JORDANO, MEGAN L., M.A. Stereotype Threat and Mind-Wandering in Older Adults. (2016)
Directed by Dr. Dayna R. Touron. 159 pp.

Research on aging and mind-wandering has revealed that, while older adults report fewer mind-wandering episodes than do younger adults, they report proportionally more task-related interference (TRI; mind-wandering about task performance or approach), whereas younger adults report proportionally more task-unrelated thoughts (TUTs). It is possible that stereotype threat (ST) acts as a mind-wandering trigger in older adults by priming cognitive concerns, leading to increased TRI. In this experiment, a sample of 90 older adults was divided into three groups: a group primed for memory-related ST, a group relieved of memory-related ST, and a control group that received no ST intervention. A sample of 30 younger adults was also included. Participants completed an automated operation span task (OSPAN) with set sizes between 3-5 letters. During the OSPAN participants were probed for mind-wandering. Consistent with past findings, younger adults reported a mean proportion of TUT reports that was significantly higher than those of all three older adult groups. Likewise, the younger adult group had a mean proportion of TRI reports that was significantly lower than those of all three older adult groups. Older adults primed for ST reported significantly more TRI than older adults relieved of ST, but not significantly more TRI than control older adults. These results were consistent with our hypothesis that stereotype threat may act as a mind-wandering trigger in older adults.

STEREOTYPE THREAT AND MIND-WANDERING IN OLDER ADULTS

by

Megan L. Jordano

A Thesis Submitted to
the Faculty of The Graduate School at
The University of North Carolina at Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Master of Arts

Greensboro
2016

Approved by

Dayna R. Touron
Committee Chair

APPROVAL PAGE

This thesis written by Megan L. Jordano has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

Committee Chair Dr. Dayna R. Touron

Committee Members Dr. Michael J. Kane

Dr. Ethan Zell

03/10/2016
Date of Acceptance by Committee

03/10/2016
Date of Final Oral Examination

TABLE OF CONTENTS

Page

Page

LIST OF TABLES

LIST OF FIGURES

Page

CHAPTER I

INTRODUCTION

Normal aging is characterized by changes in cognitive processes. Cognitive performance declines on numerous cognitive tasks, including tasks that measure executive functions such as task flexibility, attentional control, reasoning, and working memory (Craik & Salthouse, 2008). Working memory has been conceptualized as a system that actively and temporarily holds pieces of information in mind, allowing that information to then be manipulated (Baddeley & Hitch, 1974). It has been suggested that decreases in attentional control that occur with normal aging explain age differences in working memory capacity (WMC; Hasher & Zacks, 1988).

Mind-wandering has been defined as a decoupling of attention from one's external environment, during which attention instead becomes focused on an individual's internal train of thought (Smallwood & Schooler, 2006). Older adults, if they are indeed unable to suppress interfering, off-task thoughts, should show evidence of *increased* mind-wandering compared to younger adults. However, older adults typically report *less* mind-wandering compared to younger adults on tasks where good performance depends on attentional control (Giambra, 1989; Grodsky & Giambra, 1990; Jackson & Balota, 2012; Krawietz, Tamplin, & Radvansky, 2012). Furthermore, older adults report *qualitatively* different mind-wandering episodes. Whereas younger adults typically report

experiencing proportionally more interfering thoughts unrelated to the current task (task unrelated thought; TUT), older adults report proportionally more interfering thoughts related to task appraisal (task-related interference; TRI; McVay et al., 2013).

These outcomes might be explained by a perspective that assumes that mind-wandering is expected to occur when one's *current concerns* trigger the generation of off-task thoughts, and when working memory deficits result in failures to successfully inhibit those off-task thoughts (McVay & Kane, 2010a). Although being in a lab environment on a college campus may trigger task-unrelated thoughts in younger adults, that same environment may instead trigger task-related interference in older adults. Concerns about age-related decline (Hertzog & Hultsch, 2000) may be particularly triggered in older adults when they enter into the testing environment, resulting in more TRI (McVay et al., 2012a).

Stereotype threat, conceptualized as worrying about performing in a way that will confirm or reinforce a negative stereotype about a group that one belongs to (Steele & Aronson, 1995), may trigger these current concerns about age-related decline in older adults, leading to an increase in TRI (Hess et al., 2003; Rahhal et al. 2001). In this study, we examine whether or not stereotype threat triggers increased reporting of TRI by older adults as they perform a resource-demanding task (an automated version of the Operation Span Task).

If stereotype threat does indeed trigger concerns about age-related decline in older adults, then we expected that experimentally relieving memory-related stereotype threat

will result in older adults reporting significantly fewer TRI episodes than the older adult groups that do not receive stereotype threat relief. Conversely, we expected that priming unrelated thought; TUT), older adults report proportionally more interfering thoughts related to task appraisal (task-related interference; TRI; McVay et al., 2013).

These outcomes might be explained by a perspective that assumes that mind-wandering is expected to occur when one's *current concerns* trigger the generation of off-task thoughts, and when working memory deficits result in failures to successfully inhibit those off-task thoughts (McVay & Kane, 2010a). Although being in a lab environment on a college campus may trigger task-unrelated thoughts in younger adults, that same environment may instead trigger task-related interference in older adults. Concerns about age-related decline (Hertzog & Hultsch, 2000) may be particularly triggered in older adults when they enter into the testing environment, resulting in more TRI (McVay et al., 2012a).

Stereotype threat, conceptualized as worrying about performing in a way that will confirm or reinforce a negative stereotype about a group that one belongs to (Steele & Aronson, 1995), may trigger these current concerns about age-related decline in older adults, leading to an increase in TRI (Hess et al., 2003; Rahhal et al. 2001). In this study, we examine whether or not stereotype threat triggers increased reporting of TRI by older adults as they perform a resource-demanding task (an automated version of the Operation Span Task).

If stereotype threat does indeed trigger concerns about age-related decline in older adults, then we expected that experimentally relieving memory-related stereotype threat will result in older adults reporting significantly fewer TRI episodes than the older adult groups that do not receive stereotype threat relief. Conversely, we expected that priming memory-related stereotype threat above and beyond what is already triggered by the lab environment will result in older adults reporting significantly fewer TRI episodes than older adults that do not receive stereotype threat priming. Furthermore, we attempted to examine the roles that factors such as task motivation, affect, importance of memory ability, and anxiety play in stereotype threat induced mind-wandering episodes.

Mind-Wandering

Younger adults frequently report thinking about topics unrelated to their current activity. For example, one study that employed experience sampling methods found that younger adults reported experiencing task-unrelated thoughts on 30%-40% of thought probes (Klinger & Cox, 1987). However, a great amount of variability exists among subjects in terms of how frequently they report mind-wandering in daily life (McVay, Kane, & Kwapil, 2009). Different situational factors have been linked to increases in reported mind-wandering. For example, when individuals perform highly automated or simple tasks that require little executive control, more mind-wandering is reported (Smallwood et al., 2004; Smallwood et al., 2009; Smallwood et al., 2011). Additionally, both low task interest and low motivation have been linked to increases in off-task thoughts (Kane et al., 2007; Unsworth & McMillan, 2013). Affect has also been shown to

influence the types of thoughts individuals report while completing cognitive tasks. Individuals who report negative affect tend to report more mind-wandering, particularly mind-wandering about past events, than those who report neutral or positive affect (Smallwood, Fitzgerald, Miles, and Phillips, 2009).

Importantly, mind-wandering in young adults has been linked to working memory capacity (WMC). Using both laboratory assessments and everyday life experience sampling methodology, it has been demonstrated that individuals with lower WMC mind-wander more frequently than those with higher WMC during cognitively demanding tasks (Kane et al., 2007; McVay & Kane, 2009; McVay & Kane, 2012a; McVay & Kane, 2012b). Additionally, studies have found that variability in TUT rate partially mediates working memory capacity's association with performance on cognitive tasks in a variety of domains (McVay & Kane, 2009; McVay & Kane, 2012a; McVay & Kane, 2012b), indicating that the performance deficits found in lower WMC individuals may be partially due to their increased propensity to mind-wander.

Mind-Wandering and Aging

Older adults have reported *less* mind-wandering compared to young adults on a variety of cognitive tasks (Giambra, 1989; Grodsky & Giambra, 1990; Jackson & Balota, 2012; Krawietz, Tamplin, & Radvansky, 2012). Such observations regarding aging and mind-wandering are counter-intuitive given the declines in WMC commonly seen with increasing aging (Craik & Salthouse, 2008). Originally, it was suggested that reliance on retrospective questionnaires when assessing mind-wandering allowed for reporting bias

in older adult participants, with reluctance to admit to being off-task possibly contributing to the age differences in mind-wandering (Giambra, 1989). However, using instructions meant to encourage honest reporting of mind-wandering episodes, Giambra (1989) found across five experiments that older adults continued to report fewer TUTs than young adults. Again, this is surprising in light of work that has demonstrated that older adults have decreased ability to ignore both external and internal sources of distraction (Hasher & Zacks, 1988).

McVay et al. (2013) suggested that misclassification of task-related interference may have contributed to the previously reported age-related differences in mind-wandering. Earlier mind-wandering studies had failed to distinguish between task-unrelated thought and task-related interference (Giambra, 1989; Giambra, 1993; Jackson & Balota, 2012). Although TRI experiences are tangentially related to the task at hand, and although both TUTs and TRI have been linked to performance deficits (McVay Kane, 2012a), TRI experiences are not directly concerned with responding appropriately to task stimuli, making TRI distinguishable from both TUTs and on-task thoughts.

However, if a separate TRI category is not present for participants to respond to, people may instead misclassify these TRI experiences as being on-task, potentially artificially lowering the overall proportion of mind-wandering reported (McVay et al., 2013). After asking participants to distinguish between TUTs and TRI when probed during a sustained attention to response task (SART), McVay and colleagues (2013) found that TRI *did* explain some of the age-related differences in mind-wandering, with

older adults reporting significantly more TRI experiences than younger adults. However, this increase in TRI did not account completely for the difference in older and younger adults' proportion of off-task thoughts. Even taking into account differences in TRI, older adults continued to report less overall mind-wandering than young (McVay et al., 2013).

Two different theories of mind-wandering have emerged, each volunteering an explanation as to why older adults report less mind-wandering than younger adults. The Smallwood and Schooler (2006), "resource competition" theory of mind-wandering asserts that off-task thoughts require executive control resources in order for them to be generated and maintained within consciousness. Because increased automaticity on tasks has been linked to more subsequent mind-wandering, it has been proposed that automaticity with increased practice frees up these executive control resources, allowing for more mind-wandering to occur (Smallwood et al., 2004). Therefore, individual differences in WMC would be positively rather than negatively correlated with mind-wandering instances during simple tasks. If fewer resources are being used to complete the task, more resources can be then devoted to the generation and maintenance of off-task thoughts (Levinson et al., 2012). In-the-moment reported TUTs also predict performance errors, possibly alluding to competition for executive control resources (Smallwood et al., 2004). Finally, Smallwood et al. (2009), have found that most instances of off-task thought are *prospective*, or future oriented, and it is believed that this form of mind-wandering that focuses on unresolved plans, goals, and concerns is particularly resource-demanding (Schacter, Addis, & Buckner, 2008).

It has been argued by others that TUTs, resulting from thinking about "unfinished business," are spontaneously and unconsciously generated and require attentional control to enter into consciousness (Giambra, 1989). If mind-wandering requires attentional control, younger adults should experience increased mind-wandering, because they have more attentional control resources to spare when compared to older adults. Older adults, with less attentional control resources to spare and possibly less "unfinished business" than younger adults, would therefore be expected to mind-wander less than younger adults (Giambra, 1989).

McVay and Kane (2010a) have proposed a theory of mind-wandering that extends from Giambra's (1989) perspective. The "Control failures x Current concerns" framework similarly asserts that TUTs are automatically and continuously generated in response to various environmental cues that prime an individual's current goals and concerns (see Klinger 1971; Klinger 1999; Klinger 2009). However, this theory proposes that off-task thoughts *only* enter conscious awareness through a failure of executive control to suppress them. Individuals' differences in control (as measured by WMC) are typically *negatively* correlated with proportion of TUTs (McVay & Kane, 2009; McVay & Kane 2012a; McVay & Kane 2012b). Additionally, individuals with higher WMC still suffer in terms of performance costs when they do experience TUTs.

This "Control failures x Current concerns" view suggests that variations in mind-wandering are due to an interaction between attentional control capabilities, motivation to prevent off-task thoughts, and the extent to which the environmental context primes

current concerns (McVay & Kane, 2010a). According to this perspective, older adults may have fewer off-task thoughts and more TRI compared to young adults when their concerns and motivation differ from those of young adults, regardless of declines in executive functioning. For example, when younger adults enter into a typical testing environment within a psychology laboratory, the familiar college campus may trigger current concerns regarding every day, school-related duties. This same testing environment may not cue older adults' typical, more relationship-oriented current than younger adults, would therefore be expected to mind-wander less than younger adults (Giambra, 1989).

McVay and Kane (2010a) have proposed a theory of mind-wandering that extends from Giambra's (1989) perspective. The "Control failures x Current concerns" framework similarly asserts that TUTs are automatically and continuously generated in response to various environmental cues that prime an individual's current goals and concerns (see Klinger 1971; Klinger 1999; Klinger 2009). However, this theory proposes that off-task thoughts *only* enter conscious awareness through a failure of executive control to suppress them. Individuals' differences in control (as measured by WMC) are typically *negatively* correlated with proportion of TUTs (McVay & Kane, 2009; McVay & Kane 2012a; McVay & Kane 2012b). Additionally, individuals with higher WMC still suffer in terms of performance costs when they do experience TUTs.

This "Control failures x Current concerns" view suggests that variations in mind-wandering are due to an interaction between attentional control capabilities, motivation to

prevent off-task thoughts, and the extent to which the environmental context primes current concerns (McVay & Kane, 2010a). According to this perspective, older adults may have fewer off-task thoughts and more TRI compared to young adults when their concerns and motivation differ from those of young adults, regardless of declines in executive functioning. For example, when younger adults enter into a typical testing environment within a psychology laboratory, the familiar college campus may trigger current concerns regarding every day, school-related duties. This same testing environment may not cue older adults' typical, more relationship-oriented current concerns (Carstensen, 1995). However, it may instead trigger concerns about perceived cognitive performance and cognitive decline (Hertzog & Hultsch, 2000). This triggering of performance-related concerns may in turn lead to increased TRI.

The finding that older adults experience increased TRI is difficult to reconcile with Smallwood and Schooler's (2006) theory of mind wandering. If mind-wandering is dependent on the deployment of executive control resources, then older adults, who have less of these resources, should report fewer instances of *both* TRI and TUT compared to young adults. However, this is not the case. Older adults report more TRI and less TUT compared to young adults. As an example, young adults reported experiencing TRI on 21% of thought probes while completing a SART (McVay and Kane, 2013. These same young adults reported experiencing TUTs on 51% of thought probes during the SART. Older adults reported experiencing TRI on 31% of thought probes and experiencing TUTs on 17% of thought probes during the same SART (McVay & Kane, 2012b).

Although older adults reported less overall mind-wandering and fewer instances of TUT, as would be predicted by Smallwood and Schooler's theory, TRI was much more frequently reported in older adults compared to younger adults. Furthermore, SART performance was equally affected during TUT and TRI episodes (McVay & Kane, 2012b).

Stereotype Threat and Mind-Wandering

If current concerns play an important role in the generation of off-task thoughts, it is possible that concerns regarding cognitive decline may lead to increased TRI in older adults. Many individuals believe that aging causes impairment of cognitive ability, particularly in the domain of memory (Hummert, 1999). Older adults do perform more poorly than young adults on various memory tasks (for a review, see Zacks, Hasher, & Li, 2000). Whereas changes in the brain's physiological structures are one underlying cause of age-related changes in memory performance, a social component might also contribute to these changes. It is believed that differential treatment of older adults heightens their awareness of negative aging-related beliefs held by others (Kemper, 1994), and this leads to the possibility of stereotype threat.

In support of this theory, it has been found that framing a memory task as an "impression task" reduces age differences in memory performance, at least in some contexts (Hess et al., 2001; Rahhal, Hasher, & Colombe, 2001; Rahhal, May, & Hasher, 2002). Emphasizing positive rather than negative age-related stereotypes (for example, "wise" vs. "forgetful") during memory task instruction can also lead to improved

performance (Levy, 1996). Likewise, priming of negative age-related stereotypes in older adults has been shown to result in heightened physiological arousal (Levy et al., 2000). This increase in arousal following the priming of negative stereotypes is believed to be the result of increased anxiety in stereotyped individuals, and this anxiety can in turn undermine memory performance. Indeed, activation of stereotype threat in marginalized groups can influence cognition by both increasing anxiety and by lowering motivation to succeed on tasks within the stereotyped domain (Steele & Aronson, 1995).

Priming of age-related stereotypes can trigger stereotype threat in marginalized individuals. However, a variety of additional factors exist that moderate and mediate stereotype threat. For example, it is believed that the degree to which a marginalized individual *values* the stereotypes domain greatly influences the degree to which stereotype threat is experienced (Wheeler & Petty, 2001). In one study, stereotypes regarding aging were primed in both younger and older adults using fabricated, newspaper-style research reports. Participants read either two reports that presented age-related cognitive decline as a phenomenon that was mediated by one's environment and therefore not inevitable, or two reports that presented these changes as biologically-based and inevitable (Hess, Autman, Colcombe, & Rahhal, 2003). Younger and older adult controls did not read these reports. Older adults who were primed for stereotype threat using research reports used fewer beneficial memory strategies (e.g. clustering) and recalled fewer words one recall task than did young adults. These primed older adults

also clustered recall items less and recalled fewer words than both control older adults and older adults who read the positive research reports.

Within the group of older adults primed for memory and age related stereotype threat, self-rated importance of memory achievement was negatively correlated with recall performance (Hess et al., 2013). In the same study, it was found that even the control older adults had recall performance and strategy use that varied as a function of self-rated importance of memory achievement. This relationship did not hold for the older adult group that underwent the stereotype threat relief manipulation. These findings suggest that even a normal laboratory testing situation can be sufficient to induce stereotype threat in older adults (Hess et al., 2003), and that importance of the stereotyped domain influences how stereotype threat is experienced by marginalized individuals.

The age of older adult participants has also been found to moderate stereotype effect. Older adults seem more likely suffer from stereotype threat at the *beginning* of old age, with *young-old* participants (aged 60-70) performing worse on memory tasks than old-old participants (aged 71-85) when participants were reminded of typical age-related cognitive declines (Hess & Hinson, 2006; Hess et al., 2009). Individuals just entering into old age may have heightened sensitivity to their new group membership, making associated environmental cues more salient. As a result, *stigma consciousness* increases (Pinel, 1999). Stigma consciousness refers to the extent to which a marginalized

individual expects to be stereotyped, and it is believed to be an important factor in predicting whether or not an individual experiences stereotype threat (Pinel, 1999).

The cognitive mechanisms underlying stereotype threat based performance deficits have also been investigated, and it has been suggested that these mechanisms may differ between younger and older adults. For example, stereotype threat has been found to lead to decreased working memory capacity in younger adults (Blascovitch, Spencer, Quinn & Steele, 2001; Croizet et al., 2004; Schmader & Johns, 2003; Johns, Inzlicht, & Schmader, 2008). However, this finding has not been consistently replicated using an older adult sample (Hess & Hinson, 2006; Hess et al., 2009; Barber & Mather, 2012, Barker, & Mather, 2013, but see Mazerolle et al., 2012). For example, Barber and Mather (2012) found that stereotype threat manipulations did *not* harm older adults' ability to selectively choose learning high value information as opposed to low value information, even though this ability to evaluate different types of information and to prioritize learning accordingly is dependent on executive control abilities (Castel et al., 2011).

In the absence of evidence that stereotype threat operates through deficits in working memory capacity in older adults, it has been proposed that shifts in regulatory focus (Seibt & Forster, 2004) may instead explain how stereotype threat affects older adults' task approach and performance. More specifically, it has been suggested that shifts in regulatory focus causes individuals to become more vigilant in an attempt to avoid making errors and confirming the negative stereotype (Seibt & Forster, 2004; Barber & Mather, 2013).

Differences in emotional regulation may also alter how individuals respond to stereotype threat. Stereotype threat has been related to state anxiety, if inconsistently (for effects: see Chasteen, 2005 (Experiment 3), Abrams et al., 2005; for null effects: Chasteen, 2005 (Experiment 2); Hess & Hinson, 2006; Hess, Hinson, & Statham, 2004). Older adults are believed to have more well-developed emotional control abilities than do younger adults (Phillips, Henry, Hosie, & Mihne, 2008; Scheibe & Blanchard-Fields, 2009). Although stereotype threat does elicit affective responses in both young women experiencing stereotype threat regarding mathematic ability (consistent with Cadinu, Maass, Rosabianca, and Kiesner, 2005) and in older adults experiencing stereotype threat regarding memory ability, older adults may be more able to use their better emotional control to suppress interfering negative self-talk and negative emotions in order to adopt a more careful and less error-prone response style (Popham & Hess, 2013). It has been demonstrated that even subtle cues within an environment may activate aging-related schemas in both younger and older adults, influencing participants' task approach and performance without them being consciously aware of the environmental influence (Hess et al., 2009). If stereotype threat activation does indeed leads to increases in worry-laden monitoring and negative self-talk (Cadinu, Maass, Rosabianca, and Kiesner, 2005; Popham & Hess, 2013), then stereotype threat can be thought of as a mind-wandering trigger.

Research Aims

The current aging study examined the role that stereotype threat plays in triggering mind-wandering, particularly task-related inference, in older adults. We did this by relieving stereotype threat in a group of older adults and subsequently measuring performance on a cognitive task that required executive control while simultaneously assessing mind-wandering instances using online thought probes. We compared the proportion of TRI, TUTs and on-task thoughts of our stereotype threat relief participants to a stereotype threat primed group of older adults, an older adult control group, and a younger adult control group. Before we examined the contribution of stereotype threat to older adults' mind-wandering, we first established that mind-wandering (particularly TRI) is responsive to ST task and instructional manipulations. Accordingly, we conducted two pilot studies that examined stereotype threat induced TRI in younger adults.

CHAPTER II

YOUNGER ADULT PILOT EXPERIMENTS

Pilot Experiment 1

The aging study followed-up a younger adult pilot experiment that examined the effects of activating stereotype threat in female participants by priming current concerns regarding mathematical ability. Mrazek and colleagues (2011) specifically examined stereotype threat and mind-wandering patterns in young adults, predicting that heightened anxiety in stereotyped participants would lead them to monitor internal thoughts more than control participants. When attention is shifted away from the task at hand, performance deficits may result (Schmader, Johns, & Forbes, 2008; Schmader, Forbes, Zhang, & Mendes, 2009), triggering worry-laden, evaluative forms of TRI. In the study by Mrazek and colleagues female participants primed for math-related ST complete a demanding mathematical task containing thought probes. Participants also completed a retrospective measure of mind-wandering (the Dundee Stress State Questionnaire; Matthews et al., 1999), which contains both a TUT and a TRI scale. Individuals in the threat condition had poorer performance on a challenging math test than individuals in the no threat condition (Mrazek et al., 2011), and stereotype threat priming was associated with increased mind-wandering. Mrazek and colleagues (2011) also concluded

that TUTs in particular impaired performance in stereotyped individuals. Furthermore, anxiety was found to mediate the effect of ST on mind-wandering (Mrazek et al., 2011).

To foreshadow, we completed two pilot studies to determine if experimentally manipulating stereotype threat activation can lead to impairments on task performance and increased mind-wandering in younger adults. Although Mrazek and colleagues concluded that TUTs rather than TRI impaired performance in stereotyped individuals, their analyses were carried out using data from retrospective mind-wandering assessments. We instead used categorical probes of thought content, including TRI. In both pilot experiments, a group of female young adults were primed for math-related stereotype threat and then completed an Operation Span Task (OSPAN) containing thought probes presented at unpredictable internals. Participants also completed post-task questionnaires on self-reported mood, motivation, and anxiety. We hypothesized that stereotype activation would lead to an increase in probe-caught TRI. We also predicted that our stereotype threat primed group would have worse overall math verification performance on an automated OSPAN task.

Methods

Participants were recruited through the UNCG Experimetrix online subject pool and received course credit for participation. Although we collected data from both male and female participants, we only analyzed the data from our female participants. Sixty female, undergraduate participants were divided into two groups: a stereotype threat primed group and a control group. Participants were recruited using an online research

participation pool and earned course credit for their participation. Testing lasted approximately one and one half hours.

Participants in the ST primed group were told that they would complete a task designed to measure “quantitative capacity” in order to collect normative data about college students, and that this task had revealed *gender differences* in the past. Additionally, participants within the ST primed group were tested by a male experimenter and were always tested in a room along with either a male participant or a male confederate. This served as a prime for stereotype threat. Participants within the control group were told that they would complete a memory task in order to collect normative data about college students. This type of instructional manipulation has been widely used in the stereotype threat literature to prime math-related stereotype in female students.

After completing a brief demographics questionnaire, participants in both groups completed a computerized version of a gender-math Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998). The IAT is a commonly used method of measuring implicit stereotype activation. This task is well-validated and widely used within the field of social psychology (Nosek & Smyth, 2007). In this study, we used a version of the IAT tailored towards assessing attitudes towards gender (male/female) and field of study (mathematics/liberal arts). This implicit measure of stereotype threat therefore served as manipulation check in this experiment (see Banaji & Hardin, 1996).

The IAT is described in more detail in Appendix A. Instructions for our gender-field of study IAT are provided in Appendix B.

All participants then completed an automated version of the OSPAN, during which participants alternated between verifying mathematical equations and remembering letters in serial order. This OSPAN consisted of 130 trials with set sizes varying between two and three math problems to be verified and letters to be later recalled. During the OSPAN, participants were also presented with thoughts probes occurring at unpredictable intervals. When a probe appeared, participants were instructed to indicate the type of thought they had experienced just prior to the appearance of the probe. The instructions for the OSPAN are presented in Appendix C.

