a car accident would not seem to be a pleasant experience. However, intrusive thoughts do not necessarily lead to distress (Rachman, 1997; Salkovskis, 1998). We believe that there may be a fascinating dichotomy whereby older adults experience *more* difficulty suppressing recurrent intrusive thoughts during their initial attempts at thought suppression (see middle portion of Figure 1 model), but actually feel *less* distressed afterwards than would younger adults. There are numerous reasons to expect this divergence. One important reason is that older adults may have the advantage of responding more flexibly to the failure of goals than younger adults, who instead often respond to goal failure by increasing efforts to attain the goal (Heckhausen & Schulz, 1995). Older adults' flexibility should be extremely helpful when engaging in thought suppression, a task that typically results in

some failure experience (i.e., return of unwanted thoughts; Abramowitz, Tolin, & Street, 2001). For example, once older adults perceive initial or compensatory thought suppression efforts as unsuccessful (irrespective of their initial suppression effort), they may flexibly accept the thought's recurrence and instead gravitate toward alternative, positive information. This approach has been suggested to be beneficial during suppression (Beevers, Wenzlaff, Hayes, & Scott, 1999). For the same reason, older adults may be less likely to persist with other maladaptive methods of controlling their thoughts, such as compulsive rituals (e.g., excessive checking or counting). Conversely, younger adults may be more likely to engage in maladaptive efforts to suppress thoughts for prolonged periods of time, as well as attempts to control intrusive thoughts through ineffective rituals.

Additionally, this proposal of less distress following intrusive thoughts among older adults follows from the belief that older adults will, on average, attach less negative meanings to recurrences of their intrusive thoughts. According to leading lifespan theories like socioemotional selectivity theory (Carstensen, 1993, 1995), healthy older adults are thought to show motivated cognitive processing geared toward enhancing positive information while diminishing negative information (Lang & Carstensen, 2002; Mather & Carstensen, 2005). For example, while older adults show the same initial orienting toward negative information as younger adults (Mather & Knight, 2006), older adults tend to emphasize and retain more positive impressions of personal memories and choices (Mather & Johnson, 2000). In the context of intrusive thoughts, we believe that this tendency is reflected by older adults assigning fewer negative meanings to recurrences of intrusive thoughts than younger adults. It is also possible that for many healthy older adults, these meanings may stem from an inoculation to intrusive thoughts after a long life history of encountering intrusive thoughts and observing that they do not cause harm or have much significance.

While we have largely focused on the sequence of distress and meanings occurring *after* intrusive thoughts, it is important to recognize that thought suppression is a cyclical process (see the Figure 1 feedback loop from distress to activation of intrusive thoughts). Although we hypothesized that older adults would *initially* experience more difficulty suppressing intrusive thoughts than younger adults, we suspected that the lower distress and fewer negative meanings given to intrusive thoughts by older adults eventually result in lowered activation of intrusive thoughts over time. In other words, in the long run we expected that the lower distress and fewer negative meanings experienced by older adults compensate for the greater initial recurrence. It is important to note that while longer-term experiences with intrusive thoughts were assessed with a self-report questionnaire during study one, the current studies largely focused on early attempts to control intrusive thoughts. Thus, we expected to see greater perceived and/or actual difficulty suppressing intrusive thoughts for older adults during the initial thought suppression efforts reflected in the studies, despite lower frequency of intrusive thoughts for older adults in the longer term.

Taken together, we expected that despite initially having more recurrence of intrusive thoughts during thought suppression, older adults would demonstrate a more adaptive reaction to the return of these thoughts and feel less distressed than younger adults. Further, we hypothesized that older adults would experience less distress after intrusive thoughts, in part because of the fewer negative meanings they ascribe to recurrences of intrusive thoughts.

Age Differences in the Meanings Assigned to Intrusive Thoughts

Theories concerning people's *reactions* to intrusive thoughts highlight the idea that an intrusive thought is not necessarily a problem by itself, but can become harmful due to the meanings individuals ascribe to the thought (Rachman, 1997; Salkovskis, 1998). Recent evidence has supported this notion among younger adults. In an

innovative series of studies, Purdon and her colleagues examined the meanings individuals gave to their intrusive thoughts after failed attempts to suppress these thoughts (Markowitz & Purdon, 2004, as cited in Purdon, 2004; Purdon, 2001; Purdon, Rowa, & Antony, 2005). They found that participants who interpreted intrusive thought recurrences as demonstrating undesirable personal characteristics reported more distress than those who did not report such interpretations. This finding held for both clinical (Purdon et al., 2005) and healthy (Purdon, 2001) samples (see also Belloch, Morillo, & Gimenez, 2004). Further, Magee and Teachman (2007) found that younger adults who attributed the recurrence of intrusive thoughts to negative internal factors (i.e., "I am weak-minded" or "There is something wrong with the way I think") experienced more subsequent distress after the recurrence of intrusive thoughts than those who did not make such attributions. These negative personal attributions even mediated the difficulties with intrusive thoughts (e.g., recurrence of the thoughts and associated distress) experienced by highly anxious individuals.

While these studies point to the role that meanings ascribed to intrusive thoughts play in the link between intrusive thoughts and distress for younger adults, it is an open question how these meanings differ with age. The current studies thus extend this earlier work by explicitly assessing meanings of intrusive thought recurrences that are relevant to the goals of younger versus older adults.

One key factor that we believe drives age differences in the meanings given to intrusive thought recurrences is the relative value given to various life goals by younger and older adults. Major lifespan theories, such as the Selection, Optimization and Compensation model (SOC; Baltes & Baltes, 1990) and the Optimization in Primary and Secondary control across the lifespan model (OPS; Heckhausen, 1997; Heckhausen & Schulz, 1995), converge in their predictions of the way that goals should change across the lifespan. According to these theories, age-related declines in biological and

cognitive resources act as catalysts that change the types of goals that a person will pursue (Baltes, 1987; Heckhausen & Schulz, 1995). In younger adulthood, a time of limited biological and cognitive constraints, adults are faced with the challenge of selecting and pursuing goals that maximize their growth and development. Because each selection necessarily entails not selecting other possible goals (e.g., choosing to pursue a career in medicine means that one cannot spend the next several years pursuing journalism), it is important for younger adults to perceive their growth as proceeding successfully. For older adults, the number of possible growth paths has been whittled down due to previous selections and decreased cognitive and biological plasticity. Instead, the reality of age-related decline becomes a primary focus when selecting goals (Heckhausen & Schulz, 1995). Successful aging is expected to entail selecting goals that successfully maintain and compensate for the loss of cognitive and biological functioning, as well as those that emphasize emotional functioning (see Carstensen, 1993, 1995).

Similar support for the proposed age differences in the meanings given to recurrences of intrusive thoughts comes from the literature on feared selves (i.e., the self a person does not want to be but is concerned about possibly becoming; Markus & Nurius, 1986; Oyserman & Markus, 1990). Consistent with lifespan theories of goal orientation, researchers have found that the primary feared selves of older adults tend to involve losing cognitive or memory functioning (Dark-Freudeman, West, & Viverito, 2006), whereas the most common feared selves of younger adults involve failures in their development, such as not living up to their moral potential (Unemori, Omoregie, & Markus, 2004). In both cases, age groups appear to be particularly sensitive to evidence indicating that their age-relevant feared selves have come true. Existing evidence supports the idea that younger adults may be vulnerable to meanings reflecting failures in moral and emotional development (Ferrier & Brewin, 2005). In the current

studies, we expected that older adults would also assign and react emotionally to negative meanings that reflect age-relevant feared selves.

These age differences in goals and feared selves translate nicely onto the meanings that can be assigned to recurrences of intrusive thoughts. According to theories of intrusive thoughts, the meanings that should lead to the most distress and preoccupation with a particular thought are the ones that signify failure in valued goal and self-concept domains (Doron & Kyrios, 2005; Doron, Kyrios & Moulding, 2007). For both younger and older adults, the meanings that we expected to be 'maladaptive' were the ones reflecting the failure of valued age-relevant goals. In particular, the recurrence of an intrusive thought after attempted thought suppression could be perceived by younger adults as indicating a lack of moral development ("This thought about my mom being in a car accident came back; I am becoming a terribly immoral person."), or by older adults as a sign of declining cognitive ability ("I can't seem to get this thought out of my head; it must be a sign that I'm developing Alzheimer's."). Alternatively, a more adaptive meaning for both groups might be viewing the recurrence of the thought as having little meaning for their central goals ("This thought keeps returning, but thoughts do this occasionally. It doesn't have any particular significance.")

Trait Anxiety and Responses to Intrusive Thoughts

In addition to age group differences in the outcomes described above (i.e., recurrence of intrusive thoughts, meanings assigned to these recurrences, and their likelihood of causing distress), trait anxiety was expected to be an important moderator of responses to intrusive thoughts. Trait anxiety is important to consider for responses to intrusive thoughts because it is common among adults, relevant to a wide variety of mental health problems, and has been implicated in many clinical disorders (Barlow, Allen, & Choate, 2004). Previous researchers have suggested that negative affect, which is core to trait anxiety, should predict greater distress and recurrence of intrusive

thoughts during suppression attempts (i.e., during initial responses to intrusive thoughts; Wyland & Forgas, 2007). In fact, trait anxiety may actually impair the executive functioning processes needed to successfully suppress intrusive thoughts (see Attentional Control Theory; Eysenck, Derakshan, Santos, & Calvo, 2007). Therefore, we expected that while trait anxiety would predict distress and difficulty with recurrence of intrusive thoughts for everyone, these effects would be particularly heightened for older adults who were already experiencing greater executive functioning impairments than younger adults. As a result, we examined the interaction between trait anxiety and age group to determine whether trait anxiety is a particularly important risk factor among older adults for experiencing recurrence and distress associated with intrusive thoughts.

Overview

Together, the current studies examined age differences in intrusive thoughts using a two-pronged approach. In study one, we investigated perceived and recorded difficulties with intrusive thought recurrences, and the subsequent distress that occurs when younger and older adults are asked to suppress an intrusive thought, as well as obtain descriptive information about the occurrence and meanings generally assigned to intrusive thoughts. In study two, we used within-subjects manipulations to examine the role of repeated exposure to intrusive thoughts and meanings ascribed to recurrences of intrusive thoughts across a series of three intrusive thoughts. These two studies tested age-related differences in the experience of intrusive thoughts and their resulting distress, and examined the hypothesis that the meanings ascribed to intrusive thought recurrences are central in determining when intrusive thoughts recur and lead to distress for both younger and older adults.

## Study 1

In study one, we investigated perceived and recorded difficulties with intrusive thought recurrences, and the subsequent distress that occurs when younger and older

adults are asked to suppress an intrusive thought. We also asked participants to report the characteristics of their everyday personal intrusive thoughts. We expected that older adults would initially experience *more* difficulties with intrusive thoughts during thought suppression, but will feel *less* distressed afterwards than younger adults. We also expected that older adults would report less preoccupation with intrusive thoughts and fewer negative meanings given to recurrences of intrusive thoughts in their everyday lives than younger adults.

## Method

### *Participants*

Participants were 51 younger adults (mean age = 22.0, *SD* = 3.4, Range = 18-30 years, 59% female) and 49 older adults (mean age = 73.3, *SD* = 6.1, Range = 65-84 years, 56% female) recruited from the community through newspaper advertisements, flyers, and referrals from other participants. Participants were recruited according to age, with the age groups being 18-30 or 65 and above years of age. The same recruitment methods were used for both age groups to increase their comparability. To increase the generalizability of the results, participants were not excluded based upon: a) self-reported physical health, b) current/past use of medications, c) educational attainment, or d) current/past psychiatric diagnoses. All participants were evaluated for cognitive impairment with the Mini Mental Status Exam (MMSE; Folstein, Folstein, & McHugh, 1975), and scored above the screening cutoff score of 24, which indicatives significant cognitive impairment. Ethnicity was reported as ~73% Caucasian, 12% African-American, 6% Asian, and 9% indicating other or a multi-racial/ethnic background, of whom 2% reported having a Hispanic or Latino origin and 2% indicated having a Native American or American Indian origin.

*Questionnaires*[2]

*Affect.*

The *Positive and Negative Affect Schedule* (PANAS; Watson, Clark, & Tellegen, 1988) is a 20-item scale that assessed participants' state affect at baseline and following two thinking periods. The scale has separate 10-item subscales for positive and negative affect, demonstrates good psychometric properties, and has been shown to be valid and reliable in a sample aged 18 to 91 (see Crawford & Henry, 2004). Participants completed the state version of the scale. The average Cronbach's alpha across the three administrations of the scale was .90 for negative affect and .90 for positive affect.

*Anxiety Symptom Measures.*

The *Obsessive-Compulsive Inventory-Revised* (OCI-R; Foa et al., 2002) measures overall severity of OCD symptoms and is appropriate for a nonclinical sample. The 18-item measure provides subscales for specific symptom domains (i.e., Washing, Checking, Ordering, Obsessing, Hoarding, and Neutralizing) in addition to a total score, has good test-retest reliability and demonstrates convergent validity with other measures of OCD symptoms (Foa et al., 2002). Each item assesses how much participants were distressed or bothered by a symptom over the past month, with ratings on a 5-point scale ranging from 0 (not at all) to 4 (extremely). The OCI-R was included to assess age differences in obsessive-compulsive symptoms. Cronbach's alpha was .88 for the current sample.

The *State-Trait Anxiety Inventory-Trait Anxiety* scale (STAI-T; Speilberger, Gorusch, Lushene, Vagg, & Jacobs, 1983) is a widely used scale measuring the tendency to become anxious. The 20-item scale has good psychometric properties, and was used in the current study to measure trait anxiety. The STAI has been investigated

[2] Participants also completed the Thought Control Questionnaire (Wells & Davies, 1994), the Center for Epidemiological Studies-Depression scale (Radloff, 1977), and a measure of social and emotional goals. These measures were not used in the analyses for the current study.

in a sample of older adult outpatients with mixed psychiatric disorders (Kabacoff, Segal, Hersen, & Van Hasselt, 1997), and demonstrated good reliability (though there may be some differences in the factor structure across age cohorts; Kabacoff et al., 1997). We included the scale to examine expected age differences in general anxiety level. Cronbach's alpha was .79 for the current sample.

*Experiences with Intrusive Thoughts.*

A modifed version of the *Unusual Thoughts Checklist* (UTC; Woody, 2007) was used to assess the extent to which participants experience intrusive thoughts in everyday life. This 16-item checklist assessed the frequency of common types of intrusive thoughts, as well as the distress that participants associate with each type of intrusive thought they have experienced. The original measure was derived from lists of intrusive thoughts that are commonly reported in surveys (Kyrios, 2000; Rachman & de Silva, 1978), and was modified to include a 9-point Likert scale in order to record detailed information about each type of thought, rather than simply recording whether a person had experienced that type of thought before. We also added a question asking participants how much effort they put into attempting to control intrusive thoughts when they are experienced. We included this measure to gather information about baseline rates of intrusive thoughts across age groups, because little is currently known about the prevalence and content of intrusive thoughts in older adults' lives. Cronbach's alpha was .86 for the frequency subscale and .95 for the distress subscale.

We created the *Age-relevant Meaning of Intrusive Thoughts (AMIT;* Magee, Laughinghouse, Viar, Buck, & Teachman, 2009*)* scale to assess participants' beliefs about the meaning of their everyday intrusive thoughts. We used the Personal Significance Scale (Rachman, 2001) , a scale generally used with younger adults (Teachman & Clerkin, 2007; Teachman, Woody, & Magee, 2006), as a model. The newly developed AMIT scale assesses the personal meaning of intrusive thoughts in

three broad categories: cognitive decline, emotional dysfunction, and moral failing meanings. The meanings also encompass two development-related dimensions of growth versus loss: a) interpretations signifiying limits in one's potential for growth (e.g., "Are these thoughts a sign that your mind will not reach its potential?"), and b) interpretations signifying the decline/loss of functioning (e.g., "Are these thoughts a sign that your cognitive functioning is deteriorating?"). Factor analyses indicated that the final 23-item measure was best characterized by the three-factor solution of cognitive decline, emotional dysfunction, and moral failing meanings,[3] so we collapsed across the growth versus loss dimensions for analyses. Cronbach's alpha was .95 for cognitive decline, .93 for emotional dysfunction, and .94 for moral failing meanings

*Cognitive Functioning.*

The trail-making subtest of the *Delis-Kaplan Executive Function System* (TM; Delis, Kaplan, & Kramer, 2001) was used to assess the ability to inhibit attention to supraliminally-presented stimuli. In this task, participants were asked to connect circles on a paper as quickly as they could, without making mistakes. The test was administered in four parts in a set order: one part connecting sequenced number targets individually, one part connecting sequenced letter targets individually, one part connecting alternating number and letter targets, and one part assessing motor speed when tracing dotted lines between circles. For all tasks, the time to complete the task was recorded as the outcome measure. The ability of a person to inhibit attention to task-irrelevant stimuli was inferred by subtracting the time taken on the sequenced

[3] We conducted an exploratory factor analysis using principal axis factoring (following Obsessive Compulsive Cognitions Working Group, 2005) with promax rotation. We retained three factors accounting for 70% of the total variance after inspection of a scree plot and the eigenvalues. At the item level, we retained items with loadings of at least .40 that loaded exclusively on one of the three factors. This resulted in retention of 26 of the original 30 items, of which we kept 23 items for the final scale because they loaded on the three factors as hypothesized. Additionally, confirmatory factor analyses comparing this three-factor solution to alternative models (one-factor, two-factor growth versus decline, and six-factor emotional/cognitive/moral by growth/decline) revealed that the three-factor solution provided the best model according to fit indices and parsimony.

numbers task from that taken on the alternating task. This test has been validated and standardized using a nationally representative sample and is appropriate for participants between the ages of 8 and 89 (Delis et al., 2001). We included this measure to examine how differences in executive functioning relevant to thought suppression impact the recurrence of intrusive thoughts during suppression.

The *Mini Mental State Examination* (MMSE; Folstein et al., 1975) was included as a screener for dementia. This brief, standardized method evaluates cognitive status by assessing orientation, attention, recall, and language. All participants scored above the recommended cutoff of 24 (as cited in Tombaugh & McIntyre, 1992), and thus were included in the analyses.

*Thought stimulus.*

For the thinking periods, the experimenter provided participants with an intrusive thought that paralleled real-life intrusive thoughts by being high in unpleasantness and perceived immorality (Rachman & de Silva, 1978). For the current study, the thought "I hope my friend is in a car accident" was used, which we have used successfully in past research with younger adults (Magee & Teachman, 2007; Rachman, Shafran, Mitchell, Trant, & Teachman, 1996). Upon initially encountering the thought during the study, older adults rated the thought similarly to younger adults on all dimensions assessed, including unpleasantness, immorality, imagery, distress associated with the thought, whether they had previously experienced the thought, and how frequently they had experienced the thought (all $p$'s > .10). These ratings indicate that prior to thinking about the thought during the thinking periods, younger and older adults perceived the characteristics of the thought to be similar.

*Difficulty with Intrusive Thoughts, and Suppression Effort.*

During thought monitoring/suppression periods, participants recorded the *recurrence of intrusive thoughts* by pressing the space bar on the computer keyboard to

record the frequency and duration of each thought. Whenever participants experienced the experimental thought, they pressed and held down the space bar for the duration of the thought. With this approach, we were able to compute the duration (accuracy to at least a tenth of a second) of every thought as reported by the participant. Piloting indicated that participants could easily learn to use this thought recording system, and inspection of the final data revealed that the majority of participants followed instructions successfully (only 4% of participants pressed an incorrect key during one of the periods, and all of these participants pressed the wrong button consistently throughout the thinking period, which was interpreted as tracking the thought using the wrong button). Frequency and duration were log transformed due to positive skew, and after transformation were moderately correlated during the first ($r$ = .31, $p$ = .002, $N$ = 96) and second ($r$ = .45, $p$ < .001, $N$ = 96) thinking periods. We did not have different hypotheses for frequency and duration, so to increase reliability and simplify the analyses, we averaged the two transformed measures to provide the 'thought recurrence' composite score.

After each period, participants rated *suppression effort* by answering the question "Rate how hard you tried <u>not</u> to think about this thought during the period." The target thought was displayed on the screen along with the question to ensure ratings were made about the correct thought. Participants rated effort on a scale of one to five, with the scale labels being "I didn't try at all," "I tried, but only a little bit," "I tried a moderate amount," "I tried rather hard," and "I tried as hard as possible."

After rating suppression effort, participants rated *perceived difficulty with intrusive thought recurrence.* They were asked to "Rate how much difficulty you experienced keeping this thought out of your mind." The target thought was displayed on the screen along with the question to ensure ratings were made about the correct thought. Participants rated perceived difficulty on a one to five scale, with the scale labels being

"No difficulty," "A little difficulty," "Some difficulty," "Significant difficulty," and "Extreme difficulty."

*Procedure*

Participants were told that the study was about the link between thoughts and emotions; aging and age differences were not mentioned. After informed consent, participants completed the PANAS to assess baseline positive and negative affect. Next, participants completed a focusing/practice period. For this period, participants wrote out the thought "I hope my friend is in a car accident" and then focused on that thought for forty seconds while recording the duration of each thought occurrence by pressing and holding down the space bar. Participants lifted their fingers and pressed nothing whenever they thought about anything other than the assigned thought. Upon finishing this period, all participants were given a final verbal check of understanding about the keyboard system. If needed, the experimenter repeated and explained the keyboard instructions until participants were able to repeat back verbally the correct procedure.

Participants were next randomly assigned to receive either thought suppression or monitoring instructions for the four-minute experimental thinking period. During this period, participants once again monitored the car accident thought using the space bar. In the *thought suppression* condition, participants received the following instructions: "For this period, I would like you to try <u>not</u> to think about the thought you just focused on. If you do think about that thought, please mark that you did because this is very important information for us, but try your best not to think about that thought." Participants in the *monitoring* condition were told: "For this period, think about whatever you would like - it could be the thought you thought about before, or it could be anything else. If you do think about the thought, please mark that you did because this is very

important information for us." The experimenter referenced the intrusive thought in the monitoring instructions to control for its priming in the thought suppression instructions.

