

ABSTRACT

POPHAM, LAUREN ELAINE. Age Differences in the Underlying Mechanisms of Stereotype Threat Effects. (Under the direction of Thomas M. Hess, Ph.D.)

The purpose of this study was to investigate whether there are age differences in the underlying process through which stereotype threat impairs performance in a relevant domain. Research with younger adults has suggested that stereotype activation leads to cognitive processes (e.g., monitoring and worrying about performance) that deplete cognitive resources, thereby reducing working memory efficiency and resulting in performance decrements. Other research examining threat-based effects in younger adults has provided evidence for a regulatory focus explanation, such that threat induces a prevention focus motivating the use of avoidance strategies, which tend to be maladaptive for performance on most cognitive tasks. Given that stereotype threat research with older adults is more suggestive of a regulatory focus explanation than a working memory explanation, it is hypothesized that the processes through which stereotype threat is operative will be different in older and younger adults. More specifically, it is hypothesized that stereotype threat influences older adults' performance by inducing a prevention focus and the avoidance strategies that go along with it, whereas in younger adults threat influences performance primarily by reducing working memory capacity. In the present study, older ($N = 60$) and younger adults ($N = 60$) were exposed to positive or negative age-related stereotypes. The negative stereotype for older adults emphasized their slow ability to process information, whereas the negative stereotype for younger adults emphasized their lack of experience and knowledge. Regulatory focus and working memory were then assessed using the word selection task and the operation span, respectively. The results of the study revealed that

older adults in the negative condition, compared with those in the positive condition, made significantly fewer errors on the word selection task even when accounting for speed, reflecting a situational prevention focus induced by stereotype threat. For the younger adults, though, no such effects were obtained. On the operation span, as predicted, older adults did not show reduced working memory efficiency under threat. Inconsistent with expectations, younger adults did not show decreases in working memory efficiency under threat. However, when affect regulation was taken into account, younger adults who reported low ability to down-regulate negative affect showed reduced working memory under threat compared with their counterparts in the positive condition. For older adults, high versus low ability to down-regulate negative affect had no effect on working memory in either condition.

Age Differences in the Underlying Mechanisms of Stereotype Threat Effects

by
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DEDICATION

To my husband, Justin, thank you for your constant love, support, and encouragement. I also dedicate this to my parents, Andy and Judi Gregory, for always reminding me that I can achieve anything I set my mind to as long as I work hard.

BIOGRAPHY

Lauren E. Popham is from Oklahoma City. She was homeschooled through the sixth grade, after which she attended public school. After graduating from Deer Creek High School in May 2005, Lauren attended Oklahoma State University in Stillwater, Oklahoma, where she graduated summa cum laude with a B.A. in Psychology in December 2008. The following Fall semester, she entered the doctoral program in Lifespan Developmental Psychology at North Carolina State University under the direction of Dr. Thomas Hess. Lauren's master's research focused on age differences in the underlying mechanisms of stereotype threat effects.

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TABLE OF CONTENTS

	Page
LIST OF TABLES _____	vi
LIST OF FIGURES _____	vii
INTRODUCTION _____	1
METHOD _____	14
Participants _____	14
Materials _____	15
Procedure _____	18
RESULTS _____	22
Participant Characteristics _____	22
Primary Analyses _____	23
Individual Differences in Emotion Regulation _____	32
DISCUSSION _____	34
Summary of Findings _____	35
Limitations _____	38
Conclusions and Future Directions _____	39
REFERENCES _____	42
APPENDICES _____	48

LIST OF TABLES

	Page
Table 1. Descriptive Statistics for Participant Characteristics_____	23
Table 2. Vigilance and Eagerness Means (and SDs) as a Function of Age and Condition_____	27
Table 3. Speed and Inaccuracy Means (and SDs) as a Function of Age and Condition_____	28
Table 4. Means (and SDs) on the Operation Span as a Function of Age and Condition_____	32

LIST OF FIGURES

	Page
Figure 1. Means for Regulatory Focus Subscales as a Function of Age_____	25
Figure 2. Older Adults' Response Times to Global and Local Trials as a Function of Condition_____	30
Figure 3. Younger Adults' Response Times to Global and Local Trials as a Function of Condition_____	31
Figure 4. Example of a Global Trial_____	50
Figure 5. Example of a Local Trial_____	50

Aging is associated with declines in many cognitive abilities, particularly in the domain of memory (Old & Naveh-Benjamin, 2008). Whereas one approach to studying aging and memory is to attribute memory decrements to age-related changes in brain structures and the information processing system, a contextual perspective provides a more complete understanding of proximal and distal influences on memory performance (Hess, 2005). Within this perspective, normative declines in neural structures represent just one of many potential factors accounting for age differences in memory performance. Other socially based mechanisms are rooted in negative cultural stereotypes about aging. One such mechanism that may have a direct impact on older adults' memory performance is stereotype threat (Hess, 2006).

Stereotype threat occurs when members of a stereotyped group believe their performance in a relevant domain is being assessed, resulting in performance below capabilities. When the testing situation is innocuous and stereotypes are not particularly salient, however, stereotyped individuals tend to perform as well as non-stereotyped individuals (Steele, Spencer, & Aronson, 2002). Research on stereotype threat was originally driven by the academic underperformance of African-Americans (Steele, 1997). Steele and Aronson (1995) found that when a standardized test was said to be diagnostic of verbal ability, African-American students underperformed. But, more importantly, when the test was said to be non-diagnostic of verbal ability, thus making the stereotype irrelevant in the testing situation, they performed just as well as European-American students. The detrimental impact of stereotype threat on performance has been replicated with a variety of stereotypes and with different groups of people (Steele et al., 2002).

In the field of aging, several studies have examined the possibility that stereotype threat plays a role in determining age differences in memory performance. Poor memory ability in later life is a strong component of the negative aging stereotype in Western culture, and thus stereotype threat may occur when older adults engage in memory-related tasks. Hess and colleagues (Hess, Auman, Colcombe, & Rahhal, 2003; Hess, Emery, & Queen, 2009; Hess & Hinson, 2006; Hess, Hinson, & Hodges, 2009) have demonstrated that explicit stereotype activation has a negative impact on older adults' memory performance, especially for those individuals who value their abilities. Although this effect has been shown in several studies, the exact mechanisms underlying the effect are not clearly understood. It is also not clear whether stereotype threat operates in the same manner across age groups. Thus, the goal of the present research was to address these two issues.