Participants responded to a total of 10 probes. Five probes appeared during trials containing set sizes of two and five appeared on trials containing set sizes of three. Probes appeared at various points within an OSPAN trial. Probes appeared: (1) after participants saw the final mathematical equation within a trial, but before they verified the answer for that equation, (2) after the final mathematical equation within a trial had been verified, but before the final letter to be recalled was presented, and (3) at the end of a trial after participants saw the final letter to be recalled. Probes appeared approximately three minutes apart and remained on the screen until a response had been made. Participants were asked “What were you just thinking about?” and responded by selecting one of the following options using their computer keyboard:

(1) The task: Focused on completing the task, verifying equations and remembering letters

(2) Task approach: Thinking about how you can improve your task performance

(3) Task evaluation: Evaluating how effective you were completing the task, or worrying about task performance

(4) Everyday things: Thinking about recent or impending life events

(5) Current state of being: Thinking about conditions such as hunger or sleepiness

(6) Personal worries: Thinking about concerns, troubles or fear not relating to the experimental task

(7) Daydreams: Fantasies disconnected from reality

The thought probes participants saw on the computer screen contained all of the information provided in the above example. Option (1) corresponds to on-task thought, options (2) and (3) correspond to TRI, and options (4) through (8) correspond to various types of TUTs. The specific content of participants' TRI remains unknown. Task-related interference may reflect a *reactive* form of mind-wandering, during which individuals assess previous performance, or a more *proactive* form of mind-wandering, during which individuals prepare for future performance by considering strategic approaches to a task. In this study, we broke down the TRI thought probe option into proactive TRI (Option 2) and reactive TRI (Option 3).

Participants then completed various post-task questionnaires. These included the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegan, 1988; see Appendix D), which contains 20 items relating to current mood state. The PANAS was used as a measure of affect in this experiment. The anxiety (MIA-Anx) subscale of the Metamemory In Adulthood (MIA; Dixon & Hultsch, 1984; see Appendix E) questionnaire was used as a measure of anxiety. The Thought Content components of the Dundee Stress State Questionnaire (DSSQ; Matthews et al., 1999; see Appendix F) was used as an additional retrospective measure of mind-wandering and contains eight questions assessing TRI (e.g., "I thought about how I should work more carefully") and eight questions assessing TUT (e.g., "I thought about something that happened to me earlier"). The Motivation component of the DSSQ, which contains 15 questions related to motivation level, was used as a measure of participant motivation (see Appendix G).

Results and Discussion

Analysis of IAT scores, instances of probe-caught mind-wandering, and math accuracy in the ST and control groups were conducted using one-way ANOVAs. For IAT scores, a main effect of group was found, $F(1, 58)=7.374$, $p=.009$, with participants in the stereotype threat group being *slower* than participants in the control group to pair the concepts of "male" and "liberal arts" and the concepts of "female" and "mathematics" together than participants in the control group ($M_{ST} = -0.23$, $SE_{ST} = 0.07$, $M_{\text{Control}} = 0.01$, $SE_{Control} = 0.05$). This indicates stronger implicit beliefs that women are inferior to males

in terms of mathematical ability (see Figure 1). We therefore believe our ST manipulation lead to heightened stereotype threat activation in our primed group.

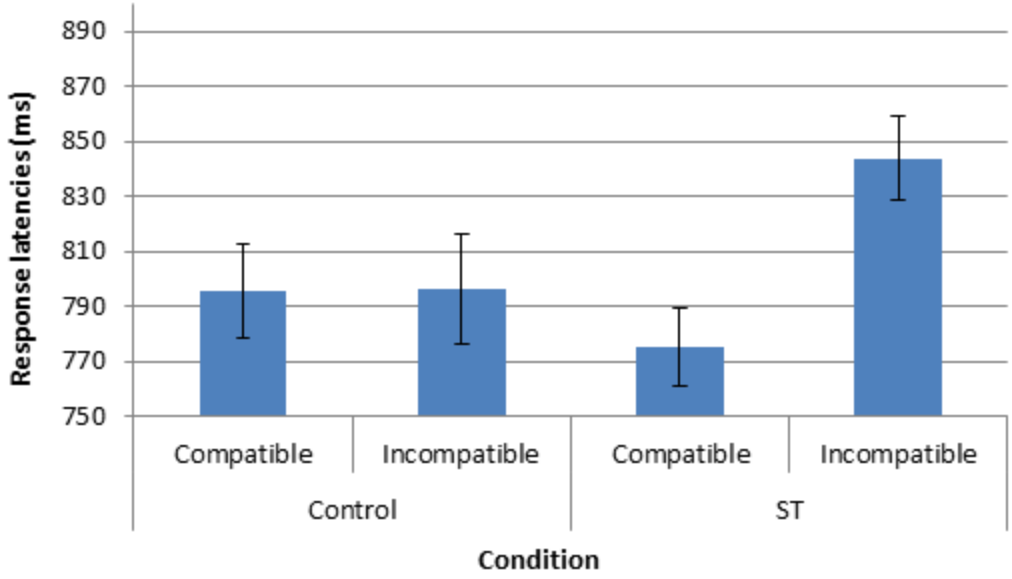


Figure 1. Pilot Study 1 Response Latencies (ms) for Compatible and Incompatible IAT Trials by Group.

Probe-caught mind-wandering in the two groups was compared (see Figure 2). We found a main effect of group on TRI rate $F(1,59) = 6.78$, $p = .012$. Participants in the stereotype threat group indicated experiencing more task-related interference on thought

probes during the OSPAN (M_{ST} = 2.17, SE_{ST} =.26, M_{Control} = 1.27, $SE_{Control}$ =.23). Again, we believe that the stereotype threat priming procedure led to increased worry-laden monitoring of performance in our stereotype threat group, which is reflected in increased TRI. Participants in the ST group reported a higher proportion of proactive TRI than did control participants (M_{ST} =.303, SE_{ST} = .003, M_{Control} = .033, $SE_{Control}$ = .001), $F(1, 58)$ = 21.391, $p < .001$. Likewise, participants in the ST group reported a higher proportion of reactive TRI than did control participants (M_{ST} =.224, SE_{ST} = .028, M_{Control} = .103, $SE_{Control}$ = .019), $F(1, 58)$ = 8.020, p = .006. This finding suggests that participants who experienced heightened stereotype threat not only engage in increased worry-laden monitoring of performance, but also experience increased mind-wandering about task strategy. Participants in the control group were also more likely to report being on-task than stereotype threat participants (M_{ST} = 3.70, SE_{ST} = .402, M_{Control} = 4.83, $SE_{Control}$ = .462), however this difference was not significant $F(1, 58)$ = 3.74, p = .058. Likewise, our two groups were not significantly different in terms of reported TUT $F(1, 59)$ = .093, p = .761

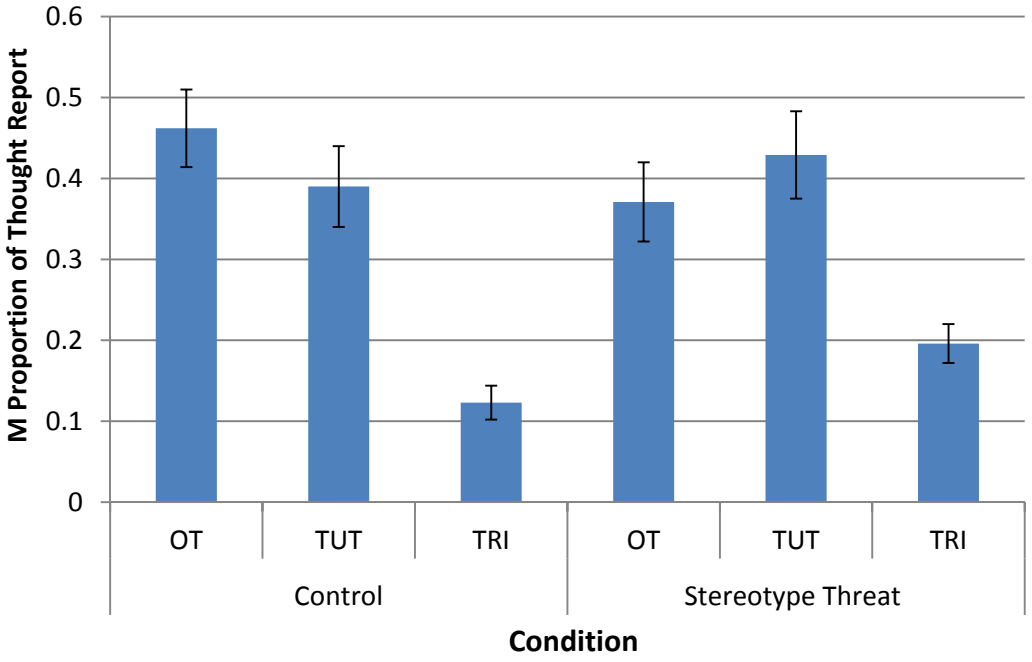


Figure 2. Pilot Study 1 Mind-Wandering Proportions for Stereotype Threat Primed and Control Groups.

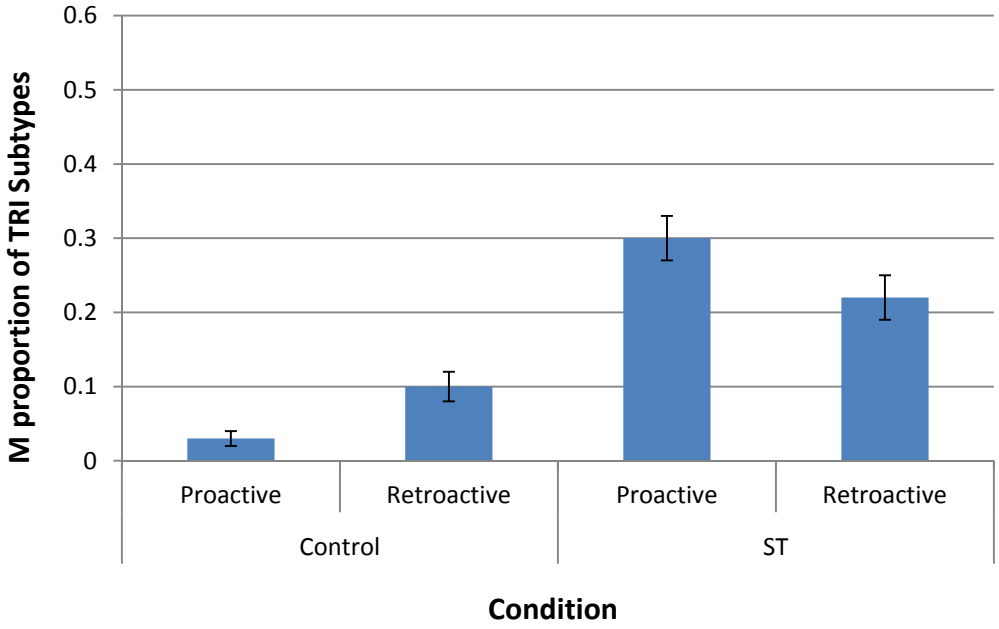


Figure 3. Pilot Study 1 TRI Subtypes for Stereotype Threat Primed and Control Groups.

OSPAN math verification accuracy was compared in the two groups (see Figure 4). Contrary to our initial hypothesis, a main effect of group was not found for math verification accuracy, $F(1, 59) = 1.801$, $p = .185$. The stereotype threat and control groups did equally well on the math verification portion of the OSPAN ($M_{ST} = 90.93$, $SE_{ST} = .73$, $M_{\text{Control}} = 91.70$, $SE_{Control} = .74$). A main effect of group was not found for letter recall accuracy, $F(1, 59) = 1.01$, $p = .276$. Participants in two groups did equally well on the letter recall portion of the OSPAN ($M_{ST} = 87.05$, $SE_{ST} = .64$, $M_{\text{Control}} = 88.10$, $SE_{Control} = .72$). It is possible that our OSPAN task, which used set sizes of two and three,

was not difficult enough to lead to performance deficits in our stereotype threat group. Therefore, we conducted Pilot Experiment 2, which used a more challenging OSPAN task.

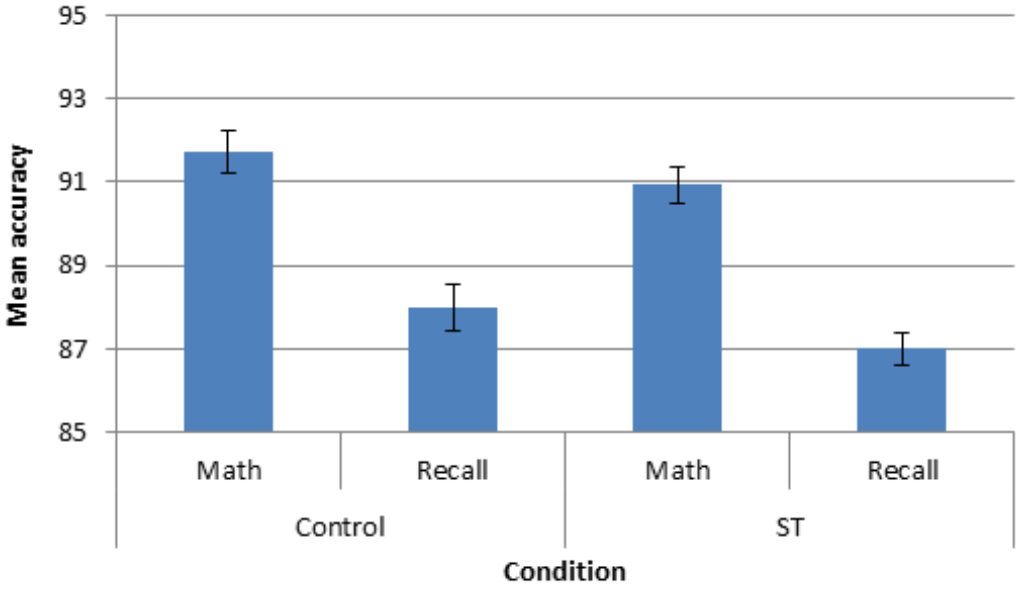


Figure 4. Pilot Study 1 OSPAN Math Verification and Letter Recall Accuracy for Stereotype Threat Primed and Control Groups.

In the current study, participants in the stereotype threat group did not appear to suffer in terms of math performance although they did report more TRI than participants

in the control group. Because the stereotype threat primed group did not show the expected performance deficits, we were unable to examine mediating effects of anxiety, mood, and motivation on task performance in those under stereotype threat. Indeed, we found no main effects of group for self-reported anxiety, $F(1,59) = 1.0$, $p = .31$, self-reported positive affect, $F(1,59) = 1.3$, $p = .26$, self-reported negative affect, $F(1,59) = 0.46$, $p = .27$, and self-reported motivation, $F(1,59) = 0.07$, $p = .78$. Again, it is possible that the OSPAN we used was not challenging enough to alter mood, motivation, or anxiety in the ST primed participants.

Pilot Experiment 2

We predicted that the stereotype threat group would be less accurate on the math verification portion of the OSPAN. This was not the case. Participants in both groups achieved a high level of performance on the math verification task, and it is possible that the version of the OSPAN used in Pilot Experiment 2 was not challenging enough to lead to performance deficits in the group primed for math-related stereotype threat. We therefore conducted an additional pilot experiment in which we made the math verification portion of the OSPAN more difficult task by increasing the set sizes from two and three math problems to be verified in a OSPAN trial to three, four, and five math problems to be verified to see if stereotype threat driven performance deficits would result.

We conducted the same analyses as in Pilot Experiment 1 and predicted that those in the stereotype threat group would be slower to pair the concept of “female” and

“mathematics” together during the IAT, would report increased TRI, and would have lower accuracy on the math portion of the OSPAN. We expected that the stereotype threat primed group would report more anxiety and negative affect than the control group. Furthermore, we hypothesized that anxiety and negative affect would mediate the relationship between stereotype threat activation (as indicated by scores on the math-gender IAT) and OSPAN math verification accuracy.

Methods

Pilot Experiment 2 was identical to Pilot Experiment 1 with the exception of the OSPAN task used. The OSPAN used in Pilot Experiment 2 consisted of 81 trials with set size varying between three, four, and five math problems to be verified and letters to be recalled. During the OSPAN, participants were presented with nine thought probes, occurring at unpredictable intervals, which asked them to indicate the type of thought they had experienced just prior to the appearance of the probe. Participants then completed the same post-task questionnaires that were used in Pilot Experiment 1.

Results and Discussion

Analysis of IAT scores, probe-caught mind-wandering episodes, and math accuracy in the ST and control groups were conducted using one-way ANOVAs. While participants in the ST primed group were slower to pair the concepts of “math” and “female” together and “male” and “liberal arts” together (perhaps indicating heightened math-related stereotype threat in ST primed participant) there was no significant group difference (M_{ST} = -0.23, SE_{ST} = 0.07, M_{Control} = 0.01, $SE_{Control}$ = 0.05) in IAT scores, $F(1, 58) = 7.374$, $p = .009$.

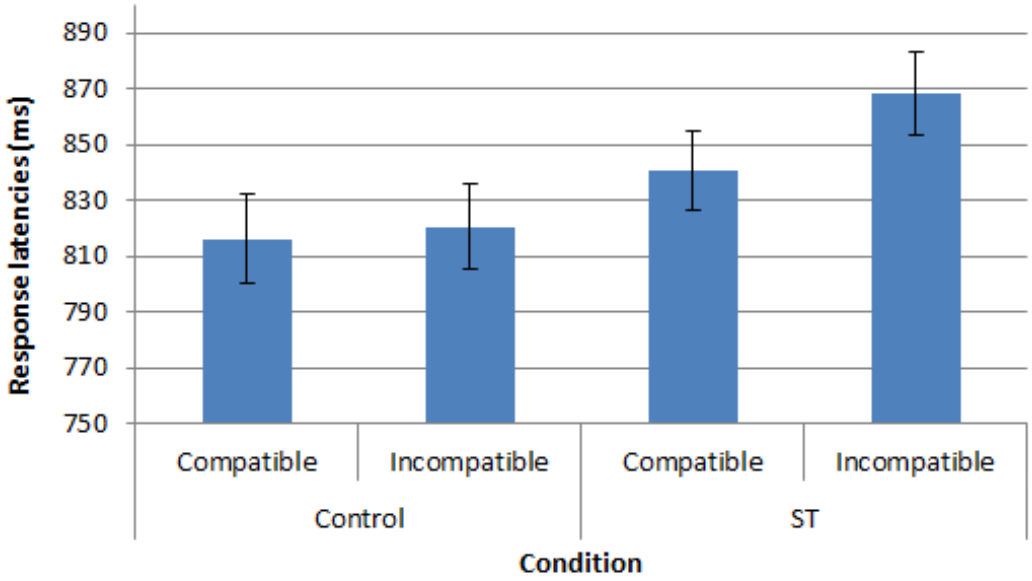


Figure 5. Pilot Study 2 Response Latencies (ms) for Compatible and Incompatible IAT Trials by Group.

Proportions of probe-caught mind-wandering were compared for our two groups (see Figure 6). We found a main effect of group on TRI, $F(1,58) = 5.488$, $p = .002$. As in Pilot Experiment 1, participants in the stereotype threat group indicated experiencing more task-related interference on thought probes during the OSPAN ($M_{ST} = 1.60$, $SE_{ST} = .31$, $M_{\text{Control}} = 0.73$, $SE_{Control} = .45$). Again, we believe that the stereotype threat priming procedure led to increased worry-laden monitoring of performance in our stereotype threat group, which is reflected in increased TRI. Participants in the ST group reported a higher proportion of proactive TRI than did control participants ($M_{ST} = .060$, $SE_{ST} = .016$,

M_{Control} = .030, $SE_{Control}$ = .009), $F(1, 58) = 3.579$, $p = .063$. Likewise, participants in the ST group reported a higher proportion of reactive TRI than did control participants (M_{ST} =.090, SE_{ST} = .012, M_{Control} = .046, $SE_{Control}$ = .013), $F(1, 58) = 3.512$, $p = .065$. This finding suggests that participants who experienced heightened stereotype threat not only engage in increased worry-laden monitoring of performance, but also experience increased mind-wandering about task strategy.

Participants in the control group were also more likely to report being on-task than stereotype threat participants (M_{ST} = 3.47, SE_{ST} = .53, M_{Control} = 5.37, $SE_{Control}$ = .33), with this difference being significant, $F(1,58) = 2.267$, $p = .006$. However, these two groups were not significantly different in terms of reported TUT $F(1,58) = 2.267$, p = .138.

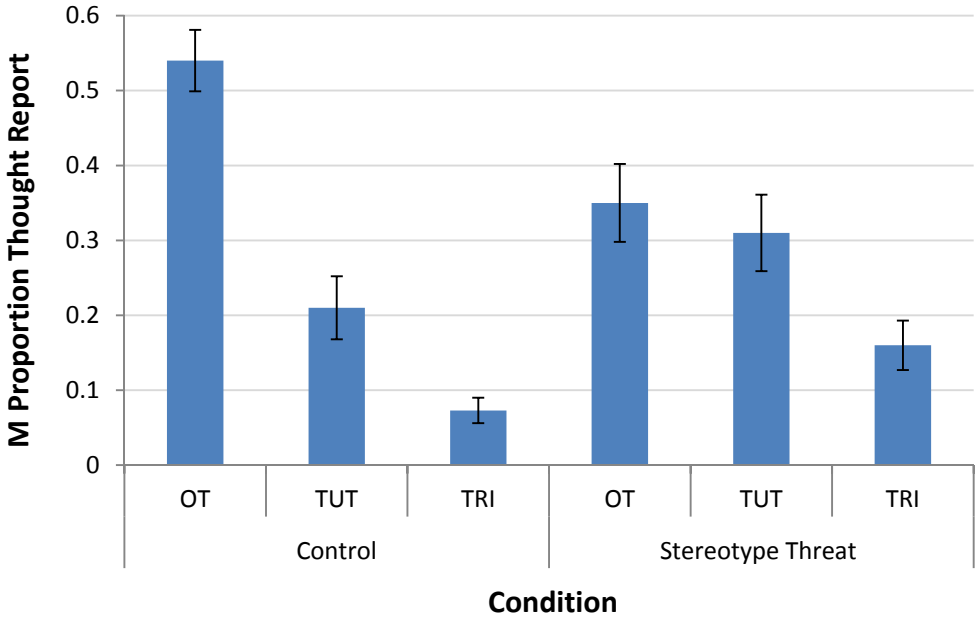


Figure 6. Pilot Study 2 Mind-Wandering Proportions for Stereotype Threat Primed and Control Groups.

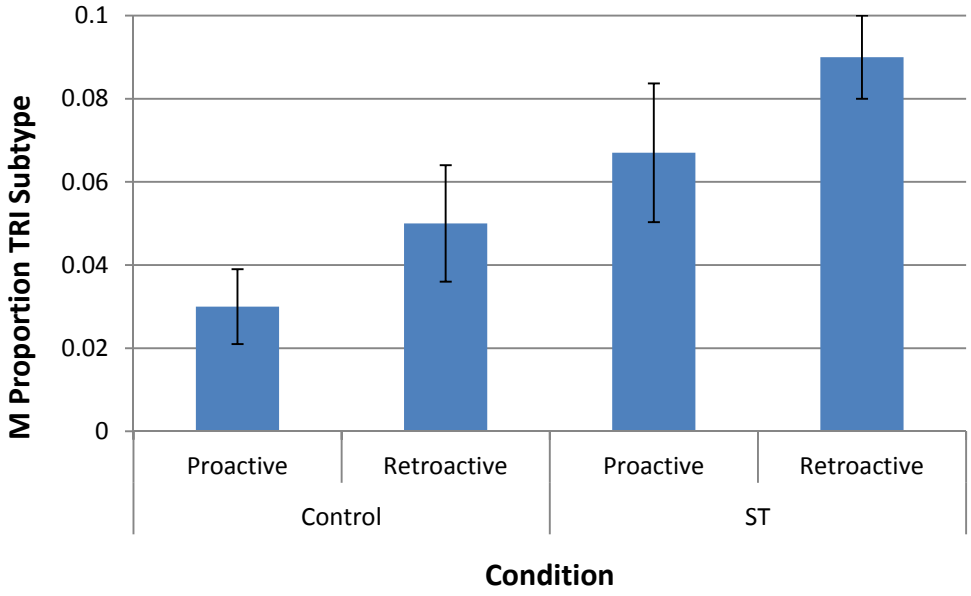


Figure 7. Pilot Study 2 TRI Subtypes for Stereotype Threat Primed and Control Groups.

OSPAN math verification accuracy was compared in the two groups (see Figure 8). Using a more challenging version of the OSPAN with larger set sizes, a main effect of group was found for math verification accuracy, $F(1, 58) = 12.11$, $p = .001$. Participants in the control group did better on the math verification portion of the OSPAN ($M_{ST} = 90.60$, $SE_{ST} = .92$, $M_{\text{Control}} = 94.11$, $SE_{Control} = .42$) than participants primed for stereotype threat, potentially because they experienced fewer off-task thoughts. There was no group difference in letter recall accuracy, $F(1,58) = .268$, $p = .790$. Participants in both groups

did equally well on the letter recall portion of the OSPAN (M_{ST} = 88.21, SE_{ST} = .80, M_{Control} = 89.62, $SE_{Control}$ = .32).

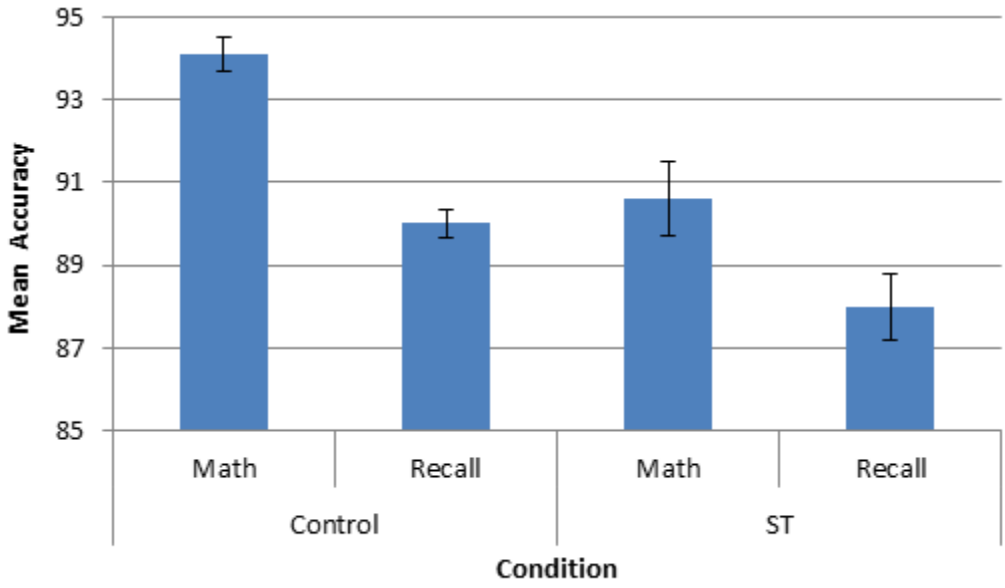


Figure 8. Pilot Study 2 OSPAN Math Verification and Letter Recall Accuracy for Stereotype Threat Primed and Control Groups.