Upon completion of the experimental four-minute thinking period, the computer prompted participants to rate how much effort they put into suppressing the thought. Participants next rated how much difficulty they experienced at keeping the thought out of their mind. Participants then completed the PANAS a second time to assess affect after the first thinking period. Next, participants completed a second four-minute thinking period. In this period, all participants received the monitoring instructions described previously. Participants again recorded their thoughts using the keyboard system, and completed the PANAS after the period. After this was completed, measures of trait anxiety (STAI-T), obsessive-compulsive symptoms (OCI-R), experiences with intrusive thoughts (UTC), and personal meanings of intrusive thought recurrences (AMIT) were administered in random order. Participants completed these measures at the end of the experiment to avoid priming particular thinking strategies or revealing the purpose of the study. After these questionnaires, the experimenter administered the trail making measure (TM) and MMSE in counterbalanced order. These cognitive functioning measures were administered after the rest of the questionnaires to avoid priming concerns about declines in cognitive functioning. Additionally, the questionnaires that were administered before the cognitive functioning measures generally took participants around 30 to 45 minutes to complete, allowing participants' affect significant time to return to baseline levels. This design feature was intended to minimize any likely influence of heightened residual affect from the intrusive thought tasks on the cognitive performance measures (e.g., Hill, van Boxtel, Ponds, Houx, & Jolles, 2005). Finally, participants completed a measure of demographic information and were debriefed.

## Results

### *Sample Characteristics*

Means and standard deviations for the measures of obsessive-compulsive symptoms (OCI-R), trait anxiety (STAI-T), executive functioning (TM), and cognitive impairment (MMSE) are listed in Table 1 by age group. T-tests showed that older adults did not differ from younger adults on the total OCI-R ($t_{(98)}$ = .61, $p$ = .54, $d$ = .12). In line with previous research on trait anxiety (Stanley, Beck, & Zebb, 1996), executive functioning (Zacks, Radvansky, & Hasher, 1996; Salthouse et al., 2003), and cognitive impairment (Folstein et al., 1975), older adults reported less trait anxiety on the STAI-T ($t_{(1,94)}$ = 2.19, $p$ = .03, $d$ = .45), poorer executive functioning on the TM ($t_{(70.8)}$[4] = 2.99, $p$ = .004, $d$ = .71) and more cognitive impairment on the MMSE ($t_{(71.5)}$ = 3.13, $p$ = .003, $d$ = .74). Chi-square tests indicated that there were no differences between the age groups for gender ($\chi^2_{(1, N=99)}$ = 0.07, $p$ = .80), although older adults were less ethnically diverse than younger adults ($\chi^2_{(1, N=99)}$ = 25.08, $p$ < .001), with ethnicity coded as Caucasian versus other.[5]

The monitoring and suppression instruction groups did not differ on the OCI-R ($t_{(98)}$ = .44, $p$ = .66, $d$ = .09), STAI-T ($t_{(94)}$ = 1.51, $p$ = .14, $d$ = .31), TM ($t_{(85)}$ = .26, $p$ = .79, $d$ = .06), or MMSE ($t_{(86.2)}$ = 1.82, $p$ = .07, $d$ = .39), indicating that randomization was successful. There were also no differences between the monitoring and suppression instruction groups for gender ($\chi^2_{(1, N=99)}$ = 0.24, $p$ = .62) or ethnicity ($\chi^2_{(1, N=99)}$ = 0.38, $p$ = .54).

*Age Differences in Everyday Intrusive Thoughts and Their Meaning*

First, we tested the hypothesis that older adults would report more meanings about intrusive thought recurrences concerning cognitive decline compared to younger

[4] For t-tests, Levine's test for equality of variances was used, and degrees of freedom were corrected when variances significantly differed.

[5] Due to the large percentage of Caucasians in the older adult group, we could not examine ethnicity as a covariate. However, when we excluded non-Caucasians and compared younger and older adults, the pattern of results was similar to the reported results using the full sample, suggesting that ethnic group differences across age groups are unlikely to account for the observed age differences.

adults, but would report fewer negative meanings outside of this older adult-relevant domain. Using the AMIT, we conducted a 2 (age group) X 3 (type of meaning: cognitive decline, moral failure, emotion dysregulation) repeated-measures ANOVA in which age group was a between-subjects factor and type of meaning was a within-subjects factor. There was no main effect of age group ($F_{(1,91)}$ = .00, $p$ = 1.00, $\eta^2_p$ < .001), indicating that the age groups did not differ in overall negative meanings endorsed across domains. However, as seen in Figure 2, the age group by type of meaning interaction was significant ($F_{(2,90)}$ = 15.19, $p$ < .001, $\eta^2_p$ = .25), in line with hypotheses. Follow-up t-tests indicated that, as expected, older (versus younger) adults reported more cognitive decline meanings ($t_{(1,69)}$ = 2.78, $p$ = .007, $d$ = .67), and fewer moral failure meanings ($t_{(1,82)}$ = 2.09, $p$ = .04, $d$ = .46). Unexpectedly, the age groups did not differ in emotion dysregulation meanings ($t_{(1,91)}$ = 1.16, $p$ = .25, $d$ = .24).

Next, we conducted within-subjects tests for the type of meaning within each age group individually, and used Least Significant Difference (LSD) comparisons of two time points to isolate the source of any significant effect. Within age-groups, both older ($F_{(2,42)}$ = 15.64, $p$ < .001, $\eta^2_p$ = .43) and younger ($F_{(2,47)}$ = 9.62, $p$ < .001, $\eta^2_p$ = .29) adults showed significant differences across the types of meanings given to intrusive thoughts. Follow-up LSD tests revealed that older adults endorsed significantly more cognitive decline meanings than emotional dysfunction ($p$ = .03) or moral failure ($p$ < .001) ones, and endorsed more emotional dysfunction meanings than moral failure ones ($p$ < .001). Younger adults reported more emotion dysregulation meanings than cognitive decline ($p$ < .001) or moral failure ($p$ = .004) ones, and did not show different endorsement of cognitive decline and moral failure meanings ($p$ = .10). Together, these results support the idea that younger and older adults interpret their everyday intrusive thoughts in line with age-relevant concerns, particularly within cognitive decline and moral failure domains.

We then tested age differences in the frequency and distress associated with common types of everyday intrusive thoughts using the UTC. We expected that older adults would report less frequent everyday intrusive thoughts than younger adults, and less distress associated with those thoughts when experienced. These hypotheses reflected the expected impact of enhanced emotion regulation skills for older adults in the long-term, and differed from our hypotheses about recurrence of intrusive thoughts during initial, short-term exposure to intrusive thoughts. We tested these hypotheses using two methods. First, to generate summary scores of intrusive thought frequency, we calculated an average for each individual across the fifteen categories of intrusive thoughts on the UTC. However, because difficulties with intrusive thoughts often center on one or a few specific thoughts, we also examined individuals' single most frequent unwanted thought. Similarly, for all thoughts on the UTC that were endorsed as having been experienced previously, we calculated an individual average of the distress associated with those thoughts, and then evaluated individuals' single most distressing thought.

For the average across intrusive thoughts, as expected, older adults ($M$ = 1.84, $SD$ = .87) reported less frequency than younger adults ($M$ = 2.76, $SD$ = 1.33; $t_{(86.6)}$ = 4.12, $p$ < .001, $d$ = .89). (Note, a rating of one corresponds to having never experienced that intrusive thought, a rating of two refers to less than once per six months, and a rating of three refers to once per three to six months.) Also, for the single most frequent thought, older adults ($M$ = 4.73, $SD$ = 2.52) reported a lower frequency for this thought than younger adults ($M$ = 6.61, $SD$ = 2.36; $t_{(98)}$ = 3.84, $p$ < .001, $d$ = .78). The older adult mean rating was near the scale label of five, "between once per week and once per month," while the younger adult rating was near the scale label of seven, "at least between once per day and once per several days."

For ratings of distress associated with previously experienced intrusive thoughts for the UTC overall, the difference between older ($M$ = 3.72, $SD$ = 1.72) and younger adults ($M$ = 4.44, $SD$ = 1.80) was in the expected direction ($t_{(90)}$ = 1.96, $p$ < .06, $d$ = .41), although it did not quite reach significance. Both groups were closer to the scale label "moderately distressing" (a rating of five) than the label "no problem" (a rating of one). For the single most distressing thought, in line with hypotheses, older adults ($M$ = 5.26, $SD$ = 2.57) reported less distress for this thought than younger adults ($M$ = 6.82, $SD$ = 2.27; $t_{(90)}$ = 3.09, $p$ = .003, $d$ = .65). Therefore, the results suggest that older adults report less frequent intrusive thoughts across a range of thoughts, and that when examining individuals' most troublesome thoughts, older adults experience these thoughts less frequently and with less distress. These results largely support the idea of enhanced long-term emotional processing of intrusive thoughts by older adults.

*Age Differences in Distress Following Induction of an Intrusive Thought*

To test whether older adults would show less emotional reactivity after being induced to experience an intrusive thought, we examined positive and negative affect separately, because the two measures of affect were negligibly correlated ($r$'s = -.07, .06, and .05, respectively at baseline and then following periods one and two)[6]. To evaluate positive affect, we conducted a 2 (age group) X 2 (thinking instructions: suppression, monitoring) X 3 (time: baseline, period one, period two) repeated-measures ANOVA in which age group and thinking instructions were between-subjects variables while time was within-subjects. There was an expected main effect of age ($F_{(1,96)}$ = 18.36, $p$ < .001, $\eta^2_p$ = .16), with older adults showing greater positive affect throughout the study than younger adults. There was no main effect of thinking instructions ($F_{(1,96)}$ = .65, $p$ = .42, $\eta^2_p$ = .007). The main effect of age group was qualified by an age group by

[6] The relative independence of positive and negative affect is in line with the results reported by Watson and Clark (1994) in the manual for the PANAS-X, as well as other researchers investigating older adults (Brose, personal communication, October 16, 2008).

time interaction ($F_{(2,95)}$ = 3.41, $p$ = .04, $\eta^2_p$ = .07). To follow up this interaction, we first examined t-tests comparing the age groups at each time point. We then examined the effect of time within each age group to see if positive affect significantly varied across time using LSD comparisons. See Figure 3a for results.

T-tests revealed that older adults reported greater positive affect at baseline ($t_{(98)}$ = 3.19, $p$ = .002, $d$ = .64), and for periods one ($t_{(98)}$ = 4.18, $p$ < .001, $d$ = .84) and two ($t_{(98)}$ = 4.40, $p$ < .001, $d$ = .89) compared to younger adults. Within-age-group follow-up tests revealed that for older adults, there was no significant effect of time ($F_{(2,47)}$ = 2.46, $p$ = .10, $\eta^2_p$ = .10), indicating that positive affect remained relatively stable throughout the study. However, for younger adults, there was a significant effect of time ($F_{(2,49)}$ = 14.08, $p$ < .001, $\eta^2_p$ = .37), with younger adults endorsing greater positive affect at baseline than periods one or two (both $p$'s < .001). Positive affect for thinking periods one and two did not differ ($p$ = .23) for younger adults, indicating that positive affect dropped after initially engaging with an intrusive thought and did not return to baseline levels. These results suggest that older adults began the study with greater positive affect and, in line with predictions, experienced steadier positive affect than younger adults after encountering an intrusive thought.

In addition to age group effects, the interaction of thinking instructions with time was also significant ($F_{(2,95)}$ = 5.74, $p$ = .004, $\eta^2_p$ = .11). T-tests showed that the two thinking instruction conditions did not differ at baseline ($t_{(98)}$ = .49, $p$ = .63, $d$ = .10), period one ($t_{(98)}$ = 1.71, $p$ = .09, $d$ = .35), or period two ($t_{(98)}$ = .98, $p$ = .33, $d$ = .20). However, within-instruction group follow-up tests revealed that participants assigned to monitor intrusive thoughts showed a significant effect of time ($F_{(2,48)}$ = 13.63, $p$ < .001, $\eta^2_p$ = .36), with positive affect at baseline being higher than periods one and two (both $p$'s < .001). Positive affect for periods one and two did not differ ($p$ = .70). For suppression instructions, positive affect did not significantly vary across time ($F_{(2,48)}$ =

2.49, $p$ = .09, $\eta^2_p$ = .09). Thus, consistent with past research, suppression instructions were associated with better short-term maintenance of mood than monitoring instructions. Finally, neither the age group by thinking instructions interaction ($F_{(1,96)}$ = 1.10, $p$ = .30, $\eta^2_p$ = .01), nor the three-way age group by thinking instructions by time interaction was significant ($F_{(2,95)}$ = 2.37, $p$ = .10, $\eta^2_p$ = .05).

For negative affect, we conducted the same analyses; however, a different pattern emerged (see Figure 3b). Neither the main effects of age group ($F_{(1,96)}$ = 2.80, $p$ = .10, $\eta^2_p$ = .03) nor thinking instructions ($F_{(1,96)}$ = 1.67, $p$ = .20, $\eta^2_p$ = .02) were significant. As with positive affect, there was a significant time by age interaction ($F_{(2,95)}$ = 3.82, $p$ = .03, $\eta^2_p$ = .08). T-tests revealed that older adults reported less negative affect than younger adults at baseline ($t_{(98)}$ = 2.25, $p$ = .03, $d$ = .45), but the two age groups did not differ for periods one ($t_{(98)}$ = 1.74, $p$ = .09, $d$ = .35) or two ($t_{(98)}$ = .56, $p$ = .58, $d$ = .11).

Follow-up tests within each age group showed that time had a significant effect in both older ($F_{(2,47)}$ = 6.52, $p$ = .003, $\eta^2_p$ = .22) and younger ($F_{(2,49)}$ = 18.92, $p$ < .001, $\eta^2_p$ = .44) adults. LSD tests showed that both older and younger adults reported increased negative affect from baseline to period one ($p$ = .01 and $p$ = .003, respectively), and decreased negative affect from period one to period two ($p$ = .001 and $p$ < .001, respectively). However, younger adults reported levels of negative affect for period two *below* their baseline level ($p$ = .02), whereas older adults' levels of negative affect did not differ between baseline and period two ($p$ = .51). Finally, the time by thinking instructions interaction ($F_{(2,95)}$ = .93, $p$ =.40, $\eta^2_p$ = .02), the age group by thinking instructions interaction ($F_{(1,96)}$ = 1.62, $p$ =.21, $\eta^2_p$ = .02), and the three-way interaction ($F_{(2,95)}$ = .85, $p$ = .43, $\eta^2_p$ = .02) were all non-significant. These results suggest that, contrary to expectations, both groups show similar initial reactivity in negative affect to an intrusive thought, followed by similar dissipation of negative affect during the second

(monitoring) period. However, younger adults' negative affect was reduced below baseline levels, unlike older adults. Overall, the patterns of results indicated dissociation between the two types of affect: older adults experienced steadier positive affect than younger adults throughout the study, but both age groups showed largely similar reactivity for negative affect, followed by greater residual negative affect by older adults.

*Age Differences in Difficulty with Intrusive Thought Recurrence*

To examine whether older adults perceived greater difficulty keeping the intrusive thought out of mind (based on self-report) compared to younger adults, we conducted a 2 (age group) X 2 (thinking instructions: suppression, monitoring) X 2 (time: period one, period two) repeated-measures ANOVA, with age group and thinking instructions as between-subjects variables, and time as the within-subjects variable. The main effect of age group did not reach significance ($F_{(1,92)} = 3.23$, $p = .08$, $\eta^2_p = .03$), although the means were in the direction of older adults reporting greater overall perceived difficulty than younger adults. There was a significant age group by time interaction ($F_{(1,92)} = 7.85$, $p = .006$, $\eta^2_p = .08$). Looking at each time point individually, older adults ($M = 2.74$, $SD = 1.20$) did not differ in perceived difficulty from younger adults ($M = 2.68$, $SD = 1.10$; $t_{(94)} = .25$, $p = .80$ , $d = .05$) during period one, but reported greater perceived difficulty in period two ($M = 2.46$, $SD = 1.17$) than younger adults ($M = 1.82$, $SD = .83$; $t_{(80.3)} = 3.06$, $p = .003$, $d = .68$). None of the other main effects, two or three-way interactions were significant (all $p$'s > .10). Thus, it appears that, as expected, older adults experienced subjectively greater difficulty keeping intrusive thoughts out of mind during the second thinking period.

Interestingly, when examining actual reported thought recurrence as tracked by participants during the thinking periods, the results did not appear to match the perceptions of younger and older adults. This was surprising given our expectations that deficits in executive functioning would impair older adults' ability to control intrusive

thoughts and these data would thus match older adults' perceptions of difficulty. For thought recurrence, we conducted a 2 (age group) X 2 (thinking instructions: suppression, monitoring) X 2 (time: period one, period two) repeated-measures ANOVA. [7] There were no main effects for age group ($F_{(1,92)}$ = .38, $p$ = .54, $\eta^2_p$ = .004) or thinking instructions ($F_{(1,92)}$ = .37, $p$ = .55, $\eta^2_p$ = .004), and none of the two or three way interactions were significant (all p's > .10). There was a significant effect of time ($F_{(1,92)}$ = 21.77, $p$ < .001, $\eta^2_p$ = .19), such that recurrence decreased from the first to the second period. Therefore, it appeared that while older adults perceived greater difficulty keeping thoughts out of mind than younger adults during the second thinking period, the age groups did not perform significantly differently according to the recurrence of thoughts they recorded during the thinking periods.

*Suppression Effort in Relation to Difficulty with Intrusive Thought Recurrence*

In a follow-up analysis, we used regression analysis to test whether suppression effort would mediate the relationship between age group and perceived difficulty keeping thoughts out of mind during the second period. This test examined the possibility that the use of greater suppression effort by older adults would account for their greater perceptions of difficulty, despite no actual measured differences in intrusive thought recurrence. Age group was entered with the older adult group coded with a one and the younger adult group coded with a zero; therefore, positive standardized coefficients indicate a positive relationship with older adults. First, we found that older adults indeed reported greater suppression effort than younger adults during the second thinking period ($\beta$ = .40, $p$ < .001). Further, we found that greater suppression effort significantly predicted greater perceived difficulty for the second period ($\beta$ = .62, $p$ < .001). Finally and most importantly, the relationship between age group and perceived difficulty was

[7] We also reran the analysis using frequency and duration as separate variables. The effect sizes and pattern of results were similar to when the two variables were combined, so we present results using this composite score.

reduced from $\beta$ = .31, $p$ = .003 to $\beta$ = .06, $p$ = .48 once suppression effort was entered into a regression with age group predicting perceived difficulty. Sobel's test statistic was 3.74 ($p$ < .001), indicating that the greater suppression effort reported by older adults for the second period appeared to account for their greater perceived difficulty suppressing the thought compared to younger adults. We also checked whether perceived difficulty would account for age differences in suppression effort, but found that this reversed model did not show significant mediation.

Finally, we also explored whether age differences in suppression effort (as well as whether meanings given to everyday intrusive thoughts, or executive functioning) would mediate the age differences in positive and negative affect. To test this, we calculated change scores for each type of affect by subtracting ratings at baseline from those at period two[8], but none of these potential mediators accounted for the age differences in affect.

*Trait Anxiety and Executive Functioning as Moderators of Responses to Intrusive Thoughts*

In addition to our primary analyses, we also hypothesized that participants' level of trait anxiety and executive functioning would moderate their responses to intrusive thoughts. Generally, we expected that greater trait anxiety and poorer executive functioning would relate to poorer responding to intrusive thoughts. We expected that these relationships would be particularly heightened among older adults due to this group already having lower levels of executive functioning on average compared to younger adults. In other words, we expected that older adults would have a weaker buffer against the impairing effects of trait anxiety and poorer executive functioning. To test these hypotheses, we reran the main analyses described above while entering

[8] These results were the same when mediation was conducted using residual change scores, which unlike simple difference change scores are uncorrelated with the initial value.

either trait anxiety or executive functioning as a continuous moderator. To reduce possible problems due to multicollinearity, we centered both moderator variables before conducting the analyses by subtracting the group mean from each participant's score. We also square root transformed the executive functioning variable before centering due to positive skew. In addition to the main effects of each moderator, we report only the interactions involving age group, as the other factors were less related to our primary questions.

*Trait Anxiety.* We began by examining the main effect of trait anxiety on the key responses to intrusive thoughts (i.e., assigned meanings, positive and negative affect, perceived difficulty, thought recurrence). Higher levels of trait anxiety predicted greater negative meanings endorsed across domains ($F_{(1,84)} = 20.69$, $p < .001$, $\eta^2_p = .20$), greater average frequency of everyday intrusive thoughts ($F_{(1,91)} = 13.64$, $p < .001$, $\eta^2_p = .13$), as well as the frequency of the single most frequent intrusive thought ($F_{(1,91)} = 8.64$, $p = .004$, $\eta^2_p = .09$). Greater trait anxiety also predicted greater average distress associated with everyday thoughts ($F_{(1,84)} = 5.09$, $p < .03$, $\eta^2_p = .06$), as well as distress regarding individuals' single most distressing intrusive thought ($F_{(1,84)} = 7.86$, $p = .006$, $\eta^2_p = .09$). Greater trait anxiety predicted greater negative affect across time points ($F_{(1,88)} = 12.87$, $p = .001$, $\eta^2_p = .13$) and showed a trend toward predicting greater recurrence of intrusive thoughts across periods ($F_{(1,85)} = 3.75$, $p < .06$, $\eta^2_p = .04$). Trait anxiety did not predict positive affect or perceived difficulty keeping thoughts out of mind (both $p$'s > .10).

None of the trait anxiety by age group interactions reached significance (all $p$'s > .10), and none of the three way interactions including trait anxiety and age group reached significance, except for meanings. Here, the trait anxiety by age group by meanings subscale interaction showed a nonsignificant trend ($F_{(2,83)} = 2.76$, $p < .07$, $\eta^2_p = .06$). Follow-up tests examining one age group at a time revealed that there was no trait anxiety by subscale interaction for older adults ($F_{(2,36)} = 2.21$, $p = .13$, $\eta^2_p = .11$) but there

was for younger adults ($F_{(2,46)}$ = 3.47, $p$ = .04, $\eta^2_p$ = .13). Examining one subscale at a time within younger adults, we found that trait anxiety predicted cognitive decline ($r$ = .32, $p$ = .02, $N$ = 49) and emotional dysfunction ($r$ = .48, $p$ < .001, $N$ = 49) meanings, but did not reach significance for moral failure ($r$ = .25, $p$ = .09, $N$ = 49) meanings.