Mechanisms of Stereotype Threat Effects

To date, the mechanisms underlying the operation of stereotype threat are unclear. In fact, there is quite a bit of inconsistency in the literature regarding the mediators of threat effects. Although originally hypothesized as a causal mechanism, most studies find that threat does not increase self-reported state anxiety (for exceptions, see Marx & Staple, 2006; Spencer, Steele, & Quinn, 1999). More recently, reduced working memory capacity under threat is an explanation that has received a considerable amount of support in research in young adults (Johns, Inzlicht, & Schmader, 2008; Schmader & Johns, 2003), whereas other research has found support for regulatory focus as a mediator of threat effects in young adults (Grimm, Markman, Maddox, & Baldwin, 2009; Seibt & Förster, 2004). For the purposes of the present study, these two alternative viewpoints are discussed further.

Working memory. Schmader and Johns (2003) hypothesized that younger adults under threat may devote extra resources attending to cues in the environment (i.e., self-monitoring) that may signal that one is confirming the stereotype. Using a sample of undergraduate student participants, they found that in the stereotype condition, in which the operation span was described as a math test, women (i.e., the stereotyped group) recalled significantly fewer words than men (i.e., the control group), indicating reduced working memory efficiency under threat. In the control condition, however, women and men performed equally well. These results should be interpreted with caution, however, because the working memory measure was also the primary outcome measure, thereby biasing the results. Lower scores on the operation span may have been due to other threat-related factors.

Note that Schmader and colleagues (Johns et al., 2008; Schmader, 2010; Schmader, Johns, & Forbes, 2008) have also discussed the impact of threat on executive resources rather than working memory, which begs the question: does threat reduce working memory efficiency or deplete executive resources in young adults? The distinction between the two terms is that executive function is an umbrella term for all processes that are involved in controlling and managing cognition, including working memory, whereas working memory involves the more task-specific cognitive processes of encoding, maintaining, and retrieving information from long-term memory in service of a task (Ilkowska & Engle, 2010). Schmader and her colleagues examine working memory in many of their studies presumably because the way they conceptualize working memory is in terms of a domain-general executive resource. Efficient performance on cognitive tasks require simultaneous information processing while inhibiting distracting information, and young adults under

threat seem to divide their attention between the task and some other psychological processes (Schmader, 2010), resulting in poor performance. When thought of in this way, reduced working memory capacity is simply the outcome of other processing resources being diverted to other cognitive functions under threat. For my study, I focused on working memory specifically, not executive resources in general; therefore, I will consistently use the term working memory when discussing the present study.

Schmader et al. (2008) have proposed a process model of stereotype threat effects to explain the reason behind executive resource depletion under threat. They have suggested that stereotype threat leads to impaired performance through three individual yet interconnected pathways: physiological stress response, monitoring processes, and emotion regulation. With regard to the emotion regulation pathway, there is some evidence that the worry component of state anxiety, as opposed to the emotional component (e.g., physiological reactions), mediates the relationship between threat and performance. For instance, using a thought-listing technique, Cadinu, Maass, Rosabianca, and Kiesner (2005) found that college-aged young adult under threat engaged in negative domain-specific thinking. That is, they were worrying about their performance on the task, and this had an increasingly negative effect on performance. Brodish and Devine (2009) also found that worry mediates threat effects in a sample of undergraduates.

In addition, Johns et al. (2008) have examined the connection between emotion regulation and cognitive resources within the context of stereotype threat. They hypothesized that threat may instigate an active effort to regulate negative emotions induced by threat, thus depleting executive resources and leaving few resources remaining for performing a

cognitive task. Using an implicit measure, they found evidence to suggest that young adults under threat were attempting to avoid appearing anxious, and this was substantiated by self-reported anxiety not being heightened under threat. In another study, they examined the effect of emotion regulation strategies on executive functioning in a stereotype threat situation. Female undergraduates instructed to reappraise negative emotions experienced less interference (i.e., fewer errors) on the Stroop task, a measure of executive resource depletion, and performed better on the math test than those instructed to suppress their negative emotions and those in the threat-control condition. Based on the results of this study and subsequent ones, Johns et al. concluded that instructions to reappraise negative emotions as benign in the testing situation reduced threat effects through reducing efforts to engage in expressive suppression. However, it is not clear whether the young adults under threat were motivated to suppress appearing anxious or to suppress feeling anxious. If the former is the case, it would provide an explanation for why most studies do not find heightened self-reported anxiety under threat.

Regulatory focus. Before discussing the findings of studies examining regulatory focus as a mediator of threat effects, a brief overview of the theory is warranted. Developed by Higgins (1997), regulatory focus is a motivational principle that distinguishes between a prevention focus and a promotion focus. Specific motivational orientations reflect desired end states: Those in a prevention focus are sensitive to negative outcomes involving loss, whereas those in a promotion focus are sensitive to positive outcomes involving gains. An important aspect of this theory is that strategic inclinations differ for prevention versus promotion orientations. Specifically, those in a promotion focus are eager to approach

matches between aspirations and accomplishments, whereas those in a prevention focus are vigilant to avoid mismatches between goals and end state. The way in which these strategic differences map onto actual task performance can be viewed in terms of speed and accuracy concerns, such that a chronic or situational promotion focus leads to faster performance, whereas a prevention focus leads to more accurate performance (Förster, Higgins, & Bianco, 2003). That is, a promotion focus inherently motivates one to attain as many hits as possible and a prevention focus motivates one to be careful not to make mistakes. Although generally thought to be inversely related, speed and accuracy are considered independent effects in the present context such that accuracy effects would occur even when controlling for speed. Research has also shown a relationship between regulatory foci and information processing styles (Förster & Higgins, 2005). In a prevention focus, the goal is to avoid a bad outcome and thus the emphasis is on self-protection. Being vigilant to detect item-specific, local details in one's environment facilitates the goal of identifying and avoiding anything that can be seen as a threat. Consequently, prevention-focused individuals are more likely to process information in a concrete and local manner. Because those in a promotion focus do not perceive any threat, there is no need to screen one's surroundings. Instead, a global, relational processing style facilitates approach-related goals because it helps with abstract and creative thinking.