In the current study, participants in the stereotype threat group did appear to suffer in terms of math performance. Additionally, these participants also reported more TRI than participants in the control group. Next, we examined which factors correlate mind-

wandering and task performance. Overall, like in Pilot Experiment 1, we found no main effects of group for self-reported anxiety, $F(1, 59) = 1.0$, $p = .31$, self-reported positive affect, $F(1, 59) = 1.3$, $p = .26$, self-reported negative affect, $F(1, 59) = 0.46$, $p = .27$, and self-reported motivation, $F(1, 59) = 0.07$, $p = .78$.

Like Mrazek and colleagues (2011), we found that stereotype threat priming altered mind-wandering patterns in female young adults. More specifically, we found using our thought probe methodology that stereotype threat primed participants specifically reported more TRI than controls. Unlike the ST primed young adults in Mrazek and colleagues' study, the ST primed young adults in our pilot experiments did not report increased anxiety. Mrazek et al. (2011) used a challenging math task that consisted of quantitative questions from the Graduate Record Examination (GRE) whereas we used a modified OSPAN task as our mind-wandering task within the stereotyped domain. The OSPAN math verification problems were relatively easy, and it is possible that our math task was not challenging enough to increase anxiety in our participants.

Aims of the Aging Study

In Pilot Experiments 1 and 2 we primed cognitive concerns within younger adults and subsequently found that they reported more task-related interference than is typical in younger adults. In the aging study, we predicted that older adults relieved of stereotype threat will report significantly less TRI than both a control older adult group and a group

primed for stereotype threat above and beyond what may already be elicited by the normal laboratory environment.

An additional goal of the proposed study is to examine the roles that affect, anxiety, motivation, and importance of stereotyped domain play in mediating relationships between stereotype threat and mind-wandering and between stereotype threat and performance within the stereotyped domain. Affect, anxiety, and motivation will be assessed in the proposed aging study using the same questionnaires used in the previously described gender and stereotype threat study. Importance of achievement in the domain of memory will be assessed using the Achievement subscale of the Metamemory in Adulthood Questionnaire (MIA-Ach; Dixon & Hultsch, 1984). Participants will also complete portions of the Thinking Content, Task Interest and Motivation subscales of the Dundee Stress State Questionnaire (DSSQ; Matthews et al., 1999, 2002). We will measure mind-wandering using both online thought probes and retrospective questionnaires to compare mind-wandering reported using these two different methods.

Furthermore, the specific content of older adults' elevated TRI remains unknown. Task-related interference may reflect a *reactive* form of mind-wandering or a more *proactive* form of mind-wandering (a form of mind-wandering that may have positive consequences). Understanding the cause and the content of older adults' elevated TRI will extend perspectives on metacognitive monitoring in older adults (Hertzog & Hultsch, 2000).

CHAPTER III

AGING STUDY METHODS

Methods

Participants

Thirty younger adults aged 18-22 (*M* = 19.20, *SD* = 1.16) and 90 older adults aged 60-75 (*M* = 67.51, *SD* = 3.89) participated in the study. Younger adults were recruited through the UNCG Experimetrix subject pool and received course credit. Older adults were recruited through the UNCG Adult Cognition Laboratory database of older adult community volunteers and received $20 (approximately $10 per hour) for participation. Older adult participants were screened for health issues such as vision problems, past seizures or strokes, and severe arthritis that would make it difficult to use a pencil or computer keyboard for a long period of time prior to being scheduled for the study. Participants all had corrected near visual acuity of 20/50 or better. Participation took approximately one and one half hours for younger adults and two hours for older adults.

Participants completed a computerized demographics questionnaire (Appendix H), followed by the Lighthouse Near Visual Acuity Test (Bailey, 1987; see Appendix I), a paper-and-pencil measure of processing speed (Pattern Comparison; Salthouse, 1993; see Appendix K), and a computerized vocabulary test (Ekstrom et al., 1976; see

Appendix J). The vocabulary task served as a rough measure of crystallized intelligence. Demographics and pretest data is found in Table 1 below. As is typically obtained, there were group differences in education (F (3,116) = 19.845, p <.001), with the older adults in each of the three OA sample having obtained more years of education than younger adults (p < .05 for all t-test focused comparisons). There were also group differences in processing speed (F (3,116) = 3.217, p .025), with younger adults scoring higher on the measure of processing speed than did older adults in all three OA groups (p < .05 for all t-test focused comparisons). Finally, as typically found, there were group differences in number of medications taken (F (3,116) = 4.273, p .007), with older adults in all three groups reporting taking more medications than younger adults (p < .05 for all t-test focused comparisons). However, there were no differences within the older adult sample in vocabulary, processing speed, age, and number of medications taken (p > .05 for all t-test focused comparisons).

Table 1

Aging Study Demographics and Pretest Data.

	Younger Adult		***OA Control***		***OA ST Relief***		***OA ST Primed***	
N	*30*		*30*		*30*		*30*	
	M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
Processing Speed	35.83	1.34	33.40	1.56	31.30	1.20	30.53	1.18
Vocabulary	13.73	.66	23.37	1.18	24.20	1.22	23.03	1.25
Age	19.20	.21	66.52	.69	67.90	.69	68.11	.86
Education	12.80	.22	16.74	.37	16.07	.53	15.48	.63
Medications	.87	.18	2.15	.24	2.07	.38	1.70	.33

Note. Processing speed = number correct on out of 40 on Salthouse's pattern comparison task (1993); Vocabulary = number correct out of 36 on the Advanced Vocabulary Test (Ekstrom, French, & Harman, 1976); Education = total years of education; Medications = total number of medications prescribed.

Materials and Procedure

Participants were tested in groups of up to six people and the older adult groups were randomized into either control, ST primed, or ST relief conditions. The stereotype threat manipulations were carried out using brief, newspaper-style reports constructed by Hess et al. (2003). Participants in the ST primed group read two reports that focused on how age-related decline is biologically-based and inevitable (see Appendix L). Participants in the ST relief group read two reports that focused on how the age-related decline that does typically occur is *not* inevitable, but is dependent on a range of social and environmental factors (see Appendix M). An additional research report was constructed that served as a control reading, which was given to both younger and older adult control participants (see Appendix N). Participants were given a few minutes to read the brief reports and were then asked to provide a rating on a scale of 1 to 5 of how easy they found it to understand that reading (1 = Very difficult to understand, 5 = Very easy to understand).

A computerized version of the age-attitudes Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) was completed next and was used as a manipulation check for the stereotype threat priming procedure. Stimuli consisted of pleasant (e.g. “happy”) and unpleasant (e.g. “boring”) words, along with pictures of old and young faces (see Appendix R). Participants first completed a practice trial in which they sorted the word stimuli into their appropriate categories, followed by a practice trial in which they sorted the pictures of old and young faces into their appropriate categories.

Next, participants completed two “critical blocks”. One of these critical blocks consisted of 20 “congruent” trials in which participants were asked to pair pictures of old adult faces with unpleasant words. The other critical block consisted of 20 “incongruent” trials in which participants were asked to pair pictures of old adult faces with pleasant words. A third practice block was completed next, during which participants practiced a different key assignment. Finally, two more “critical blocks” were completed, again consisting of 20 incongruent and 20 congruent trials. Therefore, the participants completed a total of 80 critical trials during which their response times were recorded. The order of congruent and incongruent critical blocks was counterbalanced between participants.

Next, participants completed the automated Operation Span Task (OSPAN). As in the pilot experiments, the OSPAN was used as the task during which mind-wandering was measured. For this study, we used the same version of the OSPAN that was used in Pilot Experiment 2, with set sizes varying between three, four, and five. Mind-wandering was assessed in the same way as in Pilot Experiments 1 and 2. Participants responded to a total of 9 thought probes that appeared at unpredictable intervals during the OSPAN. This study used the same probe placement as Pilot Experiment 2. The OSPAN was framed as a *memory task* for the ST primed group and was framed as a *mathematical task* in the ST relief and the control conditions. These instructions served as an additional ST manipulation. Participants practiced the math verification portion of the task, the letter recall portion of the task, and both the math verification and letter recall portions together

before data collection actually began. During the task, participants received feedback regarding their trial-level letter recall accuracy, their trial-level math verification accuracy, and their cumulative math verification accuracy.

Finally, a variety of computerized post-task questionnaires were administered to participants. As in Pilot Experiments 1 and 2, participants completed the Dundee Stress State Questionnaire (DSSQ; Matthews et al., 1999; see Appendix F), the achievement, anxiety, and locus of control subscales of the Metamemory in Adulthood questionnaire (MIA; Dixon & Hultsch, 1984; see Appendix E), the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegan, 1988; see Appendix D) and several additional Likert-scale questions about perceived task difficulty, task focus, fatigue, and stress.

CHAPTER IV

AGING STUDY RESULTS

IAT Results

For the age-attitudes IAT, IAT scores (D) can range from -2 (signifying a strong implicit bias in favor of older adults) to +2 (signifying a strong implicit bias in favor of younger adults). A one-way ANOVA on participant IAT scores did not reveal an effect of condition, F (3,114) = .380, p= .767. As evidenced by the data below in Figure 7, both younger adults and participants in all three of the older adult groups showed similar biases towards pairing young faces with pleasant words. One possible reason for the lack IAT group differences will be considered in the Discussion section

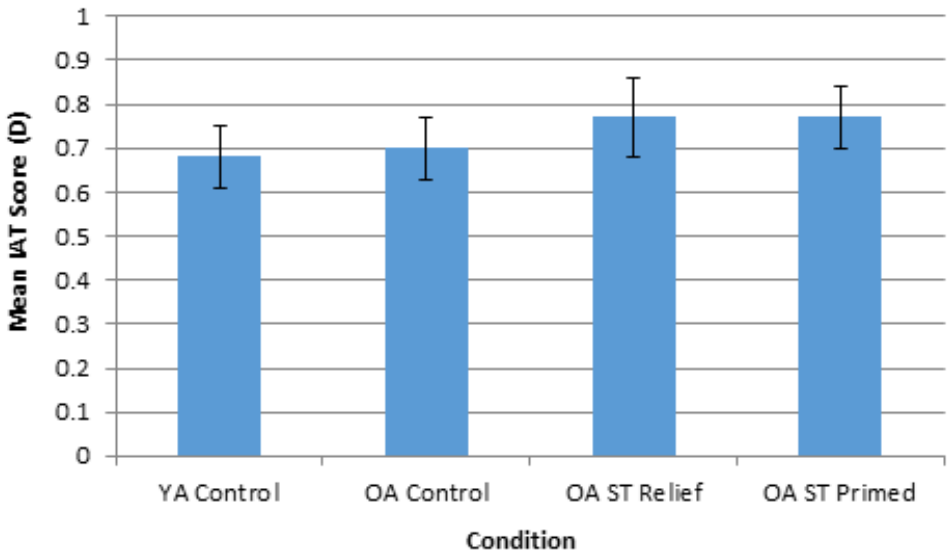


Figure 9. Mean Age-Attitudes IAT Scores by Condition.

Mind-Wandering Variables [1]

For proportion of on-task thoughts, we predicted that younger adults would report being on-task significantly less than our older adult control participants. However, a one-way ANOVA on overall proportion of OT thought reports revealed no significant effect of condition, F (3,116) = 1.615, p =.190. Each of the four groups reported comparable proportions of on-task thoughts (Figure 10).

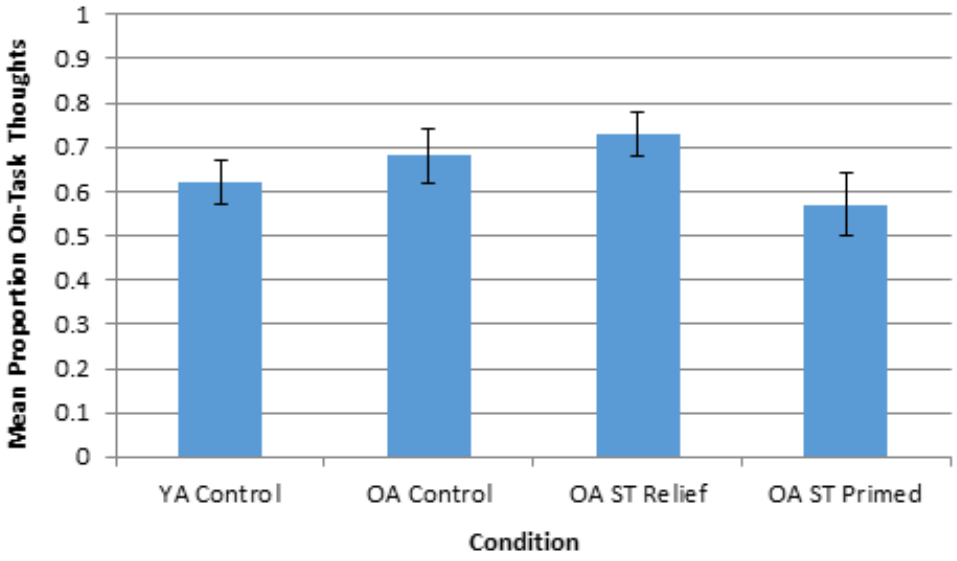


Figure 10. Mean Proportion On-Task Thoughts by Condition.

We predicted that younger adults would report a significantly higher proportion of TUTs than all of our older adult participants. As we expected, a one-way ANOVA for proportion of TUTs, revealed a significant effect of condition, F (3,116) = 4.856, p =.003.Younger adults reported a higher proportion of TUTs compared to all three of the older adult groups (p< .05 for all t-test focused comparisons) (Figure 11). While younger adults reported more TUTs than older adults in each group (p > .05 for all t-test focused comparisons), there were no differences in mean proportion of TUTs between the OA control, OA ST relief, and OA ST prime groups (p > .05 for all t-test focused comparisons).

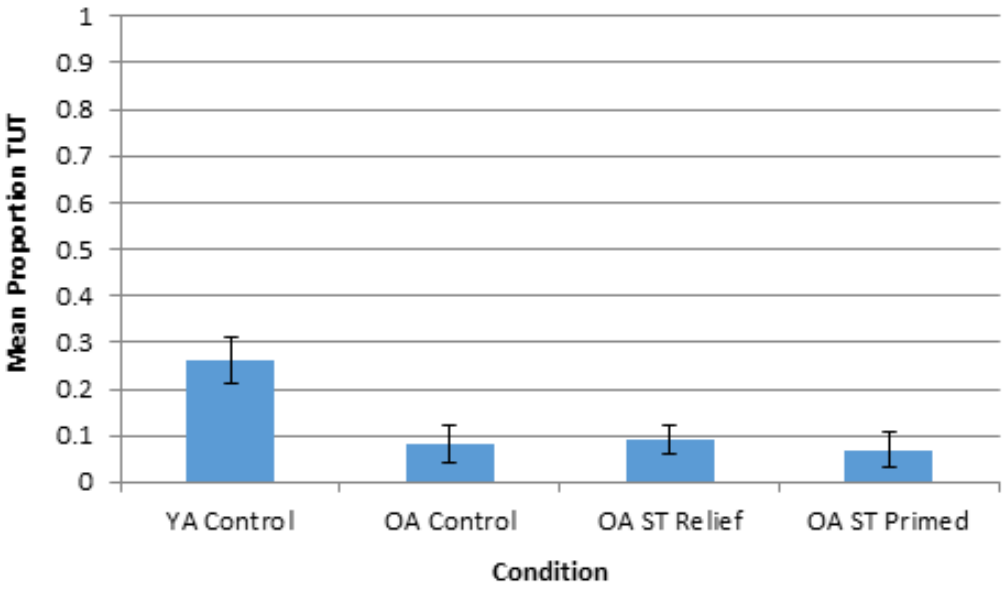


Figure 11. Mean Proportion of Task-Unrelated Thoughts by Condition.

We predicted that older adults primed for stereotype threat would report significantly more TRI than both older adults relieved of stereotype threat and younger adults. A one-way ANOVA for proportion of thought probes where TRI was indicated did reveal a significant effect of condition, F (3,116) = 5.201, p =.002. As predicted, older adults primed for ST reported a higher proportion of task-related interference than did younger adults (t(58) = -3.362, p = .001) and older adults relieved of ST (t(58) = -2.694, p = .009).

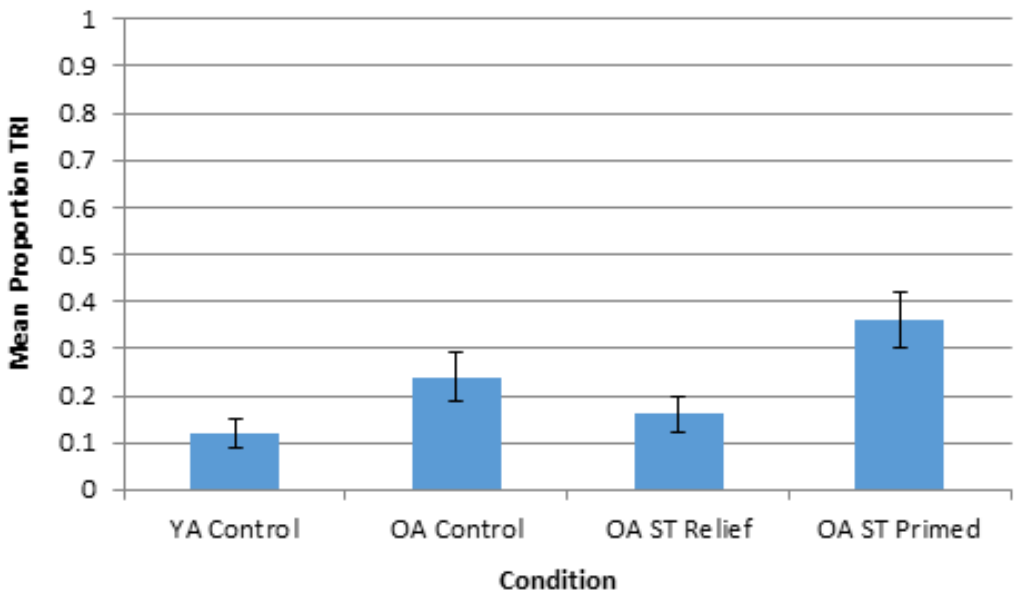


Figure 12. Mean Proportion of Task-Related Interference by Condition.

Prior to conducting our analyses, we made no predictions about which group would report the highest mean proportion of proactive TRI. However, based on work conducted on stereotype threat and worry-laden performance monitoring, we did predict that older adults primed for stereotype threat would report the highest mean proportion of reactive TRI. There was a significant effect of condition for mean proportion of proactive TRI, F (3,116) = 3.097, p =.030 with ST prime older adults reporting significantly more proactive TRI than both younger adults (t(58) = -2.312, p < .001). The difference in proactive TRI between ST prime older adults and ST relief older adults was trending (t(58) = -1.978, p = .053).

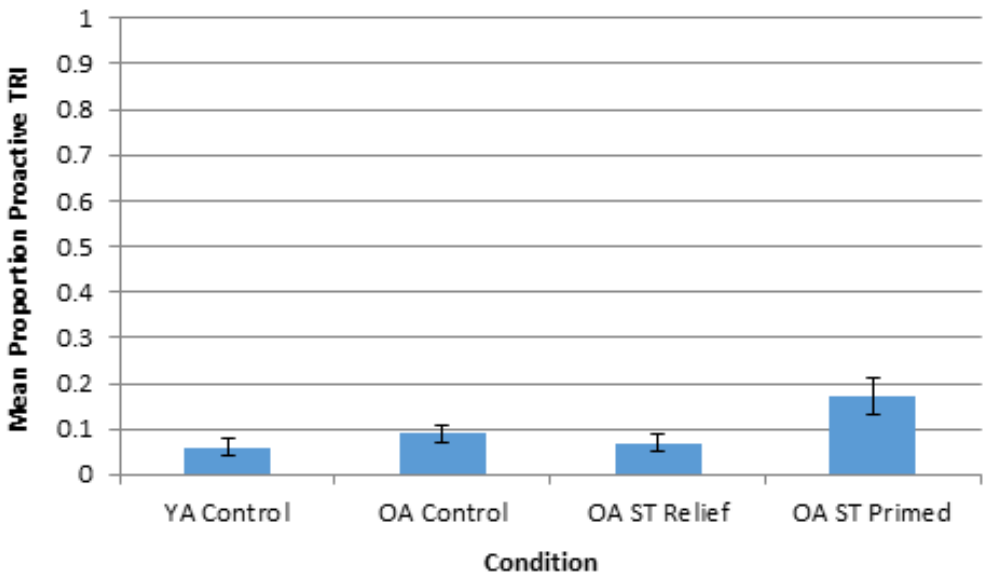


Figure 13. Mean Proportion of Proactive Task-Related Interference by Condition.

A significant effect of condition for mean proportion of reactive TRI was also found, F (3,116) = 2.702, p =.049, with older adults primed for ST reporting a higher proportion of evaluative TRI than did younger adults (Figure 14), t(58) = -2.719, p = .009. Therefore, older adults primed for memory-related stereotype threat did not only report the most TRI overall, but they also reported the most TRI regarding task strategy and the most TRI regarding performance monitoring.

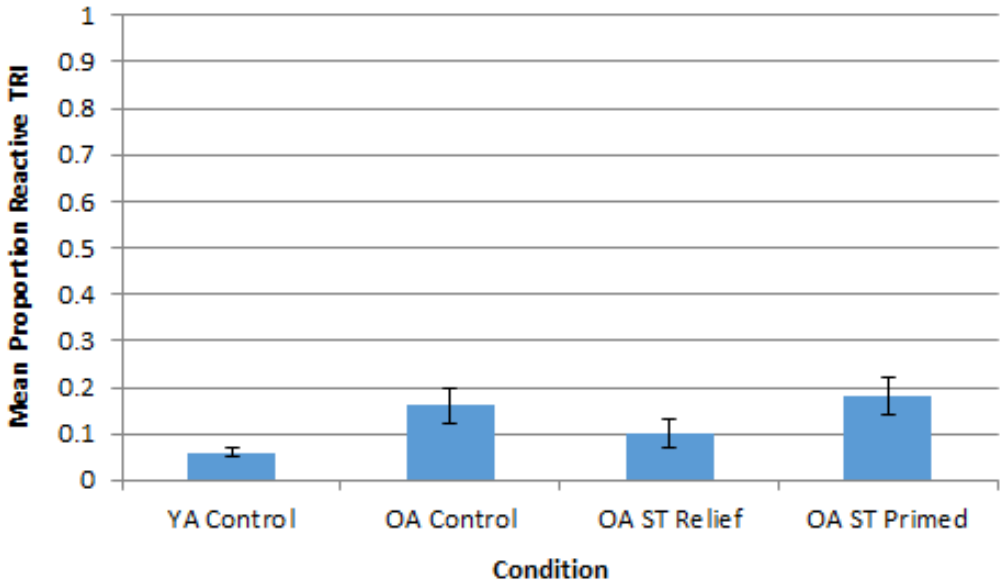


Figure 14. Mean Proportion of Reactive Task-Related Interference by Condition.

Operation Span Performance [2]

For the OSPAN, math verification accuracy and letter recall accuracy were calculated for each participant. Mean math verification and mean letter recall accuracies were then calculated for each group. We predicted that younger adults would be more accurate on both components of the OSPAN than would the older adult participants. Within the older adult sample, we predicted that older adults primed for ST would have the lowest letter recall accuracy and OA relieved of ST would have the highest letter recall accuracy. Because our stereotype threat manipulations were focused on memory-related stereotype threat, and because there does not seem to be a wide-spread stereotype regarding cognitive decline and mathematical ability, we made no predictions regarding ST condition and math verification accuracy within the sample of older adults.

A main effect of condition was found for math verification accuracy, F (3,116) = 2.910, p =.038, with younger adults obtaining higher accuracy on the math verification portion of the OSPAN than did the OA ST prime group, t(58) = 2.327, p = .024, which had the lowest math verification accuracy of the four groups. Math verification accuracy did not differ within the older adult sample (all p values >.05 for the t-test focused comparisons). More importantly, a main effect of condition was found for letter recall accuracy, F (3,116) = 3.226, p =.025. As predicted, older adults in the ST prime condition had lower letter recall accuracy than both younger adults (t(58) = 2.704, p = .009) and the older adults who were relieved of memory-related ST (t(58) = 2.391, p =.020).

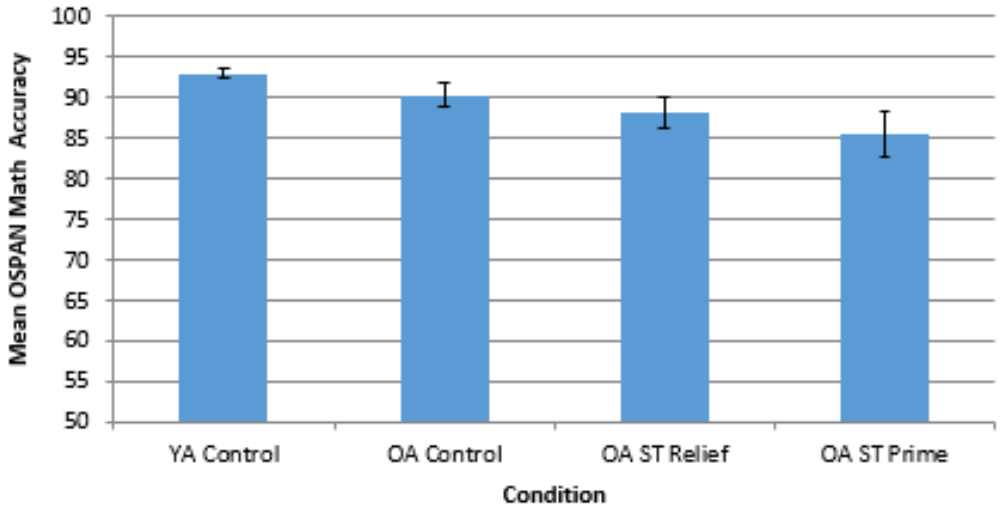


Figure 15. Mean OSPAN Math Verification Accuracy by Condition.