*Executive Functioning.* Poorer executive functioning predicted less positive affect across periods ($F_{(1,92)}$ = 7.87, $p$ =.006, $\eta^2_p$ = .08). None of the other main effects were significant (all $p$'s > .10). For the two and three way interactions including age group, there was only an executive functioning by age group by subscale interaction for meanings assigned to intrusive thoughts ($F_{(2,88)}$ = 4.92, $p$ =.009, $\eta^2_p$ = .10). Follow-up tests revealed that there was an executive functioning by subscale interaction for older ($F_{(2,41)}$ = 3.88, $p$ < .03, $\eta^2_p$ = .16), but not younger ($F_{(2,46)}$ = 2.21, $p$ =.12, $\eta^2_p$ = .09) adults. Examining one subscale at a time within older adults, poorer executive functioning predicted greater endorsement of cognitive decline meanings ($r$ = .33, $p$ = .03, $N$ = 44), but not emotional dysfunction ($r$ = .13, $p$ = .42, $N$ = 44) or moral failure ($r$ = .01, $p$ = .96, $N$ = 44) meanings.

The results for trait anxiety and executive functioning suggest that for the most part, these moderators predicted responding to intrusive thoughts broadly across age groups. Trait anxiety showed a stronger pattern of relationships than executive functioning, showing expected relationships with greater negative meanings, poorer experiences with everyday intrusive thoughts, and greater negative affect when engaging with an intrusive thought. However, executive functioning did show an interaction with age group suggesting that older adults with poorer executive functioning were the most prone to endorsing meanings about cognitive decline.

## Discussion

Study one incorporated a lifespan perspective into existing theories of intrusive thoughts to examine age-related differences in the experience of intrusive thoughts, the

meanings assigned to intrusive thought recurrences, and their likelihood of causing distress. In line with lifespan theories that suggest emotion regulation advantages for older adults (e.g., socioemotional selectivity theory; Carstensen, 1993, 1995), we found that older (versus younger) adults experienced steadier and higher levels of positive affect when experiencing intrusive thoughts. Older adults reported generally less frequent and distressing everyday intrusive thoughts, and were less likely to view recurrences of these intrusive thoughts as a sign of moral failure. However, older (compared to younger) adults also more readily interpreted their intrusive thought recurrences as a sign of declining cognitive functioning, and perceived greater difficulty keeping an intrusive thought out of mind during the second thinking period, despite no age differences in actual recorded recurrence. Both older and younger adults reported a largely similar rise and fall of negative affect after an intrusive thought, with younger adults' negative affect eventually declining below baseline levels. Finally, an exploratory analysis suggested that the deployment of suppression effort may be key for understanding age differences in perceptions of difficulty suppressing intrusive thoughts, because greater suppression effort mediated older (versus younger) adults' greater perceived difficulty keeping the intrusive thought out of mind during the second thinking period. Together, these results advance theories of intrusive thoughts by providing important descriptive data about possible risk and protective factors for older adults' emotion regulation following intrusive thoughts.

## Study 2

Study one found that older adults assign different meanings to intrusive thought recurrences than younger adults, and experience critical short- and longer-term emotion regulation differences from younger adults with intrusive thoughts. Study two sought to extend these findings by testing the impact of repeated experiences with intrusive thoughts. During study two, participants suppressed and monitored a series of three

intrusive thoughts while we manipulated the meanings given to the return of intrusive thoughts by younger and older adults. First, we asked younger and older adults to suppress an intrusive thought, and assessed the meanings individuals ascribe to intrusive thought recurrences when no particular meaning is emphasized in the instructions. We expected that despite initially experiencing more perceived and/or actual difficulties with intrusive thought recurrence during thought suppression, older adults would apply fewer negative meanings to recurrences of their intrusive thoughts, and as a result feel less distressed than younger adults. Second, we provided instructions manipulating the meaning assigned to a second recurrent intrusive thought. We tested the hypothesis that inducing participants to interpret recurrences of a second intrusive thought as indicative of declining cognitive functioning would eliminate the age difference in distress predicted for the no meaning condition (because older adults, in particular, would experience more distress in this condition relative to the no meaning condition). Finally, we provided instructions for a third recurrent intrusive thought by inducing participants to interpret recurrences as a sign of poor moral and emotional functioning. This meaning was expected to lead younger adults to experience greater distress compared to older adults than was evident under control instructions. Together, the aim was to test the recurrence and distress associated with intrusive thoughts over repeated experiences and a variety of age-relevant meanings (see middle portion of proposed model in Figure 1).

## Method

### *Participants*

Younger (*N* = 35, mean age = 22.1, *SD* = 3.3, Range = 18-30 years, 64% female) and older (*N* = 36, mean age = 74.1, *SD* = 7.7, Range = 65-94 years, 69% female) adults were recruited from the community using the same methods as used in study one. All participants were evaluated for cognitive impairment with the Mini Mental

Status Exam (MMSE; Folstei et al., 1975), and scored above the screening cutoff score of 24. Ethnicity was reported as ~72% Caucasian, 13% Asian, 7% African-American, and 7% indicating other or a multi-racial/ethnic background. One person (1%) chose not to report ethnicity.

*Questionnaires*[9]

Study two used the same questionnaires as those used in study one with four important modifications. First, we no longer administered the UTC or OCI-R, as study two was not intended to assess general rates of intrusive thoughts and obsessive-compulsive symptoms. Second, we substituted the Positive and Negative Affect Schedule – Expanded (PANAS-X; Watson & Clark, 1994) in place of the PANAS subscales for the measure of affect. This allowed us to use the identical general negative affect subscale shared by the PANAS and PANAS-X, but for positive affect to use the joviality subscale in place of the general positive affect scale used in study one. We made the switch to attempt to better capture the specific positive feelings likely to lessen in response to intrusive thoughts (e.g., joyful, delighted), rather than assessing more general positive states (e.g., attentive, active), although it should be noted that the two subscales show substantial overlap, with correlations above $r = .80$ (Watson & Clark, 1994). Third, we modified the AMIT in order to measure the meanings given to intrusive thoughts during each of the three thinking sequences. To shorten the measure, we chose the three items with the highest loadings for each of the three subscales (i.e., cognitive decline, emotional dysfunction, and moral failure). Fourth, for the trailmaking task (TM), we only administered two of the four parts from study one: one part in which participants connected sequenced number targets individually, and one part in which

[9] Upon initially viewing each thought used in the study, participants made ratings for a variety of characteristics including negative valence, immorality, imagery, how distressing the thought was, previous experience with the thought and previous experience attempting to control the thought. These measures were not used for the current study.

they connected alternating number and letter targets. As before, the time to complete the task was recorded as the outcome measure, and executive functioning was inferred by subtracting the time taken on the sequenced numbers task from that taken on the alternating task.

*Thought Stimuli*

Three different thoughts were used for the three sequences of thinking periods (the order of these thoughts was counterbalanced between participants). All thoughts were examples of intrusive thoughts that parallel real-life intrusive thoughts by being high in unpleasantness and perceived immorality (Rachman & de Silva, 1978). We used the thought from study one, "I hope my friend is in a car accident," and the thoughts "I hope my neighbor gets cancer," and "I wish my family member's house would burn down." Pilot data indicated these thoughts to be matched for distress, frequency of experience, and relevance to the concerns of older and younger adults, as rated by younger (*N* = 20) and older adults (*N* = 17).

*Assessment of Thought Frequency and Duration During Thinking Periods*

The same procedures used in study one were used to record the frequency and duration of intrusive thoughts.

*Procedure*

Figure 4 displays the main components of the study two design. As in study one, participants completed a series of thinking periods. For this study, participants completed three separate sequences that each included three stages: 1) focusing on an intrusive thought, 2) suppressing the thought, 3) monitoring that intrusive thought. The second stage of this thinking sequence was different from study one, in which participants were randomly assigned to either suppress or monitor the intrusive thought. Instead, all participants in study two were instructed to suppress the thought. This change was intended to ensure that nearly all participants would experience some

recurrence of intrusive thoughts (Magee & Teachman, 2007), enabling us to test hypotheses about emotional experiences after intrusive thought recurrences. In terms of the three within-subjects conditions, the key difference was the particular instructions participants received before the suppression period.

Upon entering, participants were told that the study was about the link between thoughts and feelings, and that they would be asked to identify and reflect on thoughts during the study. After informed consent, participants completed the PANAS-X to assess baseline positive and negative affect before the thought sequences. Next, participants completed a thought focusing/practice period. For this period, participants wrote out the assigned thought (one of the three counterbalanced thought stimuli) and then focused on that thought for thirty seconds while recording the frequency and duration of each thought occurrence by pressing and holding down the space bar. Participants lifted their fingers and pressed nothing whenever they thought about anything other than the assigned thought.

Next, all participants received thought suppression instructions for a two-minute thinking period. During this period, participants once again recorded recurrences of the provided intrusive thought using the space bar. Upon completion of the suppression period, the computer prompted participants to rate how much effort they put into suppressing the thought. Participants also rated how much difficulty they experienced in keeping the thought out of their mind.

Participants next completed the AMIT, assessing the meanings they ascribed to recurrences of this thought during the suppression period, and then completed the PANAS-X a second time to report their affect experienced during the first thinking period. Participants then engaged in a second two-minute thinking period. During this period, all participants received the monitoring instructions described previously. After this period, participants rated how much effort they put into suppressing the thought, how much

difficulty they experienced in keeping the thought out of mind, and their affect experienced during the second thinking period.

After this initial thinking period sequence, we verbally checked with participants to ascertain their current distress on a scale of 1 to 5 (matching the scale from the PANAS-X). For participants experiencing distress that was more than one point above their baseline PANAS-X rating of distress, the experimenter led the participant through a standardized script for diaphragmatic breathing (see Appendix E), and repeated the breathing exercise up to three times until participants' distress ratings fell within one point of their baseline. Following this procedure, all participants began the second thinking sequence with distress ratings no more than one point above baseline.

Participants next repeated the thinking sequence a second and third time, each time receiving a unique thought, as well as instructions intended to induce the participant to believe a particular meaning about the recurrence of this particular intrusive thought. During the second sequence, participants were provided with instructions intended to frame the recurrence of the intrusive thought as indicative of deteriorating cognitive functioning, and the third time, poor moral and emotional growth.[10] In order to induce participants to believe each of these meanings, we used a deception in which participants were told that either high or low levels of white noise (counterbalanced within participants) could reveal difficulties with a person's memory and brain functioning, or moral and emotional growth. The manipulation is described in more detail below. Participants completed the AMIT as a manipulation check after each suppression period, leading to a total of three measurements, one for each thinking sequence. Participants also completed the PANAS-X immediately after the suppression

[10] The order of these two manipulations was fixed due to the possibility that participants might become suspicious after a second reframing of the intrusive thought recurrence. Thus, we ensured that the more novel manipulation relevant to older adults would always come first and be less likely to be influenced by suspicion.

and monitoring periods in each sequence, leading to a total of seven affect measurements throughout the course of the study (one baseline and one after each of the three suppression and monitoring periods).

For the second thinking sequence, participants began by again completing a thought focusing/practice period. For this period, participants wrote out the assigned thought and then focused on that thought for thirty seconds while recording the frequency and duration of each thought occurrence by pressing and holding down the space bar. Upon completion of the focusing/practice period, the experimenter informed the participant that there would be an additional two minute thinking period, then introduced the first manipulation with the following directions: "For this period, we are entering the novel portion of our study. We are trying to replicate in our lab a finding from several other psychology labs that we find a bit strange, but seems to be rather consistent. Please read over this short summary about findings we are studying." The experimenter then handed the participant a paper that read:

> Next you will participate in thinking periods while a [high/low] level of white noise plays in the background.
>
> A 2007 study we conducted with the National Institutes of Health found that white noise has the ability to reveal difficulties with adults' thinking. The study found that even among healthier adults, thinking while a [high/low] level of white noise plays tends to reveal the worsening of a person's memory and brain functioning.
>
> Specifically, we found that with a [high/low] level of white noise playing, the thought in the current thinking periods tends to return more often for people who are beginning to experience difficulties with their memory and brain functioning.

The experimenter then queried: "So did you understand what the summary said? Since this is novel, we want people to understand the memory and brain functioning part." We

included this verbal check to ensure that all participants had understood the manipulation. Before leaving the room, the experimenter provided participants with the same suppression instructions as before, and then switched on the white noise machine to the appropriate setting (high or low). For the remainder of the thinking sequences, the experimenter turned the white noise on for the thinking periods, and off when participants were receiving instructions.

After the suppression period ended, participants completed a short check of understanding to assess whether they had retained the manipulation information correctly (see Appendix E). Participants then completed the AMIT, and the PANAS-X. Participants were then asked to complete a monitoring period using the same instructions described previously. At the end of this monitoring period participants completed another PANAS-X, and the diaphragmatic breathing procedure was used to ensure that ratings of distress were no more than one point above baseline before proceeding to the third thinking sequence.

The third thinking sequence was conducted the same way as the second one, but introduced a unique thought, and different manipulation instructions. This time, after the focusing/practice period the experimenter read: “Alright, this is the other novel part of the study that I was telling you about before. You will be asked to participate in another thinking period while keeping track of the thought you just thought about. The next thinking period will last two minutes. Please read over this short summary about the findings we are studying.” This time, participants read the following summary:

> Next you will participate in thinking periods while a [high/low] level of white noise plays in the background.
>
> As described previously, the National Institutes of Health study found that white noise has the ability to reveal difficulties with adults’ thinking. The study found that even among healthy adults, thinking while a [high/low] level of white

> noise plays tends to reveal limitations in a person's potential for moral and emotional growth.
>
> Past research has shown that with a [high/low] level of white noise playing, the thought in the current thinking periods tends to return more often for people who are beginning to experience difficulties with their moral and emotional growth.

The experimenter again verbally checked understanding by asking: "Do you understand what the summary said? This part is different than before, and we want people to understand the moral and emotional growth part." The same procedure used for the second thinking sequence was used for the remainder of the third sequence.

After the thinking sequences were completed, a measure of trait anxiety (STAI-T) was administered, followed by the TM and MMSE in counterbalanced order. Participants completed these measures at the end of the experiment to avoid priming particular thinking strategies or cognitive decline concerns, or revealing the purpose of the study. Finally, participants completed a measure of demographic information and were debriefed. Participants received a funnel debriefing (see Appendix E) in which their suspicions about the study were assessed with increasingly specific questions (i.e., general probes for suspicions about the study followed by specific probes assessing suspicions about the manipulations).

*Data Reduction*

We chose to include all participants in analyses rather than excluding anyone based on their reported suspicions or incorrect answers to the verbal checks of each manipulation. This choice was intended to maximize statistical power without altering the general pattern of results shown by these smaller subsets. For suspicions about the manipulation, only one participant expressed suspicion when asked for general reactions to the study. For incorrect answers to the verbal checks of each manipulation, 38 out of

49 participants who were administered the check correctly answered the cognitive decline manipulation check, whereas 42/48 correctly answered the moral and emotional growth manipulation check. While the general pattern of results was largely similar whether or not we excluded participants based upon these criteria, a summary of the results for the smaller subset is presented at the end of the results section.

## Results

### *Sample Characteristics*

Means and standard deviations for the measures of trait anxiety (STAI-T), executive functioning (TM), and cognitive impairment (MMSE) are listed in Table 2 by age group. In line with previous research on trait anxiety (Stanley, Beck, & Zebb, 1996) and executive functioning (Salthouse et al., 2003; Zacks, Radvansky, & Hasher, 1996), older adults reported less trait anxiety on the STAI-T ($t_{(69)} = 2.50$, $p < .02$, $d = .60$), and showed poorer executive functioning on the TM ($t_{(48.2)} = 4.04$, $p < .001$, $d = 1.16$) than younger adults. Cognitive impairment on the MMSE did not differ between the age groups ($t_{(69)} = 1.59$, $p = .12$, $d = .38$), but the means were in the direction of older adults having lower scores. Chi-square tests indicated that there were no differences between the age groups for gender ($\chi^2_{(1, N=71)} = 0.01$, $p = .93$), although older adults were less ethnically diverse than younger adults ($\chi^2_{(1, N=71)} = 14.20$, $p < .001$), with ethnicity coded as Caucasian versus other[11].

### *Manipulation Check*

Before conducting the main analyses, we examined whether there were differences in the types of meanings assigned to intrusive thoughts (on the AMIT) in response to the within-person meaning manipulations. We expected that certain

[11] Due to the large percentage of Caucasians in the older adult group, we could not examine ethnicity as a covariate. However, when we excluded non-Caucasians and compared younger and older adults, the pattern of results was similar to the reported results using the full sample, suggesting that ethnic group differences across age groups are unlikely to account for the observed age differences.

negative meanings given to intrusive thoughts would increase for both age groups during the second and third thinking sequences. Specifically, we hypothesized that the increase in meanings would match the manipulations: cognitive decline meanings would increase during the second thinking sequence, whereas the emotional and moral domains would increase during the third thinking sequence. To test these questions, we conducted a 3 (thinking sequence: no meaning sequence, sequence two, sequence three) X 3 (type of meaning: cognitive decline, moral failure, emotional dysfunction) repeated measures ANOVA. Thinking sequence and type of meaning were both within-subjects factors. (Given that hypotheses were the same for both older and younger adults for this manipulation check, age was not included as a factor.)

First, we examined the main effect of thinking sequence, but found that overall endorsement of meanings did not show a change across the three thinking sequences ($F_{(2,69)}$ = .41, $p$ = .67, $\eta^2_p$ = .01). Additionally, contrary to expectations, there was no thinking sequence by type of meaning interaction ($F_{(4,67)}$ = .49, $p$ = .75, $\eta^2_p$ = .03), indicating that the three types of meanings did not show differing patterns of change across the thinking sequences. Thus, the results seem to indicate that the AMIT measure did not pick up changes in the meanings assigned to intrusive thoughts after the manipulations. In light of this finding, we do not interpret the following analyses in terms of the differing effects of the meanings manipulations. Instead, we focus on the other major difference in the design choice from study one: the prolonged engagement participants had with suppressing and then monitoring intrusive thoughts across the three thinking sequences.

*Age Differences in Meanings Assigned to Intrusive Thoughts*

We sought to replicate the findings from study one that older adults tend to preferentially assign meanings to intrusive thought recurrences that have to do with cognitive decline, whereas younger adults report more moral failure meanings. Because

this hypothesis was not time-specific and we did not find evidence that meanings shifted according to the within-subjects manipulations, we first computed an average for type of meaning across the three thinking sequences. We then conducted a 2 (age group) X 3 (type of meaning) ANOVA on the computed meaning averages. See Figure 5 for results. First, in line with the trend found in study one, we found a main effect of age group ($F_{(1,69)} = 4.54$, $p < .04$, $\eta^2_p = .06$), with older adults reporting fewer negative meanings across domains than younger adults. This main effect was qualified by the expected interaction between age group and type of meaning ($F_{(2,68)} = 7.88$, $p = .001$, $\eta^2_p = .19$).

T-tests comparing the age groups one type of meaning at a time revealed that unexpectedly, older and younger adults did not differ in cognitive decline meanings ($t_{(69)} = .53$, $p = .60$, $d = .13$). This finding contradicted study one, in which older adults endorsed more cognitive decline meanings than younger adults. However, older adults endorsed fewer moral failure meanings than younger adults ($t_{(41.4)} = 2.62$, $p < .02$, $d = .81$), replicating the finding from study one. Older adults also reported fewer emotional dysfunction meanings than younger adults ($t_{(55.6)} = 2.52$, $p < .02$, $d = .68$). This difference was not found in study one, although the means of the age groups were in the same direction in both studies.

To further follow up on the interaction and replicate the analyses from study one, we compared the meanings assigned to intrusive thoughts within each age group. For each age group, we conducted a repeated measures ANOVA with the three types of meanings as the within-subjects factor. Both older ($F_{(2,34)} = 6.81$, $p = .003$, $\eta^2_p = .29$) and younger ($F_{(2,33)} = 7.27$, $p = .002$, $\eta^2_p = .31$) adults showed differential endorsement across the three types of meanings given to intrusive thoughts. Follow-up LSD tests indicated that older adults endorsed more cognitive decline ($p = .002$) and emotional dysfunction meanings ($p < .02$) than moral failure meanings. Older adults did not show a

difference between their endorsement of cognitive decline and emotional dysfunction meanings ($p$ = .47). The only difference between these findings and those from study one was that older adults reported significantly more cognitive decline meanings than emotional dysfunction ones in study one. However, it should be noted that in both studies, the ordering of the means was the same: cognitive decline, then emotional dysfunction, then moral failure meanings. For younger adults, the pattern also largely replicated study one. Emotional dysfunction meanings were more highly endorsed than cognitive decline meanings ($p$ < .001), while there was a nonsignificant trend toward younger adults endorsing more moral failure meanings than cognitive decline ones ($p$ = .07). Finally, there was no difference between moral failure and emotional dysfunction ($p$ = .16) meanings among younger adults. These results differed from the study one finding that younger adults endorsed more emotional dysfunction than moral failure meanings. Nevertheless, like older adults, across both studies the ordering of the means was the same: emotional dysfunction, then moral failure, then cognitive decline meanings.

Together, the between- and within-age group results generally support the idea that younger and older adults interpret intrusive thought recurrences according to age-relevant concerns. While older adults unexpectedly did not endorse more cognitive decline meanings than younger adults in study two, in both studies these meanings were among the most frequently assigned meanings for older adults. Conversely, for younger adults in both studies, emotional dysfunction meanings were consistently among the most frequently assigned meanings, while cognitive decline meanings were among the least likely meanings to be endorsed. Finally, there was a consistent age difference for moral failure meanings across studies, with older adults reporting fewer moral failure meanings than younger adults.

*Age Differences in Distress Following Induction of an Intrusive Thought*

Although there did not appear to be shifts in meanings after the manipulations, we still hypothesized that older adults would show less emotional reactivity over the three thinking sequences than younger adults. As in study one, we examined positive and negative affect separately due to their relatively low correlation (average of $r$ = -.23 across the seven ratings). In order to simplify our interpretation of the seven ratings (one at baseline, and one at the end of each suppression and monitoring period for each of the three thinking sequences), we computed change scores. For each of the post-suppression and post-monitoring ratings, we subtracted the baseline rating of positive or negative affect, leaving six change scores. Therefore, all affect results should be interpreted in terms of affect relative to baseline. We conducted repeated measures ANOVAs separately for positive and negative affect: 2 (age group) X 3 (thinking sequence) X 2 (thinking instructions: suppression vs. monitoring). Age group was a between-subjects factor, whereas thinking sequence and thinking instructions were within-subjects factors. The thinking sequence factor allowed us to examine changes in distress across a series of three thinking sequences, which was novel to study two. The thinking instructions factor allowed us to examine changes according to thinking instructions within each of the three sequences, replicating the analyses from study one.