In a series of studies, Seibt and Förster (2004) demonstrated that the activation of negative and positive stereotypes induce prevention and promotion foci, respectively. When one is confronted with a negative self-relevant stereotype, it sets up a negative reference point for which the best outcome is one that involves nonloss as opposed to gain. Positive

stereotypes, on the other hand, set up a positive reference point for which the desired end state reflects gain and achievement as opposed to loss. In Study 2, Seibt and Förster activated the stereotype that women have better verbal ability than men, and then had undergraduate students complete a word selection task, which is sensitive to differences in speed and accuracy. The results revealed that women in the positive stereotype condition were faster on the task than men in the stereotype condition as well as women in the control condition; men in the negative stereotype condition made fewer mistakes than women in the stereotype condition as well as men in the control condition. In subsequent studies, these results were replicated in that positive stereotypes induced a promotion focus, leading to faster performance but reduced accuracy, and negative stereotypes induced a prevention focus, leading to greater accuracy but reduced speed. In sum, these findings demonstrate that stereotype threat induces a motivational orientation (i.e., prevention focus) in young adults with strategic inclinations aimed at avoiding loss, resulting in performance decrements on most tasks.

Impaired performance under stereotype threat has also been shown to be due to a regulatory mismatch in young adults. Grimm et al. (2009) found that when the reward structure of the task was framed in terms of gains (e.g., gaining more points for correct responses than for incorrect responses), undergraduate students in the positive stereotype condition performed better. When the task was framed in terms of losses as opposed to gains (e.g., losing fewer points for correct responses than incorrect responses), those in the negative stereotype condition performed significantly better because of a match between situational prevention focus and the outcome framed in terms of loss/non-loss. An important

implication is that most laboratory-based and real-world cognitive tasks have a gains structure, and because stereotype threat results in a situational prevention focus, invoking the use of strategies oriented toward non-loss as opposed to gain, performance will suffer on most cognitive tasks.

Age-Related Differences in the Underlying Mechanisms of Threat Effects

While there has been some evidence to suggest that younger adults under threat are experiencing working memory deficits, which in turn impairs performance, there is no conclusive evidence that reduced working memory efficiency is the causal mechanism of threat effects in older adults. In fact, Hess and colleagues (2009) recently found no performance differences between threatened and non-threatened older adults on the computation span task, thus failing to find support for a working memory explanation of threat effects in later life. In an earlier study by Hess et al. (2003), older and younger adults assigned to either positive or negative stereotype conditions studied a list of categorized words, after which their memory was tested using a free-recall task. Results revealed that older adults in the negative stereotype condition recalled significantly fewer words than older adults in the positive and control conditions. In addition, older and younger adults' memory performance was equivalent in the positive condition, whereas in the negative condition older adults performed worse than younger adults. When clustering at retrieval (i.e., recalling semantically related words together)—a possible indicator of strategy use—was examined, results showed that older adults' recall performance was positively correlated with degree of clustering. In fact, strategy use accounted for 58% of the variance in stereotype threat effects on recall performance. This finding is consistent with a regulatory focus explanation, in that a

prevention focus is associated with disruptions in relational processing (Higgins, 1997), making it difficult to see the connections between words from the same semantic categories.

In another study, older adults studied a list of words and then completed a recognition test with either an unlimited amount of time or a deadline (2500 ms) to make a recognition response (Hess et al., 2009). Results revealed that stereotype threat only had a negative effect on memory performance when responses had to be made within a limited window of time. When unlimited time was given, however, the threat group performed at equivalent levels with the nonthreat group. This may be seen as consistent with a regulatory focus explanation, because when speed was not a factor, as was the case in the unlimited time condition, accuracy was high and thus performance was unimpaired. However, these results do not necessarily conflict with a working memory explanation, as the constraints on performance may have only been high enough in the deadline condition to produce threat effects (Hess et al., 2009). Additional evidence pointing toward a regulatory focus explanation came from changes in subjective experiences of memory; older adults in the deadline condition who were under threat reported a higher proportion of Remember as opposed to Know responses. This reflects increased cautiousness, which is consistent with the vigilance associated with a prevention focus.

A study by Gaillard, Desmette, and Keller (2011) examined the impact of positive and negative stereotypes on older adults' performance on a driving knowledge test in prevention focus and promotion focus conditions. Regulatory focus was manipulated by using a scoring strategy where prevention focus was induced by emphasizing to participants that they will lose points for incorrect answers, whereas promotion focus was induced by

emphasizing that points can be gained for correct answers. For older adults in the prevention focus condition, they found that negative stereotypes hurt performance but positive stereotypes helped. For older adults in the promotion focus condition, negative and positive stereotypes did not differentially affect performance. Gaillard et al. viewed these results as evidence that regulatory focus moderates the relationship between stereotypes and performance. In contrast to their study, my study proposes regulatory focus as a mediator, not a moderator, of threat effects for older adults, but not for younger adults.

Given that some of these initial results could be construed as supportive of a regulatory focus explanation of threat effects in older adults, the question can be raised as to whether stereotype threat operates differently in younger and older adults. The underlying reason behind this hypothesized age difference is based in age differences in emotion regulation abilities. Given that “anxiety is an aversive emotional and motivational state occurring in threatening circumstances” (Eysenck, Derakshan, Santos, & Calvo, 2007, p. 336), the implication is that, regardless of whether participants under threat report feeling anxious or not, there is an affective component inherently part of stereotype threat. More specifically, stereotype threat induces worry (i.e., the cognitive aspect of anxiety), and it is those intrusive thoughts associated with worry that have been shown to be disruptive to performance under conditions of threat (Brodish & Devine, 2009; Cadinu et al., 2005).