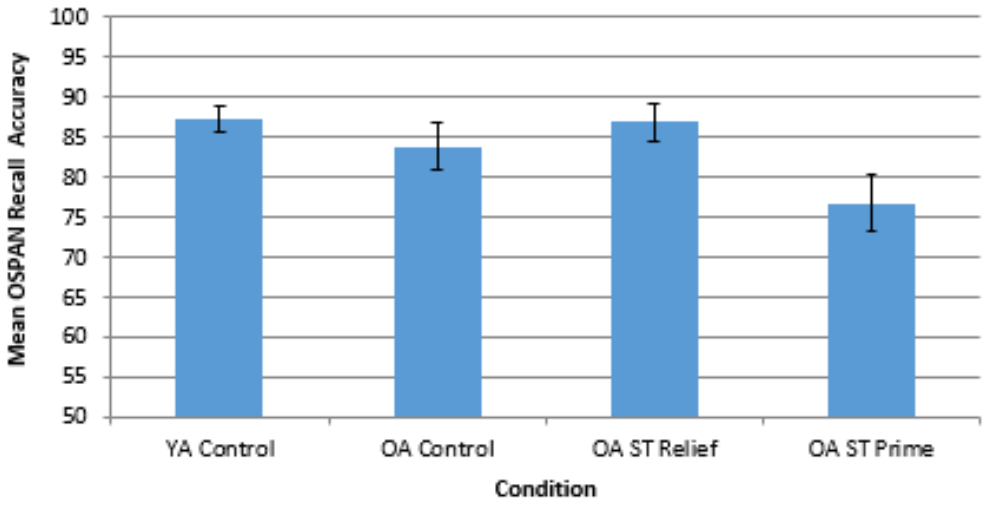


Figure 16. Mean OSPAN Letter Recall Accuracy by Condition.

A variety of post-task questionnaires were administered in order to gain a better understanding of which factors influence mind-wandering and OSPAN performance in younger and older adults. Possible contributing factors include mood, self-rated stress, and anxiety, perceived task difficulty, self-rated focus on the OSPAN task, interest in the task, and motivation to do well in the task. Two retrospective mind-wandering questionnaires (the TUT and TRI subscales of the DSSQ) were also administered to see if scores on retrospective mind-wandering reports correlated with instances of online, probe-caught mind-wandering. In this study, an additional scale of the DSSQ designed to measure self-consciousness or self-focused attention was included, as it is possible that older adults under ST would have more interfering thoughts regarding the self as it relates to task performance. The overall correlations between the mind-wandering and performance variables and the post-task questionnaire variables are presented below in Table 2 below. Correlations for the younger adult group can be found in Appendix S. The correlations collapsed across the three OA groups can be found in Appendix T. Finally, the correlations for the OA control group, OA ST relief group, and OA ST primed group can be found in Appendices U, V, and W, respectively.

Table 2

Overall Correlations for Mind-Wandering and OSPAN Variables.

	TUT	Overall TRI	Reactive TRI	Proactive TRI	On-task	Recall accuracy	Math accuracy
PTQ Task Difficulty	-.164	.236*	.131	.212*	-.067	-.284**	-.203*
PTQ Recall Difficulty	-.096	.291**	.128	.336**	-.172	-.279**	.064
PTQ Math Difficulty	-.105	.176	.211*	.031	-.063	-.198*	-.455**
PTQ Effort	-.400**	.145	.079	.134	.175	-.040	.135
PTQ Fatigue	.063	.018	.033	.008	-.068	-.206*	-.012
PTQ Stress	-.005	.197*	.157	.152	-.162	-.202*	.009
PTQ Task Interest	.321**	-.218*	-.155	-.174	-.049	.036	.091
PTQ Distraction	.500**	-.062	.053	-.185*	-.301**	-.080	-.057
PTQ Recall Focus	-.238**	-.050	-.071	.023	.209*	.367**	.194*
PTQ Math Focus	-.221*	.054	-.007	.122	.102	.083	.112
DSSQ TUT	.416**	.052	.096	-.030	-.340**	-.027	-.070
DSSQ TRI	-.060	.347**	.324**	.173	-.247**	-.119	-.063
DSSQ Motivation	.311**	-.205*	-.165	-.162	-.050	.053	-.120
DSSQ SFA	-.032	.324**	.169	.293**	-.233*	-.116	-.167
MIA Anxiety	.031	.155	.142	.021	-.129	-.116	.023
MIA Achieve	-.215*	.220*	.168	.185*	-.039	-.120	-.002
MIA Locus	-.214*	.058	.023	.037	.128	-.188*	-.051
PANAS Pos	-.305**	.128	.052	.175	.104	-.045	-.013
Cage	-.349**	.210*	.195*	.135	.059	-.109	-.213*

Note. Explanations of all PTQ variables are given in Table 4; Explanations of all DSSQ variables are given in Table 5; Explanations of MIA and PANAS variables is given in Table 3; Cage = Chronological age in year; * = $p < .05$ and ** = $p < .01$.

Probe-Caught and Retrospective Mind-Wandering

Scores on the TRI subscale of the DSSQ did not differ by condition, F (3,113) = 1.646, p =.183. Although scores on the TRI subscale of the DSSQ did not differ by condition, DSSQ TRI did correlate overall with probe caught proportion of TRI (r = .416**). Breaking down this correlation by group revealed a significant correlation in the older adult control (r = .392*) and older adult ST prime (r = .562**) groups, but not the younger adult (r = .294) and older adult ST relief (r = .100) groups. As DSSQ-TRI scores increased, do did proportion of reactive TRI in these two older adult groups. Scores on the TUT subscale of the DSSQ did differ by condition, F (3,113) = 5.753, p = .001. Participants in the younger adult group had significantly higher scores of the DSSQ TUT scale than did participants in all three OA groups (all p values < .05 for t-test focused comparisons). DSSQ TUT did correlate overall with probe caught (r = .416**). Breaking down this correlation by group revealed that this correlation was significant in the YA group (r = .407*), the OA control group (r = .425**), and the OA ST relief group (r = .476**), but not in the OA ST primed group (r = -.013).

Mood and Mind-Wandering

Positive and negative affect was assessed using the PANAS. For positive affect scores, there was a main effect of condition, F (3,113) = 12.035, p < .001. Younger adults reported lower positive affect than did older adult controls (t(57)= -4.227, p <.001), older adults relieved of ST (t(57)= -4.678, p <.001), and older adults primed of ST (t(57) = -4.208, p <.001). There were no differences in positive affect between the three older adult

groups (all p values > .05 for t-test focused comparisons). There were no differences in negative affect between the different conditions (F (3,113) = 1.979, p = .121). The descriptive data for the PANAS are contained below in Table 3.

Table 3

PANAS and MIA Descriptive Statistics.

	Younger Adult		***OA Control***		***OA ST Relief***		***OA ST Primed***	
N	*30*		*29*		*29*		*29*	
	M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
PANAS Positive	26.57	1.65	35.31	1.22	36.55	7.21	34.59	.91
PANAS Negative	15.77	.58	14.03	.84	13.48	1.03	13.31	.71
MIA Achievement	53.67	1.50	52.55	.98	53.62	.95	53.41	.95
MIA Anxiety	40.77	1.48	35.45	1.64	35.07	1.07	38.93	1.48
MIA Locus of Control	26.03	.53	26.14	.42	25.52	.55	26.00	.51

Note. PANAS Positive = score out of 50 for the positive mood scale of the PANAS where higher scores indicate greater positive mood; PANAS Negative = score out of 50 for the negative mood scale of the PANAS where greater scores indicate greater negative mood; MIA Achievement = score out of 75 for the Achievement scale of the MIA where higher scores indicate higher importance placed on personal memory achievement; MIA Anxiety = score out of 65 for the Anxiety scale of the MIA where higher scores indicate more anxiety; MIA Locus of Control = score out of 40 for the Locus scale of the MIA where higher scores indicate more internal locus of control for memory ability .

We hypothesized that, as negative mood increased or positive mood decreased, the proportion of on-task thoughts would decrease in each conditions and the proportion of task-related interference (particularly reactive TRI) would increase in the older adult ST primed group. As negative mood increased, so did reactive TRI, but only within the OA control group (r =.383*). Likewise, as self-rated stress increased (as measured by our single-item post-task question), so did proportion of overall TRI, but only in the control older adults (r = .481**). We did not observe any significant correlation between mood, positive or negative, and any type of TRI within the older adult groups. Reactive TRI also positively correlated with self-reported stress in older adult controls (r =.377*), but not in the OA ST relief group (r = -.033) or the OA ST primed group (r = .152).

Task Difficulty and Mind-Wandering

The descriptive data for the various post-task questions are contained in Table 4 below. Self-rated difficulty for the OSPAN did not differ for the math verification, F (3,113) = .377, p = .770, the letter recall portion, F (3,113) = 1.106, p =.350, or the task overall, F (3,113) =1.992, p =.119. Although these ratings did not differ by group, self-rated OSPAN difficulty did correlate with some mind-wandering variables. Self-rated task difficulty was overall correlated with TRI (r = .236**). Breaking down this correlation by group revealed that this correlation was trending in older adults controls (r = .344, p = .064) and older adults primed for ST (r = .366, p = .051). In OA controls proactive TRI was significantly correlated with self-rated task difficulty (r = .411**). Self-rated task difficulty and TRI were not significantly correlated in younger adults (r =

.214) and older adults relieved of ST (r = -.303). Self-rated letter recall difficulty was also overall positively correlated with TRI (r = .291**). More specifically, this correlation was significant in younger adults (r = .368*) and was trending in the OA ST primed group (r = .344, p = .068). In YAs and OA ST primed participants, reactive TRI in particular was correlated with self-rated recall difficulty (r = .431** and r = .444*, respectively).

Task Engagement and Mind-Wandering

Self-rated focus on the math verification portion of the OSPAN differed by condition, F (3,113) = 3.326, p =.022, with younger adults indicating that they placed more focus on the math verification portion of the OSPAN than did the OA control group (t(57) = 3.219, p = .002) and the OA ST primed group (t(57) = 2.017, p = .048). Self-rated focus on the letter recall portion of the OSPAN did not differ by condition, F (3,113) =2.381, p =.073.

Table 4

Post-Task Questions Descriptive Statistics.

	Younger Adult		***OA Control***		***OA ST Relief***		***OA ST Primed***	
N	*30*		*29*		*29*		*29*	
	M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
PTQ Overall Task Difficulty	2.37	.19	2.76	.18	2.62	.21	3.00	.93
PTQ Math Difficulty	2.23	.21	2.21	.17	2.48	.21	2.38	.24
PTQ Recall Difficulty	2.80	.19	2.93	.23	2.62	.90	3.14	.23
PTQ Task Performance	4.07	.13	3.76	.15	3.86	.16	3.66	.15
PTQ Satisfaction	2.23	.21	2.59	.18	2.34	.15	2.69	.19
PTQ Effort	3.80	.21	4.31	.20	4.45	.15	4.28	.20
PTQ Better Performance	2.63	.25	3.28	.28	3.66	.26	3.45	.21
PTQ Task Interest	3.00	.17	1.62	.14	1.69	.16	1.83	.15
PTQ Fatigue	3.70	.19	2.79	.22	2.66	.19	3.10	.22
PTQ Stress	2.73	.23	2.28	.24	2.69	.21	2.48	.20
PTQ Distraction	2.50	.23	1.48	.15	1.90	.18	1.66	.16
PTQ Recall Focus	3.93	.19	4.52	.14	4.52	.18	4.34	.21
PTQ Math Focus	3.70	.17	4.41	.78	3.97	.94	4.21	.19
PTQ Reading Interest	2.40	.15	3.03	.18	3.79	.22	3.45	.17
PTQ Stereotype Belief	3.33	.22	3.79	.17	4.10	.20	4.34	.17

Note. All responses to the post-task questions above were made on a 1 to 5 Likert scale. PTQ Overall Task Difficulty = perceived overall OSPAN difficulty where 1 = Not at all difficulty and 5 = Very difficult. PTQ Math Difficulty = perceived OSPAN math verification difficulty where 1 = Not at all difficulty and 5 = Very difficult. PTQ Recall Difficulty = perceived OSPAN letter recall difficulty where 1 = Not at all difficulty and 5 = Very

difficult. PTQ Task Performance = how well participant thought they did overall on the OSPAN where 1 = Very poorly and 5 = Very well. PTQ Satisfaction = how satisfied participant was with performance where 1 = Not at all satisfied and 5 = Very satisfied. PTQ Effort = how much effort the participant thought they put into the OSPAN where 1 = No effort at all and 5 = Very high effort. PTQ Better Performance = the degree to which the participant thought they could have done better on the OSPAN where 1 = Not at all better and 5 = Very much better. PTQ Task Interest = how interesting the participant thought the OSPAN was where 1 = Not at all interesting and 5 = Very interesting. PTQ Fatigue = how fatiguing participants thought the OSPAN was where 1 = Not at all fatiguing and 5 = Very fatiguing. PTQ Stress = the degree to which participants felt during the OSPAN where 1 = Not at all felt stress and 5 = Very much felt stress. PTQ Distraction = how distracted participants thought they were during the OSPAN was where 1 = Not at all distracted and 5 = Very distracted. PTQ Recall Focus = how focused participants were on the letter recall portion of the OSPAN was where 1 = Not at all focused and 5 = Very focused. PTQ Math Focus = how focused participants were on the math verification portion of the OSPAN was where 1 = Not at all focused and 5 = Very focused. PTQ Reading Interest = how interesting participants found the ST manipulation newspaper reports where 1 = Not at all interesting and 5 = Very interesting. PTQ Stereotype Belief = how much participants believe that there is a negative stereotype about aging and memory where 1 = do not at all believe that there is a stereotype and 5 = Very much believe that there is a stereotype.

As self-rated focus on the recall portion of the OSPAN increased, proportion of TRI tended to decrease in the OA control participants (r = -.556*), but not in the OA ST relief (r = .251) and OA ST primed participants (r = -.170). As recall difficulty increased so did proportion of proactive TRI in younger adults and OA ST primed participants (r = .431* and r = .444*, respectively). Self-rated effort to do well on the OSPAN did not differ by condition, F (3,110) =2.231, p = .089. Self-rated effort was overall correlated with proportion of TUTs (r = -.400**). As self-rated effort increased, proportion of probe-caught TUTs decreased in younger adults (r = -.492*) and in older adult controls (r = -.503*).

Motivation to do well, as measured by the DSSQ Motivation subscale, differed by condition, F (3,113) =3.243, p = .025. Surprisingly, younger adults had higher motivation scores than OA controls (t(57) = 2.436, p = .018) and OAs primed for ST (t(57) = 2.342, p = .023). Overall, DSSQ Motivation was correlated with both proportion of TRI (r = -.205*) and proportion of TUTs (r = .311**). Task interest, as measured by the DSSQ Interest subscale, also differed by condition, F (3,113) =2.813, p =.043. Younger adults reported higher task interest as measured by the DSSQ than participants in all OA groups (all p values < .001 for t-test focused comparisons). Although DSSQ interest differed by condition, it did not correlate significantly with mind-wandering variables or OSPAN performance variables.

Interest in the OSPAN task as measured by the single-item PTQ question also differed by condition, F (3,113) =17.895, p < .001. Participants in the younger adult

group gave higher PTQ Task Interest ratings than did older adults in all three OA groups (p values < .001 for all t-test focused comparisons). PTQ Task Interest did correlate with mind-wandering variables. Overall, PTQ Task Interest positively correlated with probe caught TUT (r = .321**) and negatively correlated with probe-caught TRI (r = -.218*). Breaking down the correlation by group, the positive correlation between PTQ Task Interest and probe caught TUT was present in OA controls (r = .414**), but not in younger adults (r = .016), OAs relieved of ST (r = .367), and OAs primed for ST (r = .030). Breaking down the correlation between PTQ Task Interest and probe caught TRI by group, the negative correlation between PTQ Task Interest and probe caught TUT was present in younger adults (r = -.497**), but not in OA controls (r = -.047), OAs relieved of ST (r = -.111), and OAs primed for ST (r = -.051).

The PTQ Effort item asked participants to rate how much effort they put into the OSPAN portion of the study. There was not a significant effect of group for PTQ Effort, F (3,113) =2.231, p = .089, but PTQ Effort did correlate with mind-wandering variables. Overall, PTQ Effort was negatively correlated with probe caught TUT (r = -.400**). Breaking this correlation down by group, PTQ Effort was negatively correlated with probe caught TUT in the YA group (r = -.492**) and OA control group (r = -.503**), but not in the OA ST relief (r = .104) or ST prime groups (r = -.323).

The PTQ Distraction item asked participants to rate how distracted they were during the OSPAN and there were group differences for these ratings, F (3,113) =6.018, p = .001. Younger adults have higher ratings for PTQ Distraction than did OA controls

and OAs in the ST relief group (p values > .05 for t-test focused comparisons), but notthe participants in the OA ST primed group (p > .05). The PTQ Distraction ratings did not differ between the different OA groups (all p values > .05). PTQ Distraction was positively correlated with probe caught TRI overall (r = .500**). This positive correlation was found in the YA (r = .627**) and OA control (r = .503**) group, but not in the ST relief (r = .316) and ST prime OA (r = .144) groups. PTQ Distraction was overall negatively correlated with proactive TRI (r = -.185*) but they were not significantly correlated in any of the individual groups (all p values < .01).

Self-Focused Attention and Mind-Wandering

Self-consciousness, as measured by the self-focused attention subscale of the DSSQ, differed by condition, F (3,113) = 2.990, p = .034.Younger adults had higher self-focused attention scores than did participants in the ST relief condition (t(57) = 2.536, p = .014), but the older adult groups did not differ from each other in terms of their DSSQ-SFA scores (all p values >.05 for the t-test focused comparisons). Descriptive data for the DSSQ scales are presented in Table 5 below. DSSQ-SFA scores were overall positively correlated with proportion of TRI (r = .324**). More specifically, proportion TRI and DSSQ SFA were significantly correlated in the YA and OA ST prime group (r =.624** and .396*, respectively). Reactive TRI was also correlated overall with DSSQ SFA (r = .293**). As self-focused attention increased, so did reactive TRI in the both the OA ST relief (r = .384*) and prime groups (r =.513**).

Table 5

DSSQ Descriptive Statistics.

	Younger Adult		***OA Control***		***OA ST Relief***		***OA ST Primed***	
N	*30*		*29*		*29*		*29*	
	M	*SE*	*M*	*SE*	*M*	*SE*	*M*	*SE*
DSSQ TUT	13.07	.99	9.79	.61	9.38	.59	9.90	.57
DSSQ TRI	20.27	1.17	18.10	.94	18.28	.83	20.52	.99
DSSQ SFA	15.13	.85	15.31	.83	12.34	.68	14.97	.85
DSSQ Motivation	21.57	1.30	17.72	.88	19.62	.91	18.10	.68
DSSQ Interest	15.97	.63	14.31	.82	13.66	.39	14.79	.39

Note. DSSQ TUT = score out of 40 for the TUT subscale of the Thinking Content scale where higher scores indicate more task-unrelated thinking; DSSQ TRI = number out of 40 for the TRI subscale of the Thinking Content scale where higher scores indicate more task-related interference; DSSQ SFA = score out of 40 for the Self-Focused Attention subscale of the Thinking Style scale where higher scores indicate more self-conscious thinking; DSSQ Motivation = score out of 35 for the Success Motivation subscale of the Motivation scale where higher scores indicate more motivation to do well on the task; DSSQ Interest = score out 35 of for the Intrinsic Motivation subscale of the Motivation scale where higher scores indicate more task interest.

Memory Anxiety, Achievement, and Locus of Control

Descriptive statistics for the MIA scales are presented above in Table 2. Anxiety, as measured by the anxiety subscale of the MIA, did differ by condition, $F(3,113) = 3.716$, $p = .014$. Younger adults had higher anxiety scores than ST relief participants ($t(57) = 3.092$, $p = .003$), but anxiety scores did not differ between the three older adult groups (all p values >.05 for the t-test focused comparisons). Overall, anxiety did not correlate with the mind-wandering and performance variables. Importance of memory achievement, as measured by the achievement subscale of the MIA, did not differ by condition, $F(3,113) = 0.212$, p =.888 but did correlate overall with proportion of TRI (r = .220*) and proportion of TUTs (r = -.215*). More specifically, importance of memory achievement was significantly correlated with proportion of TRI in younger adults (r = .391*). Memory-related locus of control, as measured by the locus subscale of the MIA, did not differ by condition, $F(3,113) = 0.294$, $p = .830$. Overall, locus of control correlated with proportion of TUTs (r = -.214*). As internality increased, proportion of TUTs increased.

Other Mind-Wandering Correlates

Unsurprisingly, as proportion of TUT increased proportion of OT thoughts decreased in all groups (r = -577**). Likewise, as proportion TRI increased the proportion of OT thoughts decreased (r = -.183*). Overall, proportion of TRI was positively and significantly correlated with both proactive (r = .805**) and reactive (r =

.667**) type of TRI. Perceived fatigue during the OSPAN, as measured by the single item PTQ Fatigue question, differed between groups, $F(3,113) = 5.070$, $p = .002$.

Younger adults reported feeling more fatigued during the OSPAN than did older adults in all three OA groups (all p values < .05 for t-test focused comparisons). Perceived fatigue did not differ between the OA groups (all p values > .05). PTQ Fatigue did not correlate significantly with any of the OSPAN performance or mind-wandering variables. Perceived stress during the OSPAN, as measured by the single-item PTQ Stress question, did not differ between groups, $F(3,113) = .897$, $p = .445$. Self-rated stress was overall correlated with proportion of TRI ($r = .197$*). This positive correlation was present in OA controls ($r = .481$**), but not in YAs ($r = .348$), OA ST relief participants ($r = -.140$), and OA ST primed participants ($r = .271$).

We asked two questions regarding ST and our ST priming procedure. The Stereotype Belief item asked participants if they believed a negative stereotype existed regarding aging and memory ability. For PTQ Stereotype Belief ratings there were differences between groups, $F(3,113) = 5.186$, $p = .002$. Younger adults were less likely to say that a negative stereotype about aging and memory existed than did OAs in the ST relief ($t(57) = -2.607$, $p = .012$) and ST prime ($t(57) = -3.631$, $p = .001$) group, but not the OA control group ($t(57) = -1.648$, $p = .105$). Older adults in the control group were also less likely to say that a negative stereotype about aging and memory existed than did OAs in the ST prime group ($t(57) = -2.239$, $p = .029$). No other differences in PTQ Stereotype

Belief ratings existed between the OA groups (all p values < .05). PTQ Stereotype Belief did not correlate overall with any performance or mind-wandering variables.

PTQ Reading Interest is a single item question asking participants to rate how interesting they found the newspaper-style reports used in our ST priming procedure. There were group differences for this rating, $F(3,113) = 11.087$, $p < .001$. Younger adults gave significantly lower interest ratings than did participants in all three OA groups (all p values < .05 for focused t-test comparisons). OA control participants also gave significantly lower interest ratings than did OAs in the ST relief and ST primed groups (all p values < .05 for focused t-test comparisons). The two ST OA groups did not differ in their interest ratings ($p < .05$). PTQ Reading Interest did not correlate overall with any performance or mind-wandering variables.

Letter Recall and Math Verification Accuracy Correlates

For OA ST prime participants, self-rated stress was negatively correlated with recall accuracy (r =-.487**). Proactive TRI was, perhaps surprisingly, negatively correlated with recall accuracy (r = -.371*) in OA ST primed participants. Although participants primed for stereotype threat engaged in more proactive TRI than any other group and therefore experienced increased mind-wandering about task-strategy, they also had the worst recall accuracy of all the groups. For OA controls, both overall proportion of TRI and proportion of reactive TRI were negatively correlated with recall accuracy (r = -.620** and r = -.704**, respectively).

CHAPTER V

AGING STUDY DISCUSSION

The primary question of this study was whether stereotype threat acts as a mind-wandering trigger in older adults, and whether stereotype threat particularly leads to elevated TRI. In this aging study, we replicated the results of our pilot experiments and extended those results to older adults. Older adults primed for memory-related stereotype threat reported proportionally more TRI than did both younger adults and older adults who were relieved of memory-related stereotype threat. As predicted by the "Control failures x Current concerns" framework (McVay & Kane, 2010a), the degree to which one's current concerns are primed by the context greatly influences if, and how, mind-wandering occurs. Younger adults coming into the testing environment reported a higher proportion of TUTs than did older adults in all groups, most likely because that environment primed every day, school-related concerns. In the OA ST primed group and possibly the OA control group, the testing environment instead triggered current concerns about cognition, resulting instead in increased TRI. Furthermore, the older adults who were primed for stereotype threat had significantly worse recall performance than did younger adults and older adults primed for stereotype threat.

We were also interested in qualifying which type of TRI older adults report. Older adults have been found to perform as well as younger adults in spite of stereotype threat

on some tasks, possibly due to superior emotional control abilities (Phillips, Henry, Hosie, & Mihne, 2008; Schiebe & Blanchard-Fields, 2009; Hess, Emory, & Queen, 2009). However, it was expected that the task demands for the OSPAN would be too high to allow emotional control abilities to override negative mood and increased arousal triggered by stereotype threat (Blascovitch, Spencer, Quinn, & Steele, 2001; Croizet et al., 2004; Mazerolle, et al., 2012). We therefore expected to see a significant difference in the amount of evaluative, reactive TRI reported by older adults in the ST and control conditions, with these older adults reporting more reactive TRI. We made no predictions regarding differences between the three older adult groups in terms of proactive TRI.

Our hypotheses regarding overall proportion of TRI and proportion of reactive TRI were confirmed. Older adults in the ST relief group reported the lowest proportion of TRI, older adults in the ST primed group reported the highest proportion of TRI, and control older adults had a mean proportion of TRI that was intermediate between those of the other two OA groups, with a mean proportion of TRI higher than that of the ST relief group and lower than that of the ST primed group. Therefore, it appears that the normal testing environment in the absence of specific ST manipulations is sufficient to at least somewhat prime older adults' performance concerns and, by extension, task-related interference. While the proportions of reactive and proactive TRI were roughly equivalent within each group, there were between groups differences in the proportion of these two subtypes of TRI, with ST primed OAs reporting more of both types of TRI than participants in the other groups.

Older adults in the ST control condition were expected to have lower accuracy on the letter recall portion of the OSPAN compared to older adults in the ST relief and control conditions, as TRI is associated with performance impairment on tasks that require executive control (McVay & Kane, 2009, 2011a; McVay et al., 2012) and because performance on a task in the stereotyped domain is expected to suffer in those under stereotype threat. The pattern on means for OSPAN letter recall performance was as expected, with older adults in the ST relief group demonstrating higher recall accuracy than both OA controls and participants in the ST primed group. Participants in the ST primed group had the lowest letter recall accuracy of all older adult groups in addition to reporting the most task-related interference.