For positive affect, we first examined whether the older adults would report greater positive affect relative to their baseline across thinking sequences and instructions. However, the main effect of age group showed no difference ($F_{(1,68)}$ = .00, $p$ = .99, $\eta^2_p$ < .001), indicating that both age groups showed similar positive affect relative to baseline (see Figure 6a). Next, we examined whether positive affect differed according to thinking sequence or thinking instructions. There was no main effect of thinking sequence ($F_{(2,67)}$ = .45, $p$ = .64, $\eta^2_p$ = .01) nor an age group by thinking sequence interaction ($F_{(2,67)}$ = 1.32, $p$ = .27, $\eta^2_p$ = .04), suggesting that positive affect did not differ across the three thinking sequences. However, there was a main effect of

thinking instructions ($F_{(1,68)}$ = 43.68, $p$ < .001, $\eta^2_p$ = .39), with less positive affect during suppression than monitoring (i.e., positive affect was lower during the suppression period than at baseline but then returned closer to baseline during monitoring).

This main effect of thinking instructions was qualified by a thinking instruction by age group interaction ($F_{(1,68)}$ = 6.44, $p$ = .01, $\eta^2_p$ = .09). Follow-up t-tests demonstrated that the two age groups did not differ for suppression ($t_{(69)}$ = .50, $p$ = .62, $d$ = .12) or monitoring ($t_{(69)}$ = .62, $p$ = .54, $d$ = .15) instructions, and both younger ($t_{(34)}$ = 6.17, $p$ < .001, $\eta^2_p$ = .53) and older ($t_{(35)}$ = 3.26, $p$ = .002, $\eta^2_p$ = .23) adults showed increases in positive affect between the suppression and monitoring instructions. Although the age group comparison for each thinking instruction was not significant, further examination of the means clarified the source of the interaction. The means revealed that relative to younger adults, older adults experienced less reactivity across thinking instructions (see Figure 6a). Specifically, during the suppression periods older adults did not report as much of a decrease from baseline in positive affect as younger adults. Older adults then did not report as much of a return toward baseline in positive affect as younger adults during the subsequent monitoring periods. This pattern supports the study one results for positive affect, which also indicated that older adults reported a steadier level of positive affect during engagement with an intrusive thought. Finally, the age group by thinking sequence by thinking instruction interaction was not significant ($F_{(2,67)}$ = .30, $p$ = .74, $\eta^2_p$ = .009).

For negative affect, we found no main effect of age group (see Figure 6b; $F_{(1,68)}$ = .54, $p$ = .47, $\eta^2_p$ = .008). There was a main effect of thinking sequence ($F_{(2,67)}$ = 9.44, $p$ < .001, $\eta^2_p$ = .22), indicating that negative affect differed across the three thinking sequences. Follow-up LSD tests comparing two sequences at a time indicated that negative affect ratings were higher (relative to baseline) during the no meaning sequence compared to the second ($p$ < .02) and third ($p$ < .001) sequences. The

second sequence was also higher than the third sequence ($p$ = .04). These results suggest that negative affect gradually decreased across the three thinking sequences after an initial increase from baseline. There was no interaction between age group and thinking sequence ($F_{(2,67)}$ = 2.31, $p$ < .11, $\eta^2_p$ = .06).

As with positive affect, there was also a main effect of thinking instructions ($F_{(1,68)}$ = 31.57, $p$ < .001, $\eta^2_p$ = .32); the means showed that there was a relative increase in negative affect during suppression periods, followed by a relative decrease during the monitoring periods (see Figure 6b). Again, the main effect of thinking instruction was qualified by a thinking instruction by age group interaction ($F_{(1,68)}$ = 9.73, $p$ = .003, $\eta^2_p$ = .013). Follow-up t-tests showed that both age groups experienced similarly elevated negative affect following suppression periods ($t_{(69)}$ = .55 $p$ = .58, $d$ = .13), but older adults showed greater residual negative affect during monitoring ($t_{(69)}$ = 2.01 $p$ < .05, $d$ = .48). Finally, the age group by thinking sequence by thinking instruction interaction was not significant ($F_{(2,67)}$ = 2.29, $p$ = .11, $\eta^2_p$ = .06).

The study two results for distress appeared to extend the results from study one across the three sequences of intrusive thoughts. Replicating the pattern found in study one, older adults experienced steadier levels of positive affect throughout the study. Further, the negative affect results resembled study one. Both younger and older adults experienced similar increases in negative affect by the end of the suppression periods, but older adults reported more residual negative affect by the end of the monitoring periods.

*Age Differences in Difficulty with Intrusive Thought Recurrence*

To examine whether older adults perceived greater difficulty keeping the intrusive thoughts out of mind (based on self-report) compared to younger adults, we conducted a 2 (age group) X 3 (thinking sequence) X 2 (thinking instructions) repeated-measures ANOVA.

Consistent with hypotheses, there was a nonsignificant trend for the main effect of age group ($F_{(1,69)}$ = 3.79, $p$ < .06, $\eta^2_p$ = .05), with older adults reporting greater perceived difficulty across thinking sequences and thinking instructions than younger adults. This finding matches the trend found for the main effect of age group in study one. While the main effect of thinking sequence was not significant ($F_{(2,68)}$ = .57, $p$ = .57, $\eta^2_p$ = .02), there was a main effect of thinking instructions ($F_{(1,69)}$ = 33.67, $p$ < .001, $\eta^2_p$ = .33). As expected, participants reported greater perceived difficulty during the suppression periods compared to the subsequent monitoring periods. None of the other two or three-way interactions with age group reached significance (all $p$'s > .10).

Next, we examined reported thought recurrence as tracked by participants during the thinking periods. As described above, thought recurrence was computed by log transforming the two measures of thought recurrence, frequency and duration, and then averaging them to provide one recurrence score. We then conducted a 2 (age group) X 3 (thinking sequence) X 2 (thinking instructions) repeated-measures ANOVA. As found in study one, older and younger adults did not differ in thought recurrence when we examined the main effect of age group ($F_{(1,69)}$ = 1.50, $p$ =.23, $\eta^2_p$ = .02). [12] There was a main effect of thinking sequence ($F_{(2,68)}$ = 8.82, $p$ < .001, $\eta^2_p$ = .21). Follow-up LSD tests showed that thought recurrence did not differ between the no meaning and second sequences ($p$ = .40), but both the no meaning sequence ($p$ = .001) and the second sequence ($p$ = .002) had greater recurrence than the third sequence. Next, we examined the main effect of thinking instructions, and found that participants experienced greater thought recurrence for suppression instructions compared to the subsequent monitoring instructions ($F_{(1,69)}$ = 21.02, $p$ < .001, $\eta^2_p$ = .23), matching the

[12] We reran this analysis using frequency and duration as separate variables. The only discrepant result from the finding when the variables were combined was a significant main effect of age group on thought frequency, with older adults reporting fewer recurrences of intrusive thoughts ($F_{(1,69)}$ = 4.46, $p$ < .04, $\eta^2_p$ = .06). The remaining pattern of results was similar to when the two variables were combined.

results of study one. None of the other two or three-way interactions with age group reached significance (all *p*'s > .10).

Together, the results for perceived difficulty and the recurrence of intrusive thoughts generally supported the results for study one: older adults showed a trend toward perceiving greater difficulty keeping intrusive thoughts out of mind, while not showing any differences in the actual recorded recurrence of intrusive thoughts.

*Suppression Effort in Relation to Difficulty with Intrusive Thought Recurrence and Distress*

Next, we sought to replicate the study one finding that greater suppression effort mediated older adults' greater perceived difficulty keeping intrusive thoughts out of mind. Even though perceived difficulty in study two showed only a trend toward differing between age groups, we went ahead with the test due to the similar pattern found in study one. We used regression analysis, and expanded our analysis from study one by looking at suppression effort and perceived difficulty over the course of the entire study (given no age group by thinking instructions interaction), rather than solely examining the monitoring periods. To examine the pattern across the entire study, we averaged across the six ratings for suppression effort and for perceived difficulty, providing one score for each.

Age group was entered with the older adult group coded with a one and the younger adult group coded with a zero; therefore, positive standardized coefficients indicate a positive relationship with older adults. First, we found that older adults indeed reported greater suppression effort than younger adults over the course of the study ($\beta$ = .31, $p$ = .01). Further, we found that greater suppression effort significantly predicted greater perceived difficulty ($\beta$ = .77, $p$ < .001). Finally, and most importantly, the relationship between age group and perceived difficulty was reduced from $\beta$ = .23, $p$ <

.06 to β = -.01, *p* = .91 once suppression effort was entered into a regression with age group predicting perceived difficulty. Thus, the magnitude of the regression coefficient was almost completely reduced once suppression effort was entered. Additionally, Sobel's test statistic was 2.58 (*p* = .01), indicating that the greater suppression effort reported by older adults appeared to account for the trend toward greater perceived difficulty suppressing thoughts compared to younger adults. As in study one, we also checked whether perceived difficulty would account for age differences in suppression effort, but found that this reversed model did not show significant mediation. Thus, in both studies we found that suppression effort appeared to be a key mediator of age differences in perceived difficulty.

Finally, we examined whether suppression effort would mediate older adults' more stable positive affect, or their greater residual negative affect during the monitoring instructions. When examining positive effect, we found that the average suppression effort across thinking periods did not predict the change in positive affect between the suppression and monitoring periods (β = -.03, *p* = .80), negating the possibility of potential mediation. To examine negative affect and effort during the monitoring instructions, we averaged across the three thinking sequences, providing one score for each variable. First, we found that older adults reported greater suppression effort during monitoring instructions than younger adults (β = .35, *p* = .003). Further, we found that greater suppression effort significantly predicted more residual negative affect during monitoring instructions (β = .44, *p* < .001). Most importantly, the relationship between age group and negative affect was reduced from β = .24, *p* < .05 to β = .09, *p* = .42 once suppression effort was entered into a regression with age group predicting perceived difficulty. Sobel's test statistic was 2.46 (*p* = .01), indicating that the greater suppression effort reported by older adults appeared to account for their greater

negative affect relative to baseline when following monitoring instructions. When we also checked whether negative affect during monitoring instructions would account for age differences in suppression effort, we found that this reversed model did not show significant mediation. Therefore, suppression effort appeared to be an important mediator of perceived difficulty across the study, as well as changes in negative affect during monitoring instructions.

*Trait Anxiety and Executive Functioning as Moderators of Responses to Intrusive Thoughts*

In addition to our primary analyses, we also hypothesized that participants' level of trait anxiety and executive functioning would moderate their responses to intrusive thoughts. Generally, we expected that greater trait anxiety and poorer executive functioning would relate to poorer responding to intrusive thoughts. We expected that these relationships would be particularly heightened among older adults due to this group already having lower levels of executive functioning on average compared to younger adults. To test these hypotheses, we reran the main analyses described above while entering either trait anxiety or executive functioning as a continuous moderator. To reduce possible problems due to multicollinearity, we centered both moderator variables before conducting the analyses by subtracting the group mean from each participant's score. We also square root transformed the executive functioning variable before centering due to positive skew. In addition to the main effects of each moderator, we report only the interactions involving age group, as the other factors were less related to our primary questions.

*Trait Anxiety*. We began by examining the main effect of trait anxiety on the key responses to intrusive thoughts (i.e., assigned meanings, positive and negative affect, perceived difficulty, thought recurrence). We found that as expected, higher levels of trait anxiety trended toward predicting more negative meanings across subscales ($F_{(1,67)}$

= 3.50, $p < .07$, $\eta^2_p = .05$). Also as expected, trait anxiety predicted greater perceived difficulty keeping thoughts out of mind ($F_{(1,67)} = 8.05$, $p = .006$, $\eta^2_p = .11$) and greater recurrence of thoughts ($F_{(1,67)} = 4.12$, $p < .05$, $\eta^2_p = .06$). Surprisingly, trait anxiety did not predict changes in positive or negative affect relative to baseline (both *p*'s > .10).

Next, we examined the interaction of age group and trait anxiety on the key responses to intrusive thoughts. As expected, we found an interaction for perceived difficulty ($F_{(1,67)} = 6.55$, $p = .01$, $\eta^2_p = .09$). Follow-up tests examining one age group at a time revealed that trait anxiety was related to more perceived difficulty for older ($F_{(1,34)} = 12.67$, $p = .001$, $\eta^2_p = .27$), but not younger ($F_{(1,33)} = .05$, $p = .83$, $\eta^2_p = .001$) adults, in line with our expectations of stronger moderating effects of trait anxiety for older adults. None of the other outcomes showed age group by trait anxiety interactions (all *p*'s > .10). Together, these results suggest that trait anxiety showed more of a link with the non-affective outcomes. Significantly, there was support for the hypothesis that trait anxiety would predict relatively poorer responding for older adults compared to younger adults, but only when it came to perceived difficulty.

*Executive Functioning.* Next, we examined the other predicted moderator, executive functioning. For these analyses, none of the main effects of executive functioning or interactions including age group reached significance (all *p*'s < .10). Thus, executive functioning did not appear to be strongly linked to poorer responding to intrusive thoughts.

*Subset Analyses*

Finally, to check whether results may have been different when using more stringent criteria for participant inclusion, we reran the main analyses with a subset of the sample. Specifically, we included only participants who answered each question about the two within-person manipulations correctly and expressed no suspicions about the study after a general prompt. Eight younger and 14 older adults were not

administered the questions, leaving 27 younger and 21 older adults. Of these, eight younger and seven older adults were excluded due to answering these questions incorrectly, whereas only one younger adult was excluded due to expressing suspicions. The final subset included 18 younger and 15 older adults.

The results appeared similar to those using the whole sample for meanings in response to the manipulations, as well as for age differences in the meanings assigned to intrusive thought recurrences, positive and negative affect, and perceived difficulty. Frequently, results that were significant with the entire sample were reduced to trends or non-significance, but in all cases the direction of the means was the same as with the whole sample. Further, the effect sizes were generally comparable to those found with the larger sample.

The only novel finding occurred for recorded recurrence of thoughts, in which there was a significant interaction of age group with thinking instructions ($F_{(1,31)} = 5.35$, $p < .03$, $\eta^2_p = .15$). Inspection of the marginal means indicated that older adults experienced a steeper drop in thought recurrence from suppression to monitoring than younger adults. This differed from the larger sample, in which both age groups showed similar drops in recurrence from suppression to monitoring. Overall, the pattern of results was similar whether using the entire sample or a smaller subset, supporting use of the full sample.

## Discussion

The results for study two extended many of the findings from study one across a series of three intrusive thought thinking sequences. While the measure of meanings given to intrusive thoughts did not show change according to the within-person manipulations, this extension was important for generalizing the findings across novel thoughts, alternative meanings presented to participants about the return of intrusive thoughts, and prolonged engagement with intrusive thoughts. Several significant novel

results emerged in study two, including the finding that increased suppression effort accounted for greater residual negative affect by older adults. When combined with the replicated findings from study one, these results suggest that in addition to age-related protective factors (i.e., assigning fewer meanings about moral failure, more stable positive affect), increased suppression effort may be a key risk factor for older adults when engaging with intrusive thoughts.

## General Discussion

Intrusive thoughts are common for both younger and older adults, but little is known about how older adults respond to these common stressors (Calamari, Janeck, & Deer, 2002). The current two studies reveal the complex nature of older adults' experiences with intrusive thoughts by identifying both age-related risk and protective factors for experiencing distress following intrusive thoughts. Regarding the meanings assigned to recurrences of intrusive thoughts, older adults in both studies were less likely to view intrusive thought recurrences as a sign of moral failure than younger adults. However, older adults consistently rated the return of intrusive thoughts as a sign of declining cognitive functioning, as much as or more so than ratings assigned to other types of meanings. This is in line with the idea that this age-relevant meaning is a primary concern for older adults. With respect to distress following the return of intrusive thoughts, in both studies older adults reported steadier levels of positive affect than younger adults, but exhibited greater residual negative affect than younger adults. Regarding difficulty with recurrence of intrusive thoughts, across studies older adults showed a trend toward perceiving greater difficulty keeping intrusive thoughts out of mind, while not showing any differences in the actual recorded recurrence of intrusive thoughts. Suppression effort emerged as an important mediator of age differences in responding to intrusive thoughts. Older adults reported that they expended greater effort (than younger adults) in attempting to suppress intrusive thoughts, a strategy that

mediated older adults' trend toward greater perceived difficulty keeping intrusive thoughts out of mind in each study. Greater suppression effort also mediated the higher residual negative affect by older adults in study two, perhaps pointing to a negative consequence of greater suppression effort as a response style to intrusive thoughts.

These results inform cognitive models of intrusive thoughts and contribute to the growing body of work examining lifespan influences on responding to intrusive thoughts. They also identify concerns about cognitive decline as a crucial potential risk factor for the development of psychopathology in older adults. In terms of the model proposed in Figure 1, the results offered mixed support. In particular, the portions of the model involving age differences in difficulty with the recurrence of intrusive thoughts and resulting distress need refinement to incorporate the more complex pattern of results. The portion of the model predicting age-relevant meanings was largely supported. Figure 7 displays a revised working model of age-relevant predictors of distress following recurrent, intrusive thoughts. This revised model accounts for the observed differences in these studies of age differences in thought suppression effort and separates distress into positive and negative affect, which followed consistently different trajectories across the current studies.

*Meanings Assigned to Intrusive Thoughts*

Much of the current work built upon cognitive models of intrusive thoughts, which predict that the meanings individuals assign to intrusive thoughts play a large role in determining the emotional consequences of the thought (Rachman, 1997; Salkovskis, 1998). In the current studies, we expanded upon the types of meanings previous researchers have considered by including meanings that are related to important age-relevant goals. While some researchers have theorized that aging-related goals might be important for intrusive thoughts (Calamari et al., 2002), most of the extant research was conducted almost exclusively with younger adults. Perhaps due to this sampling,

most research has focused on appraisals related to moral functioning, a domain that tends to be more highly valued by younger adults (Unemori et al., 2004). In line with this previous research, we found that younger adults did consistently endorse more moral failure meanings than older adults across studies. However, meanings about declining cognitive functioning were consistently among the most highly endorsed type of meanings for older adults, indicating that much of the current work on intrusive thoughts has overlooked what is possibly the greatest concern for older adults about recurrences of their intrusive thoughts. While lifespan theories have long noted the primary focus on age-related decline during goal selection for older adults, (Heckhausen & Schulz, 1995), these results highlight the need for clinical researchers to more fully consider adult development in models of psychopathology. For example, increased efforts could be made to incorporate assessments of fears about age-related decline into treatment studies and clinical work. Further, modular treatments for older adults might consider testing components that provide psychoeducation and cognitive restructuring specific to fears of cognitive decline. Like existing modular treatments for Generalized Anxiety Disorder in older adults (Wetherell et al., 2009), the use of this particular treatment component could be tailored according to older adults' needs.

*Emotional Responding to Intrusive Thoughts*

In general, older adulthood may be a time of relatively adaptive responding to intrusive thoughts in their usual everyday context. Older adults reported lower rates of everyday intrusive thoughts, and lower distress and frequency for their single most frequent or distressing intrusive thought, compared to younger adults. These findings are consistent with epidemiological studies showing lower rates of diagnosed conditions such as OCD among older adults (Brickman & Eisdorfer, 1989; Regier et al., 1988), and likely stem from a healthier long-term approach to intrusive thoughts compared to younger adults. Lifespan theories, such as socioemotional selectivity theory

(Carstensen, 1993, 1995), that emphasize some increased emotion regulation abilities in older adulthood may translate well, on average, to the experiences of intrusive thoughts in older adults. Specifically, these theories predict that older adults tend to emphasize motivated processing of positive information, while diminishing negative information. As we expected, this processing style extended to meanings given to intrusive thought recurrences based on the lower endorsement of some negative meanings by older, versus younger, adults (outside the domain of cognitive decline).

It should be noted that the age groups did not significantly differ in overall reported obsessive-compulsive symptoms in study one, similar to findings by Teachman (2007). On the one hand, it is possible that subclinical OCD symptoms do not show much of a difference among younger and older adults, but the symptoms are less likely to reach a diagnosable level for older adults. However, there could also be a methodological explanation for this difference between the age rates found for symptoms versus diagnoses. The measure used to assess OCD symptoms in the current study (OCI-R) asked about the distress associated with different symptoms, but did not determine the frequency with which the symptoms occur. When we assessed both frequency and distress associated with intrusive thoughts using the UTC, a measure conceptually related to the OCI-R, larger age differences were evident for reported frequency than for distress. Thus, older adults may still experience OCD symptoms less frequently than younger adults, in line with epidemiological studies of OCD diagnoses. When the symptoms do occur, older adults may experience somewhat less distress than younger adults (in line with Figure 1), but not to the same extent as the age differences in frequency.

When examining immediate emotional reactivity after engaging with intrusive thoughts, results unexpectedly diverged by type of affect. Across studies, older adults reported steadier levels of positive affect than younger adults in line with models

predicting optimization of positive affect by older adults (Labouvie-Vief & Medler, 2002). However, for negative affect, both age groups showed similar increases in negative affect after initially encountering an intrusive thought. Older adults then showed a subsequent lack of volatility compared to younger adults after this initial increase. This lack of volatility by older adults' was evident in their greater residual negative affect in both studies.