There is some evidence to suggest that emotion regulation abilities are enhanced with age (Carstensen & Mikels, 2005). In fact, Scheibe and Blanchard-Fields (2009) found age differences in the cognitive costs of emotion regulation. Younger adults instructed to down-regulate negative affect experienced working memory decrements, whereas older adults did

not. Additional evidence of the reduced costs of emotion regulation in later life was found in a recent study by Emery and Hess (2011). In that study, older adults experienced fewer cognitive costs associated with expressive suppression than younger adults, so even when people are engaging in suppression, which is a largely inefficient emotion regulation strategy (Richards & Gross, 2000), older adults are less likely to experience reduced executive resources from their emotion regulation efforts than are younger adults.

Given that regulation of emotional responses appears to be less taxing of older adults' processing resources compared with that of younger adults, I propose that the processes through which stereotype threat is operative will be different depending on the age of the stereotyped individual. Specifically, I hypothesize that older adults' performance will be influenced by adjustments in situational regulatory focus, whereas younger adults' performance will be influenced primarily by a reduction in processing resources indexed by reduced working memory capacity. Thus, I anticipate a qualitative difference between older adults' performance under positive and negative stereotype conditions, and a quantitative difference between younger adults' performance under positive and negative stereotype conditions. That is, older adults exposed to negative stereotypes are hypothesized to show increased accuracy and reduced speed, whereas their counterparts in the positive condition will show the opposite, with increased speed and reduced accuracy. Younger adults exposed to negative stereotypes, however, are expected to show decrements in both speed and accuracy compared with their counterparts in the positive condition.

The Present Study

The purpose of this study was to test for age differences in the mechanisms underlying stereotype-based effects. Older and younger adult participants were assigned to positive and negative stereotype conditions. Stereotype-induced prevention and promotion orientations were assessed using two tasks: one measured differential speed and accuracy concerns, and the other measured differential attention to global versus local details. A working memory measure was also used to test for threat-induced decreases in working memory efficiency.

The word selection task was adapted from Seibt and Förster (2004) to measure regulatory focus. It was predicted that a promotion focus induced by a positive stereotype would lead to faster but less accurate performance, and this was the anticipated pattern of performance of older adults exposed to positive aging stereotypes. It was further predicted that a prevention focus induced by a negative stereotype would lead to slower but more accurate performance, which was the anticipated pattern of performance of older adults exposed to negative aging stereotypes. Although there is some evidence that threat effects are mediated by a prevention focus in younger adults (Grimm et al., 2009; Seibt & Förster, 2004), the bulk of the literature points toward a working memory explanation in younger adults. According to research with high- and low-span participants (e.g., Kane, Bleckley, Conway, & Engle, 2001), individuals with high working memory capacity tend to be faster and more accurate. The activation of a negative self-stereotype, on the other hand, would have a detrimental effect on working memory capacity and lead to slower speed and worse accuracy (Kane et al., 2001). Therefore, in the case of younger adults, it was anticipated that

those in the negative stereotype condition would show decreased speed and accuracy, reflecting reduced working memory efficiency. For young adults in the positive stereotype condition, increased speed and accuracy was expected. In other words, qualitatively different patterns of performance across stereotype conditions were expected for the young and older adults.

Situational regulatory focus was further assessed using the global-local task (Derryberry & Reed, 1998), as regulatory focus has been linked with global and local processing styles (Förster & Higgins, 2005). Due to eagerness and approach strategies induced by a promotion focus, positive stereotypes were expected to facilitate global processing, and this was the predicted pattern of results in older adults in the positive condition. Negative stereotype activation, on the other hand, was expected to facilitate local processing in older adults in the negative condition, due to vigilance and avoidance strategies induced by a prevention focus. In contrast, young adults in the positive condition were expected to have quicker responses to both local and global trials due to high working memory capacity compared with their stereotype threatened peers.

In order to test for working memory decrements under threat, the operation span (Turner & Engle, 1989) was used. As found in Schmader and Johns (2003), younger adults in the positive stereotype condition were expected to have sufficient cognitive resources and thus perform at high levels, whereas younger adults in the negative stereotype condition were expected to show low levels on the working memory task as a result of processing resources being diverted to other threat-related cognitive functions. It was hypothesized that older adults in the positive and negative stereotype conditions would perform at equivalent levels

on the working memory task. The impact that regulatory focus could potentially have on the operation span was not as clear. The avoidance strategies induced by a prevention focus are maladaptive for this task; a prevention focus would likely lead to fewer false alarms and hits, whereas a promotion focus would likely lead to more false alarms and hits (Higgins, 1997). This task is scored in such a way that a low hit rate is penalized but not a high false alarm rate, so it cannot be ruled out that a prevention focus may be detrimental for performance. However, participants set the pace of the task themselves, so those in a prevention focus may take longer on the task and, therefore, might not be significantly disadvantaged compared to those with a promotion focus. Despite these difficulties in interpreting the explanation behind outcomes on the operation span, it was still worthwhile to administer the test to see if positive and negative stereotypes differentially affect working memory in younger and older adults.

Method

Participants

This study involved an extreme age-groups design comparing older and younger adults. Young adults between the ages of 18 and 24 ($N = 60$) were recruited from Introductory Psychology classes at North Carolina State University, and they received credits toward fulfilling a course option. Because two young adults failed to complete a measure that was included as a covariate in all of the analyses, they were excluded, leaving a final sample of 58 young adults. Older adult participants between 65 and 80 years of age ($N = 60$) were members of the local community in Raleigh, NC. Recruitment of older adults involved calling individuals from an existing database of people who have participated in the past or

who, upon seeing a newspaper ad, contacted the Adult Development Laboratory to be included in the database. In exchange for participation, older adults were given \$15 per hour of participation.

Materials

Word selection task. The primary dependent measure was the word selection task, adapted from Seibt and Förster (2004), who used it to measure regulatory focus induced by stereotype threat. The measure contained 15 items, and each item contained 5 words. Four of the words belonged to the same semantic category (e.g., *banana, apple, cherry, strawberry*) whereas the fifth did not (e.g., *carrot*). The participant's task was to select the word that does not belong to the same category as the majority of words. In order to make the task difficult enough to produce errors within a time limit, all five words shared membership in a higher-order category (e.g., *produce*). In doing this, the goal was to identify items that are easy enough to produce high accuracy under no time limit but also produce many errors when under time pressure. I consulted an updated version of Battig and Montague's (1969) category norms (i.e., Van Overschelde, Rawson, & Dunlosky, 2004) to select appropriate words, with the objective of selecting words that were medium to low category exemplars. (See Appendix A for a copy of the measure.) Note that the order of the items was counterbalanced across age group and condition, and analyses confirmed that item order had no impact on performance for either age group or condition. Younger participants were given 40 s to complete as much of the task as possible, whereas older adults were given 60 s. The longer time limit for older adults was decided upon after pilot testing. This way, younger and older adults were expected to show similar variability in speed.