We expected older adults in the ST primed condition to report more negative affect as measured by the mood component of the PANAS (Popham & Hess, 2013). While the younger adult group reported lower mood than all of the older adult groups, no group differences in positive or negative affect existed between the OA groups. We also expected a positive relationship between increased negative affect and increased mind-wandering rates, particularly increases in evaluative TRI within the ST primed OA group, however we did not find evidence of this relationship. It should be noted that the negative scale of the PANAS contain some items about emotions that are extremely negatively valenced, and that the emotions are unlikely to be experienced by participants coming into a psychology lab to complete a study. For example, it seems unlikely that our participants would be feeling “hostile”, “scared”, or even “guilty”.

We chose to use the PANAS because it is the affect scale that is most widely used within the mind-wandering literature. However, we may be more likely to find differences between groups or correlations between negative mood and mind-wandering variables if we use a measure of negative affect that contained items that were more likely to be experienced by participants while they do a tedious but not impossible cognitive task.

Due to the findings that stereotype threat works, in part, by decreasing motivation within the stereotyped individual (Desrichard & Kopetz, 2005; Seibt & Forster, 2004), we expected that participants in the control and ST relief conditions would report higher motivation as measured by the motivation component of the DSSQ. We expected higher levels of motivation to be related to fewer reports of TUT, but not TRI. This was not the case. No differences between the OA groups existed for motivation and motivation as measured by the DSSQ did not correlate with mind-wandering and OSPAN performance variables. We also expected that value placed in the memory domain, as measured by the Achievement subscale of the MIA, will be positively correlated with TRI. However, MIA Achievement scores did not correlate with probe-caught TRI.

The relationship between anxiety and stereotype threat is not straight-forward. Hess et al. (2003) hypothesized that anxiety would act as a mediator of stereotype threat's detrimental effect on performance. Individuals under stereotype threat were hypothesized to experience increased physiological arousal, which might in turn hijack cognitive control (Levy et al., 2000; Blascovitch, Spencer, Quinn, & Steele, 2001; Croizet et al., 2004).

However, Hess et al. (2003) reported no significant results for anxiety as measured by the MIA-Anx score. Other researchers have found effects (Chasteen et al., 2005 (Experiment 3); Abrams et al., 2008). We predicted that those in the ST primed and control OA groups would report increased anxiety compared to the ST relief OA group. However, this was not the case. Furthermore, MIA-Anx did not correlate with TRI or with either OSPAN performance variable. The MIA Anxiety items tap into how anxious the participant would feel if they had to complete a variety of different tasks that had a memory component. Many of the items corresponded to everyday tasks such as navigating to a previously visited but unfamiliar location or introducing someone that you had just met. It is possible that this measure of anxiety was not capturing how anxious participants feel while completing the kinds of novel memory tasks that they would do in a cognitive psychology lab. A better way to have measured anxiety may have been to include an additional Likert-style post-task question asking people how anxious they felt while trying to remember the letter stimuli during the OSPAN.

Finally, we intended to use the Age-Attitudes IAT as a manipulation check in this study. In Pilot Experiments 1 and 2, we found that female YAs that were primed for math-related stereotype threat were slower to pair the concepts of “female” and “math” together on a Math-Gender IAT than controls. In the aging study, we predicted that older adults primed for memory-related stereotype would be slower to pair photos of old faces with positively-valenced words on the IAT than would participants relieved of stereotype threat. Instead, IAT scores did not differ between any of our groups.

It is possible that the Age-Attitudes IAT used was not sensitive enough to be used as ST manipulation check. In the pilot experiments, we created an IAT that was specifically about gender and math by modifying the existing Gender-Science IAT. However, in the aging study the IAT used was *not* specifically about age and cognition. The Age-Attitudes IAT may reflect general preferences for or against older adults, but it may not specifically reflect underlying implicit beliefs about aging and cognitive ability. Perhaps if we modified the Age-Attitudes IAT to specifically be about aging and cognition we would have found group differences after reliving or priming participants for memory-related ST. For example, we could have switched out unpleasant words (such as “boring”) for words about cognitive decline (such as “forgetful”).

CHAPTER VI

GENERAL DISCUSSION

This research extends and informs prior work on mind-wandering in a few different ways. First, stereotype threat has been examined as a possible mind-wandering trigger in three different experiments. Although it has been proposed that individuals experiencing stereotype threat have increased in worry-laden monitoring of performance and increased negative self-talk (Cadinu, Maass, Rosabianca, and Kiesner, 2005; Popham & Hess, 2013), this research has more directly examine the thought processes of those individuals through the use of online thought probes.

Again, the results of our two younger adult pilot studies suggest that female younger adults primed for math-related stereotype threat do specifically report increased TRI. In our aging study, we found that priming memory-related stereotype threat in older adults similarly resulted in increased reporting of TRI and decreased accuracy on a letter recall task. Relief of memory-related stereotype threat in older adults resulted in decreases in TRI compared to OA controls and improved accuracy on a letter recall task.

Past work has found that stereotype threat does seem to trigger overall levels of mind-wandering, at least in young adults (Mrazek et al., 2011). However, the thought probes used by Mrazek and colleagues did not allow participants to distinguish between different types of mind-wandering such as TRI. Rather, participants were instructed to

indicate, on a Likert-scale, the degree to which they were mind-wandering in general (1=thoughts were completely on task, 5 = thoughts were completely about unrelated concerns). Participants only indicated whether they were experiencing TUTs or TRI on post-task questionnaires (Mrazek, et al., 2011).

Using online thought probes, we have been able determine the specific type of mind-wandering those under stereotype threat experience, verifying that while proportion of TUTs does not increase with ST, proportion of TRI does. While work within the stereotype threat literature has proposed increased worry-laden monitoring (which we refer to as reactive TRI) in those under stereotype threat (Cadinu, Maass, Rosabianca, and Kiesner, 2005; Popham & Hess, 2013), we have found evidence that those under stereotype threat experience elevated amounts of both evaluative TRI and TRI regarding task strategy. However, it is unclear if the evaluative TRI experienced by those in our ST primed conditions is representative of the worry-laden, negative self-appraisal believed to occur with stereotype threat. Across studies, we found little evidence of increased negative mood or increased anxiety in our ST primed participants.

Furthermore, while we know that individuals, particularly those under stereotype threat, engage in mind-wandering about task approach, it is unclear exactly *how* participants were strategizing during the OSPAN task in the aging study. Likewise, it is unclear if proactive TRI could have positive down-stream benefits for performance. In this aging study, we found no evidence of improved performance with increasing amounts of mind-wandering about task strategy. Indeed, the participants in the ST primed

group reported more proactive and reactive TRI than any other condition and also had the worst performance on both the letter recall and math verification portions of the OSPAN.

Indeed, in the OA ST primed group, proactive TRI was actually negatively correlated with recall accuracy. More work can be done looking at the emotional valence of reactive TRI reports and determining whether or not proactive TRI can be beneficial for performance on other types of cognitive tasks. Finally, the correlational analyses for these studies are somewhat underpowered. We expected a variety of factors would correlate with our mind-wandering and performance variables, and that we might find differential patterns on correlations between our control, ST relief and ST primed conditions. However, many of the variables we believed would correlate (such as mood and motivation) with mind-wandering and task performance did not correlate in these studies, or were correlated inconsistently across our stereotype threat groups. A larger *N* study may be necessary to determine which variables mediate the relationship between mind-wandering and stereotype threat and between stereotype threat and performance on tasks within the stereotyped domain.

Conclusions

In three separate experiments evidence was found for stereotype threat as a mind-wandering trigger. Following the priming of math-related stereotype, young women in Pilot Experiment 1 and Pilot Experiment 2 exhibited significantly more task-related interference than controls. In the subsequent aging study, older adults exhibited decreased task-related interference and improved accuracy on a memory task compared to older

adult controls and older adults primed for memory-related stereotype threat. Current concerns primed by instruction manipulations and by the typical testing environment appear to be one cause for the elevated TRI typically seen in older adults. However, it is still unclear which factors mediate the relationships between stereotype threat, mind wandering, and performance on tasks within the stereotyped domain.

REFERENCES

Abrams, D., Crisp, R. J., Marques, S., Fagg, E., Bedford, L., & Provias, D. (2008). Threat inoculation: Experienced and imagined intergenerational contact prevents stereotype threat effects on older people's math performance. *Psychology and Aging*, *23,* 934–939. doi:10.1037/a0014293

Abrams, D., Eller, A., & Bryant, J. (2006). An age apart: The effects of intergenerational contact and stereotype threat on performance and intergroup bias. *Psychology and Aging*, *21,*691–702. doi:10.1037/0882-7974.21.4.691

Baddeley, A.D., & Hitch, G. (1974). Working memory. In G.H. Bower (Ed.), *The psychology of learning and motivation: Advances in research and theory.* (pp. 47-89). New York: Academic Press.

Banaji, M. R. (2001). Implicit attitudes can be measured. In H. L. Roediger III, J. S. Nairne, I. Neath, & A. Surprenant (Eds.), *The nature of remembering: Essays in honor of Robert G. Crowder.* (pp. 117–150). Washington, DC: American Psychological Association.

Banaji, M., & Hardin, C. (1996). Automatic stereotyping. *Psychological Science, 7,* 136-141.

Barber, S.J., & Mather, M. (in press). Stereotype threat in older adults: When and why does it occur, and who is most affected? To appear in P. Verhaeghen & C.

Hertzog (Eds.), *The Oxford handbook of Emotion, Social Cognition, and Everyday Problem Solving During Adulthood.*

Barber, S.J., & Mather, M. (2013). Stereotype threat can both enhance and impair older adults' memory. *Psychological Science, 24*(12), 2522-2529.

Beilock, S. L., Rydell, R. J., & McConnell, A. R. (2007). Stereotype threat and working memory: Mechanisms, alleviation, and spillover. *Journal of Experimental Psychology: General, 136,* 256–276.

Blascovich, J., Spencer, S. J., Quinn, D., & Steele, C. (2001). African Americans and high blood pressure: The role of stereotype threat. *Psychological Science, 12,* 225–229. doi:10.1111/1467-9280.00340

Cadinu, M., Maass, A., Rosabianca, A., & Kiesner, J. (2005). Why do women underperform under stereotype threat? Evidence for the role of negative thinking. *Psychological Science, 16,* 572–578.

Carstensen, L. L. (1995). Evidence for a life-span theory of socioemotional selectivity. *Current Directions in Psychological Science, 4,* 151-156.

Castel, A.D., Humphreys, K.L., Lee, S.S., Galván, A., Balota, D.A., & McCabe, D.P. (2011). The development of memory efficiency and value-directed remembering across the lifespan: A cross-sectionals study of memory and selectivity. *Developmental Psychology, 47,* 1552-1564.

Chasteen, A. L., Bhattacharyya, S., Horhota, M., Tam, R., & Hasher , L. (2005). How feelings of stereotype threat influence older adults' memory performance. *Experimental Aging Research*, *31*, 235–260.

Conway, A.R.A., Kane, M.J., Bunting, M.F., Hambrick, D.Z., Wilhelm, O., & Engle, R.W. (2005). Working memory span tasks: A methodological review and user's guide. *Psychonomic Bulletin & Review*, *12*, 769–786. doi:10.3758/BF03196772

Craik, F.I.M., and Salthouse, T.A. (2008). *The Handbook of Aging and Cognition*, 3rd Edn. Hillsdale, NJ: Erlbaum.

Croizet, J. C., Després, G., Gauzins, M. E., Huguet, P., Leyens, J. P., & Méot, A. (2004). Stereotype threat undermines intellectual performance by triggering a disruptive mental load. *Personality & Social Psychology Bulletin*, *30*, 721–731. doi:10.1177/0146167204263961

Desrichard, O & Kopetz, C. (2005). A threat in the elder: The impact of task instructions and self-efficacy on memory performance in the elderly. *European Journal of Social Psychology*, *35*(4), 537-552.

Dixon, R. A., & Hultsch, D. F. (1984). The metamemory in adulthood (MIA) instrument. *Psychological Documents*, *14*, 3.

Dixon, R. A., Rust, T. B., Feltmate, S. E., and See, S. K. (2008). Memory and aging: Selected research directions and application issues. *Can. Psychol*. *48*, 67–76.

Ekstrom, R. B., French, J. W., & Harman, H. H. (1976). Kit of factor-referenced cognitive tests. Princeton, NJ: US: Education Testing Service.

Giambra, L. M. (1978). Adult male daydreaming across the life span: A replication, Further analyses, and tentative norms based upon retrospective reports. *International Journal o*f *Aging & Human Development, 8,* 197–228.

Giambra, L. M. (1989). Task-unrelated thought frequency as a function of age: A laboratory study. *Psychol. Aging, 4,* 136–143.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, 74, 1464–1480.

Grodsky, A., & Giambra, L. M. (1990–91). The consistency across vigilance and reading Tasks of individual differences in the occurrence of task-unrelated and task related images and thoughts. *Imagination, Cognition, and Personality, 10,* 39–52.

Hasher, L., & Zacks, R. T. (1988). Working memory, comprehension, and aging: A review and a new view. In G. H. Bower (Ed.), *The Psychology of Learning and Motivation, Vol. 22* (pp.193-225). New York, NY: Academic Press.

Hertzog, C., & Hultsch, D. F. (2000). Metacognition in adulthood and old age. In F. I. M. Craik, & T. A. Salthouse (Eds.), *The handbook of aging and cognition* (pp. 417-466). (2nd ed.). Mahwah, NJ US: Lawrence Erlbaum Associates Publishers.

Hess, T. M. , & Hinson , J. T. (2006). Age-related variation in the influences of aging stereotypes on memory in adulthood . *Psychology and Aging, 21*, 621 – 625.

Hess, T.M., Auman, C., Colcombe, S.J., & Rahhal, T.A. (2003). The impact of stereotype threat on age differences in memory performance . *Journal of Gerontology*: *Psychological Sciences*, *58*, 3-11.

Hess, T. M., Emery, L., & Queen, T. L. (2009). Task demands moderate stereotype threat effects on memory performance. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, *64*, 482–486. doi:10.1093/geronb/gbp044

Hess, T. M., Hinson, J. T., & Hodges, E. A. (2009). Moderators of and mechanisms underlying stereotype threat effects on older adults' memory performance. *Experimental Aging Research*, *35*, 153–177. doi:10.1080/03610730802716413

Hess, T. M., Hinson, J. T., & Statham, J. A. (2004). Explicit and implicit stereotype activation effects on memory: Do age and awareness moderate the impact of priming? *Psychology and Aging*, *19*, 495–505. doi:10.1037/0882-7974.19.3.495

Hess, T. M., Rosenberg, D. C., & Waters, S. J. (2001). Motivation and representational processes in adulthood: The effects of social accountability and information relevance. *Psychology and Aging*, *16*, 629–642.

Hummert, M. L. (1999). A social cognitive perspective on age stereotypes. In T. M. Hess & F. Blanchard-Fields (Eds.), *Social cognition and aging* (pp. 175-195). New York: Academic Press.

Hummert, M. L., Garstka, T. A., Shaner, J. L., & Strahm, S. (1994).Stereotypes of the elderly held by young, middle-aged, and elderly adults. *Journals of Gerontology, 49*, 240-249.

Jackson, J. D., & Balota, D. A. (2012). Mind wandering in younger and older adults: converging evidence from the sustained attention to response task and reading for comprehension. *Psychol. Aging, 27,* 106–119.

Johns, M., Inzlicht, M., & Schmader, T. (2008). Stereotype threat and executive resource depletion: Examining the influence of emotion regulation. *Journal of Experimental Psychology: General, 137,* 691-705.

Kane, M. J., Brown, L. H., McVay, J. C., Silvia, P. J., Myin-Germeys, I., & Kwapil, T. R. (2007). For whom the mind wanders, and when: An experience-sampling study of working memory and executive control in daily life. *Psychological Science, 18,* 614–621.

Kemper, S. (1994). "Elderspeak": Speech accommodations to older adults. *Aging and Cognition, 1,* 17–28.

Killingsworth, M. A., & Gilbert, D. T. (2010). A wandering mind is an unhappy mind. *Science, 330,* 932.

Klinger, E. (1971). *Structure and Functions of Fantasy*. New York: Wiley.

Klinger, E. (1999). Thought flow: Properties and mechanisms underlying shifts in content. In J. A. Singer, & P. Salovey (Eds.), *At Play in the Fields of Consciousness: Essays in honor of Jerome L. Singer* (pp. 29–50). Mahwah, NJ: Erlbaum.

Klinger, E. (2009). Daydreaming and fantasizing: Thought flow and motivation. In K. D. Markman, W. M. P.Klein, and J. A. Suhr (Eds), *Handbook of Imagination and Mental Simulation* (pp. 225-239). New York: Psychology Press.

Klinger E., & Cox W. M. (1987). Dimensions of thought flow in everyday life. *Imagination, Cognition, and Personality, 7,* 105–128, doi: 10.2190/7K24-G343 MTQW-115V

Krawietz, S. A., Tamplin, A. K., & Radvansky, G. A. (2012). Age and mind wandering during text comprehension. *Psychol. Aging, 27,* 951–958.

Levinson, D. B., Smallwood, J., & Davidson, R. J. (2012). The persistence of thought: Evidence for a role of working memory in the maintenance of task unrelated thinking. *Psychological Science, 23,* 375–380.

Levy, B. (1996). Improving memory in old age by implicit self-stereotyping. *Journal of Personality and Social Psychology, 71,* 1092–1107.

Levy, B. R., Hausdorff, J. M., Hencke, R., & Wei, J. Y. (2000). Reducing cardiovascular stress with positive self-stereotypes of aging. *Journal of Gerontology: Psychological Sciences, 55B,* 205–213.

Maillet, D. & Rajah, N. (2013). Age-related changes in frequency of mind-wandering and task related interferences during memory encoding and their impact on retrieval. *Memory, 21*(7), 818-831.

Matthews, G., Joyner, L., Gilliland, K., Huggins, J., & Falconer, S. (1999). Validation of a comprehensive stress state questionnaire: Towards a state big three? In I. Merville, I. J. Deary, F. DeFruyt, & F. Ostendorf (Eds.), *Personality psychology in Europe* (pp. 335-350). Tilburg: Tilburg University Press.

Mazerolle, M., Régner, I., Morisset, P., Rigalleau, F., & Huguet, P. (2012). Stereotype threat strengthens automatic recall and undermines controlled processes in older adults. *Psychological Science, 23,* 723– 727. doi:10.1177/0956797612437607

McVay, J. C., & Kane, M. J. (2009). Conducting the train of thought: Working memory capacity, goal neglect, and mind wandering in an executive-control task. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *35,* 196–204.

McVay, J. C., & Kane, M. J. (2010a). Does mind wandering reflect executive function or executive failure? Comment on Smallwood and Schooler (2005) and Watkins (2008). *Psychological Bulletin, 136,* 188–197.

McVay, J. C., & Kane, M. J. (2010b). Adrift in the stream of thought: The effects of mind wandering on executive control and working memory capacity. In A. Gruszka, G. Matthews, & B. Szymura (Eds.), *Handbook of Individual Differences in Cognition: Attention, Memory and Executive Control.* New York: Springer.

McVay, J. C., & Kane, M. J. (2012a).Why does working memory capacity predict variation in reading comprehension? On the influence of mind wandering and executive attention. *Journal of Experimental Psychology. General, 141*(2), 302-320. http://dx.doi.org/10.1037/ a0025250

McVay, J. C.,& Kane, M. J. (2012b). Drifting from slow to “D'oh!”: Working memory capacity and mind wandering predict extreme reaction times and executive control errors. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 38*(3), 525-549.. http://dx.doi.org/ 10.1037/a0025896

McVay, J. C., Kane, M. J., & Kwapil, T. R. (2009). Tracking the train of thought from the laboratory into everyday life: An experience-sampling study of mind wandering across controlled and ecological contexts. *Psychonomic Bulletin & Review*, *16*, 857-863.

McVay, J. C., Meier, M. E., Touron, D. R., & Kane, M. J. (2013). Aging ebbs the flow thought: Adult age differences in mind wandering, executive control, and self evaluation. *Acta Psychologica, 142*(1), 136-147.

Mrazek, M.D., Smallwood, J., Franklin, M.S., Chin, J.M., Baird, B., & Schooler, J.W. (2012). The role of mind-wandering in measurements of general aptitude. *Journal of Experimental Psychology: General, 141*(4), 788–798.

Nosek, B.A., & Smyth, F.L. (2007). A multitrait-multimethod validation of the Implicit Association Test: Implicit and explicit attitudes are related but distinct constructs. *Experimental Psychology, 54*(1), 14-29.

Phillips, L. H., Henry, J. D., Hosie, J. A., & Milne, A. B. (2008). Effective regulation of The experience and expression of negative affect in old age. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences, 63,* 138-145. doi:10.1093/ geronb/63.3.P138

Pinel, E. C. (1999). Stigma consciousness: The psychological legacy of social stereotypes. *Journal of Personality and Social Psychology*, 76, 114-128.

Popham, L. E., & Hess, T. M. (2013). Age differences in the underlying mechanisms of Stereotype threat effects. *The Journal of Gerontology, Series B: Psychological and Social Sciences, 70*(2), 225-234.

Rahhal, T. A., Hasher, L., & Colcombe, S. J. (2001). Instructional manipulations and age differences in memory: Now you see them, now you don't. *Psychology and Aging, 16,* 697–706.

Rahhal, T. A., May, C. P., & Hasher, L. (2002). Truth and character: Sources that older Adults can remember. *Psychological Science, 13,* 101–105.

Salthouse, T. A. (1993). Speed mediation of adult age differences in cognition. *Developmental Psychology, 29*(4), 722–738. doi:10.1037//0012-1649.29.4.722

Schacter, D. L., Addis, D. R. and Buckner, R. L. (2008). Episodic simulation of future events: Concepts, data, and application. *Annals of the New York Academy of Sciences, Special Issue: The Year in Cognitive Neuroscience 2008, 1124,* 39- 60.

Scheibe, S., & Blanchard-Fields, F. (2009). Effects of regulating emotions on cognitive performance: What is costly for young adults is not so costly for older adults. *Psychology and Aging, 24,* 217–223. doi:10.1037/a0013807

Schmader, T., & Johns, M. (2003). Converging evidence that stereotype threat reduces working memory capacity. *Journal of Personality and Social Psychology, 85,* 440–452.doi:10.1037/0022-3514.85.3.440

Schmader, T., Forbes, C. E., Zhang, S., & Mendes, W. B. (2009). A metacognitive perspective on the cognitive deficits experienced in intellectually threatening environments. *Personality and Social Psychology Bulletin, 35*, 584–596.

Schmader, T., Johns, M., & Forbes, C. (2008). An integrated process model of stereotype threat effects on performance. *Psychological Review, 115*, 336–356.

Seibt, B., & Förster, J. (2004). Stereotype threat and performance: How self-stereotypes influence processing by inducing regulatory foci. *Journal of Personality and Social Psychology, 87*, 38–56. doi:10.1037/0022-3514.87.1.38

Smallwood, J. M., & Schooler, J. W. (2006). The restless mind. *Psychological Bulletin, 132*, 946–958.

Smallwood, J. M., Baracaia, S. F., Lowe, M., & Obonsawin, M. (2003). Task unrelated thought whilst encoding information. *Consciousness and Cognition, 12*, 452-484.

Smallwood, J. M., Davies, J. B., Heim, D., Finnigan, F., Sudberry, M., O'Connor, R., et al. (2004). Subjective experience and the attentional lapse: task engagement and disengagement during sustained attention. *Conscious. Cogn. 13*, 657–690.

Smallwood, J., Brown, K. S., Tipper, C., Giesbrecht, B., Franklin, M. S., Mrazek, M. D., et al. (2011). Pupillometric evidence for the decoupling of attention from perceptual input during offline thought. *PLoS One, 6*(3), 182-198. http://dx.doi.org/10.1371/journal.pone.0018298

Smallwood, J., Fitzgerald, A., Miles, L. K., & Phillips, L. H. (2009). Shifting moods, wandering minds: Negative moods lead the mind to wander. *Emotion, 9*, 271-276.

Smallwood, J., McSpadden, M., & Schooler, J. W. (2008). When attention matters: The curious incident of the wandering mind. *Memory & Cognition, 36*, 1144–1150.

Smallwood, J., O'Connor, R. C., Sudbery, M. V., & Obonsawin, M. (2007). Mind-wandering and dysphoria. *Cognition & Emotion, 21*, 816–842.

Stawarcyk, D., Majerus, S., Maj, M., van der Linden, M., & D'Argembeau, A. (2011). Mind wandering: Phenomenology and function as assessed with a novel experience sampling method, *Acta Psychologica, 136*, 370-381.

Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist, 52*, 613–629.

Steele, C. M., & Aronson, J. (1995). Contending with a stereotype: African-American intellectual test performance and stereotype threat. *Journal of Personality and Social Psychology, 69*, 797–811.

Watson, D., Clark, L.A., & Tellegan, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063-1070.

Wheeler, S. C., & Petty, R. E. (2001). The effects of stereotype activation on behavior: A review of possible mechanisms. *Psychological Bulletin, 127*, 797–826.

Zacks, R. T., Hasher, L., & Li, K. Z. H. (2000). Human memory. In F. I. M. Craik & T. A. Salthouse (Eds.), *The Handbook of Aging and Cognition* (2nd ed., pp. 293-357). Mahwah, NJ: Erlbaum.

FOOTNOTES

1. Appendix S contains plots of mean proportion of thought report (On-task, TUT, TRI, Proactive TRI, and Reactive TRI) by OSPAN block for each group. The OSPAN was divided into eight blocks and subjects responded to an online thought-probe once per block. The plots therefore provide a time course of mind-wandering during the OSPAN.
2. Appendix S contains plots of mean letter recall accuracy by OSPAN block for each group. The OSPAN was divided into eight blocks and subjects completely roughly eight trials per block. The plots therefore provide a time course of letter recall accuracy during the OSPAN. For each group, recall accuracy increased during the course of the OSPAN.
3. For all of the correlations reported in this section of the manuscript, a single asterix (*) denotes a p value < .05. A double asterix (**) denotes a p value <.01.

APPENDIX A

THE IMPLICIT ASSOCIATION TASK

The IAT indirectly assesses attitudes towards a group or category by collecting the response latencies for category judgment tasks. It has been argued that, because the IAT directs people to make correct category membership judgments rather than explicit category/group evaluations, the IAT avoids having participants respond in a way that is based on social desirability rather than underlying beliefs (Greenwald et al., 1998). The IAT is based on the idea that judgments *congruent* with participants' implicit associations between categories and exemplars, or between categories and their associated characteristics, will be easier and therefore quicker to make than judgments that are *incongruent* with a view held by the participants. Stronger implicit associations should result in faster congruent and slower incongruent judgments, increasing the difference between congruent and incongruent response times (RTs).