It should be noted that lifespan researchers frequently find divergences between positive and negative affect (Charles, Reynolds, & Gatz, 2001; Ong, Bergeman, Bisconti, & Wallace, 2006) and have tied these divergences directly to styles of emotion processing. Specifically, some recent research has suggested that older adults may recruit positive affect as a strategy when facing daily stressors and negative affect (Ong et al., 2006). Ong and colleagues (2006) examined how emotion regulation among older adults varied according to levels of trait resilience, which was conceptualized as the self-reported tendency to flexibly respond and adapt to stressors. Compared to less resilient peers, more resilient older adults reported higher levels of both positive and negative affect in response to initial stressors. Analyses of intraindividual changes in affect demonstrated that the positive affect experienced after a stressor appeared to dampen the ability of later stressors to generate negative affect (Ong et al., 2006). The authors interpreted these findings as evidence that emotional complexity (i.e., experiencing and processing of both positive and negative information) during stressful experiences is beneficial for 1) integrating negative affect rather than avoiding it, and 2) inducing positive affect that acts as a buffer against later stressors. According to this interpretation, striving to reduce initial negative affect may not be an adaptive coping strategy as it avoids necessary integration of negative information. Thus, the goal of optimizing positive affect can be distinct from the goal of reducing negative affect. Linking these findings to the present studies, it is possible that the pattern of positive and

negative affect demonstrated by older adults in the current studies represents heightened emotional complexity in the face of intrusive thought stressors. By experiencing and processing both positive and negative information, older adults could have been setting the stage for emotional benefits after later stressors.

On the other hand, these results parallel findings by Charles and Carstensen (2008) in which both older and younger adults experienced initial increases in sadness when encountering aversive stimuli, but older adults showed greater residual sadness with continued exposure compared to younger adults. To explain this pattern, Charles and Carstensen proposed that older adults adaptively attempt to head off distressing experiences by selectively avoiding them, but sometimes apply this strategy in situations that are not suited for avoidance. At these times, older adults may suffer worse emotional consequences than younger adults. The crux of this account is that when a stressor will recur in spite of avoidance attempts, avoidance is likely to be a poor strategy.

Intrusive thoughts appear to be one such stressor, as avoidance attempts frequently have the paradoxical effect of *increasing* the recurrence of those same intrusive thoughts (Wenzlaff & Wegner, 2000). In the current studies, the greater suppression effort by older adults, especially when coupled with its mediation of greater residual negative affect in study two, suggests that older adults attempted to avoid the intrusive thought (and the associated negative affect) when it was encountered. Notably, suppression effort did not mediate age differences in positive affect in either study. This increases the likelihood that suppression effort was an unsuccessful strategy that was intended to avoid a distressing environment, similar to the Charles and Carstensen (2008) explanation. Because suppression effort did not appear to aid older adults in recruiting positive affect, it is less likely that it reflects emotional complexity skills designed to create a buffer for future stressors (Ong et al., 2006).

This evidence suggests that the Figure 1 model should be amended to account for the timing of efforts to avoid distressing intrusive thought stimuli. The present results suggest that older adults are likely to use strategies intended to head off distressing environments, often with initial benefits. It is important to note that even thought suppression effort may not necessarily be maladaptive if conducted briefly. For example, thought suppression can be successful for short amounts of time, particularly when other cognitive demands are low and the thought is relatively discrete (versus elaborated; Abramowitz et al., 2001). However, an avoidance-focused coping style is likely to lead older adults to engage in prolonged avoidance strategies that have unintentionally maladaptive effects, such as continued thought suppression effort. Thus, the initial and prolonged use of avoidance strategies are likely due to both older-adult specific motivational (i.e., avoiding negative affect) and compensatory (i.e., compensating for perceived deficiencies in cognitive functioning) goals. The key distinction is whether older adults continue to use such efforts after evidence arises that they are unable to avoid a stressor.

The difference between the age comparisons for immediate emotional reactions (i.e., older adults reporting steadier positive affect and greater residual negative affect during laboratory engagement with intrusive thoughts) and those for reactions to everyday intrusive thoughts (i.e., older adults reporting less distressing everyday intrusive thoughts) may be due to the different time courses targeted. The laboratory portion of the study may have captured only the initial stages of emotion regulation, when older adults pursue the initial goal of avoiding the return of intrusive thoughts and any associated negative affect. With longer thinking periods or additional thinking sequences, it is possible that most older adults may begin to substantially reappraise and devalue the worth of suppressing intrusive thoughts.

In support of this interpretation, older adults showed increased suppression effort

compared to younger adults throughout much of each study, but suppression effort did decrease across the three thinking sequences of study two for both age groups. Given older adults' tendency to gradually devalue unsuccessful goal attempts (Heckhausen & Schultz, 1995), older adults would be likely to continue devaluing suppression attempts as time goes on. In terms of our proposed model, this devaluing would be expected to lead to less of a need to explain intrusive thought recurrences by assigning negative meanings. Further, lessened assignment of negative meanings to intrusive thought recurrences would be expected to lead to less negative affect after the thoughts, thus generating the precise experience of everyday intrusive thoughts reported by older adults. Consistent with this model, study two demonstrated decreases across thinking sequences and age groups in negative affect and intrusive thought recurrence. We did not, however, find direct evidence for devaluing by older adults in terms of meanings given to intrusive thought recurrences, which did not show changes across the three thinking periods. It should be noted though that study two did not offer an ideal test of this explanation for negative meanings, because participants received two manipulations intended to cause increases in negative meanings. Thus, following older adults over a longer time frame and more sensitively assessing the devaluing process will be important for testing this model in the future.

Examining patterns across studies, older adults appeared to show less volatility in their positive and negative affect than younger adults in response to the study manipulations: study one (between-subjects manipulation of suppression versus monitoring instructions) and study two (within-subjects manipulation of meanings). These results raise the possibility that the distress reported by older adults is less susceptible to manipulation with intrusive thoughts than the distress reported by younger adults. Future research can test whether age-related individual differences, such as obsessive beliefs, moderate or mediate reactions to similar manipulations.

*Difficulties with Recurrence of Intrusive Thoughts*

One finding we did not anticipate was the relative equivalence of the age groups in recorded thought recurrence across both studies. We had expected that due to poorer executive functioning, older adults would have more difficulty suppressing intrusive thoughts, which would be exhibited through greater recurrence of intrusive thoughts and perceived difficulty keeping thoughts out of mind compared to younger adults. However, older adults instead perceived greater difficulty with intrusive thoughts in most thinking periods compared to younger adults without showing any corresponding differences in recorded thought recurrence. There are several plausible explanations for this finding. First, it may be that among this relatively healthy sample of older adults, participants attempted to compensate for deficits in executive functioning with greater suppression effort, leading to greater perceived difficulty for older adults. In other words, there would have been real differences in recurrence that were not evident due to greater suppression effort by older adults. Along these lines, older adults expended extra effort suppressing intrusive thoughts across studies, and this effort mediated older adults' greater perceived difficulty.

While this explanation may be likely due to its fit with known motivational strategies used by older adults, it is not the only possibility. An alternative explanation for the discrepancy between perceived difficulty and actual thought recurrence is that older adults may perceive deficits in their control of intrusive thoughts despite no actual age differences in suppression ability. This interpretation follows from analogous research noting that there exists an inconsistent relationship between objective and subjective evaluations of cognitive functioning (Jorm, Christensen, Henderson, Korten, MacKinnon, & Scott 1994), but a meaningful relationship between subjective cognitive functioning and anxiety symptoms (e.g., Teachman, 2007). Along the same lines, in the current studies, older adults' perceived difficulty was not strongly related to recorded

recurrence (average of $r$ = .12 in study one and $r$ = .32 in study two) but was correlated with negative affect (average of $r$ = .42 in study one and $r$ = .55 in study two). Thus, older adults' perceptions of difficulty during suppression may be tied more to emotion dysfunction rather than actual cognitive performance.

*Suppression Effort*

Greater suppression effort by older adults appeared to be an important characteristic of older adults' responding to intrusive thoughts - it accounted for increased perceptions of difficulty suppressing thoughts, and the greater residual negative affect of older adults in study two. Given evidence for increased flexibility responding to goal failures (like unsuccessful thought suppression) by older adults (Heckhausen & Schultz, 1995), a logical question is why older adults would expend sustained suppression effort, given that this effort is often linked to negative outcomes (Wenzlaff & Wegner, 2000).

One hint may lie in the cognitive resources needed to avoid distressing experiences versus the resources needed to regulate negative affect in other ways. If used successfully, emotion regulation strategies that operate at an early stage of emotional processing tend to consume less cognitive resources than those that require sustained effort (Gross & John, 2003). It may be that older adults attempted to head off intrusive thoughts by suppressing them, but this effort was not fully successful. A related idea is that dedicating extra resources to keeping thoughts out of mind might have left fewer concurrent cognitive resources available for the task of regulating subsequent negative affect (Pratto & John, 1991). Regulating negative affect appears to be less resource-demanding for older adults than younger adults (Scheibe & Blanchard-Fields, 2009), but this advantage may be eliminated when adding simultaneous cognitive demands such as suppressing intrusive thoughts. In short, more research is needed to explore the tradeoffs in cognitive resources between expending effort suppressing

thoughts versus regulating negative affect. Nonetheless, it is clear that increased suppression effort seemed to be a central part of older adults' experience with intrusive thoughts in the current studies. The timing of thought suppression effort may be key to understanding when it leads to adaptive or maladaptive outcomes for older adults.

*Moderators of Responses to Intrusive Thoughts: Trait Anxiety and Executive Functioning*

Of the two moderators we examined, trait anxiety showed more links to emotional responding than executive functioning. We had expected that trait anxiety could act by impairing the executive functioning processes needed to successfully suppress intrusive thoughts (Eysenck et al., 2007). Supporting this hypothesis, greater trait anxiety predicted greater recurrence of intrusive thoughts across studies. While we did not measure the demands placed on cognitive resources by trait anxiety (Eysenck et al., 2007), the results were nonetheless consistent with the proposed model. We also found an exciting piece of evidence suggesting that the effects of trait anxiety might be particularly heightened for older adults. Specifically, in study two, greater trait anxiety predicted greater perceived difficulty with intrusive thoughts among older, but not younger, adults. While this finding did not occur during the shorter examination of responding in study one, it nonetheless is interesting to interpret within Eysenck et al.'s (2007) proposed model of the relationship between trait anxiety and executive functioning. In this account, trait anxiety is proposed to display direct effects on the products of executive functioning (i.e., recurrence of intrusive thoughts during suppression in the current context), unless compensatory strategies such as increased effort are used (i.e., suppression effort). When compensatory strategies are used, the effects of trait anxiety tend to be seen on perceptions of processing efficiency, similar to the perceived difficulty suppressing thoughts assessed in the current studies. The results of this study fit the compensatory scenario. This account is a potential explanation for why trait anxiety predicted perceived difficulty among older adults, but did

not predict recurrence of intrusive thoughts; specifically, this is a case where compensatory effort was used so effects were more evident on perceived processing efficiency instead of on actual efficiency.

Among other outcomes, greater trait anxiety also predicted more negative meanings assigned to intrusive thoughts. This finding is consistent with models suggesting that trait anxious people are prone to more negative, pessimistic appraisals of events (Stöber, 1997). Unexpectedly, trait anxiety predicted negative affect (in study one) and perceived difficulty with intrusive thoughts (in study two) in only one study each, demonstrating inconsistent relationships. While we expected trait anxiety to predict these outcomes more consistently, trait anxiety is also a fairly general construct that overlaps significantly with a general proneness to negative emotionality across symptoms of anxiety and depression (Clark & Watson, 1991). The measure of trait anxiety may not have been sufficiently specific to responding in the context of intrusive thoughts or perceived cognitive functioning to predict these outcomes more consistently.

For executive functioning, the results suggested little role in moderating responding to intrusive thoughts. However, it is important to interpret the results within the context of the particular older adults sampled in the two studies. While these older adult samples demonstrated greater variability in executive functioning compared to younger adults, they also scored above normative means for their age group (approximately 1/3 of a standard deviation; Delis et al., 2001). Additionally, no participants scored below the screening cutoff on the mini-mental status exam, indicating a high functioning group of older adults. It is possible that relationships between executive functioning and responding to intrusive thoughts were obscured in our samples by an oversampling of higher-functioning individuals.

*Clinical Implications*

Older adults' high endorsement of cognitive decline meanings highlights possible

targets for older adults suffering from OCD or other problems in which intrusive thoughts are a central concern. Existing cognitive therapies for intrusive thoughts often focus on thought interpretations more relevant to younger adults, and the treatments have generally been less effective for older (versus younger) adults (Ayers et al., 2007). There has been some speculation that these cognitive treatments may fare worse with older adults due to the processing demands of cognitive techniques when compared to other options such as exposure and response prevention (Wetherell, Sorrell, Thorp, & Patterson, 2005). However, it may also be that cognitive treatments have been minimizing a major area of concern for older adults - fears about cognitive decline. The modification of cognitive treatments to focus on aging concerns, such as cognitive decline related to intrusive thoughts, may be helpful for improving treatment efficacy. For example, older adults might benefit from Socratic questioning that explores the aging-related feared consequences of being unable to control an intrusive thought, making a memory error, or suffering an aging-related setback. In each case, traditional cognitive restructuring techniques could be used to generate a balanced perspective on the accuracy of the meaning (e.g., “I’m not thrilled about having trouble controlling this thought, but it has been a particularly stressful day. In fact, I’ve tended to experience thoughts like this throughout my life when I am stressed. This occurrence is extremely unlikely to be a sign of Alzhemer’s.”). For situations in which the meanings given to intrusive thought recurrences or other events are judged to be accurate assessments of cognitive decline, cognitive restructuring can still be used to generate realistic perspectives that do not overestimate the possible negative consequences.

While we were unable to provide an ideal test of whether meanings assigned to intrusive thoughts mediated emotional reactions to intrusive thoughts (i.e., due to the fact that the measure of meanings did not respond to the within-person manipulations), we have found strong evidence for this relationship in past research when assessing

meanings about specific thoughts *in vivo* (Magee & Teachman, 2007). Further, the model presented in this study has implications for clinical problems outside of intrusive thoughts. Cognitive models could easily be adapted to incorporate aging-related concerns for other anxiety disorders, such as panic disorder, where individuals often misinterpret common physical sensations as threatening signs of health problems. Given older adults' concerns about their health, emotion regulation advantages for older adults may be reduced or eliminated when physical sensations are perceived to be problematic (see Teachman & Gordon, 2009).

More broadly, older adults' greater endorsement of cognitive decline meanings over other types of measured meanings may have implications for theories about the development of psychopathology in older adults. Previous research focusing on younger adults has proposed that a person's specific OCD symptoms likely develop based upon the individual's highly valued goals and self-concept domains that are misinterpreted as being threatened (Doron & Kyrios, 2005; Doron et al., 2007). This model suggests that the content of OCD symptoms is not random, but instead linked to the idiosyncratic domains valued by the sufferer. While this example concerns OCD, valued goals and self-concept domains also likely impact the development of many clinical disorders involving intrusive thoughts, including Generalized Anxiety Disorder, Panic Disorder, and Insomnia (Magee & Carmin, 2010). As a result, existing cognitive models concerning development of these disorders could be modified to consider the domains most valued by older adults, such as cognitive and physical decline.

Finally, the age differences found in the rate of change for affect have significant implications for treatments of older adults. In both studies, older adults maintained steadier positive affect while experiencing greater residual negative affect compared to younger adults. Typically, many treatments for intrusive thoughts aim to expose clients to feared intrusive thought stimuli in order to allow clients' negative affect to habituate

over time. For treatments involving older adults, clinicians may need to allow more time for this habituation process to occur with negative affect than with younger adults. Older adults did appear to experience similar initial "peaks" in their levels of negative affect as younger adults when encountering intrusive thought stimuli. This peak of negative affect is helpful for exposure therapies in which inducing strong levels of negative affect has been thought to be a necessary component (Foa & Kozak, 1986). Thus, these results suggest that older adults do not need special adaptations in order to experience a similar rise in their negative affect during exposure to intrusive thoughts; however, they may need more time for their negative affect to habituate.

Interestingly, older adults' better maintenance of positive affect could potentially be a strength in exposure treatments. Given older adults' tendency to gravitate toward positive information, greater positive affect could be used by clinicians as an anchor to keep older adults engaged through the more difficult parts of treatment. Further, the evidence discussed above suggests that positive affect among older adults can be recruited to facilitate management of later stressors (Ong et al., 2006). Given the high dropout or refusal rates for exposure therapies with intrusive thoughts (Kozak, Liebowitz, & Foa, 2000), a greater focus on positive affect could be a helpful supplement to treatment.

Older adults' greater thought suppression effort in the current studies revealed another opportunity for possible intervention. For older adults who use prolonged thought suppression effort, explicit coaching about the costs, benefits, and timing of thought suppression effort could lead to more adaptive responding to intrusive thoughts. Psychoeducation could discuss the negative consequences of prolonged suppression effort while presenting alternatives such as tolerating intrusive thoughts as a mildly distressing but normative experience. This psychoeducation could lead older adults to devalue the importance of avoiding the thoughts and/or associated negative affect,

similar to cognitive (Wilhelm & Steketee, 2006) and mindfulness-based strategies for intrusive thoughts (Beevers et al., 1999). For older adults who perceive heightened difficulty keeping thoughts out of mind, additional interventions may be helpful for alleviating any emotional costs of this perception. Given that greater thought suppression effort by older adults accounted for their greater perceived difficulty in these studies, it seems plausible that interventions aimed at reducing thought suppression effort would also decrease perceived difficulty. Also, older adults may benefit from cognitive restructuring aimed at modifying their negative beliefs about experiencing perceived difficulty keeping thoughts out of mind. Because perceived difficulty was not strongly tied to actual recurrences of intrusive thoughts, cognitive restructuring could focus on replacing older adults' inaccurate appraisals of perceived difficulty (e.g., "Keeping this thought out of mind is difficult; if I don't try harder to suppress it, it will take over my thoughts.") with more balanced statements (e.g., "Keeping this thought out of mind seems difficult to me, but it doesn't mean anything about my functioning. If I simply tolerate the thought instead of suppressing it, the thought will pass eventually and not feel so difficult to control."). Together, these intervention components may accelerate older adults' devaluing of any negative meanings they give to their suppression attempts and perceived difficulty keeping thoughts out of mind.

*Future Research Directions*

The current studies set the stage for a number of important future research questions. One intriguing question concerns the relationships among the components of the revised model in Figure 7. While the revised model identifies processes and outcomes that have been conceptualized as differing quantitatively between younger and older adults (e.g., older adults will perceive *greater* difficulty suppressing intrusive thoughts), there is reason to believe that there may also be qualitative age differences in the relationships among some of the components. For example, if thought suppression

is used for compensatory reasons in older adults, there may be a relationship between thought suppression effort and executive functioning that only exists in older adults (or is significantly stronger than in younger adults). Future research can test whether the relationships among the proposed components of the model demonstrate age invariance.

Another interesting direction for future research will be examining age differences in the full range of meanings that can be applied to intrusive thoughts. The current studies focused on several specific age-relevant meanings (e.g., cognitive decline) due to previous evidence of analogous age-relevant concerns in younger and older adults (Calamari et al., 2002). However, there are a large range of positive, negative, and neutral meanings that can be applied to intrusive thoughts. It is possible that higher-order beliefs that have to do with the general possibility of whether or not intrusive thoughts have meaning (e.g., "Intrusive thoughts are normal and do not have any meaning") may influence whether any subsequent, more specific meanings are applied. Given older adults' generally lower endorsement of most meanings measured in these studies, it is possible that they may differ from younger adults in higher-order beliefs about intrusive thoughts.

Finally, future research should examine how varying the age-relevance or other characteristics of the *content* of intrusive thoughts impacts emotional consequences. While cognitive models of intrusive thoughts emphasize the meanings given to intrusive thoughts, intrusive thoughts nonetheless tend to arise disproportionately with themes of sex, violence, or immorality in younger adults (Rachman, 1997; 1998). It is possible that using intrusive thoughts that have content relevant to older adults may lead to worse emotional outcomes, especially when paired with age-relevant meanings.

*Limitations and Conclusion*

The samples of older adults in both studies were largely Caucasian and cognitively healthy. It is likely that reactions to intrusive thoughts by people with more pronounced cognitive decline could differ in terms of affective consequences (Petrican, Moscovitch, & Schimmack, 2008) or difficulty suppressing intrusive thoughts. Additionally, our measure of executive functioning was relatively brief, and did not provide us the ability to discriminate among a variety of proposed executive functioning constructs. We selected the trail-making subtest of the Delis-Kaplan Executive Functioning System (Delis et al., 2001) due to its purported assessment of the ability to inhibit attention to supraliminally-presented stimuli. However, this measure may have reflected other aspects of executive functioning as well. It would be ideal for future research to use a battery of cognitive tests to take an in-depth look at the relations between various components of executive functioning, the ability to suppress intrusive thoughts, and the ability to regulate positive and negative affect after intrusive thoughts. We identified various features of inhibition that we expected to underlie thought suppression, but were unable to test these features except within our broad look at executive functioning. Also, in the current cross-sectional studies, age was confounded with cohort for the age comparisons, leaving untested the assumption that these findings reflect developmental changes rather than cohort differences.

Self-report measures were used extensively throughout both studies. While these measures can be prone to response biases, it is unlikely that such a bias accounted for the pattern of age differences in the current studies. For the crucial age differences in suppression effort, older adults reported greater suppression effort even when no demand effects were possible (i.e., when they were assigned to monitor an intrusive thought during study one and thought suppression was not mentioned). Further, some of the findings (i.e., the initial increase in negative affect for both age groups) were consistent with past research using multiple methods of measurement

after age-relevant stressors (Teachman & Gordon, 2009). Finally, it is unclear why response biases would lead older adults to differ in one direction on some affective measures (i.e., greater residual negative affect) while showing no differences (i.e., recurrence) or opposite differences (i.e., less trait anxiety) on other measures. Notwithstanding, it would be valuable in future research to include a more multi-modal assessment approach. Along similar lines, participants were recruited with advertising specifying the age requirements of the study (i.e., 18-30 or 65 and above years of age). While we did not mention age as an object of research during the two studies, our recruitment could have led some participants to suspect that the studies involved an examination of age differences. Nevertheless, we believe it is unlikely that these suspicions strongly influenced the results, in part because few participants endorsed suspicion about the age-relevant manipulations in study two, even when directly asked about their suspicious about the manipulations.