Global-local task. The global-local task, a modified version of the Navon (1977) task (Derryberry & Reed, 1998), is a measure of global and local processing. In this task, participants were presented with a series of large global letters on a computer screen, and these global letters were made up of smaller local letters. One of eight composite letters was randomly presented at a time. Four of the trials included global targets: (a) an L made of smaller Fs, (b) an L made of smaller Ts, (c) an H made of smaller Fs, and (d) an H made of smaller Ts. The other four trials included local targets: (a) a T made of smaller Ls, (b) a T made of smaller Hs, (c) an F made of smaller Ls, and (d) an F made of smaller Hs. See Appendix B for an example of a global and local trial.

Operation span. The operation span (Turner & Engle, 1989) was used to assess working memory. In this task, participants were presented with a mathematical equation [e.g., Is $(5 \times 4) - 8 = 12$?] on a computer screen, which was followed by a word (e.g., cottage) that that they are asked to remember. Participants were to read the equation aloud and then respond with “yes” if the equation was correct and “no” if it was incorrect. Then, they were to say the word aloud. Participants were to remember the words from a series of equation-word pairs (i.e., sets) until they were asked to recall as many as they could at the end of a set. Sets ranged from three to five equation-word pairs, and participants were instructed that words could be recalled in any order, as long as the last word in the set was not recalled first. There was a total of 72 equation-word pairs, and the task took approximately 10 minutes. Following the scoring method of Schmader and Johns (2003), working memory was indexed by the *absolute span score* (i.e., the total number of words recalled from only those sets where all the words were recalled correctly). This scoring method is preferred over less

conservative methods, as it is more sensitive to differences in working memory capacity. Span tasks like this one have been shown to have good test-retest reliability, with correlations ranging from .70 to .80 (Conway et al., 2005).

Vigilance and eagerness questionnaire. The vigilance and eagerness questionnaire (VEQ) was used to assess the experience of specific regulatory focus motivations after the stereotype manipulation, but just prior to completing the primary dependent task. It was adapted from the questions posed in Seibt and Förster (2004), where vigilance and eagerness were tested using one question for each. In the proposed study, vigilance and eagerness were assessed with two as opposed to one item for each. Promotion focus questions included (a) “How eager are you to complete this task?” and (b) “How much do you want to solve all the items?” Prevention focus questions included (a) “How careful will you be in selecting your answers?” and (b) “How cautious will you be on this task?” The first question in each case was adapted from Seibt and Förster. On this same questionnaire, a few questions related to general motivation, interest, and expectations were included. These were also adapted from Seibt and Förster, because they will allow for testing of the “independence of the predicted effects from general motivation and performance expectation” (p. 42).

Regulatory focus questionnaire. The Regulatory Focus Questionnaire (RFQ; Lockwood, Jordan, & Kunda, 2002) was administered as part of a pre-testing packet of questionnaires that participants completed prior to the session. This measure assesses chronic regulatory focus, and thus goals consistent with a prevention focus or a promotion focus make up the two subcomponents of the scale. RFQ scores were used as covariates in the analyses to control for chronic effects. A copy of the questionnaire can be found in Appendix

C. (Note that four questions were adapted to be more relatable to people of all ages by omitting or replacing words related to school with words related to life in general.) Previous research with older and younger adults has shown both subscales to have good reliability (.75 for prevention focus and .81 for promotion focus) (Lockwood et al., 2002).

Action control scale. The action control scale (ACS; Kuhl & Beckmann, 1994) was used as a measure of emotion regulation. For the present study, two of the three scales were used. The first is the decision-related action orientation scale, which was used to measure the tendency to up-regulate positive affect in demanding situations. The second was the failure-oriented action orientation scale, which was used to measure the tendency to down-regulate negative affect after experiencing a failure or a negative event. These scales have been shown to measure implicit emotion regulation in demanding or difficult situations (Koole & Fockenberg, 2011). An example of a down-regulation item is, “When something really gets me down: (a) I have trouble doing anything at all, or (b) I find it easy to distract myself by doing other things.” An example of an up-regulation item is, “When I have a lot of important things to do and they must all be done soon: (a) I often don’t know where to begin, or (b) I find it easy to make a plan and stick with it.” Previous research has shown good internal consistency for the decision-related scale (Cronbach’s alpha = .78) and the failure-oriented scale (Cronbach’s alpha = .70) (Kuhl & Beckmann, 1994).

Procedure

Prior to testing sessions, participants were assigned to either the positive or negative stereotype condition. Approximately half of participants from each age group were randomly assigned to the positive stereotype condition and the other half to the negative stereotype

condition. The final participant group included 30 young adults in the negative condition and 30 in the positive, and 31 older adults in the negative condition and 29 in the positive. Participants completed a packet of questionnaires at their homes approximately one week prior to their sessions. Packets included a basic background questionnaire that asks for demographic information, the SF-36 Health Questionnaire (Ware, 1993), the RFQ, the ACS, and a basic depression screening measure, the Geriatric Depression Scale (GDS; Sheikh & Yesavage, 1986). If participants scored a 10 or above on the GDS indicating possible clinical depression, they would be excluded from analyses.

At the beginning of the session, participants were greeted by the experimenter and brought into a room to be tested individually. Participants turned in their completed pre-testing questionnaires at this time. The experimenter briefly introduced the study and then asked participants to read and sign the informed consent form. Next, the experimenter read aloud the task instructions to activate positive or negative stereotypes about older or younger adults. Note that previous research on aging has typically induced threat by activating negative aging stereotypes about memory (Hess et al., 2003; Hess & Higgins, 2006; Hess et al., 2009). In this study, however, due to the fact that stereotype inductions were used for both young and older adults, I needed the stereotypes to be consistent with both age and the characteristics of the main task. Thus, for older adults, the negative stereotype was related to slow processing speed. For younger adults, the negative stereotype emphasized their inexperience and lack of knowledge.