For example, an age-based IAT, such as the Age Attitude IAT, involves judgments being made about targets of two "bipolar" categories, for example, *Age* ("young" and "old", represented by photographs of a young individual and an old individual) and *Valence* ("pleasant" and "unpleasant", represented by positively or negatively valenced words). Figure 1 below offers a schematic of a typical IAT trial.

Figure 2 below offers a schematic of a typical IAT. In this example, the category *Age* is practiced on Blocks 1 and 4 (with key assignments reversed between these two blocks) and *Valence* categorization is practiced on Block 2. These trials allow the participant to practice the key assignments for the various categories.

Blocks 3 (a congruent block) and 5 (an incongruent block) both force participants to simultaneously concentrate on the two categories (*Age* and *Valence*) in order to sort either a pleasant versus unpleasant word or a young versus an old photograph into the appropriate category. On trials in the congruent block, the right-hand and left-hand assignment of the category poles is consistent with the expected, stereotype-based attitudes (e.g., *Old* and *Unpleasant* appear on the same side of the computer screen while *Young* and *Pleasant* appear together on the other side). Pleasant versus unpleasant words appearing in the middle of the computer screen must be sorted into the appropriate category using a left-handed or right-handed key response. In the aforementioned example, a word corresponding to the category *Unpleasant* would be sorted with a left-handed response. On trials in the incongruent block, exemplars from one of the categories are switched (e.g., *Old* and *Pleasant* now appear on the same side of the screen and *Young* and *Unpleasant* appear on the opposite side). Order of congruent and incongruent blocks are counterbalanced between participants.

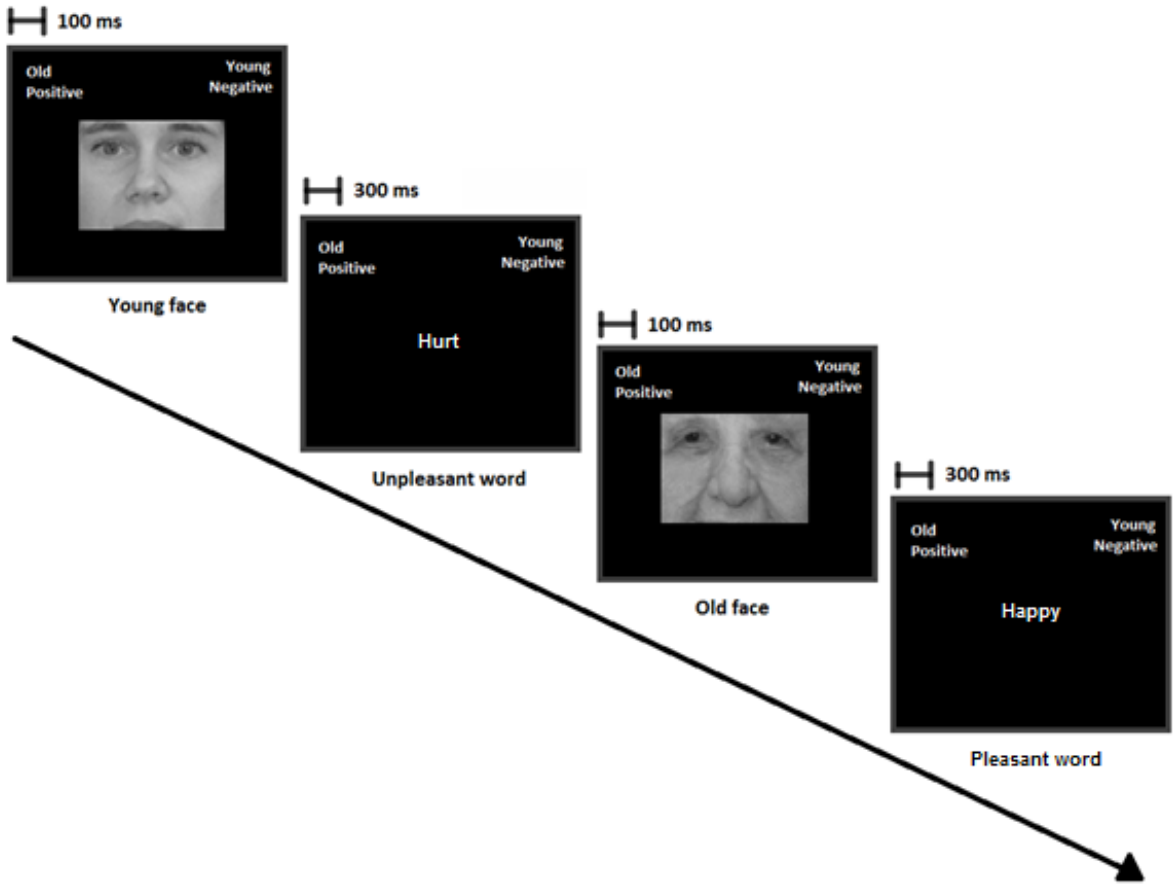


Figure 1. A schematic representation of an IAT sequence. Faces and words are presented for a short time. Both old and young faces, along with positively or negatively valenced words, are present in the stimuli set. The stimuli are presented in a randomized sequence. The subject must classify each stimuli to the left or right category according to the labels displayed on the top of the screen. Reaction times are recorded in each session.

Sequence	**Block 1:** Category I Discrimination	**Block 2:** Category II Discrimination	**Block 3:** Category I + II Discrimination	**Block 4:** Reversed Category I Discrimination	**Block 5:** Category I + II Incongruent Task
Hand Assignment	Left Hand Right Hand	Left Hand Right Hand	Left Hand Right Hand	Left Hand Right Hand	Left Hand Right Hand
Age Attitude IAT	Old Young	Unpleasant Pleasant	Old Unpleasant Young Pleasant	Young Old	Young Unpleasant Old Pleasant

Figure 2. IAT task blocks for an Age Attitude IAT. Categories (e.g., *Young* and *Old*) are assigned to either right or left response keys. For the above IAT, the difference in average response time for incongruent Block 5 and congruent Block 3 are used in the calculation of IAT scores. In this example, a positive IAT score represents more positive implicit attitudes towards young compared to old adults.

APPENDIX B

PILOT EXPERIMENTS IAT INSTRUCTIONS

Note: Lines indicate page breaks.

You will now begin a task designed to assess individuals' *underlying attitudes towards mathematics*. The Math Attitudes Task assesses implicit feelings participants have towards different fields of studies by measuring how long a participant takes to sort items into different categories. This task will assess ability of participants to quickly and correctly sort *mathematical items* into the appropriate category (MATHEMATICS) compared to their ability to quickly and correctly sort *liberal arts items* into their appropriate category (LIBERAL ARTS).

Additionally, participants are asked to complete a secondary, unrelated sorting task. In this study, the secondary task will be sorting different items into the categories of MALE or FEMALE.

You will complete two practice trials of this Math Attitudes Task before the experimental trials begin.

Press ENTER to continue.

In the following tasks, you will be presented with a set of words to classify into categories. The following is a list of *category labels* and the various *items* that belong to those categories. Please take a moment to look over the table below and press ENTER when finished.

CATEGORY	**Items**
MALE	Man, Boy, Father, Husband, Son, Uncle
FEMALE	Woman, Girl, Mother, Wife, Daughter, Aunt
MATHEMATICS	Physics, Engineering, Algebra, Geometry, Calculus, Math
LIBERAL ARTS	English, Literature, Art, History, Humanities, Philosophy

Please note:

- Two category labels on the *top* of the computer screen will tell you which words presented in the *middle* of the screen go with each key
- Each word has one correct classification
- Sort items by category membership. Words in red are categorized with the **red** labels. Words in **black** are categorized with the black labels.
- For best results avoid distractions

Press ENTER to continue.

Place your middle or index fingers on the **E** and **I** keys of your keyboard. Different words representing the *categories* seen at the top of the computer screen will appear one-by-one in the middle of the screen.

When an item belongs to a category on the *left*, press the **E** key; when the item belongs to a category on the *right*, press the **I** key. If you make an error, an **X** (red) will appear. If you make an error it is okay. Quickly correct the error by pressing the opposite key.

This is a *timed* sorting task. Please GO AS QUICKLY AS YOU CAN while making as few mistakes as possible. While occasional mistakes are fine, going too slow or making too many errors may result in a null score and unusable data.
You will now complete the first practice trial of this task.
Press ENTER to begin.

Participant will complete the first practice block. Here, MALE will be presented as the category heading on the top right portion of the screen. FEMALE will be presented as the category heading on the top left portion of the screen.

Very good. You will now complete the second practice trial of this task. New items will appear, and this time rather than sorting people into the categories of MALE or FEMALE, you will be asked to sort fields of study into MATHEMATICS or LIBERAL ARTS.
Again, this is a *timed* sorting task. Please GO AS QUICKLY AS YOU CAN while making as few mistakes as possible. While occasional mistakes are fine, going too slow or making too many errors may result in a null score and unusable data.
Press ENTER to begin.

Participant will complete the second practice block. Here, MATHEMTATICS will be presented as the category heading on the top right portion of the screen. LIBERAL ARTS will be presented as the category heading on the top left portion of the screen.

For the experimental portions of the task, FOUR categories heads will appear, two on each side of the computer screen. Here, the category headings of MALE and FEMALE will be presented in one color, and the category headings of MATHEMATICS and LIBERAL ARTS will be presented in a *different* color.

Again, you will be required to sort items presented one-by-one in the middle of the screen into the appropriate category seen at the top of the screen, using the E key to sort items into categories appearing on the left and using the I key to sort categories appearing on the right.

Items belong to one category. The color of the items may help you identify the appropriate category.

Remember to go as fast as you can while making as few mistakes as possible. Correct any errors by hitting the opposite key, as you have done before.

Press ENTER to begin.

Participants will now see MALE/LIBERAL ARTS as FEMALE/MATHEMATICS as category labels on the right.

Sort the same four categories again. Remember to go as fast as you can while making as few mistakes as possible. The color of the category and item labels may help you identify the appropriate category. Use the E and I keys to categorize items into the four groups left and right, and correct errors by hitting the opposite key, as you have done before.

Press ENTER to begin.

Participants will now see MALE/MATHEMATICS as category labels on the left and FEMALE/LIBERAL ARTS as category labels on the right.

For the next portion of the task, only two categories will appear on the top left and top right of the screen, and they have now switched positions. The concept that was previously on the left now appears on the right, and the concept that was on the right is now on the left. Practice this new configuration by sorting items into left categories using the E key and into right categories using the I key, as you have done before.
Press ENTER to begin.

Participants will now see FEMALE as category label on the left and MALE as category label on the right.

Very good. For the next experimental portions of the task, FOUR categories heads will appear once again, two on each side of the computer screen. Again, the category headings of MALE and FEMALE will be presented in one color, and the category headings of MATHEMATICS and LIBERAL ARTS will be presented in a *different* color. The color of the items presented in the middle of the screen may help you sort items into the appropriate categories.

Continue to sort items into the appropriate categories as you have done so before.

Remember to go as fast as you can while making as few mistakes as possible. Correct any errors by hitting the opposite key, as you have done before.
Press ENTER to begin.

Participants will now see FEMALE/MATHEMATICS as category labels on the left and MALE/LIBERAL ARTS as category labels on the right.

Sort the same four categories again. Remember to go as fast as you can while making as few mistakes as possible.

The color of the category and item labels may help you identify the appropriate category. Use the E and I keys to categorize items into the four groups left and right, and correct errors by hitting the opposite key, as you have done before.

Press ENTER to begin.

Participants will now see FEMALE/LIBERAL ARTS as category labels on the left and MALE/MATHEMATICS as category labels on the right.

You are now finished with the Math Attitudes Task!

Press the ENTER key to continue onto the next task.

APPENDIX C

OPERATION SPAN TASK INSTRUCTIONS

Note: Lines indicate page breaks.

In the next portion of the experiment, you will be asked to memorize letters that you see on the screen while you also solve mathematical equations.

In the next few minutes, you will have some practice to become familiarized with how this portion of the experiment works.
We will begin by practicing the letter part of the experiment.
Click the mouse to continue**.**

For this practice set, letters will appear on the screen one at a time. Try to remember each letter in the order presented.
After 2-3 letters have been shown, you will see a screen listing 12 possible letters with a check box beside each one.
Your job is to select each letter in the order presented. To do this, use the mouse to select the box beside each letter. The letters you select will appear at the bottom of the screen.
Click the mouse button to continue.

When you have selected all the letters, and they are in the correct order, hit the EXIT box at the bottom right of the screen.
If you make a mistake, hit the CLEAR box to start over. If you forget one of the letters, click the BLANK box to mark the spot for the missing letter.
Remember, it is very important to get the letters in the same order as you see them. If you forget one, use the BLANK box to mark the position.

Do you have any questions? If yes, press BACKSPACE to read the instructions again.
If not, click the mouse to continue.

Participants will complete one cycle consisting 5 letter memorization trials. A total of 12 letters will be memorized during the cycle, but with letter set size will vary between 2 and 3 letters.

Now you will practice doing the math part of the experiment.
A math problem will appear on the screen, like this:
(2 * 1) + 1 = ?
As soon as you see the math problem, you should compute the correct answer.
In the above problem, the answer 3 is correct.
When you know the correct answer, you will click the mouse button.
Click the mouse to continue.

You will see a number displayed on the next screen, along with a box marked TRUE and a box marked FALSE.
If the number on the screen is the correct answer to the math problem, click on the TRUE box with the mouse.
If the number is not the correct answer, click on the FALSE box.
For example, if you see the problem
(2 * 2) + 1 = ?
and the number on the following screen is 5 click the TRUE box, because the answer is correct.
If you see the problem
(2 * 2) + 1 = ?
and the number on the next screen is 6 click the FALSE box, because the correct answer is 5, not 6.

After you click on one of the boxes, the computer will tell you if you made the right choice.
Click the mouse to continue.

It is important that you get the math problems correct. It is also important that you try and solve the problem as quickly as you can.
Do you have any questions? If yes, press BACKSPACE to read the instructions again.
If not, click the mouse to continue.

Participants will verify 16 mathematical equations during this practice trial.

Now you will practice doing *both* parts of the experiment at the same time.
In the next practice set, you will be given one of the math problems. Once you make your decision about the math problem, a letter will appear on the screen. Try and remember the letter.
In the previous section where you only solved math problems, the computer computed your average time to solve the problems. If you take longer than your average time, the computer will automatically move you onto the letter part, thus skipping the True or False part and will count that problem as a math error.
Therefore it is VERY important to solve the problems as quickly and as accurately as possible
Click the mouse to continue.

After the letter goes away, another math problem will appear, and then another letter.
At the end of each set of letters and math problems, a recall screen will appear. Use the mouse to select the letters you just saw. Try your best to get the letters in the correct order.

It is important to work QUICKLY and ACCURATELY on the math. Make sure you know the answer to the math problem before clicking to the next screen.
You will not be told if your answer to the math problem is correct.
After the recall screen, you will be given feedback about your performance regarding both the number of letters recalled and the percent correct on the math problems.
Do you have any questions? If yes, press BACKSPACE to read the instructions again.
If not, click the mouse to continue.

Participants will now go through the OSPAN practice block.

That is the end of the practice.
The real trials will look like the practice trials you just completed. First you will get a math problem to solve, then a letter to remember.
When you see the recall screen, select the letters in the order presented. If you forget a letter, click the BLANK box to mark where it should go.
Some sets will have more math problems and letters than others.
It is important that you do your best on both the math problems and the letter recall parts of this experiment.
Remember on the math you must work as QUICKLY and ACCURATELY as possible.
Click the mouse to continue.

Occasionally, the experimental task with pause and *thought probes* will come up asking you to report on what you were *just thinking* about before the thought probe appeared.
The probe will appear as follows:
What were you *just* thinking about?
1. The task: Focused on completing the task, verifying equations and remembering letters
2. Task approach: How to improve your task performance

---

3. Task evaluation: How effectively you were completing the task, or worrying about performance.

4. Everyday things: Thinking about recent or impending life events

5. Current state of being: Thinking about conditions such as hunger or sleepiness.

6. Personal worries: Thinking about concerns, troubles or fears not relating to the experimental task.

7. Daydreams: fantasies disconnected from reality

8. Other

Please respond to the probes honestly by indicating using the keyboard the number that corresponds to what you were thinking about JUST BEFORE the probe appeared.

Do you have any questions? If yes, press BACKSPACE to read the instructions again.

If not, click the mouse to continue.

Participants will now complete the experimental OSPAN block, consisting of 90 trials. Thought probes will be presented randomly and will appear approximately every 2 minutes. There are 10 thought probes.

APPENDIX D

POSITIVE AND NEGATIVE AFFECT SCALE

The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988)

PANAS Questionnaire
This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word.

Indicate to what extent you feel this way right now, that is, at the present moment OR indicate the extent you have felt this way over the past week (circle the instructions you followed when taking this measure)

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely

_____ 1. Interested	_____ 11. Irritable
_____ 2. Distressed	_____ 12. Alert
_____ 3. Excited	_____ 13. Ashamed
_____ 4. Upset	_____ 14. Inspired
_____ 5. Strong	_____ 15. Nervous
_____ 6. Guilty	_____ 16. Determined
_____ 7. Scared	_____ 17. Attentive
_____ 8. Hostile	_____ 18. Jittery
_____ 9. Enthusiastic	_____ 19. Active
_____ 10. Proud	_____ 20. Afraid

Scoring: Items 1, 3, 5, 9, 10, 12, 14, 16, 17, and 19 are added to obtain the positive affect score. The positive affect score can range from 10-50 with higher scores indicating higher

levels of positive affect. Items 2, 4, 6, 7, 8, 11, 13, 15, 18, and 20 are added to obtain the negative affect score. The negative affect score ranges from 10-50 with lower scores indicating higher levels of negative affect.

APPENDIX E

METAMEMORY IN ADULTHOOD QUESTIONNAIRE

Memory Questionnaire

Directions Different people use their memory in different ways in their everyday lives. For example, some people make shopping lists, while others do not. Some people are good at remembering names, while others are not. In this questionnaire, we would like you to tell us how you use your memory and how you feel about it. There are no right or wrong answers to these questions because people are different. Please take your time and answer each of these questions to the best of your ability. Each question is followed by five choices. Draw a circle around the letter corresponding to your choice. Mark only one letter for each statement. Some of the questions ask your opinion about memory-related statements; for example:

My memory will get worse as I get older.
a. agree strongly
b. agree
c. undecided
d. disagree
e. disagree strongly

In this example you could, of course, choose any one of the answers. If you agree strongly with the statement you would circle a. If you disagree strongly you would circle letter e. The b and d answers indicate less strong agreement. The letter c answer gives you a middle choice, but don't use c unless you really can't decide on any of the other responses.

Some of the questions ask how often you do certain things that may be related to your memory. For example:

Do you make a list of things to be accomplished during the day?
a. never
b. rarely
c. sometimes
d. often
e. always

Again, you could choose any one of the answers. Choose the one that comes closest to what you usually do. Don't worry if the time estimate is not exact, or if there are some exceptions.

Keep these points in mind:
Answer every question, even if it doesn't seem to apply to you very well.
Answer as honestly as you can what is true for you. Please do not mark something because it seems like the "right thing to say."

1.	For most people, facts that are interesting are easier to remember than facts that are not.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
2.	I am good at remembering names.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
3.	Do you keep a list or otherwise note important dates, such as birthdays and anniversaries?	a. never b. rarely c. sometimes d. often e. always
4.	It is important to me to have a good memory.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
5.	I get upset when I cannot remember something.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
6.	When you are looking for something you have recently misplaced, do you try to retrace your steps in order to locate it?	a. never b. rarely c. sometimes d. often e. always
7.	I think a good memory is something of which to be proud.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly

8.	I find it harder to remember things when I am upset.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
9.	I am good at remembering birth-dates.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
10.	I can remember things as well as always.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
11.	When you have not finished reading a book or magazine, do you somehow note the place where you have stopped?	a. never b. rarely c. sometimes d. often e. always
12.	I get anxious when I am asked to remember something.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
13.	It bothers me when others notice my memory failures.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
14.	I'm less efficient at remembering things now than I used to be.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly

15.	I have difficulty remembering things when I am anxious.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
16.	The older I get the harder it is to remember clearly.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
17.	Do you think about the day's activities at the beginning of the day so you can remember what you are supposed to do?	a. never b. rarely c. sometimes d. often e. always
18.	I am just as good at remembering as I ever was.	a. agree strongly b. agree c. undecided d. often e. always
19.	I have no trouble keeping track of my appointments.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
20.	For most people, it is easier to remember information they need to use immediately than information they will not use for a long time.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
21.	Most people find it easier to remember directions to places they want or need to go than to places they know they will never be going.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly

22.	I am usually uneasy when I attempt a problem that requires me to use my memory.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
23.	I feel jittery if I have to introduce someone I just met.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
24.	Having a better memory would be nice but it is not very important.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
25.	Do you post reminders of things you need to do in a prominent place, such as bulletin boards or note boards?	a. never b. rarely c. sometimes d. often e. always
26.	It doesn't bother me when my memory fails.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
27.	I am poor at remembering trivia.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
28.	I am much worse now at remembering the content of news articles and broadcasts than I was 10 years ago.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly

29.	Do you routinely keep things in a familiar spot so you won't forget them when you need to locate them?	a. never b. rarely c. sometimes d. often e. always
30.	Compared to 10 years ago, I am much worse at remembering titles of books, films, or plays.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
31.	For most people it is easier to remember words they want to use than words they know they will never use.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
32.	I remember my dreams much less now than 10 years ago.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
33.	I can't expect to be good at remembering zip codes at my age.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
34.	Most people find it easier to remember the names of people they especially dislike than people they hardly notice.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
35.	I have little control over my memory ability.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly

36.	When you want to take something with you, do you leave it in an obvious, prominent place, such as putting your suitcase in front of the door?	a. never b. rarely c. sometimes d. often e. always
37.	I think it is important to work at sustaining my memory ability.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
38.	I misplace things more frequently now than when I was younger.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
39.	As people get older they tend to forget where they put things more frequently.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
40.	I work hard at trying to improve my memory.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
41.	Compared to 10 years ago, I now forget many more appointments.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
42.	If I am put on the spot to remember names I know I will have difficulty doing it.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly

43.	For most people, it is easier to remember the names of people they especially like than people that don't make much of an impression on them.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
44.	Most people find it easier to remember words they understand than words that don't mean very much to them.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
45.	My memory for important events has improved over the last 10 years.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
46.	I admire people who have good memories.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
47.	My friends often notice my memory ability.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
48.	When you try to remember people you have met, do you associate names and faces?	a. never b. rarely c. sometimes d. often e. always
49.	I am good at remembering the order that events occurred.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly

50.	For most people, words they have seen or heard before are easier to remember than words that are totally new to them	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
51.	Familiar things are easier to remember than unfamiliar things.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
52.	I am good at remembering conversations I have had.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
53.	I would feel on edge right now if I had to take a memory test or something similar.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
54.	My memory for phone numbers will decline as I get older.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
55.	I often notice my friends' memory ability.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
56.	My memory for dates has greatly declined in the last 10 years.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly

57.	When you have trouble remembering something, do you try to remember something similar in order to help you remember?	a. never b. rarely c. sometimes d. often e. always
58.	My memory for names has greatly declined in the last 10 years.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
59.	I often forget who was with me at events I have attended.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
60.	Do you consciously attempt to reconstruct the day's events in order to remember something?	a. never b. rarely c. sometimes d. often e. always
61.	As long as I exercise my memory it will not decline.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
62.	I am good at remembering the places I have been.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
63.	I know if I keep using my memory I will never lose it.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly

64.	Do you try to relate something you want to remember to something else hoping that this will increase the likelihood of your remembering later?	a. never b. rarely c. sometimes d. often e. always
65.	It's important that I am very accurate when remembering names of people.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
66.	When I am tense and uneasy at a social gathering I cannot remember names very well.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
67.	Do you try to concentrate hard on something you want to remember?	a. never b. rarely c. sometimes d. often e. always
68.	It's important that I am very accurate when remembering significant dates.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
69.	It's up to me to keep my remembering abilities from deteriorating.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
70.	When someone I don't know very well asks me to remember something I get nervous.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly

71.	I have no trouble remembering where I have put things.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
72.	It is easier for most people to remember things that are unrelated to each other than things that are related.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
73.	Even if I work on it my memory ability will go downhill.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
74.	Most people find it easier to remember concrete things than abstract things.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
75.	Do you make mental images or pictures to help you remember?	a. never b. rarely c. sometimes d. often e. always
76.	I know of someone in my family whose memory improved significantly in old age.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
77.	I am good at remembering things like recipes.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly

78.	I get anxious when I have to do something I haven't done for a long time.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
79.	It bothers me when I forget an appointment.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
80.	Most people find it easier to remember things that happen to them than things that happen to others.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
81.	Do you mentally repeat something you are trying to remember?	a. never b. rarely c. sometimes d. often e. always
82.	My memory has greatly improved over the last 10 years.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
83.	I like to remember things on my own, without relying on other people to remind me.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
84.	I get tense and anxious when I feel my memory is not as good as other peoples'.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly

85.	Do you ask other people to remind you of something?	a. never b. rarely c. sometimes d. often e. always
86.	I'm highly motivated to remember new things I learn.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
87.	I do not get flustered when I am put on the spot to remember new things.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
88.	I am good at remembering titles of books, films, or plays.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
89.	My memory has greatly declined in the last 10 years.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
90.	For most people it is easier to remember things in which they are most interested than things in which they are less interested.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
91.	I have no trouble remembering lyrics of songs.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly

92.	My memory will get better as I get older.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
93.	It is easier for most people to remember bizarre things than usual things.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
94.	Do you write yourself reminder notes?	a. never b. rarely c. sometimes d. often e. always
95.	I am good at remembering names of musical selections.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
96.	Most people find it easier to remember visual things than verbal things.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
97.	After I have read a book I have no difficulty remembering factual information from it.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
98.	Do you write appointments on a calendar to help you remember them?	a. never b. rarely c. sometimes d. often e. always

99.	I would feel very anxious if I visited a new place and had to remember how to find my way back.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
100.	I am good at remembering the content of news articles and broadcasts.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
101.	No matter how hard a person works on his memory, it cannot be improved very much.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
102.	If I were to work on my memory I could improve it.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
103.	It gives me great satisfaction to remember things I thought I had forgotten.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
104.	Remembering the plot of stories and novels is easy for me.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
105.	I am usually able to remember exactly where I read or heard a specific thing.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly

106.	I think a good memory comes mostly from working on it.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
107.	Most people find it easier to remember unorganized things than organized things.	a. agree strongly b. agree c. undecided d. disagree e. disagree strongly
108.	Do you write shopping lists?	a. never b. rarely c. sometimes d. often e. always

Note: The above questionnaire includes additional items that will not be used in the proposed study. Participants will only complete the Achievement, Anxiety, and Locus of Control subscales of this questionnaire.