During study two, the measure of meanings given to intrusive thought recurrences (AMIT) did not show any changes according to the within-person manipulations. Unfortunately, this finding left open the possibilities that either 1) the manipulation was not effective, or 2) the measure was not sufficiently sensitive to changes in meanings. The latter explanation follows in part from a similar past manipulation we conducted with younger adults (Teachman et al., 2006). In this study, the meaning given to an intrusive thought was similarly manipulated by verbal and written instructions. Interestingly, the explicit manipulation check in Teachman et al. (2006), which was the same measure modified to create the current AMIT measure, also did not show significant changes after the manipulation. However, the Teachman et al. (2006) study also measured implicit responses to the manipulation, finding that relevant implicit associations did indeed change in the expected direction. Thus, it may be that manipulations of meanings given to intrusive thought recurrences are subtle and

relatively implicit in nature. In the future, we suggest that both implicit and explicit measures be used to assess the effects of such manipulations. In addition, the current measure could be tweaked to capture greater variability in responses among younger and older adults. In particular, the instructions could be changed to emphasize a person's degree of confidence or level of concern that a meaning might be true. For example, with the item: "Does this thought coming to mind mean that your memory is failing?," participants could be asked "How concerned are you that the this could be true?," rather than being asked to rate "the extent to which you agree with this statement." We expect that this wording might reflect more of the variability in meanings applied than the current assessment of to what degree participants agreed with a series of rather threatening meanings.

It is also plausible that the manipulation was not entirely believed by older adults. While we did not find widespread evidence of suspicion in the funnel debriefing, the manipulation was relatively involved and was sufficiently unusual that participants may not have found it completely believable. If older adults truly believed that a recurrent intrusive thought was a sign of cognitive decline, it seems likely that we would have seen effects on their distress and recurrence after the manipulation. Instead, the data showed no changes within older adults in negative affect, positive affect, or recurrence after the older-adult relevant manipulation.

Notwithstanding these limitations, the current studies highlight the importance of integrating a lifespan perspective into theories of intrusive thoughts. Older adults experienced a range of risk and protective factors when encountering intrusive thoughts, including differences in meanings assigned to intrusive thought recurrences and the tendency to employ thought suppression effort. The evidence from the two studies demonstrates that an individual's reactions to intrusive thoughts must be considered

within an ‘age context’ that takes into account the age-relevant concerns of the individual.

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Table 1

*Study One Descriptive Statistics for OCD Symptoms, Trait Anxiety, Executive Functioning, and Cognitive Impairment*

| | Age Group | | | |
|---|---|---|---|---|
| | Younger Adult | | Older Adult | |
| | *M* | *SD* | *M* | *SD* |
| OCI-R | 16.93 | 11.51 | 15.62 | 9.84 |
| STAI-T | 41.06[a] | 9.53 | 36.22[b] | 12.13 |
| TM | 31.43[a] | 19.48 | 49.63[b] | 38.15 |
| MMSE | 29.43[a] | .70 | 28.76[b] | 1.35 |

*Note:* Group differences are noted by unique letter superscripts (i.e., 'a' versus 'b') and are all significant at $p < .05$. OCI-R = Obsessive-Compulsive Inventory – Revised; STAI-T = State-Trait Anxiety Inventory – Trait Version; TM = Trailmaking subtest; MMSE = Mini-Mental Status Exam.

Table 2

*Study Two Descriptive Statistics for Trait Anxiety, Executive Functioning, and Cognitive Impairment*

| | Age Group | | | |
|---|---|---|---|---|
| | Younger Adult | | Older Adult | |
| | *M* | *SD* | *M* | *SD* |
| STAI-T | 41.20[a] | 10.36 | 35.53[b] | 8.72 |
| TM | 33.56[a] | 16.38 | 60.28[b] | 35.45 |
| MMSE | 29.21 | .90 | 28.79 | 1.29 |

*Note:* Group differences are noted by unique letter superscripts (i.e., 'a' versus 'b') and are all significant at $p < .05$. STAI-T = State-Trait Anxiety Inventory – Trait Version; TM = Trailmaking subtest; MMSE = Mini-Mental Status Exam.

Figure 1. Proposed Model of Age-Relevant Predictors of Distress Following Recurrent, Intrusive Thoughts

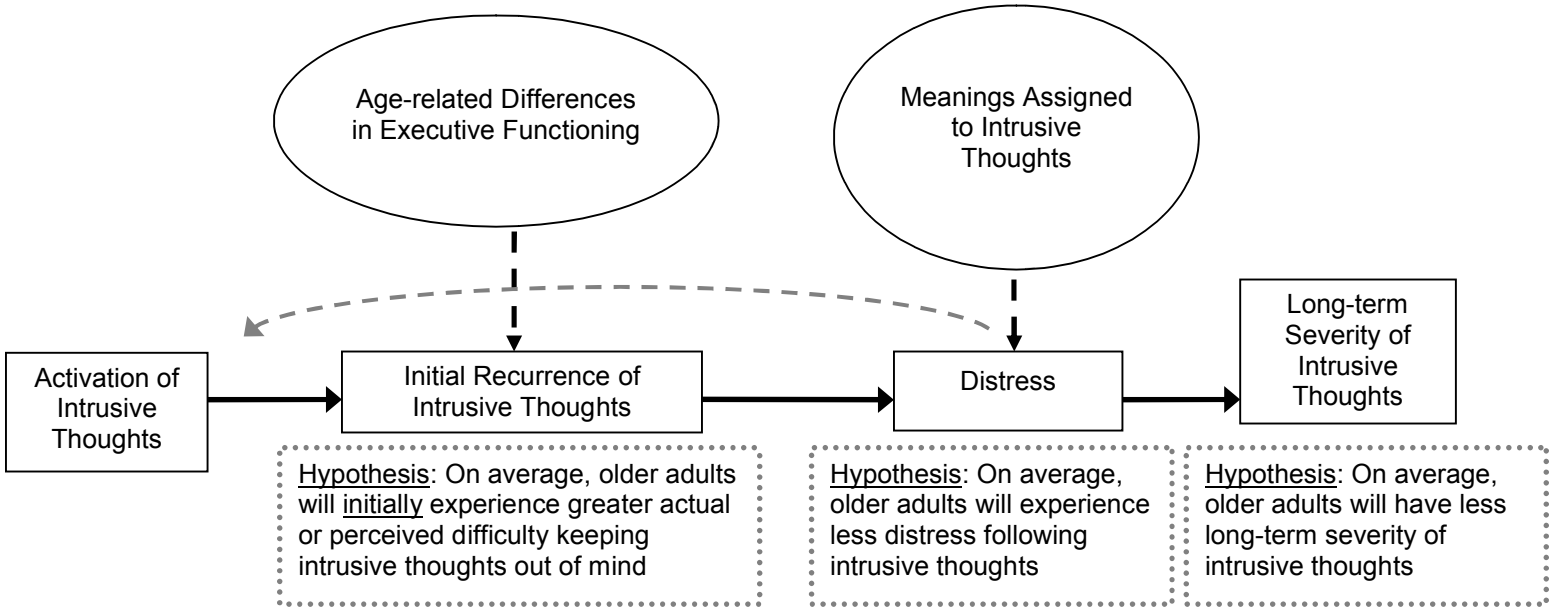
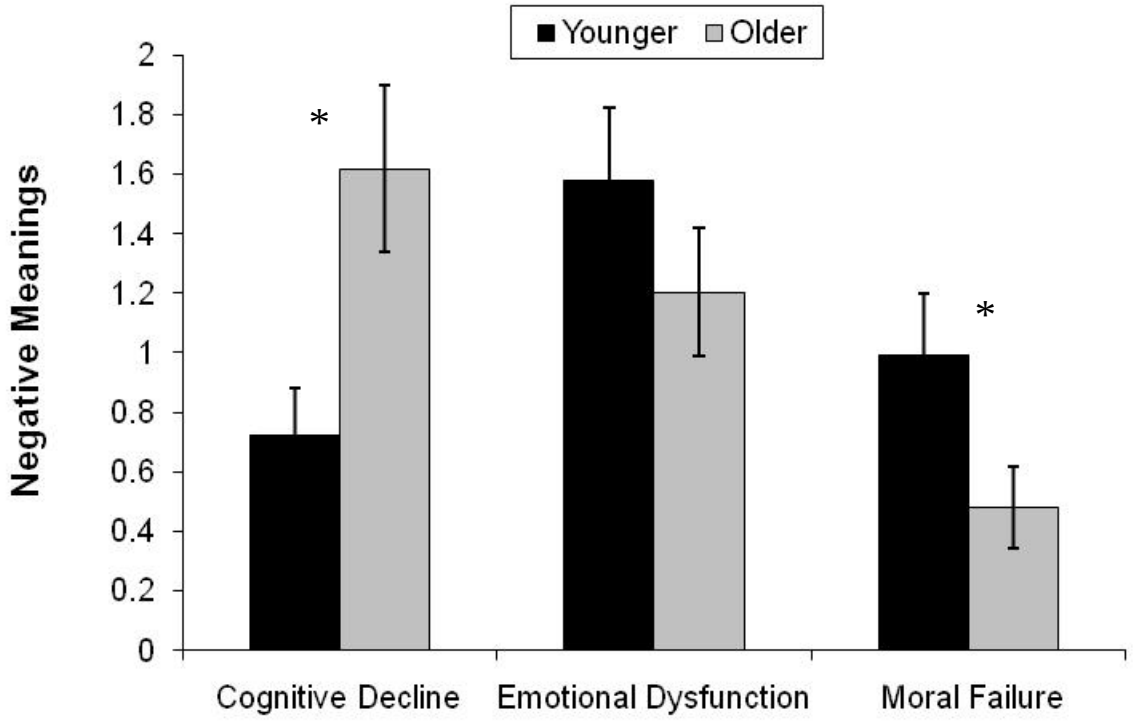
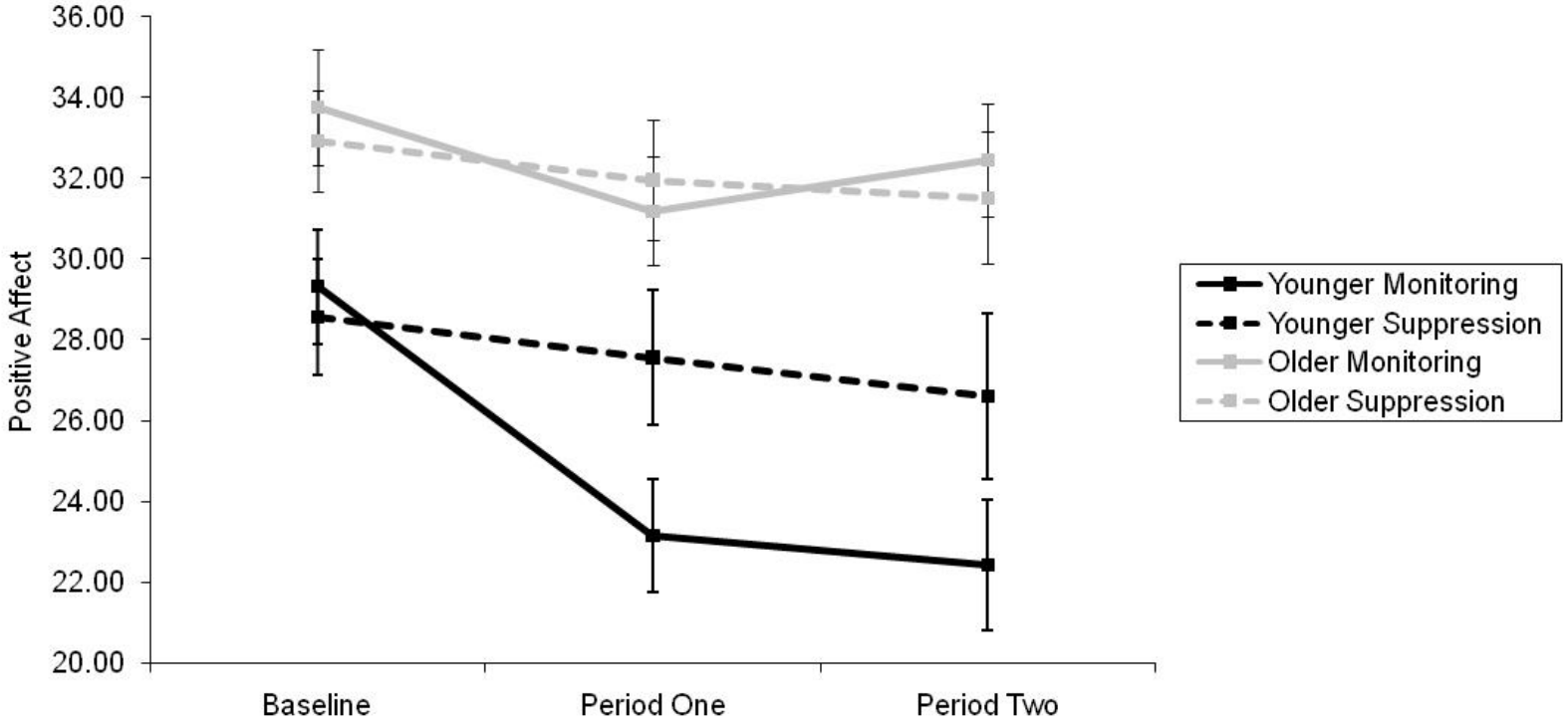


Figure 2. Study One Meanings Assigned to Intrusive Thoughts by Age Group



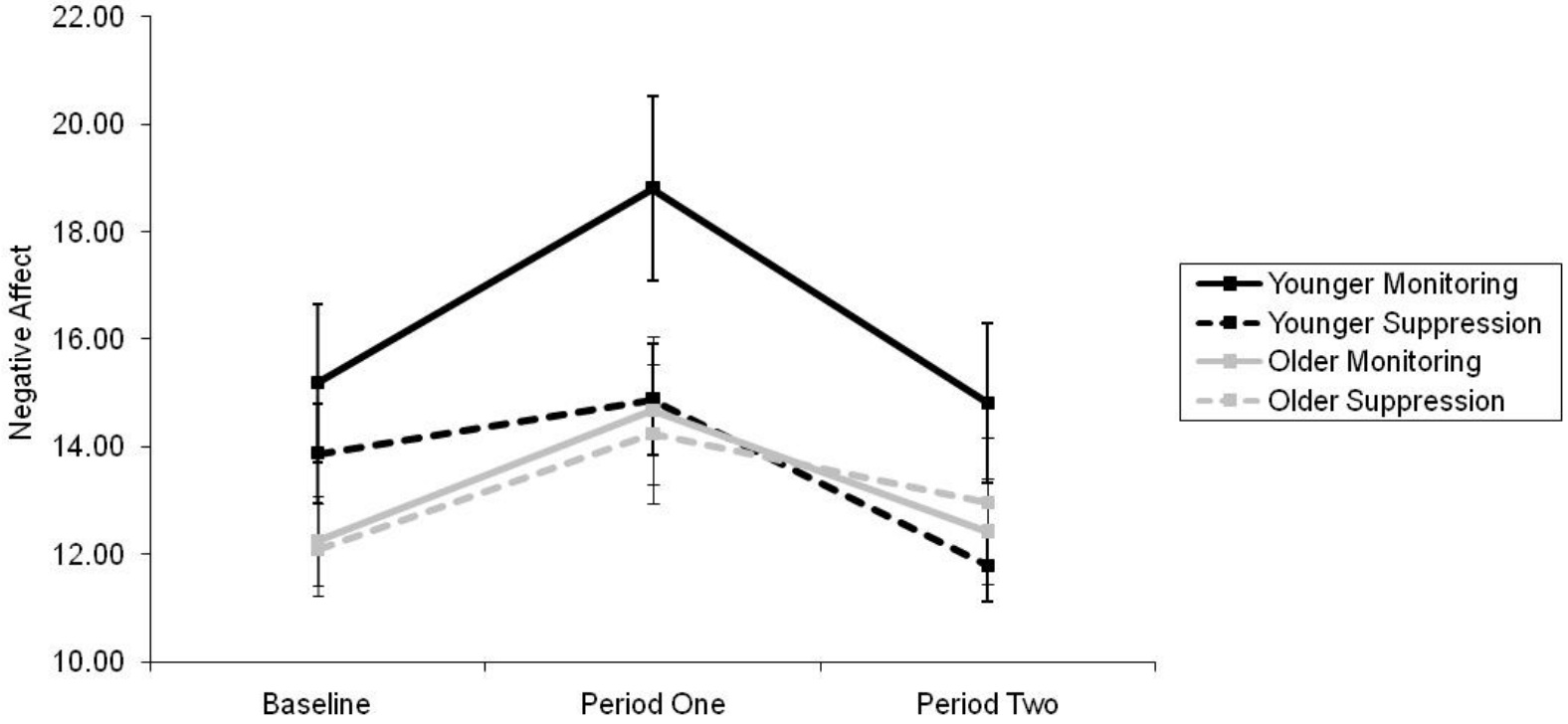

*Note:* * refers to $p < .05$. Meanings were measured using the Age-relevant Meaning of Intrusive Thoughts scale.

Figure 3a. Study One Positive Affect by Age Group and Thinking Instructions




*Note:* Monitoring and suppression refer to the thinking instructions received by participants during period one. All participants received monitoring instructions during period two. Positive affect was measured using the Positive and Negative Affect Schedule.

Figure 3b. Study One Negative Affect by Age Group and Thinking Instructions




*Note:* Monitoring and suppression refer to the thinking instructions received by participants during period one. All participants received monitoring instructions during period two. Negative affect was measured using the Positive and Negative Affect Schedule.

Figure 4. Design of Study Two

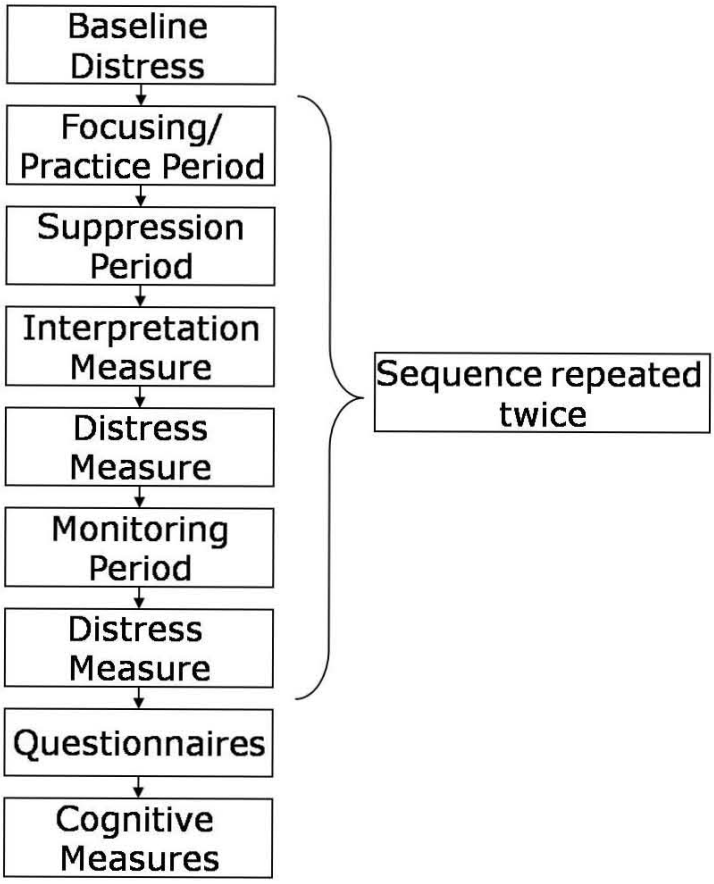
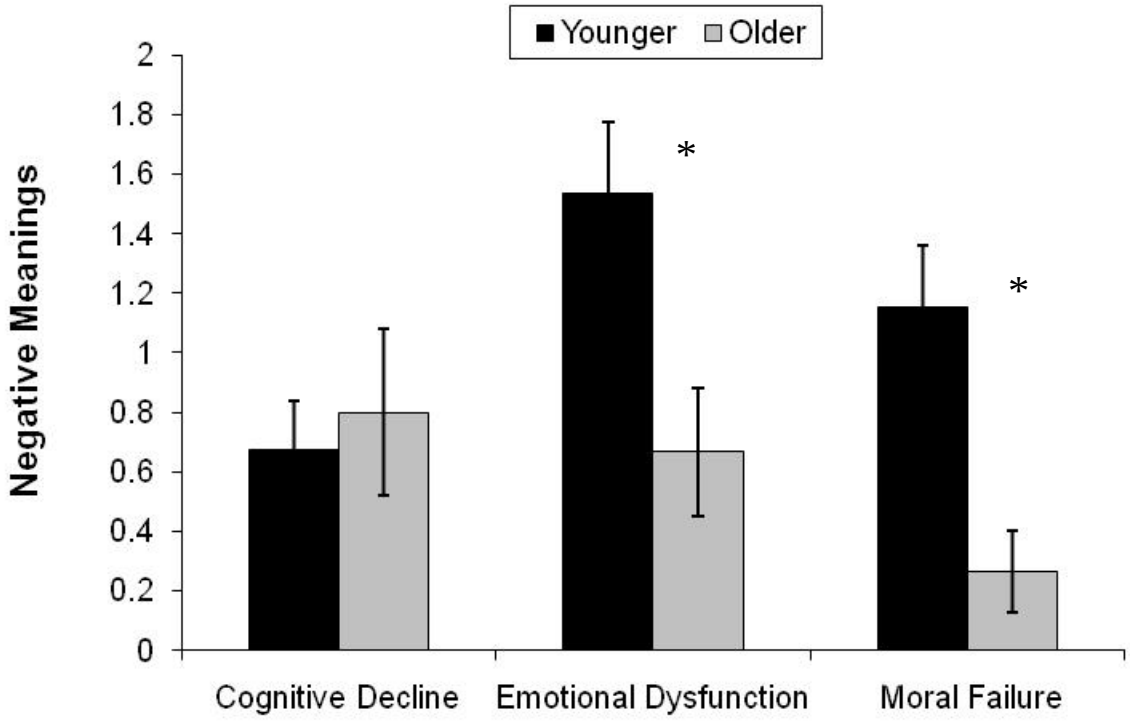
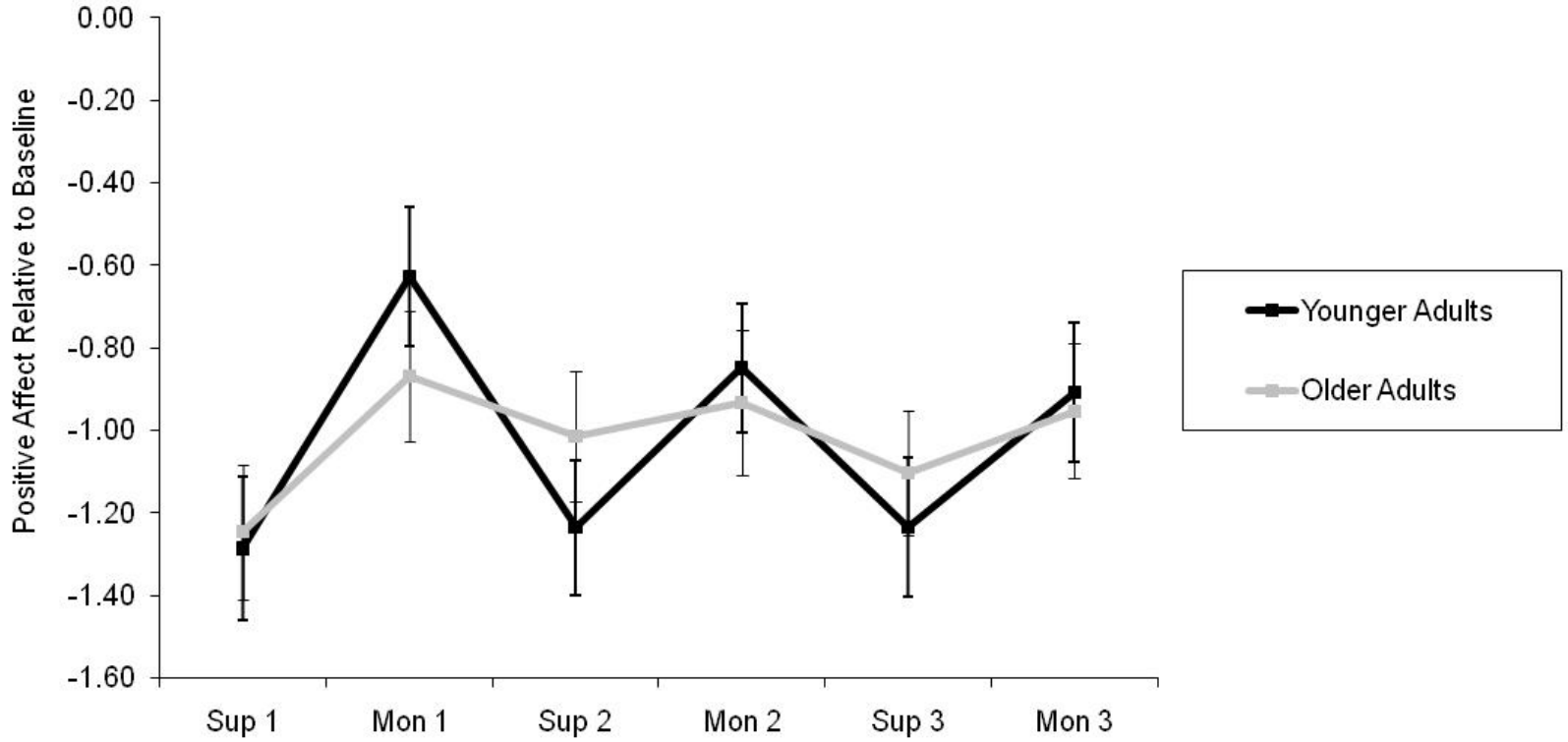