In the present study, older adults in the positive stereotype condition and younger adults in the negative stereotype condition were both read the following instructions:

In this study, we are investigating verbal and analytical reasoning skills throughout the lifespan. Successful performance on these tasks is dependent upon strong word knowledge and extensive life experience; therefore, research shows that older adults tend to do better than younger adults on these tasks.

For older adults in the negative stereotype condition and younger adults in the positive stereotype condition, these task instructions were read:

In this study, we are investigating cognitive ability and mental agility skills throughout the lifespan. Successful performance on these tasks is dependent upon thinking quickly and detecting novel relationships; therefore, research shows that young adults tend to do better than older adults on these tasks.

Before participants moved on to the main task, they were asked to complete the Vigilance and Eagerness Questionnaire to assess those specific motivational orientations associated with a prevention or promotion focus. This questionnaire took 1 to 2 min to complete. Next, the experimenter read the instructions for the word-selection task aloud, while participants read along on the cover sheet. They were instructed to select the word that does not belong to the category of the majority of words, and an example was provided. Additionally, participants were told that they had 40 s (60 s for older adults) to complete the task and that both accuracy and speed are of equal importance. Participants were then asked to indicate their age on the cover sheet for the ostensible purpose of efficient data processing. However, the actual purpose was to reactivate the positive or negative age-related stereotypes. The experimenter then started the timer and participants began the test.

After the time limit was up, the experimenter took up the task, and they moved on to the Global-Local task, which was conducted on the computer using a program in E-prime. The instructions were read aloud by the experimenter, after which the participants completed 12 practice trials. Participants were instructed to respond as quickly as possible by pressing one of two response keys: one for trials in which the stimulus contained the letter L and the other for the letter H. To reactivate the stereotypes, participants again indicated their age by typing it into the computer, after which they began the actual test. In order to determine reaction times to global and local trials, response latencies between stimulus presentation and response key presses were recorded along with information about when the stimulus was a global or local target. Only response latencies to trials that were answered correctly were examined. Overall, there were 18 global trials and 18 local trials, and the order of presentation was random. This task took around 4 min.

The operation span task was given next. This task was also presented on the computer screen in an E-prime program. The experimenter read the instructions and provided examples of how to perform the task on the computer screen. Again, participants typed their age into the computer. The actual test began once participants successfully completed a practice trial set. The experimenter advanced the screen after each trial by pressing a key on the keyboard. Accuracy of participants' responses to the concurrent task (i.e., solving mathematical equations) as well as the words recalled at the end of a trial set were recorded by the experimenter on a sheet of paper.

Before administering the remaining tasks, the experimenter debriefed participants, thereby making the positive and negative stereotypes irrelevant in the upcoming tasks.

Participants then completed several ability tests that were used to characterize the sample, including the Digit-Symbol Substitution task and the Vocabulary test from the Wechsler Adult Intelligence Scale III (WAIS-III; Wechsler, 1997). Next, the Short Blessed Orientation-Memory-Concentration test (Katzman, 1983), a measure of cognitive functioning, was used to screen participants who may be cognitively impaired. Individuals with scores of 7 or higher may be excluded from analyses.

Results

Participant Characteristics

The GDS and Short Blessed were used as screening measures of possible clinical depression and cognitive impairment, respectively. Examining these data, only one younger adult participant scored above the cutoff for possible clinical depression, with a score of 11 out of the possible 15 on the GDS. Additionally, two younger adult participants scored a 10 on the Blessed. Because excluding these participants did not alter the results of the analyses, however, their data were included in all of the following tests.

A series of analyses of variance (ANOVA) were conducted to examine participant characteristics for each age group, and results revealed typical age differences (Table 1). An examination of sample characteristics within each age group revealed no significant differences between conditions. Gender was distributed evenly within each condition and age group. No gender effects were found for any of the analyses.

Table 1
Descriptive Statistics for Participant Characteristics

	Younger Adults			Older Adults			<i>p</i> ^a
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	
Age	58	19.4	1.2	60	72.2	3.9	<.001
Education	57	13.0	1.1	60	16.1	2.9	<.001
Physical health	55	50.2	6.6	59	46.7	8.0	.01
Self-reported eyesight ^b	56	1.7	0.8	60	2.3	0.9	<.001
Mental health	55	40.6	6.0	59	57.6	5.5	<.001
WAIS Digit-symbol	58	84.5	14.8	60	62.1	10.7	<.001
WAIS Vocabulary	58	44.8	7.5	60	48.2	7.4	.05
NFC	58	3.8	0.9	60	4.0	0.9	.19
PNS	58	3.6	0.8	60	3.8	0.8	.12
30-day Negative affect	58	1.9	0.6	60	1.5	0.4	<.001
30-day Positive affect	58	3.9	0.6	60	3.6	0.6	.02
Up-regulation	56	7.7	3.2	58	9.2	2.5	.01
Down-regulation	56	7.1	2.8	57	8.6	3.0	.001

Note. NFC = Need for Cognition; PNS = Personal Need for Structure; Up- and Down-regulation are subscales of the Action Control Scale; Positive and Negative affect are subscales of the Positive and Negative Affect Schedule (PANAS-30day).

^aTest of age group difference.

^bGreater numbers represent worse eyesight.