Scoring: The Achievement subscale evaluates importance of having a good memory. Higher scores indicate higher levels of motivation to perform well on memory tasks. This subscale consists of 16 items: 2, 7, 13, 24, 37, 40, 46, 47, 55, 65, 68, 79, 83, 86, and 103. Items 24 and 26 are reverse-scored.

The Anxiety subscale evaluates the influence of anxiety on cognitive performance. Higher scores indicate higher levels of anxiety while performing memory tasks. This subscale consists of 14 items: 5, 8, 12, 15, 22, 23, 42, 53, 66, 70, 78, 84, 87, and 99. Item 87 is reverse-scored.

The Locus subscale evaluates perceived control over memory skills. Higher scores indicate higher levels of internality. This subscale consists of nine items: 33, 34, 35, 62, 63, 69, 73, 101, 102, and 106. Items 33, 34, and 73 are reverse-scored.

APPENDIX F

DUNDESS STRES STATE QUESTIONNAIRE (THOUGHT CONTENT)

THINKING CONTENT

This set of questions concerns the kinds of thoughts that go through people's heads at particular times, for example while they are doing some task or activity. Below is a list of thoughts, some of which you might have had recently. Please indicate roughly how often you had each thought while performing the task, by circling a number from the list below.

1= Never 2= Once 3= A few times 4= Often 5= Very often

1. I thought about how I should work more carefully.	1 2 3 4 5
2. I thought about how much time I had left.	1 2 3 4 5
3. I thought about how others have done on this task.	1 2 3 4 5
4. I thought about the difficulty of the problems.	1 2 3 4 5
5. I thought about my level of ability.	1 2 3 4 5
6. I thought about the purpose of the experiment.	1 2 3 4 5
7. I thought about how I would feel if I were told how I performed.	1 2 3 4 5
8. I thought about how often I get confused.	1 2 3 4 5
9. I thought about members of my family.	1 2 3 4 5
10. I thought about something that made me feel guilty.	1 2 3 4 5
11. I thought about personal worries.	1 2 3 4 5

12. I thought about something that made me feel angry.	1 2 3 4 5
13. I thought about something that happened earlier today.	1 2 3 4 5
14. I thought about something that happened in the recent past (last few days, but not today).	1 2 3 4 5
15. I thought about something that happened in the distant past	1 2 3 4 5
16. I thought about something that might happen in the future.	1 2 3 4 5

Scoring: Items 1-18 on this questionnaire are summated to provide a measure of task-related interference (TRI). Items 9-16 on this questionnaire are summated to provide a measure of task-unrelated thinking (TUT).

APPENDIX G

DUNDEE STRESS STATE QUESTIONNAIRE (MOTIVATION)

MOTIVATION

Please answer some questions about your attitude to the task you are about to do. Rate your agreement with the following statements by circling one of the following answers:

Extremely = 4 Very much = 3 Somewhat = 2 A little bit = 1 Not at all = 0

1. The content of the task was interesting	0 1 2 3 4
2. The only reason to do the task is to get an external reward (e.g. payment)	0 1 2 3 4
3. I would rather have spent the time doing the task on something else	0 1 2 3 4
4. I was concerned about not doing as well as I can	0 1 2 3 4
5. I wanted to perform better than most people do	0 1 2 3 4
6. I became fed up with the task	0 1 2 3 4
7. I was eager to do well	0 1 2 3 4
8. I would be disappointed if I failed to do well on this task	0 1 2 3 4
9. I was committed to attaining my performance goals	0 1 2 3 4
10. Doing the task was worthwhile	0 1 2 3 4
11. I found the task boring	0 1 2 3 4
12. I felt apathetic about my performance	0 1 2 3 4
13. I wanted to succeed on the task	0 1 2 3 4

14. The task brought out my competitive drives	0 1 2 3 4
15. I was motivated to do the task	0 1 2 3 4

Scoring: Items 1-15 assess motivation. Items 4, 5, 7, 8, 9, 13, and 14 are summated to get a measure of success motivation, or motivation to excel in task performance. Item number 15 can be used to provide an overall level of motivation, if needed. The remainder of the items are summated to provide a measure of how interesting participants thought the task was. Items 1 and 10 are positively scores while items 2, 3, 6, 11, and 12 are reversed scored.

APPENDIX H

DEMOGRAPHICS QUESTIONNAIRE

Participant Information Survey

In order to better understand the results of the study you have agreed to participate in, we need to know a few things about you and your background.
We will use this information for research purposes only, and it will be kept strictly confidential. You will note that we do not ask for your name during this survey.
Please respond to the following questions completely. Ask the Experimenter if you need assistance in answering any question.
If you have limited experience with computers, or are unsure about how to use the computer in answering these questions, please ask the Experimenter for assistance at any time.
Please press ENTER to begin.

---

1. My sex is (please circle): Male Female

2. My birth date is:

(Month) (Day) (Year)

3. What is your native language?
English: _____ Other (please specify): _____

4. What is your ethnic background? Please check the appropriate alternative.

_____ **First Nations** origin (A person having origins in any of the original peoples of North America, and who maintains a cultural identification through tribal or band affiliation or community recognition)

_____ **Asian or Pacific Islander** (A person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands. This area includes, for example, China, India, Pakistan, Japan, Korea, the Philippine Islands, and Samoa.)

_____ **Black**, not of Hispanic origin (A person having origins in any of the black racial groups of Africa)

_____ **Hispanic** (A person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race)

_____**White**, not of Hispanic origin (A person having origins in any of the original peoples of Europe, North Africa, or the Middle East)

5. Which academic diplomas / degrees / certificates have you obtained? (Please circle **ALL** that apply)

a) no degree
b) high school diploma
c) technical/trade school or community college
d) Bachelor's (e.g., BA, BSc, BComm.)
e) Master's (e.g., MA, MSc, MEd, LLM)
f) Law degree (Bachelor=s, LLB)
g) Medical degree (MD)
h) PhD or other doctoral degree
i) other or additional degrees (please specify)

6. For **EACH** of the following levels of education, please circle the highest grade or years of full-time attendance you have **COMPLETED.** Do not include part-time or extension courses taken for interest.

a) **Grade/Intermediate School**
Grade 1 Grade 2 Grade 3 Grade 4 Grade 5 Grade 6 Grade 7 Grade 8

b) **Secondary/High School**
none Grade 9 Grade 10 Grade 11 Grade 12 Grade 13

c) **Technical, Trade, Nursing or Business School, or Community College**
none 1 year 2 years 3 years 4 years 5+ years

d) **University** (Bachelor=s Level)
none 1st year 2nd year 3rd year 4th year 5th year

e) **Post-Graduate School** (e.g., Master's, PhD)
none 1 year 2 years 3 years 4 years 5+ years

7. Are you currently involved in volunteer work? Yes _____ No _____

If yes, please briefly describe your volunteer activities:

8. Are you currently a student? Yes _____ No _____

If yes, how many hours a week do you spend in classes? _____ hrs

Are you pursuing a specific certificate, diploma or degree? Yes _____ No _____

Please briefly describe what you are studying:

9. Compared to a perfect state of health, I believe my overall health to be (Please circle one):

a. very good
b. good
c. fair
d. poor
e. very poor

10. Compared to other people my age, I believe my overall health to be (Please circle one):

a. very good
b. good
c. fair
d. poor
e. very poor

11. Compared to other people my age, I believe my eyesight to be (Please circle one):

a. very good
b. good
c. fair
d. poor
e. very poor

12. Compared to other people my age, I believe my hearing to be (Please circle one):

a. very good
b. good
c. fair
d. poor
e. very poor

13. In the past 3 years, my health has affected my daily activities in the following way (Please circle one):

a. not applicable
b. improved
c. no change
d. slightly reduced
e. moderately reduced
f. drastically reduced
g. gave up employment
h. gave up travel

14. The following chart lists a number of health-related conditions that may apply to you. Please answer all parts of each question as concisely as you can. The first part of each question is the most important for you to answer. Specifically, we would like to know whether or not you have ever been diagnosed by a medical practitioner with the condition in question. **If you responded YES,** please complete the remaining parts of the question.

Do you suffer from this condition?	**If YES, how serious is your condition? (please check one)**				**At what AGE were you diagnosed with this condition?**
	No	**Yes, not serious**	**Yes, moderately serious**	**Yes, very serious**	
Hearing problems (e.g., tinitus) that cannot be corrected with a hearing aid					
Visual disorders (e.g., glaucoma, cataracts, macular degeneration) that cannot be corrected with glasses					
Asthma					
Bronchitis					
Tuberculosis					
Hardening of the arteries					
High blood pressure					
Stroke					
Low blood pressure					
Gall bladder problems					
Liver trouble					
Stomach ulcer					
Kidney or bladder trouble or cystitis					
Gynecological problems					
Colitis or diverticulitis					
Paralysis not related to stroke					
Spinal condition (e.g., scoliosis)					
Back trouble					
Parkinson's disease					

Epilepsy					
Thyroid					
Prostate problems					
Anemia					
Depression					
Alcohol dependence					
Drug dependence					
Heart trouble					
Osteo-arthritis					
Rheumatoid arthritis					
Osteoporosis					
Diabetes (sugar sickness)					
Cancer					
Migraine					
Encephalitis					
Meningitis					
Head injury					

15. Are you presently taking any drugs or medications (prescription or other)?

a. Yes

b. No

If yes, here is a chart of medications that people often have to take. Please indicate whether you are taking any of these medications (Check all that apply).

	medicine for high blood pressure (e.g., Prinivil, Lopressor, Procardia, Vasotec, etc.)
	digitalis or other medication for your heart
	medicine for chest pain/angina (e.g., Nitroglycerine, Digoxin, Procardia, etc.)
	any sort of diabetes medicine (pills, pumps, or injections: e.g., Glucotrol, Tolinase, Insulin)
	cortisone or anti-inflammatory drugs for arthritis (e.g., Prednisone, Tolectin, etc.)
	pills to make you lose water or salt (diuretics: e.g., Lasix, Bumex, etc.)
	tranquillizers or sedatives (e.g., Ativan, Xanax, Valium, etc.)
	sleeping pills/hypnotics (e.g., Chloral hydrate, Restoril, Dalmane, etc.)
	blood thinner medicine (anticoagulants: e.g., Coumadin, Heparin, etc.)
	vitamin or mineral supplements (e.g., Iron, Calcium, Potassium, etc.)
	female hormone supplements (e.g., Estrogen, Premarin, etc.)
	appetite suppressants or diet pills
	pain medication (more than 2-3 times a week: e.g., Tylenol, Advil, Percocet, Darvocet-N-100, etc.)
	allergy or asthma medicine
	ulcer or other stomach medicine (e.g., Tagamet, Lactate, Prilosec, etc)
	antibiotics (e.g., Penicillin, Ampicillin, Tetracycline, etc.)
	medicine to control seizures (e.g., Dilantin, Tegretol, etc.)
	medicine to control tremors (e.g., L-dopa, Sinemet, Parlodel, etc.)
	oral contraceptives
	stimulants to help you stay awake
	eye medication (e.g., eye drops/ointments: e.g., IsoptoCarpine, etc.)
	anti-depressant medication (e.g., Wellbutrin, Elavil, Zoloft, Prozac, etc.)
	anti-psychotic medication (e.g., Lithium, Prolixin, etc.)
	chemotherapy for cancer
	oral medication for cancer (e.g., Nolvadex, Cytoxan, etc.)
	medicine for a thyroid condition (e.g., Synthroid, Eltroxin, etc.)
	other prescription or non-prescription drugs (please indicate)

16. Today, have you taken any drugs or medications (prescription or other) that tend to make you drowsy?

a. Yes
b. No

17. Do you smoke or use tobacco products? (Please circle one)

a. Yes At what age did you start smoking? _____
b. No, I previously used tobacco but I have quit completely
For how many years did you use tobacco? _____
c. No, I have never used tobacco

If you **currently** use tobacco, what do you use? (Please circle. Complete all that apply)

a. **Cigarettes**
How many cigarettes do you smoke?
_____ cigarettes per _____ (day/week/month/year)
b. **Cigars**
How many cigars do you smoke?
_____ cigars per _____ (day/week/month/year)
c. **Pipe**
How many pipe bowls do you smoke?
_____ pipe bowls per _____ (day/week/month/year)
d. **Snuff or chewing tobacco**
How many pinches or plugs do you use?
_____ pinches/plugs per_____ (day/week/month/year)

18. Do you drink alcoholic beverages? (Please circle one)

a. Yes At what age did you start drinking? _____
b. No, I used to drink but have now completely given it up
For how many years did you drink? _____
c. No, I never drink

If you **currently** drink alcoholic beverages, what do you drink? (Please circle. Complete all that apply)

a. **Beer**
How many cans/bottles of beer do you consume?
_____ bottles/cans per _____ (day/week/month/year)

b. Wine

How many glasses of wine do you consume?

_____ glasses per _____ (day/week/month/year)

c. Hard liquor (i.e., with no mix added)

How many drinks do you consume? (1 drink = 1 ounce of alcohol)

_____ drinks per _____ (day/week/month/year)

d. Mixed drinks (i.e., alcohol with mix added)

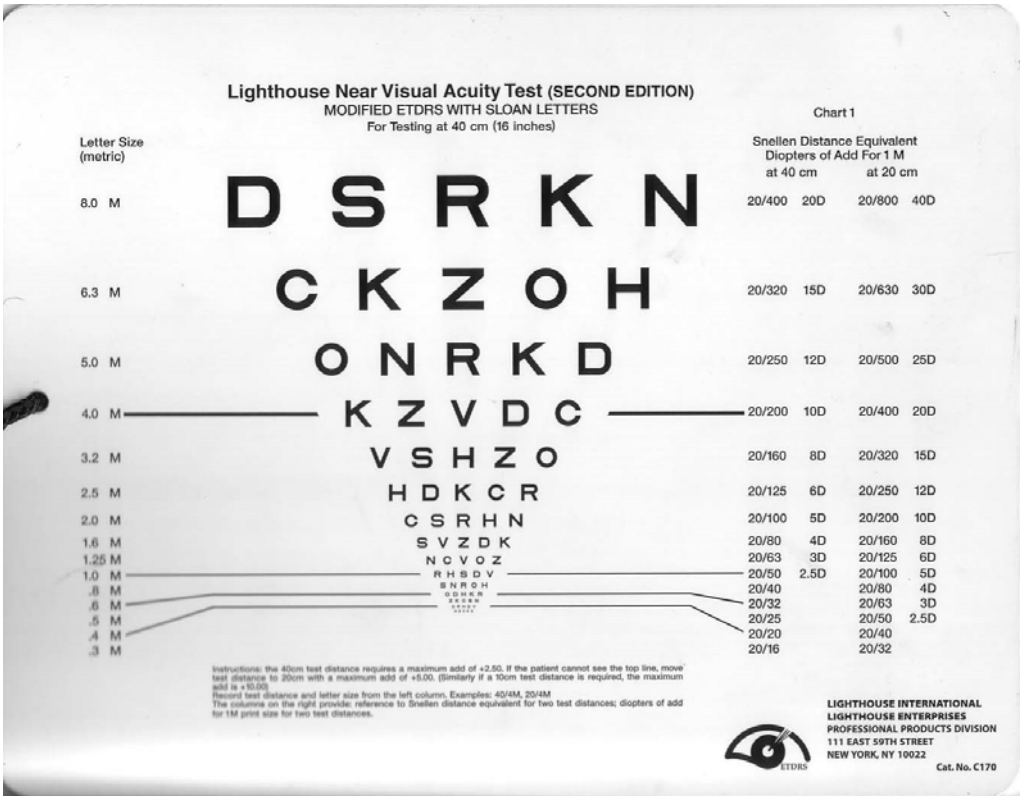
How many mixed drinks do you consume? (1 drink = 1 ounce of alcohol)

_____ mixed drinks per _____ (day/week/month/year)

Thank You for your time!

APPENDIX I

LIGHTHOUSE NEAR VISUAL ACUITY



Verbal instructions:

> "This is a near acuity test. Hold this card such that the end of the cord is next to your eye and the string is pulled taut. Now read the lowest line of which you can easily read all five letters."

Scoring:

> If a participant reads a line incorrectly they are instructed to read the line immediately above it. This process repeats until the participant in able to correctly read all five letters of a line. Scores are based on the lowest line that participants can read all five letter for.

APPENDIX J

ADVANCE VOCABULARY TEST

Part 1 (4 minutes)

1. mumble
   1-speak indistinctly
   2-complain
   3-handle awkwardly
   4-fall over something
   5-tear apart

2. perspire
   1-struggle
   2-sweat
   3-happen
   4-penetrate
   5-submit

3. gush
   1-giggle
   2-spout
   3-sprinkle
   4-hurry
   5-cry

4. massive
   1-strong and muscular
   2-thickly populated
   3-ugly and awkward
   4-huge and solid
   5-everlasting

5. feign
   1-pretend
   2-prefer
   3-wear
   4-be cautious
   5-surrender

6. unwary
   1-unusual
   2-deserted
   3-incautious
   4-sudden
   5-tireless

7. veer
   1-change direction
   2-hesitate
   3-catch sight of
   4-cover with a thin layer
   5-slide

8. orthodox
   1-conventional
   2-straight
   3-surgical
   4-right-angled
   5-religious

9. stripling
   1-stream
   2-narrow path
   3-engraving
   4-lad
   5-beginner

10. salubrious
   1-mirthful
   2-indecent
   3-salty
   4-mournful
   5-healthful

11. limpid
   1-lazy
   2-crippled
   3-clear
   4-hot
   5-slippery

12. procreate
   1-sketch
   2-inhabit
   3-imitate
   4-beget
   5-encourage

13. replete
   1-full
   2-elderly
   3-resentful
   4-discredited
   5-restful

14. frieze
   1-fringe of curls on the forehead
   2-statue
   3-ornamental band
   4-embroidery
   5-sherbet

15. treacle
   1-sewing machine
   2-framework
   3-leak
   4-apple butter
   5-molasses

16. ignominious
   1-inflammable
   2-elflike
   3-unintelligent
   4-disgraceful
   5-mysterious

17. abjure
   1-make certain
   2-arrest
   3-renounce
   4-abuse
   5-lose

18. duress
   1-period of time
   2-distaste
   3-courage
   4-hardness
   5-compulsion

DO NOT TURN THIS PAGE UNTIL ASKED TO DO SO.

STOP.

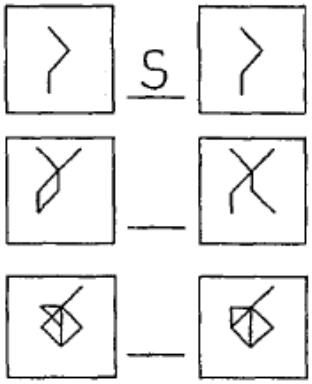
APPENDIX K

PATTERN COMPARISON TASK

PATTERN COMPARISON

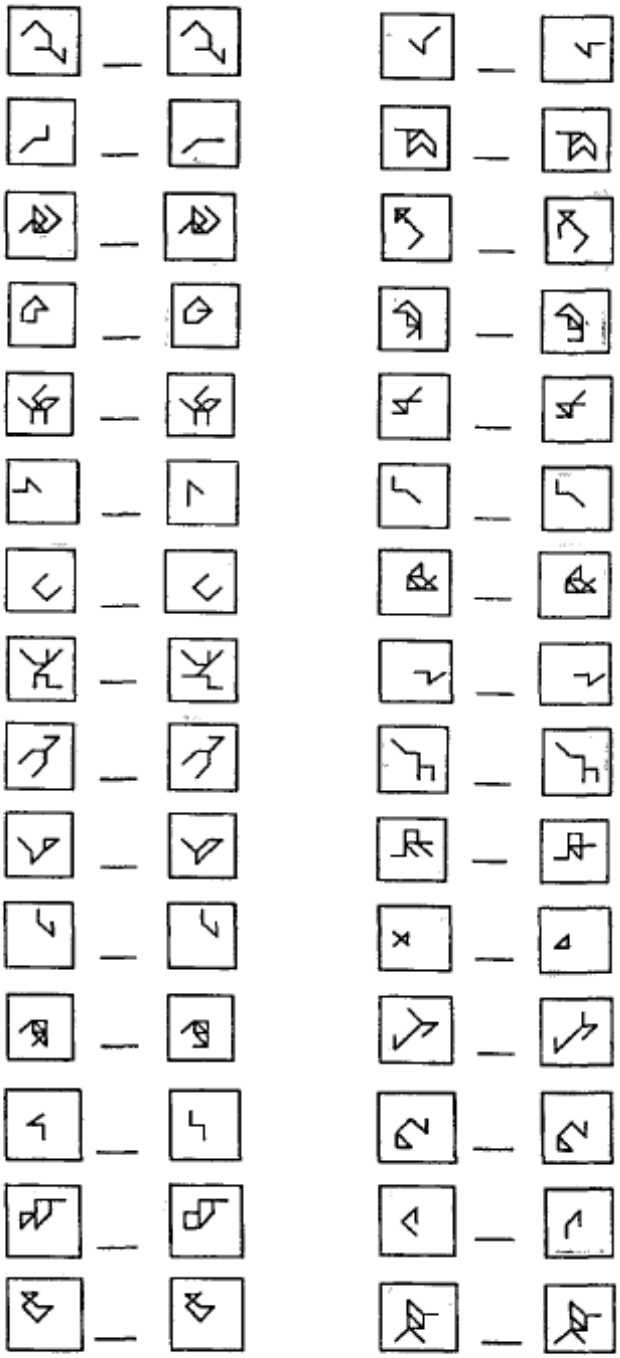
In this test you will be asked to determine whether two patterns of lines are the same or different. If the two patterns are the SAME, write an S on the line between them. If they are DIFFERENT, write a D on the line. Please try to work as rapidly as you can, writing an answer to each pair of line patterns.

Try the following examples.



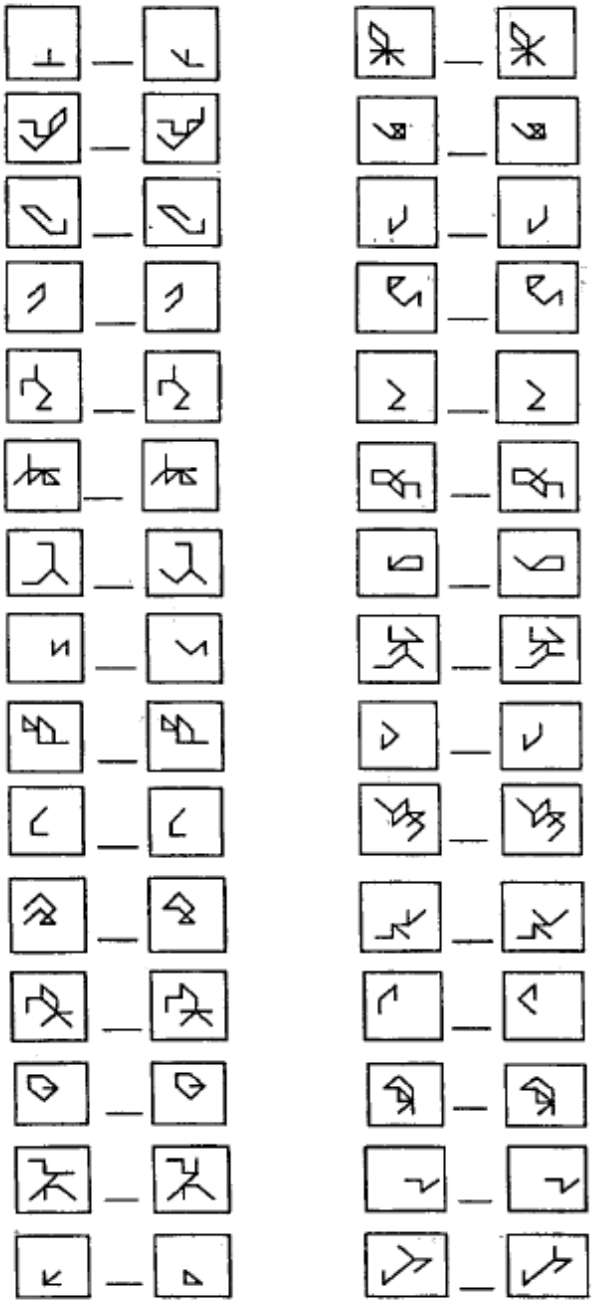
PLEASE DO NOT TURN THE PAGE UNTIL INSTRUCTED TO DO SO.

Part I



STOP

Part II



STOP

APPENDIX L

NEWSPAPER REPORTS FOR STEREOTYPE THREAT PRIMING

Palo Alto (AP). In a study published in the journal Nature, scientists working at Harvard Medical School have found an interesting explanation for the stereotypical decline in memory as people age. “We have known for a long time that older adults don’t remember certain things like names or dates as well as they did when they were young” says Harvard professor Dr. William Lutz, “and older adults also have particularly poor memory for words.” Dr. Lutz explains that older adults tend to use fewer words and simpler sentences in conversation than their younger counterparts, and have thus lost many useful language skills as they aged.

Interestingly, there is even evidence that the parts of the brain that deal with memory are different in both size and function in older adults when compared to younger adults. Using a technique called fMRI (Functional Magnetic Resonance Imaging), Dr. Lutz and his colleagues viewed a region of the brain called the prefrontal cortex, which is thought to be partially responsible for verbal memory. This research team found that the prefrontal cortex shrinks more with age than other parts of the brain. And more importantly, when asked to perform verbal memory tasks, this area in older adult brains was significantly less active. “The loss of prefrontal cortical tissue in older adults’ brains is consistent with the poor verbal memory performance observed in older adults.”

These findings shed new light on the long-standing debate between those scholars who have argued that the brain simply declines in old age, and those who have argued that at least some memory skills are spared. “I hope that the Harvard [Medical School] data can finally close the book on this debate” says Stanford researcher Penny Delong, “Now we know that it’s just a fact of nature. Our brains deteriorate as we age, and as a result, so does our memory.”