Figure 5. Study Two Meanings Assigned to Intrusive Thoughts by Age Group



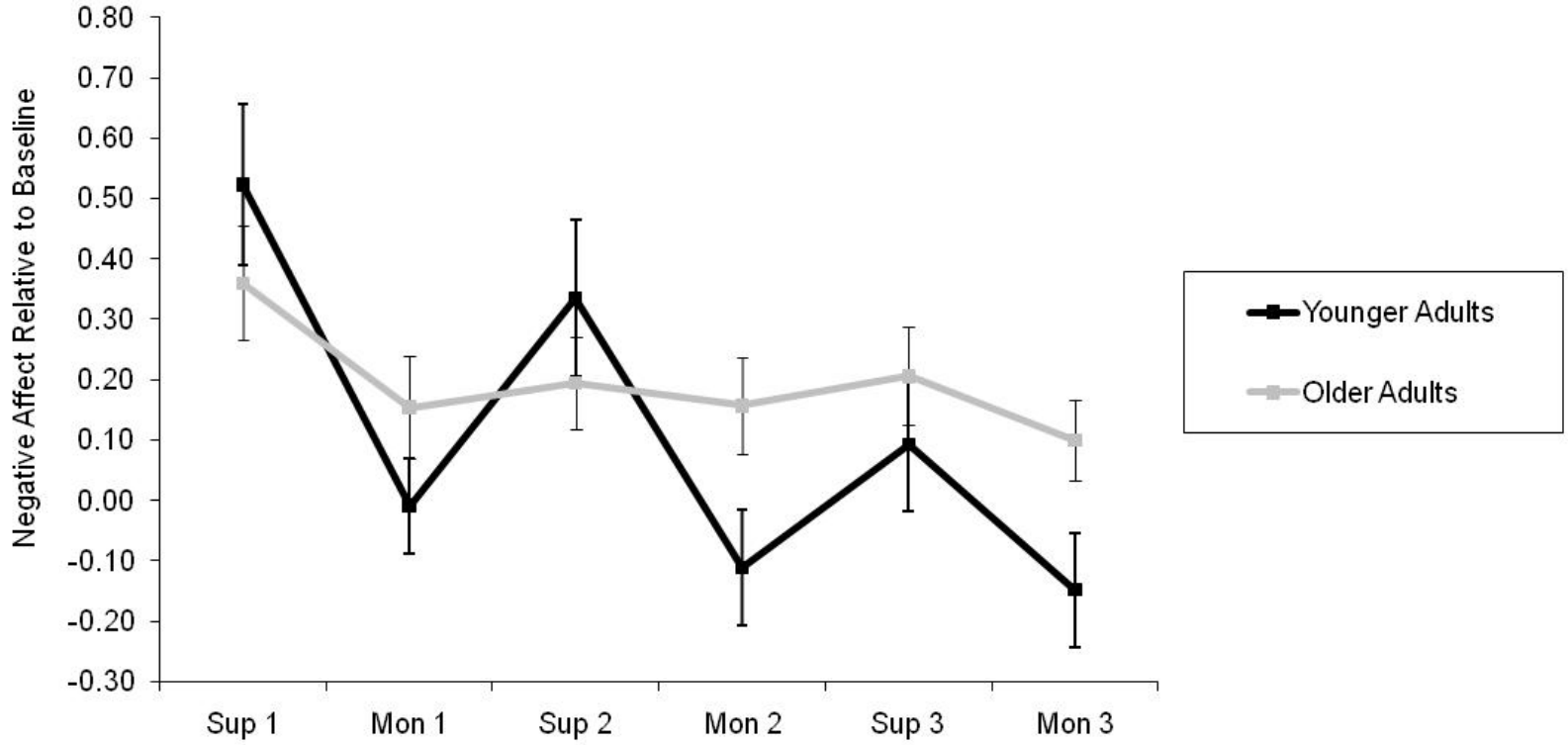

*Note:* * refers to $p < .05$. Meanings were measured using the Age-relevant Meaning of Intrusive Thoughts scale.

Figure 6a. Study Two Positive Affect Relative to Baseline by Age Group



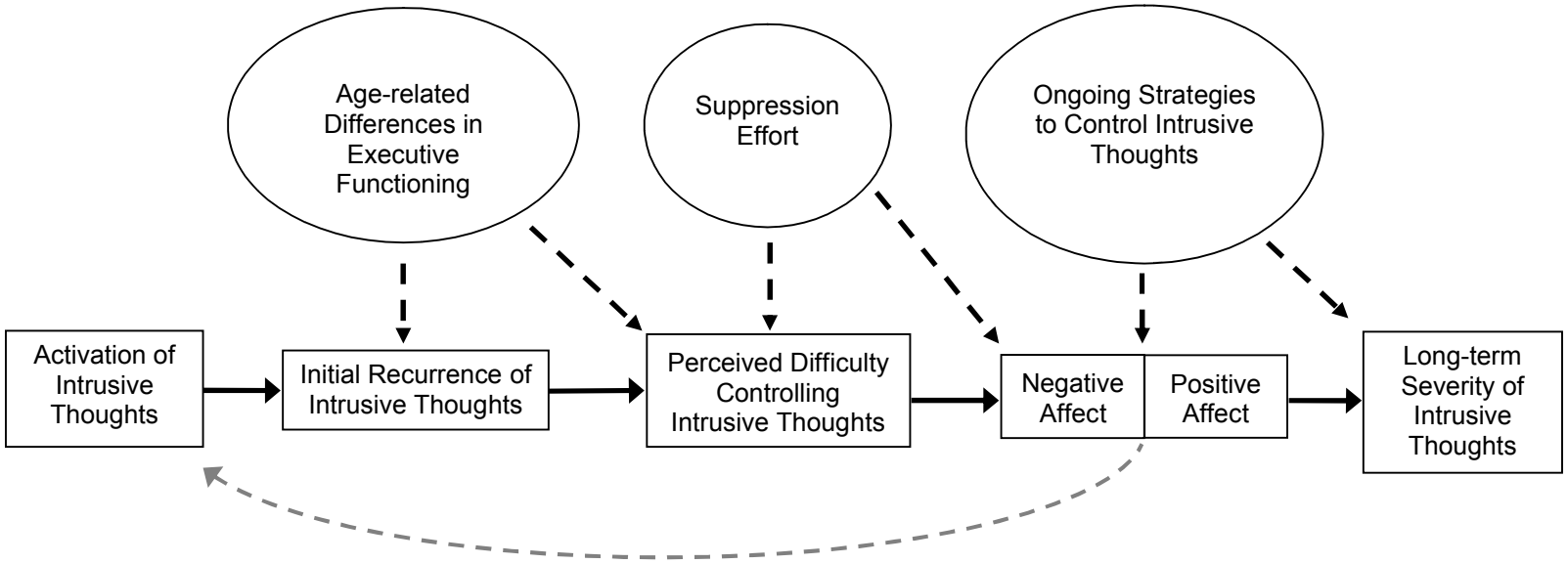

*Note:* Sup and Mon refer to Suppression and Monitoring thinking instructions. The numbers refer to the no meaning, second, and third thinking sequences, respectively. Positive affect was measured using the Positive and Negative Affect Schedule.

Figure 6b. Study Two Negative Affect Relative to Baseline by Age Group




*Note:* Sup and Mon refer to Suppression and Monitoring thinking instructions. The numbers refer to the no meaning, second, and third thinking sequences, respectively. Positive affect was measured using the Positive and Negative Affect Schedule.

Figure 7. Revised Model of Age-Relevant Predictors of Distress Following Recurrent, Intrusive Thoughts



Appendix A: Study One Consent and Debriefing Forms

**Informed Consent Agreement**
**Project Title: Linking Thoughts and Emotions**
**Please read this consent agreement carefully before you decide to participate in the study.**

**Purpose of the research study:**
The purpose of the study is to examine how people's thoughts and emotions can influence one another.

**What you will do in the study:**
1. Complete a series of "thought periods" in which you will be asked to think about particular thoughts, some which you may find unpleasant, according to provided directions. We will ask you to identify thoughts you have that you find intrusive and undesirable because we are interested in learning how people react to these thoughts

2. Complete questionnaires and that describe your current mood, and reactions to thoughts and feelings you may find undesirable. Some of the questionnaires will be computerized.

Please feel free to ask the experimenter any questions about the procedures, although some questions about the purpose of the study might be deferred until after you have finished. Some people do find it mildly upsetting to think about undesirable thoughts and we encourage you to talk frankly with the experimenter if you still feel upset at the end of the study.

**Time required:** The total experiment will require approximately 1.5 hours.

**Risks:** There is no risk of harm to you (other than possible temporary discomfort) as a result of participating in this experiment.

**Benefits:** There are no direct benefits to you for participating in the study. The study may help us understand how thoughts and feelings are related when people think about thoughts that may make them uncomfortable, which may ultimately help us to reduce this discomfort.

**Confidentiality:**
The information that you give in the study will be handled confidentially. The only exceptions to this guideline are if we learn of possible child or elderly abuse or danger to self or others. Your information will be assigned a code number. The list connecting your name to this code will be kept in a locked file. When the study is completed and the data have been analyzed, this list will be destroyed. Your name will not be used in any report.

**Voluntary participation:** Your participation in the study is completely voluntary.

**Right to withdraw from the study:**
You have the right to withdraw from the study at any time without penalty. Your data will be destroyed if you withdraw from the study.

**How to withdraw from the study:**
If you want to withdraw from the study, tell the experimenter quietly and leave the room. You will be debriefed if you withdraw from the study. There is no penalty for withdrawing. You will still receive full payment for the experiment.

**Payment:** You will receive $20 payment for participating in the study.

**If you have questions about the study, contact:**
Joshua C. Magee, Department of Psychology, 102 Gilmer Hall, rm. 202, University of Virginia, Charlottesville, VA 22903. Telephone: (434) 243-7646.

Bethany Teachman, Ph.D. Department of Psychology, 102 Gilmer Hall, rm. 207, University of Virginia, Charlottesville, VA 22903. Telephone: (434) 924-0676.

**If you have questions about your rights in the study, contact:**
Dr. Tonya Moon, Chair, Institutional Review Board for the Social and Behavioral Sciences, One Morton Drive, 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

**Agreement:**
I agree to participate in the research study described above.

**Signature:** _____
**Date:** _____

**You will receive a copy of this form for your records.**

**Debriefing: Linking Thoughts and Emotions**

Thank you for participating in our study. We are currently investigating age differences in "unwanted thoughts," which are thoughts and images that pop into mind unexpectedly and are often experienced as strange or unusual. Occasionally people find they can rid their mind of unwanted thoughts fairly easily, but usually this is a very difficult thing to do. The purpose of the present study is to examine how younger and older adults feel after they have not been able to rid their mind of unwanted thoughts (known as 'thought suppression').

Little is known about age differences in how people feel and think after difficulty suppressing their thoughts, but we know this is a very common experience. In fact, while the thoughts you were asked to think about in this study may have been temporarily distressing, having unwanted thoughts like these is a normal experience. **There is no reason to believe that either the thoughts or the thought suppression difficulties you may have had are informative about your personality or values.**

**In fact, most people report unwanted thoughts that don't make a lot of sense to them. It also appears that nearly everyone has difficulty completely suppressing his or her thoughts.** The thoughts used during this experiment were chosen because they are common examples of unwanted thoughts found in real surveys of undergraduates and older adults. There is no reason to believe that thinking any of these thoughts increases the chances of those thoughts coming true. The most current research indicates that these thoughts are similar to other mental phenomena like getting a song stuck in your head. We are interested in whether changes that often occur with age, such as the tendency to focus more on social and emotional goals (see Carstensen & Mikels, 2005), will change how people experience having unwanted thoughts and difficulties trying to suppress them. In particular, we expect that while some older adults may experience more unwanted thoughts during the thinking periods, they will find these thoughts less distressing than younger adults will find them.

If you are interested in learning more about unwanted thoughts and thought suppression, or about age-related changes in emotions and goals, see:


- Purdon, C. & Clark, D.A. (2001). Suppression of obsession-like thoughts in non-clinical individuals: impact on thought frequency, appraisal, and mood state. *Behaviour Research and Therapy, 39,* 1163-1181.

- Carstensen, L.L. & Mikels, J.A. (2005). At the intersection of emotion and cognition: Aging and the positivity effect. *Current Directions in Psychological Science, 14,* 117-121.


If you feel especially concerned about your own unwanted thoughts, please feel free to phone our lab (434-924-0676) and speak to one of the investigators about options for counseling. Alternatively, you could also phone the UVA Counseling and Psychological Services (434-243-5556) or the Mary D. Ainsworth Psychological Clinic in the psychology department (434-982-4737).

Once again, thank you for participating in our study. If you have any further questions regarding any aspects of this research, please feel free to contact Joshua Magee, Department of Psychology, 102 Gilmer Hall, rm. 202 at (434) 243-7646 or Prof. Bethany Teachman, Department of Psychology, 102 Gilmer Hall, rm. 207 at (434) 924-0676. In addition, if you have any concerns about any aspect of the experiment, you may contact Dr. Tanya Moon, Chairman, Institutional Review Board for the Social and Behavioral Sciences, Suite 500, Morton Bldg., One Morton Dr., University of Virginia, P.O. Box 800392 Charlottesville, VA 22908. Telephone: (434) 924-5999. Email: irbsbshelp@virginia.edu Website: www.virginia.edu/vprgs/irb

## Appendix B: Study One Measures (Alphabetical Order)

### AMIT

Please read the following statements carefully and circle the number that best corresponds to the extent to which you agree with each statement regarding <u>your personal intrusive thoughts and images</u> OR <u>the following thoughts/images:</u> _____.

Please use the following scale:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Not at all | | | | Somewhat | | | | Totally/Definitely |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Are these thoughts a sign that your cognitive functioning is deteriorating? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 2 | Are these thoughts a sign that you are no longer a decent person? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 3 | Does this mean your emotional health is declining? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 4 | Do these thoughts mean that your brain can't function as well as it used to? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 5 | Do these thoughts reflect your difficulties in developing emotional maturity? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 6 | Do these thoughts mean that you are losing your "brainpower"? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 7 | Do these thoughts reflect your inability to become an honorable member of society? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 8 | Do these thoughts mean that your thinking is not progressing as well as it should? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | Do these thoughts mean that you are not developing into a good person? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 10 | Are these thoughts a sign that your emotional control has begun to go downhill? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Do these thoughts mean that you are losing control of your morality? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 12 | Do these thoughts limit your potential for emotional growth? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 13 | Do these thoughts limit your potential for moral growth? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 14 | Do these thoughts mean that your mind is not as sharp as it used to be? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 15 | Are these thoughts a sign that you are losing the ability to tend to your emotions? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 16 | Are these thoughts a sign of your declining morals? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 17 | Are these thoughts a sign that you are becoming immoral? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 18 | Are these thoughts a sign that you are <u>not</u> gaining the right emotional experiences? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 19 | Is this a sign that you will be a person of limited cognitive abilities? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 20 | Do these thoughts mean that you are losing the ability to control your emotions? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 21 | Do these thoughts mean that you are becoming an immoral person? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 22 | Do these thoughts mean that your memory is failing? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 23 | Do these thoughts mean that you are becoming a less admirable member of society? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

# Demographics Form

*For the following questions, please fill in the requested information.*

Age: _____

Gender: _____

*For the next couple questions, please circle one choice.*

Highest education level completed:

Some high school
High school
Some college
Associate's degree
Bachelor's degree
Master's degree
Doctoral degree
Professional degree (e.g. M.D., J.D.)

I would describe my ethnicity as...

Hispanic/Latino
Not Hispanic/Latino

I would describe my race as:

American Indian/Alaskan Native
Asian
Black or African American
Native Hawaiian or Other Pacific Islander
White
More than one race (*Please specify:* _____)
Other (*Please specify:* _____)

I have participated in a study of psychology, memory or cognitive aging before:

YES NO

If yes, approximately how long ago did you participate? _____

# Mini-Mental Status Exam

**1** I would like to ask you a few questions dealing with concentration and memory. Some are a little bit more difficult than others.

| | correct | error | not attempted refused | Record answers in error: |
|---|---|---|---|---|
| a. What is the year? | 1 | 0 | 9 | year: _____ |
| b. What season of the year is it? | 1 | 0 | 9 | season: _____ |
| c. What is the date? | 1 | 0 | 9 | date: _____ |
| d. What is the day of the week? | 1 | 0 | 9 | day: _____ |
| e. What is the month? | 1 | 0 | 9 | month: _____ |
| f. What state are we in? | 1 | 0 | 9 | state: _____ |
| g. What county are we in? | 1 | 0 | 9 | county: _____ |
| h. What (city/town) are we in? | 1 | 0 | 9 | city: _____ |
| i. What floor of the building are we on? | 1 | 0 | 9 | floor: _____ |
| j. What is this address? (If institutionalized: What is the name of this place?) | 1 | 0 | 9 | address/name: _____ |

**2** I am going to name 3 objects. After I have said them, I want you to repeat them. Remember what they are because I am going to ask you to name them again in a few minutes:

APPLE TABLE PENNY

Could you repeat the 3 items for me?

*Do not repeat the items for the participant until after the first trial. The participant may give the items in any order. If there are errors on the first trial, repeat the items up to six times until they are learned.*

| first trial only | correct | error | not attempted refused |
|---|---|---|---|
| a. apple | 1 | 0 | 9 |
| b. table | 1 | 0 | 9 |
| c. penny | 1 | 0 | 9 |

**3** Can you subtract 7 from 100, and then subtract 7 from the answer you get and keep subtracting 7 until I tell you to stop? Please do the subtraction out loud.

*Count only 1 error if participant makes subtraction error, but subsequent answers are 7 less than the error.*

| Record Response: | correct | error | can't do | not attempted refused |
|---|---|---|---|---|
| a. 93 _____ | 1 | 0 | 7 | 9 |
| b. 86 _____ | 1 | 0 | 7 | 9 |
| c. 79 _____ | 1 | 0 | 7 | 9 |
| d. 72 _____ | 1 | 0 | 7 | 9 |
| e. 65 _____ | 1 | 0 | 7 | 9 |

**4** I am going to spell a word forwards and I want you to spell it backwards. The word is *world*. W-O-R-L-D. Spell *world* backwards.