Primary Analyses

Chronic Regulatory Focus. I first examined scores on the RFQ to determine if age differences existed in chronic regulatory focus. Both the prevention (Cronbach's $\alpha = .84$) and promotion subscales (Cronbach's $\alpha = .93$) had good internal consistency. A mixed ANOVA was conducted on these scores, with age group and condition as the between-subjects variables and RFQ scale (promotion vs. prevention) as the within-subjects variable. Consistent with past research (Lockwood, Chasteen, & Wong, 2005), promotion-oriented motivation ($M = 6.3$, $SD = 2.0$) was higher than prevention-oriented motivation ($M = 4.2$, $SD = 1.7$), $F(1, 114) = 174.08$, $p < .001$, $\eta^2 = .60$. There was a main effect of Age Group, with older adults having lower scores on both subscales compared with younger adults, $F(1, 114) = 82.41$, $p < .001$, $\eta^2 = .42$. A significant Age X Regulatory Focus interaction was also obtained (see Figure 1), $F(1, 114) = 3.99$, $p = .05$, $\eta^2 = .03$. As found in Lockwood et al., there was a greater discrepancy between promotion and prevention subscales in younger adults compared with older adults. Given these age differences and their potential to affect the power of experimental manipulations designed to affect regulatory focus, I decided to control for dispositional levels of promotion and prevention focus in all subsequent analyses involving the examination of threat effects on task performance. Finally, there were no effects due to condition, $F(1, 114) = 0.74$, $p = .39$, $\eta^2 = .01$.

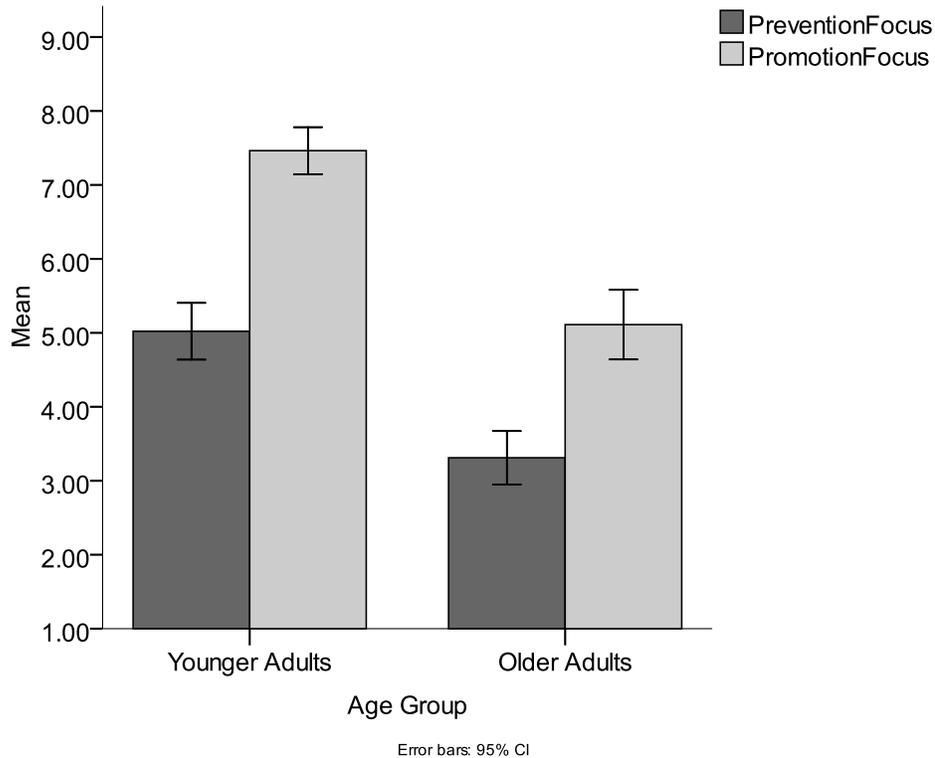


Figure 1. Means for regulatory focus subscales as a function of age.

Vigilance and eagerness questionnaire. I next examined responses on the VEQ as a means for determining if the threat manipulation influenced affective responses in a manner consistent with regulatory focus theory. Four specific items were of interest. The questions concerning being careful and cautious were significantly correlated, $r = .41$, $p < .001$, and therefore they were averaged together to create the variable vigilance. The questions concerning being eager and wanting to solve all the items were significantly correlated as well, $r = .57$, $p < .001$, and therefore they were averaged together to create the variable eagerness.

Separate 2 (Age Group) X 2 (Condition) analyses of covariance (ANCOVA) were conducted on the two dependent variables, vigilance and eagerness (Table 2). Contrary to predictions, no significant effects were obtained ($ps > .15$). Thus, self-reported vigilance was not influenced by threat in either age group. For eagerness, however, a significant main effect of age group was obtained, $F(1, 112) = 9.69, p = .001, \eta^2 = .08$. There was also a significant Age Group x Condition interaction, $F(1, 112) = 5.11, p = .03, \eta^2 = .04$. To decompose this interaction, the Age Group main effect was examined within each condition. Due to the number of follow-up univariate ANOVAs being conducted, Bonferonni corrections were used to control for alpha inflation.

Older adults in the positive condition indicated greater eagerness than younger adults in the positive condition, $F(1, 112) = 14.28, p < .001, \eta^2 = .11$. As expected, there were no age differences in eagerness between older adults and younger adults in the negative condition, $F(1, 112) = 1.27, p = .26, \eta^2 = .01$. When the impact of condition was examined within each age group, older adults in the positive condition indicated marginally greater eagerness than their counterparts in the negative condition, $F(1, 112) = 3.14, p = .08, \eta^2 = .03$, whereas the condition effect in the young adults was not significant, $F(1, 112) = 2.02, p = .16, \eta^2 = .02$. Thus, in line with expectations, exposure to positive aging stereotypes induced approach-oriented motivation in older adults but not in younger adults, even when controlling for dispositional levels of promotion focus and prevention focus.

Table 2

Vigilance and Eagerness Means (and SDs) as a Function of Age and Condition

Condition	Younger Adults		Older Adults	
	Positive	Negative	Positive	Negative
Vigilance	7.38 (1.01)	7.68 (0.77)	7.53 (1.27)	7.18 (1.17)
Eagerness	6.77 (1.65)	7.28 (1.35)	8.22 (0.75)	7.66 (1.04)

Word selection task. For this task, there were two dependent variables: speed and inaccuracy. Speed was indexed by the number of items attempted. Inaccuracy was indexed by a ratio score of the number of errors divided by the number of items attempted. This latter scoring method controlled for individual differences in the number of items that were attempted. A 2 (Age Group) X 2 (Condition) ANCOVA was conducted with the inaccuracy ratio score. The only significant effect obtained was the Age X Condition interaction, $F(1, 112) = 3.83, p = .05, \eta^2 = .03$ (Table 3). Consistent with predictions, older adults in the positive condition had higher inaccuracy rates than older adults in the negative condition, $F(1, 112) = 4.55, p = .04, \eta^2 = .04$. This suggests that older adults exposed to positive aging stereotypes took a promotion-focused approach to the task and made significantly more errors in relation to the number of items attempted compared with older adults exposed to negative aging stereotypes. In contrast, younger adults in the negative condition had error rates similar to their counterparts in the positive condition, $F(1, 112) = 0.42, p = .52, \eta^2 = .00$. This is inconsistent with both a working memory and regulatory focus account of stereotype effects.