Research: Aging is Linked to Memory Problems

(Associated Press). The negative stereotype about old age in American society is associated with a variety of things, not the least of which is a failing memory. Psychologists are quick to point out that stereotypes are often based in misconceptions. Unfortunately, an increasing number of research findings are strongly suggesting that this one is based in fact. A recent study by psychologists Sandra Dawson and Andrea Long at Harvard Universitydemonstrates this point quite clearly.

"We were interested in finding out how aging affects the memory performance of people in our country," said Dr. Long. "Our belief was that age differences in memory skills were not as pervasive as we are led to believe. We especially thought that this would be true in today's society, where older adults are healthier than ever before."

Dawson and Long tested their ideas by comparing the memory abilities of young and older adults on a series of tests that examined many different aspects of memory. Much previous research had shown that age differences existed in almost every type of remembering situation. These researchers felt, however, that some of these findings were dated.

"We were extremely discouraged by our findings," said Dr. Dawson.

In several studies, the researchers examined memory for a variety of things, such as faces, spatial patterns, and words. The older adults in their sample, who ranged in age from 59 to 91, remembered less on average of every type of material than did younger adults, aged 15 to 30. Dawson and Long were not necessarily surprised that they observed older adults having memory problems. They were surprised, however, at the apparently pervasive nature of these problems.

"Unfortunately, our findings reinforce the inevitability of aging-related memory loss," noted Dr. Long. "The fact that we continue to observe age differences in the current population suggests that historical changes in health practices have not had much of an impact on memory functioning. This suggests that memory problems may be based in biologically based aging processes that are relatively immune to interventions."

Although findings such as these only reinforce our mostly negative conceptions of the effects of aging on mental abilities, these researchers note that this does not necessarily imply that older adults are unable to function in everyday life. Given the inevitability of decline, however, they recommend that instructions for older people—such as taking medicine or directions to a restaurant—be written down rather than be left to failing memories. These researchers also suggest that, in order to maintain adequate levels of functioning, older adults may have to increasingly depend upon the help of memory tools as well as friends and family.

APPENDIX M

NEWSPAPER REPORTS FOR STEREOTYPE THREAT RELIEF

Science Notes
Memory for Words Spared in Old Age

Palo Alto (AP). In a study published in the journal Nature, scientists working at Harvard Medical School have found an interesting explanation for the stereotypical decline in memory as people age. “We have known for a long time that older adults don’t remember certain things like names or dates as well as they did when they were young” says Harvard professor Dr. William Lutz, “but older adults tend to have very good memory for words.” Dr. Lutz explains that older adults have had much more experience with words than their younger counterparts, and have gained useful language skills that do not decline with age, particularly in the context of everyday interactions.

Interestingly, there is even evidence that certain parts of the brain that deal with memory are not differentially affected by aging, and that other parts of the brain that support memory actually work harder in older adults than in younger adults. Using a technique called fMRI (Functional Magnetic Resonance Imaging), Dr. Lutz and his colleagues viewed a region of the brain called the prefrontal cortex, which is thought to be partially responsible for verbal skills. Dr. Lutz found that, when asked to perform verbal memory tasks, this area was active on in both hemispheres of older adults’ brains, whereas significant activity was only observed in the left hemisphere for younger adults. “This increased brain activity in the prefrontal cortex of older adults’ brains is consistent with the generally strong verbal memory performance observed in these individuals.”

These findings shed new light on the long-standing debate between those scholars who have argued that the brain simply declines in old age, and those who have argued that at least some memory skills are spared. “I hope that the Harvard [Medical School] data can finally close the book on this debate” says Stanford researcher Penny Delong, “Now we know that it’s just a fact of nature. The brain does not uniformly deteriorate as we age. Some cognitive skills, such as those having to do with verbal memory, are maintain relatively well, and may even increase as we get older.”

Positive Outlook on Aging and Memory

(Associated Press). A recent study by researchers at Harvard University has shed new light on the factors associated with memory changes associated with aging. Psychologists Sandra Dawson and Andrea Long have proposed that culturally determined beliefs about aging may have an important effect on the prevalence of memory problems in later life.

"Widespread beliefs about the inevitability of memory decline is common in some cultures, but not in others," said Professor Long. "The interesting implication of this view is that members of cultures with positive beliefs regarding aging may actually have memory skills that equal or exceed those of younger members of that culture."

Dawson and Long tested the impact of culture by comparing the memory abilities of young and older adults in the People's Republic of China. The Chinese culture has a long tradition of honoring their old people. In the 2000 years preceding 1949, the Chinese government officially endorsed the practice of ancestor worship and respect for the old. Interestingly, the Communist Revolution in China has actually strengthened rather than weakened these traditional views of old age. The researchers reasoned that these positive views should be translated into superior memory performance by older adults in China. Their findings were very supportive of their hypothesis. Using a variety of memory tasks, including memory for letters and words, Dawson and Long found that older adults aged 59 to 91 performed at the same level as younger adults aged 15 to 30. Interestingly, they also found that, regardless of age, these Chinese citizens had very positive views about aging and old age.

"We were extremely encouraged by our findings," said Dawson. "They provide strong support for the idea that memory loss is not an inevitable aspect of old age." She notes that there is most certainly a causal link between how a culture views and treats its older citizens, and memory performance.

"If you live in a culture that views old age as being necessarily associated with memory decline, and everyone around you expects to see you having memory problems, then you will most likely behave in a way consistent with these expectations," Long noted.

Findings such as these continue to damage our mostly negative conceptions of the effects of aging on metal abilities. Rather than supporting the view that biological changes lead to inevitable losses, these findings suggest that the degree of memory loss is to a certain extent dependent upon the environment.

APPENDIX N

PILOT STUDY POST-TASK QUESTIONS

The following questionnaire consists of a number of items that participants must respond to using various Likert scales. This is the last set of questions that participants respond to.

5-point scale where 1=Not at all and 5=Very difficult

1. How difficult did you find the experimental task overall?

5-point scale where 1=Not at all and 5=Very difficult

2. How fatiguing did you find the experimental task overall?

5-point scale where 1=Not at all and 5=Very much

3. How focused were you on accurately recalling letters in the correct order during the experimental task?

5-point scale where 1=Not at all and 5=Very much

4. How focused were you on accurately verifying the math equations during the experimental task?

5-point scale where 1=Not at all and 5= Very much

5. Did you feel stress or tension during this study?

5-point scale where 1=Not at all and 5= Very much

6. Were you interested in this study?

5-point scale where 1=Very little effort and 5= A lot of effort

7. How much effort did you put into this study?

5-point scale where 1=Not at all and 5= Always

8. Did you get distracted easily during the study?

5-point scale where 1=Not at all difficult and 5= Very difficult

9. How difficult did you find the math portion of the experimental task?

5-point scale where 1=Very poorly and 5= Very well

10. How well do you think you did in this study?

5-point scale where 1=Not at all and 5= Very much

11. Regardless of what you personally believe, do you think that there is a stereotype that women are inferior to men in terms of mathematical ability?

Note: The above questions were used for Pilot Experiments 1 and 2. The post-task questionnaire for the proposed aging study was similar to this questionnaire. However, a few items will be changed to reflect the proposed study's focus on memory-related aging stereotyped and accurate OSPAN letter recall. Items 9 and 11 will be rephrased for the proposed study:

5-point scale where 1=Not at all difficult and 5= Very difficult

9. How difficult did you find the letter recall portion of the experimental task?

5-point scale where 1=Not at all and 5= Very much

11. Regardless of what you personally believe, do you think there is a stereotype that older adults are inferior to younger adults in terms of memory ability?

APPENDIX O

AGE-ATTITUDES IAT STIMULI

Old faces:

Young faces:

Pleasant words:

Joy, Love, Peace, Wonderful, Pleasure, Glorious, Laughter, Happy

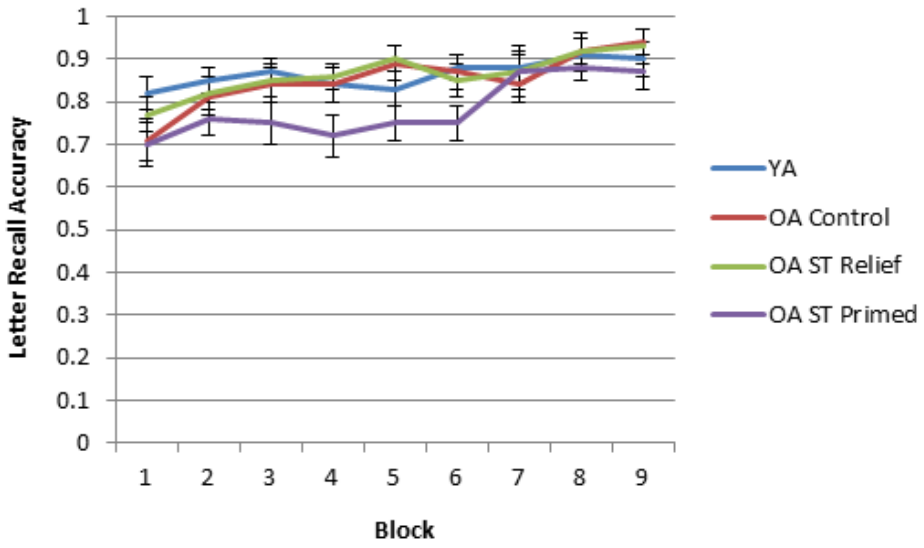
Unpleasant words:

Agony, Terrible, Horrible, Nasty, Evil, Awful, Failure, Hurt

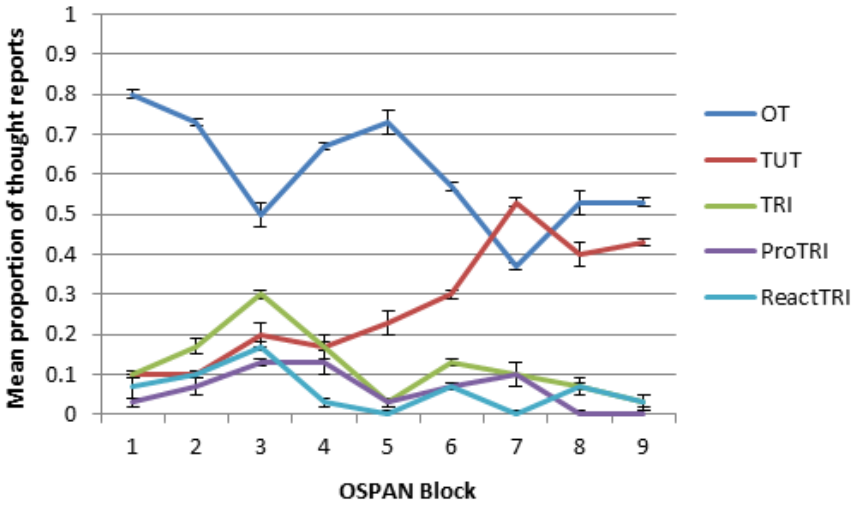
APPENDIX P

AGING STUDY RECALL ACCURACY AND THOUGHT PROBES OVER OSPAN BLOCK

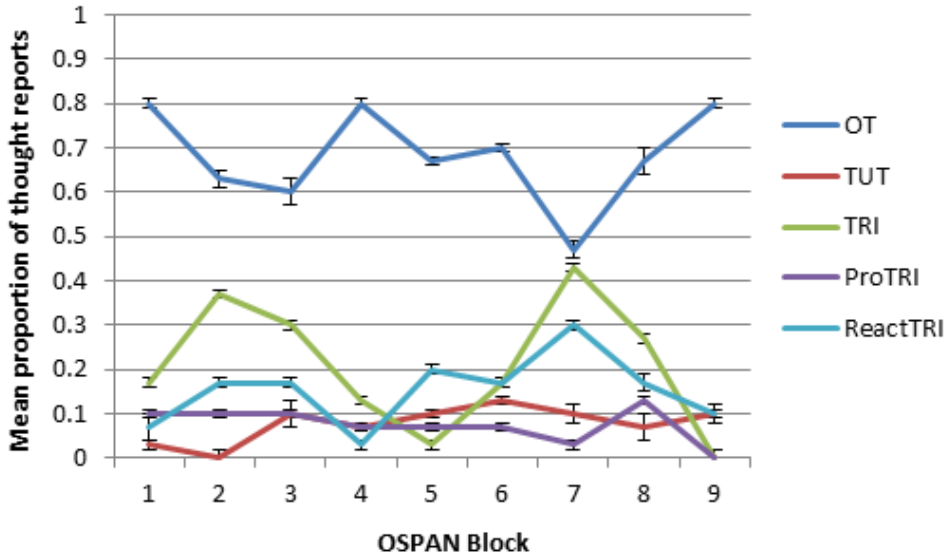
Letter recall accuracy over block for each condition



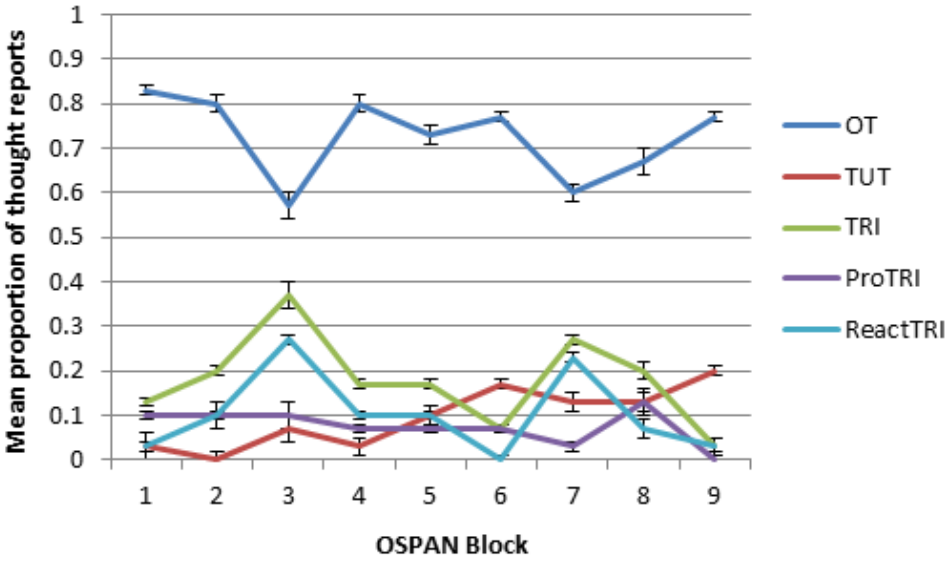
Mean proportion of mind-wandering thought reports during the OSPAN for younger adults



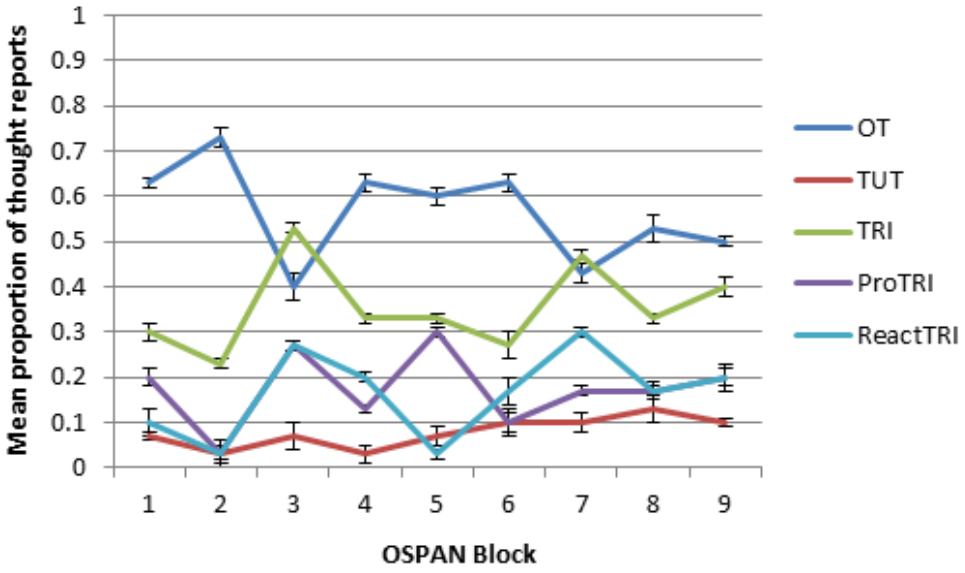
Mean proportion of mind-wandering thought reports during the OSPAN for OA controls



Mean proportion of mind-wandering thought reports during the OSPAN for OA ST relief



Mean proportion of mind-wandering thought reports during the OSPAN for OA ST primed



APPENDIX Q

AGING STUDY YA CORRELATIONS

	TUT	Overall TRI	Reactive TRI	Proactive TRI	On-task	Recall accuracy	Math accuracy
PTQ Task Diff	-.182	.241	.052	.341	.043	-.098	-.043
PTQ Recall Diff	-.202	.368*	.186	.431*	-.005	-.337	.108
PTQ Math Diff	-.305	.244	-.011	.380*	.154	-.146	-.062
PTQ Effort	-.492**	.325	.176	.371*	.284	-.111	.393*
PTQ Fatigue	-.138	.069	-.098	.194	.091	-.058	.281
PTQ Stress	-.095	.348	.262	.329	-.093	-.330	-.080
PTQ Interest	.016	-.497**	-.519**	-.353	.243	.541**	-.068
PTQ Distracted	.627**	-.291	-.038	-.433*	-.426*	-.105	-.051
PTQ Recall Focus	-.302	.196	.048	.273	-.176	-.024	.594**
PTQ Math Focus	-.499**	.217	-.010	.355	.347	.045	.318
DSSQ TUT	.407*	-.122	-.079	-.127	-.312	-.123	.213
DSSQ TRI	-.296	.294	.130	.359	.120	-.242	.106
DSSQ Motivation	.368*	-.225	-.087	-.286	-.222	.104	-.273
DSSQ SFA	-.034	.009	-.032	.041	.027	-.127	-.008
MIA Anxiety	-.096	.104	.120	.064	.034	-.092	.043
MIA Achieve	-.327	.391*	.243	.419*	.098	-.279	.444*
MIA Locus	-.243	.213	.201	.170	.113	-.136	.100
PANAS Pos	.045	.339	.281	.304	.043	-.321	.167
Cage	-.108	.074	.073	.056	.061	-.400*	.250

Note. Explanations of all PTQ variables are given in Table 4; Explanations of all DSSQ variables are given in Table 5; Explanations of MIA and PANAS variables is given in Table 3; Cage = Chronological age in year; * = $p < .05$ and ** = $p < .01$.

APPENDIX R

AGING STUDY OVERALL OA CORRELATIONS

	TUT	Overall TRI	Reactive TRI	Proactive TRI	On-task	Recall accuracy	Math accuracy
PTQ Task Diff	-.081	.203	.170	.107	-.113	-.308**	-.199
PTQ Recall Diff	-.042	.284**	.326**	.120	-.222*	-.271*	.076
PTQ Math Diff	.005	.161	-.042	.245*	-.135	-.209	-.533**
PTQ Effort	-.282**	.055	.056	.012	.131	.009	.191
PTQ Fatigue	-.007	.105	.035	.139	-.101	-.302**	-.118
PTQ Stress	-.008	.210	.143	.182	-.182	-.220	-.004
PTQ Interest	.258*	-.038	-.071	.024	-.127	-.171	-.029
PTQ Distracted	.311**	.100	-.088	.191	-.263*	-.152	-.176
PTQ Recall Focus	-.111	-.177	-.068	-.162	.216*	.521**	-.339**
PTQ Math Focus	-.005	-.038	.049	-.068	.019	.131	.167
DSSQ TUT	.286**	.258*	.074	.293**	-.393**	-.076	-.257*
DSSQ TRI	.015	.431**	.167	.433**	-.391**	-.117	-.121
DSSQ Motivation	.164	-.158	-.106	-.146	.044	.000	-.210
DSSQ SFA	-.082	.435**	.220*	.391*	-.315**	-.134	-.226*
MIA Achieve	-.175	.222*	.153	.201	-.107	-.094	-.076
MIA Anxiety	-.029	.251*	.057	.226*	-.175	-.170	-.036
MIA Locus	-.233*	.038	.018	.006	.135	-.211	-.078
PANAS Pos	-.135	-.061	.087	-.134	.123	.115	.111
Cage	.114	-.115	-.051	-.115	.035	.238*	.005

Note. Explanations of all PTQ variables are given in Table 4; Explanations of all DSSQ variables are given in Table 5; Explanations of MIA and PANAS variables is given in Table 3; Cage = Chronological age in year; * = $p < .05$ and ** = $p < .01$.

APPENDIX S

AGING STUDY OA CONTROL CORRELATIONS

	TUT	Overall TRI	Reactive TRI	Proactive TRI	On-task	Recall accuracy	Math accuracy
PTQ Task Diff	-.037	.344	.177	.411*	-.257	-.151	-.169
PTQ Recall Diff	-.070	.263	.151	.328	-.167	.055	.087
PTQ Math Diff	.074	.226	.199	.111	-.235	-.335	-.485**
PTQ Effort	-.503**	.144	.042	.210	.224	-.069	.007
PTQ Fatigue	.068	.396*	.264	.313	-.370*	-.155	-.119
PTQ Stress	-.026	.481**	.377*	.326	-.376*	-.097	.076
PTQ Interest	.414*	-.047	.050	-.173	-.242	-.033	-.070
PTQ Distracted	.503**	.032	.048	.018	-.368*	.069	-.088
PTQ Recall Focus	-.022	-.566**	-.624**	.027	.478**	.733**	.115
PTQ Math Focus	-.065	-.299	-.364	.047	.289	.565**	.428*
DSSQ TUT	.425*	.087	.214	-.115	-.360	.080	.205
DSSQ TRI	.164	.391*	.292	.201	-.431*	-.172	.228
DSSQ Motivation	.211	-.219	-.179	-.097	.036	.055	-.440*
DSSQ SFA	-.006	.161	.215	.004	-.128	.129	.262
MIA Anxiety	.160	.257	.200	.075	-.319	-.142	.228
MIA Achieve	-.216	.279	.160	.206	-.081	-.338	.090
MIA Locus	-.191	-.194	-.164	-.081	.288	.000	-.288
PANAS Pos	-.365	-.091	-.195	.175	-.255	.240	.169
Cage	.019	-.197	-.252	.108	.160	.217	.021

Note. Explanations of all PTQ variables are given in Table 4; Explanations of all DSSQ variables are given in Table 5; Explanations of MIA and PANAS variables is given in Table 3; Cage = Chronological age in year; * = $p < .05$ and ** = $p < .01$.

APPENDIX T

AGING STUDY OA ST RELEF CORRELATIONS

	TUT	Overall TRI	Reactive TRI	Proactive TRI	On-task	Recall accuracy	Math accuracy
PTQ Task Diff	-.072	-.303	-.281	-.231	.292	-.195	.007
PTQ Recall Diff	.339	-.015	.080	-.048	-.228	-.348	.302
PTQ Math Diff	.120	.076	.135	-.100	-.105	-.290	-.503**
PTQ Effort	.104	.311	.315	.038	-.255	-.061	-.181
PTQ Fatigue	-.225	-.449*	-.352	-.091	.387*	-.259	-.183
PTQ Stress	.016	-.140	-.033	-.133	.073	-.024	.148
PTQ Interest	.367	-.111	-.107	.007	-.175	-.302	.200
PTQ Distracted	.316	.237	.280	-.092	-.315	-.282	-.191
PTQ Recall Focus	-.404*	.251	.189	.247	.049	.058	.110
PTQ Math Focus	-.147	-.075	-.205	.281	.084	.132	.363
DSSQ TUT	.476**	.228	.230	.023	-.438*	-.418*	-.558**
DSSQ TRI	-.096	.100	.348	-.175	-.033	-.007	-.148
DSSQ Motivation	-.025	-.032	-.019	-.170	.093	-.217	-.007
DSSQ SFA	.052	.319	.384*	-.041	-.223	-.038	-.400*
MIA Anxiety	-.215	.350	.415*	-.198	-.013	.220	.144
MIA Achieve	-.087	.188	.226	.256	-.162	-.138	-.282
MIA Locus	-.236	-.165	-.172	-.189	.315	-.121	-.189
PANAS Pos	.016	.234	.163	.267	-.212	-.093	-.234
Cage	-.132	.012	-.016	.000	.088	.197	-.204

Note. Explanations of all PTQ variables are given in Table 4; Explanations of all DSSQ variables are given in Table 5; Explanations of MIA and PANAS variables is given in Table 3; Cage = Chronological age in year; * = $p < .05$ and ** = $p < .01$.

APPENDIX U

AGING STUDY OA ST PRIMED CORRELATIONS

	TUT	Overall TRI	Reactive TRI	Proactive TRI	On-task	Recall accuracy	Math accuracy
PTQ Task Diff	-.122	.366	.272	.260	-.272	-477**	-.376*
PTQ Recall Diff	-.221	.344	.046	.444*	-.194	-.419*	.004
PTQ Math Diff	-.134	.209	.387*	-.072	-.113	-.155	-583**
PTQ Effort	-.323	-.066	-.130	.031	.254	.054	.509**
PTQ Fatigue	.097	.069	.229	-.121	-.113	-.378*	-.038
PTQ Stress	-.020	.271	.152	.240	-.236	-.487**	-.146
PTQ Interest	.030	-.051	.068	-.137	.043	-.156	-.160
PTQ Distracted	.144	.155	364	-.127	-.225	-.358	-.213
PTQ Recall Focus	.025	-.170	-.039	-.205	.154	.650**	.361
PTQ Math Focus	.169	.060	.167	-.075	-.164	-.048	-.076
DSSQ TUT	-.013	.410*	.418*	.183	-.390*	.003	-.324
DSSQ TRI	-.028	.562**	.604**	.221	-.523**	-.004	-.215
DSSQ Motivation	.309	-.142	-.156	-.052	-.066	-.023	-.306
DSSQ SFA	-.218	.624**	.513**	.396*	-.468*	-.247	-.411*
MIA Anxiety	-.103	.109	.125	.035	-.030	-.213	-.209
MIA Achieve	-.214	.245	.264	.096	-.097	.093	-.006
MIA Locus	-.267	.259	.226	.152	-.071	-.407*	.091
PANAS Pos	-.050	-.181	-.284	.014	.207	.062	.430*
Cage	.316	-.142	-.049	-.155	-.058	.303	.176

Note. Explanations of all PTQ variables are given in Table 4; Explanations of all DSSQ variables are given in Table 5; Explanations of MIA and PANAS variables is given in Table 3; Cage = Chronological age in year; * = $p < .05$ and ** = $p < .01$.