*Repeat spelling if necessary.*

| Record Response: | correct | error | can't do | not attempted refused |
|---|---|---|---|---|
| a. D _____ | 1 | 0 | 7 | 9 |
| b. L _____ | 1 | 0 | 7 | 9 |
| c. R _____ | 1 | 0 | 7 | 9 |
| d. O _____ | 1 | 0 | 7 | 9 |
| e. W _____ | 1 | 0 | 7 | 9 |

**5** Now what were the 3 objects I asked you to remember?

*Objects may be repeated in any order.*

| | correct | error | not attempted refused |
|---|---|---|---|
| a. apple | 1 | 0 | 9 |
| b. table | 1 | 0 | 9 |
| c. penny | 1 | 0 | 9 |

**6** *Show wrist watch.* What is this called? 1 0 9

**7** *Show pencil.* What is this called? 1 0 9

**8** I'd like you to repeat a phrase after me: No if's, and's, or but's.

*Allow only 1 trial. Code 1—Correct required an accurately articulated repetition.*

correct 1 error 0 refused 9

**9** Read the words on this card and then do what it says.

*Hand card 11. Code 1—Correct required the participant to close his or her eyes. Card says: Close your eyes*

correct 1 error 0 refused 9

**10** *Read the full statement below and then hand participant a blank piece of paper. Do not repeat instructions or coach.*

I am going to give you a piece of paper. When I do, take the paper in your right hand, fold the paper in half with both hands, and put the paper down on your lap.

| | correct | error | refused |
|---|---|---|---|
| a. takes paper in right | 1 | 0 | 9 |
| b. folds paper in half | 1 | 0 | 9 |
| c. puts paper down on lap | 1 | 0 | 9 |

**11** Write any complete sentence on that piece of paper for me. 1 0 9

*Must have a subject and verb and make sense. Spelling and grammatical errors are OK. Repeat the instructions, if necessary.*

**12** Here's a drawing. Please copy the drawing on the same paper. 1 0 9

*Hand participant card 12. Correct if 2 convex 5-sided figures and intersection makes a 4-sided figure.*

*Drawing*

**Obsessive—Compulsive Inventory—Revised**

The following statements refer to experiences that many people have in their everyday lives. Circle the number that best describes **HOW MUCH** that experience has **DISTRESSED or BOTHERED you during the PAST MONTH**. The numbers refer to the following verbal labels:

| 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Not at all | A little | Moderately | A lot | Extremely |

| | |
|---|---|
| 1. I have saved up so many things that they get in the way. | 0 1 2 3 4 |
| 2. I check things more often than necessary. | 0 1 2 3 4 |
| 3. I get upset if objects are not arranged properly. | 0 1 2 3 4 |
| 4. I feel compelled to count while I am doing things. | 0 1 2 3 4 |
| 5. I find it difficult to touch an object when I know it has been touched by strangers or certain people. | 0 1 2 3 4 |
| 6. I find it difficult to control my own thoughts. | 0 1 2 3 4 |
| 7. I collect things I don't need. | 0 1 2 3 4 |
| 8. I repeatedly check doors, windows, drawers, etc. | 0 1 2 3 4 |
| 9. I get upset if others change the way I have arranged things. | 0 1 2 3 4 |
| 10. I feel I have to repeat certain numbers. | 0 1 2 3 4 |
| 11. I sometimes have to wash or clean myself simply because I feel contaminated | 0 1 2 3 4 |
| 12. I am upset by unpleasant thoughts that come into my mind against my will. | 0 1 2 3 4 |
| 13. I avoid throwing things away because I am afraid I might need them later. | 0 1 2 3 4 |
| 14. I repeatedly check gas and water taps and light switches after turning them off. | 0 1 2 3 4 |
| 15. I need things to be arranged in a particular order. | 0 1 2 3 4 |
| 16. I feel that there are good and bad numbers. | 0 1 2 3 4 |
| 17. I wash my hands more often and longer than necessary. | 0 1 2 3 4 |
| 18. I frequently get nasty thoughts and have difficulty in getting rid of them. | 0 1 2 3 4 |

## Positive and Negative Affect Scale

The scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way right now, that is, at the present moment. Use the following scale to record your answers.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| very slightly or not at all | a little | moderately | quite a bit | extremely |

_____ interested

_____ distressed

_____ excited

_____ upset

_____ strong

_____ guilty

_____ scared

_____ hostile

_____ enthusiastic

_____ proud

_____ irritable

_____ alert

_____ ashamed

_____ inspired

_____ nervous

_____ determined

_____ attentive

_____ jittery

_____ active

_____ afraid

## STAI- Trait

A number of statements which people have used to describe themselves are given below. Read each statement and then write the appropriate number next to the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

1- Almost never
2- Sometimes
3- Often
4- Almost always

___ 1. I feel pleasant.

___ 2. I feel nervous and restless.

___ 3. I feel satisfied with myself.

___ 4. I wish I could be as happy as others seem to be.

___ 5. I feel like a failure.

___ 6. I feel rested.

___ 7. I am "calm, cool, and collected".

___ 8. I feel that difficulties are piling up so that I cannot overcome them.

___ 9. I worry too much over something that really doesn't matter.

___ 10. I am happy.

___ 11. I have disturbing thoughts.

___ 12. I lack self-confidence.

___ 13. I feel secure.

___ 14. I make decisions easily.

___ 15. I feel inadequate.

___ 16. I am content.

___ 17. Some unimportant thought runs through my mind and bothers me.

___ 18. I take disappointments so keenly that I can't put them out of my mind.

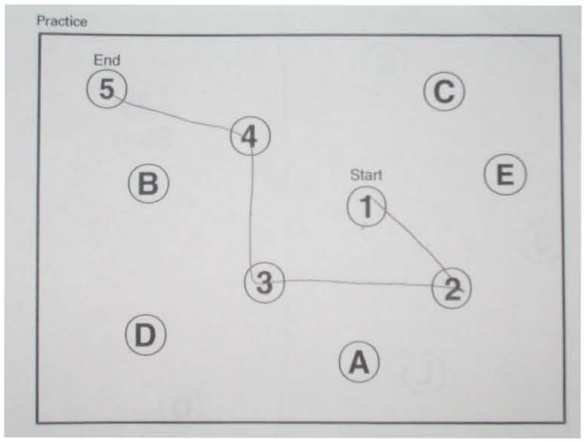
___ 19. I am a steady person.

___ 20. I get in a state of tension or turmoil as I think over my recent concerns and interests.

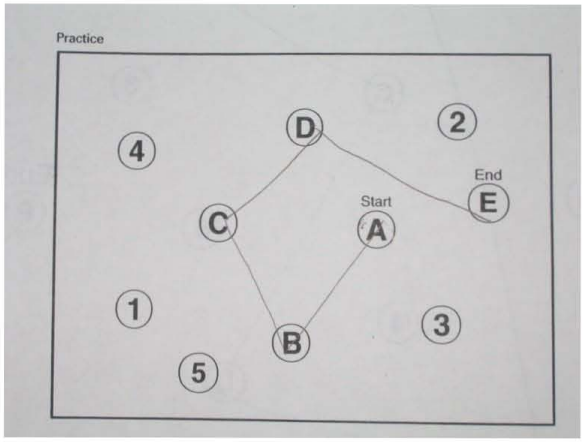
**The trail-making subtest of the *Delis-Kaplan Executive Function System***

Sample practice sheets from the four types of tests administered in Study One:

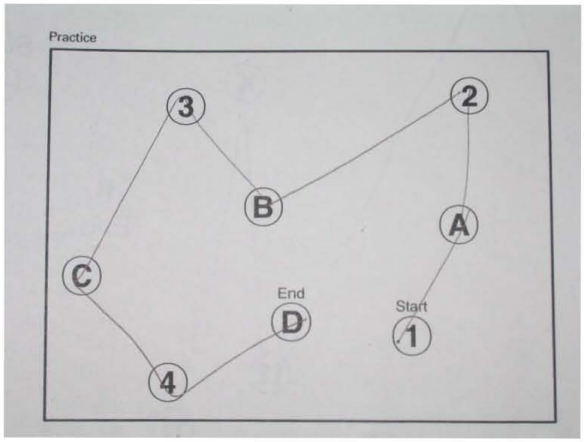
Number Sequencing Condition:



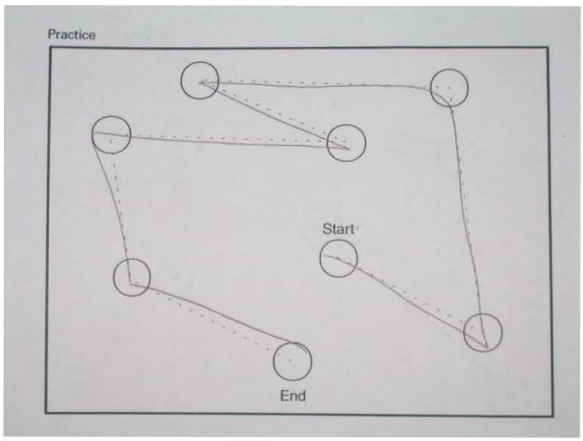

Letter Sequencing Condition:




Number-letter Switching Condition:




Motor Speed Condition:



**Unusual Thoughts Checklist**

Most people experience weird or unwanted thoughts or images that pop up into their mind unexpectedly, even though the thoughts or images may not make sense to them or they may not like them. Please let us know which of the following thoughts or images occur for you, and how much they bother you (based on how distressing the thoughts or images are). Please rate according to the following scales:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Distress:** | **1 No problem** | **2** | **3** | **4** | **5 Moderately distressing** | **6** | **7** | **8** | **9 Extremely distressing** |
| **Frequency:** | **1 Never** | **2 Less than once per 6 months** | **3 Once per 3-6 months** | **4 Once per 1-3 months** | **5 Between once per week and once per month** | **6 Between once per several days and once per week** | **7 Between once per day and once per several days** | **8 Once per day** | **9 Several times per day** |

Place a check on the line indicating whether you've had this thought or image in the last month. If yes, please rate the associated distress and frequency. For example,

| Yes | No | Thought or Image | Distress | Frequency |
|---|---|---|---|---|
| X | | Having an impulse to harm an animal | 6 | 7 |

****Please note that with actual administration of the Unusual Thoughts Checklist, the following is presented on the same page:****

| Yes | No | Thought or Image | Distress | Frequency |
|---|---|---|---|---|
| | | Forbidden or perverse sexual thoughts or images | | |
| | | Forbidden or perverse sexual impulses about others | | |
| | | Intrusive thoughts or unwanted images about homosexuality | | |
| | | Sexual thoughts or images that involve children or incest | | |

| | | | | |
|---|---|---|---|---|
| | | Thoughts or images of “unnatural” sexual acts | | |
| | | Sacrilegious or blasphemous thoughts or images | | |
| | | Excessive concern with right/wrong or morality | | |
| | | Thoughts or images contrary to your religious beliefs | | |
| | | Thoughts or images of blurting out something during worship | | |
| | | Inappropriate ideas about God or religious leaders | | |
| | | Having an impulse to harm others | | |
| | | Having the idea of hurting someone you love | | |
| | | Feeling an impulse to attack a certain person | | |
| | | Thoughts or images that a person would die | | |
| | | Thoughts or images of physical aggression towards others | | |

Please rate the following:

When you have unusual thoughts or images, how much effort do you put into trying to control them (e.g. getting rid of the thought/image, distracting yourself, etc.)?

| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
|---|---|---|---|---|---|---|---|---|
| **No effort** | | | | **Moderate effort** | | | | **Extreme effort** |

Appendix C: Study Two Consent and Debriefing Forms

## Informed Consent Agreement

**Please read this consent agreement carefully before you decide to participate in the study.**

**Purpose of the research study:** The purpose of the study is to examine how people's thoughts and feelings can influence one another.

**What you will do in the study:**
1. Complete a series of "thought periods" in which you will be asked to think about particular thoughts, some which you may find unpleasant. We will ask you to identify thoughts you have that you find intrusive and undesirable because we are interested in learning how people react to these thoughts.

2. Complete questionnaires that describe your current mood, and reactions to thoughts and feelings you may find undesirable. Some of the questionnaires will be computerized.

**Please feel free to ask the experimenter any questions about the procedures, although some questions about the purpose of the study might be deferred until after you have finished. Some people do find it mildly upsetting to think about undesirable thoughts and we encourage you to talk frankly with the experimenter if you still feel upset at the end of the study.**

**Time required:** The study will require about 1.5 hours of your time.

**Risks:** There is no risk of harm to you (other than possible temporary discomfort) as a result of participating in this experiment. It is possible that individuals diagnosed with Obsessive Compulsive Disorder could find this study more distressing and experience lingering unpleasant thoughts compared to other participants.

**Benefits:** There are no direct benefits to you for participating in the study. The study may help us understand how thoughts and feelings are related when people think about thoughts that may make them uncomfortable, which may ultimately help us to reduce this discomfort.

**Confidentiality:** The information that you give in the study will be handled confidentially. The only exceptions to this guideline are if we learn of possible child or elderly abuse or danger to self or others. Your information will be assigned a code number. The list connecting your name to this code will be kept in a locked file. When the study is completed and the data have been analyzed, this list will be destroyed. Your name will not be used in any report.

**Voluntary participation:** Your participation in the study is completely voluntary.

**Right to withdraw from the study:** You have the right to withdraw from the study at any time without penalty.

**How to withdraw from the study:** If you want to withdraw from the study, tell the experimenter quietly and leave the room. You will be debriefed if you withdraw from the study, and your data will be destroyed. There is no penalty for withdrawing. You will still receive payment for the experiment. If you would like to withdraw after your materials have been submitted, please contact Joshua Magee (contact information below).

**Payment:** You will receive $15 payment for participating in the study.

**If you have questions about the study, contact:**
Joshua C. Magee, Department of Psychology, 102 Gilmer Hall, P.O. Box 400400, University of Virginia, Charlottesville, VA 22904-4400. Telephone: (434) 243-7646. Email: jcm7m@virginia.edu.

Bethany Teachman, Ph.D. Department of Psychology, 102 Gilmer Hall, P.O. Box 400400, University of Virginia, Charlottesville, VA 22904-4400. Telephone: (434) 924-0676. Email: bat5x@virginia.edu.

**If you have questions about your rights in the study, contact:**
Tonya R. Moon, Ph.D., Chair, 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

**Agreement:**
I agree to participate in the research study described above.

**Signature: _____ Date: _____**
**You will receive a copy of this form for your records.**

**Debriefing Form: Linking Thoughts and Feelings**

Thank you for participating in our study. We are currently investigating age differences in "unwanted thoughts," which are thoughts and images that pop into mind unexpectedly and are often experienced as strange or unusual. Occasionally people find they can rid their mind of unwanted thoughts fairly easily, but usually this is a very difficult thing to do. The purpose of the present study is to assess the frequency of these thoughts and images, and learn about their negative impact on adults' experiences.

Little is known about age differences in how people feel and think after difficulty suppressing their thoughts, but we know this is a very common experience. In fact, while unwanted thoughts can be temporarily distressing, having intrusive thoughts is a normal experience. **There is no reason to believe that either unwanted thoughts or thought suppression difficulties are informative about your personality or values.**

**In fact, most people report unwanted thoughts that don't make a lot of sense to them.** There is no reason to believe that thinking about unwanted thoughts increases the chances of those thoughts coming true. The most current research indicates that these thoughts are similar to other mental phenomena like getting a song stuck in your head. We are interested in whether changes that often occur with age, such as the tendency to focus more on social and emotional goals (see Carstensen & Mikels, 2005), will change how people experience intrusive thoughts and difficulties trying to suppress them. In particular, we expect that while some older adults may experience more intrusive thoughts, they will find these thoughts less distressing than younger adults will find them.

If you are interested in learning more about unwanted thoughts and thought suppression, or about age-related changes in emotions and goals, see:

- Purdon, C. & Clark, D.A. (2001). Suppression of obsession-like thoughts in non-clinical individuals: Impact on thought frequency, appraisal, and mood state. *Behaviour Research and Therapy, 39,* 1163-1181.

- Carstensen, L.L. & Mikels, J.A. (2005). At the intersection of emotion and cognition: Aging and the positivity effect. *Current Directions in Psychological Science, 14,* 117-121.

You can obtain a copy of these articles from the experimenter, or by visiting http://projectimplicit.net/bethany/ and following the link for the 'Linking Thoughts and Feelings' study.

If you feel concerned about your unwanted thoughts or other emotional difficulties, please feel free to phone our lab (434-924-0676) and speak to one of the investigators about options for counseling. Alternatively, you could also phone the UVA Counseling and Psychological Services (434-243-5556) or the Mary D. Ainsworth Psychological Clinic in the psychology department (434-982-4737). If you have concerns about your cognitive functioning, also feel free to phone our lab (434-924-0676) and speak to one of

the investigators about options for referrals. Alternatively, please call the UVA Memory Disorders clinic (434-243-5420), or visit their website at: http://www.healthsystem.virginia.edu/internet/neurology/what_we_treat/alzheimers/index.cfm.

Once again, thank you for participating in our study. If you have any further questions regarding any aspects of this research, please feel free to contact Joshua Magee, Department of Psychology, 102 Gilmer Hall, P.O. Box 400400, University of Virginia, Charlottesville, VA 22904-4400 at (434) 243-7646 or Prof. Bethany Teachman, Department of Psychology, 102 Gilmer Hall, P.O. Box 400400, University of Virginia, Charlottesville, VA 22904-4400 at (434) 924-0676. In addition, if you have any concerns about any aspect of the study, you may contact Tonya Moon, Ph.D., Chair, Institutional Review Board for the Social and Behavioral Sciences, One Morton Drive, Suite 500, University of Virginia, P.O. Box 800392, Charlottesville, VA 22908-0392. Telephone: (434) 924-5999.

**Post-Debrief Release Form for Deception Studies**
**Project Title: Linking Thoughts and Feelings**

During the experiment, you were asked to participate in a series of thinking periods in which we asked you to try not to think about different unwanted thoughts. You were told that the purpose of the study was to examine the links between thoughts and feelings. During the study, you were told that when one thought returned with a particular level of white noise, it was a sign of worsening functioning. You were also told that when a second thought returned with a different level of white noise, it was a sign of limits in a person's potential for moral and emotional growth. Neither one of these meanings of the thought returning were true. We told you these false meanings because we were interested in how younger and older adults would experience unwanted thoughts when they believed that an age-relevant fear was coming true. We thought that worsening functioning would be a more common fear for older adults, whereas encountering limits in potential for moral and emotional growth would be a more common fear for younger adults. We deceived you because in order to study your reactions to these types of meanings, it was necessary for you to believe that they were true.

Because you were deceived, you now have the right to refuse to allow all of your information, both paper questionnaires and computer data to be used and to ask that they be destroyed immediately. If you do so, there is no penalty. You will still receive full credit or payment for the experiment.

If you agree to include your paper questionnaires and computer data in the experiment, they may be reviewed and analyzed by graduate and undergraduate research assistants.

___ I give permission for my paper questionnaires and computer data to be used in the analysis for this experiment.

___ I do NOT give my permission for my paper questionnaires and computer data to be used in the analysis for this experiment. Please withdraw them from the study and destroy them immediately.

Signature: _____ Date: _____

**You will receive a copy of this form for your records.**

Appendix D: Study Two Novel and Modified Measures (Alphabetical Order)

AMIT

Please read the following statements carefully and circle the number that best corresponds to the extent to which you agree with each statement regarding the thought that you thought about during the previous thinking period.

The thought for this thinking period was: _____

Please use the following scale:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Not at all | | | | Somewhat | | | | Totally/Definitely |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Is this thought coming to mind a sign that your cognitive functioning is deteriorating? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 2 | Is this thought coming to mind a sign that you are no longer a decent person? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 3 | Is this thought coming to mind a sign that you are losing the ability to tend to your emotions? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 4 | Is this thought coming to mind a sign that you are becoming immoral? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 5 | Does this thought coming to mind mean that your memory is failing? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 6 | Is this thought coming to mind a sign that you are not gaining the right emotional experiences? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 7 | Does this thought coming to mind mean that your mind is not as sharp as it used to be? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 8 | Does this thought coming to mind mean that you are losing the ability to control your emotions? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | Does this thought coming to mind mean that you are becoming an immoral person? | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

## Positive and Negative Affect Scale

The scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you felt this way, on average, during the past thinking period. Use the following scale to record your answers.

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| very slightly or not at all | a little | moderately | quite a bit | extremely |

| | | | |
|---|---|---|---|
| _____ delighted | _____ nervous | _____ cheerful | _____hostile |
| _____ guilty | _____ ashamed | _____ upset | _____ distressed |
| _____ irritable | _____ lively | _____ energetic | _____ happy |
| _____ joyful | _____ excited | _____ afraid | _____ scared |
| _____ jittery | _____ enthusiastic | | |

# Appendix E: Study Two Additional Materials

## Diaphragmatic Breathing Script

*Now I would like you to participate in some breathing exercises with me. Please sit straight in your chair, and find a comfortable sitting position. Go ahead and relax your muscles. Place one hand over your chest* [demonstrate] *and the other hand over your diaphragm, which is located slightly above your belly button* [demonstrate]. *Now I would like you to take three slow breaths with me. When we do this, focus on breaths that move the hand on your diaphragm, not the hand on your chest. Does that make sense? Alright, please take a breath in with me….count to 1……2…….3…..and now exhale….1…..2……3… Breath in……1…….2……..3…….Breath out……1……2……3….. Breath in……1…….2……..3…….Breath out……1……2……3…..*

**Before the last thinking period, you read about a study we conducted with the National Institutes of Health. What did you learn from this research? Please circle the number of your choice.**

With a high/low level of white noise playing, the thought used in the current thinking periods tends to return more often for:

**1:** people who are beginning to experience difficulties with their memory and brain functioning.

**2:** people who are experiencing no changes in their memory and brain functioning.

**3:** people who are beginning to experience improvements in their memory and brain functioning.

**Before the last thinking period, you read about a study we conducted with the National Institutes of Health. What did you learn from this research? Please circle the number of your choice.**

With a high/low level of white noise playing, the thought used in the current thinking periods tends to return more often for:

**1:** people who are beginning to experience difficulties with their moral and emotional growth.

**2:** people who are experiencing no changes in their moral and emotional growth.

**3:** people who are beginning to experience improvements in their moral and emotional growth.

**Funnel Debriefing** Participant #: _____

We like to take a few minutes at the end to ask you about your impressions of the study, just so we can get an idea of what each participant experienced.

1. Do you have any general reactions to or comments about the study?

It's not uncommon for people to be somewhat suspicious when they take part in psychology experiments, and to wonder if something is going on that they weren't told about. It would really help us to hear about any suspicions that you may have had at any time during the study or in the time since, so I'm going to go back over some parts of the experiment again.

2. At any point while I was giving you instructions, did you experience any suspicions?
Y N Comments, if yes:

3. At any point while you were doing the thinking exercises, did you experience any suspicions?
Y N Comments, if yes:

4. When you were given feedback that the return of thoughts reflected worsening functioning, did you experience any suspicions?
Y N Comments, if yes:

5. When you were given feedback that the return of thoughts reflected limitations in moral and emotional growth, did you experience any suspicions?
Y N Comments, if yes:

Experimenter Comments:
_____
_____
_____