Speed was examined next using a 2 X 2 ANCOVA (Table 3). Results revealed a main effect of age group, $F(1, 112) = 10.34, p < .001, \eta^2 = .08$, which was not surprising given that older adults were provided with more time to complete the items than were younger adults. The expected main effect of condition did not reach significance, $F(1, 112) = 2.23, p = .14, \eta^2 = .02$, although the trend was in the expected direction. The 2-way interaction was not significant, $F < 1$, which was consistent with the expectation that older and younger adults would show the same pattern of performance with regard to speed. There was some concern with the fact that six older adults (three in the positive condition) completed all 15 items before the time limit. This may have biased the results, as the task was specifically designed to be too difficult to attempt all items within the allotted time, with the goal of having sufficient variance in speed. A comparison of the standard deviations for both speed and inaccuracy suggests that there was more variability in error rates than there was in speed. Nonetheless, excluding these six participants did not alter the results.

Table 3

Speed and Inaccuracy Means (and SDs) as a Function of Age and Condition

Condition	Younger Adults		Older Adults	
	Positive	Negative	Positive	Negative
Speed	8.30 (1.84)	7.90 (2.17)	10.62 (2.62)	9.71 (2.67)
Inaccuracy	0.18 (0.12)	0.20 (0.17)	0.24 (0.15)	0.17 (0.13)

Note. Speed = number of items attempted (out of 15) on the word selection task; Inaccuracy = ratio of errors divided by number of items attempted.

Global-local task. Before analyzing the global-local data, response times that were less than 500 ms for any given trial were removed, as these responses were most likely the result of accidental button presses that occurred before seeing the stimulus. Response times to individual trials where participants pressed the incorrect button were removed. In addition, response times that were three standard deviations above or below each individual's own mean were removed. This resulted in the elimination of 2% of local trials within each age group. After eliminating the error data, mean response times were calculated for global and local trials separately. For this analysis, seven older adults who were confused with the task and responded incorrectly to most of the trials were excluded.

A mixed ANCOVA was conducted, with age group and condition as the between-subjects variables and trial type (global vs. local) as the within-subjects variable. The only significant effect obtained was an age group main effect, $F(1, 105) = 56.25, p < .001, \eta^2 = .35$, with older adults (Figure 2) having slower response times than younger adults (Figure 3). Although the 3-way interaction was not significant, $F(1, 105) = 1.14, p = .29, \eta^2 = .01$, more focused analyses within age groups is warranted because power (0.19) may have been too low to detect this effect. The pattern of results for older adults would suggest that response times to global trials were similar across conditions, but that perhaps response times to local trials were faster for older adults in the positive condition compared with those in the negative condition. To test whether this pattern was statistically significant, univariate analyses using Bonferonni corrections were conducted. Results revealed that response times to local trials were equivalent between conditions in the older adults, $F(1, 105) = 0.39, p = .53, \eta^2 = .00$, and so were response times to global trials, $F(1, 105) = 0.37, p = .55, \eta^2 = .00$.

Thus, among the older adults positive and negative stereotypes did not significantly impact response times to local trials or global trials. Results also revealed that across conditions older adults responded more quickly to global than local trials, $F(1, 105) = 6.66, p = .01, \eta^2 = .06$.

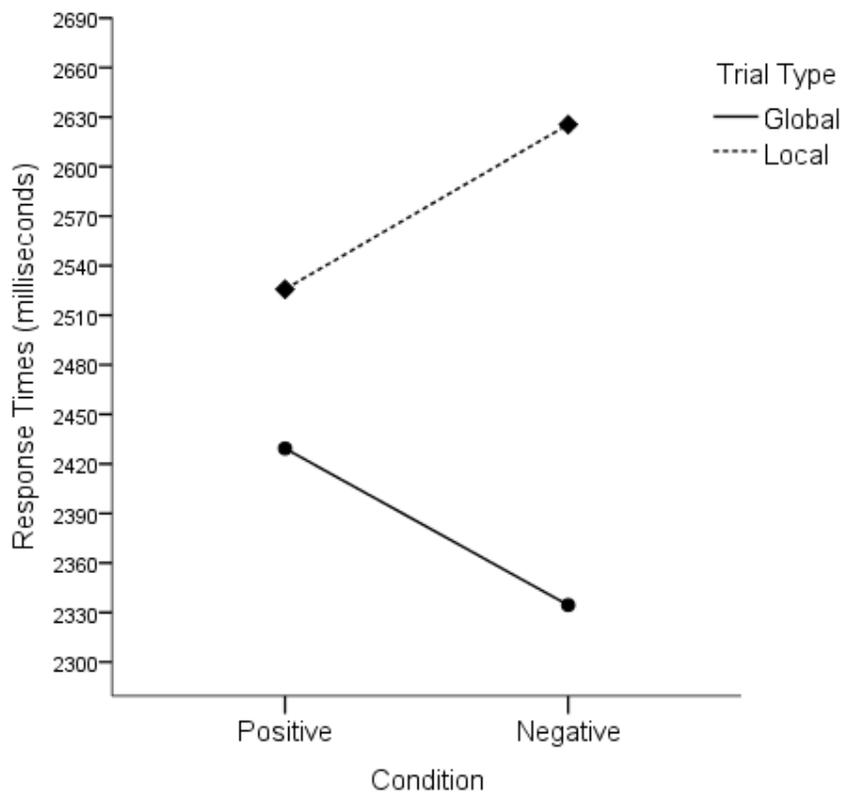


Figure 2. Older adults' response times to global and local trials as a function of condition.

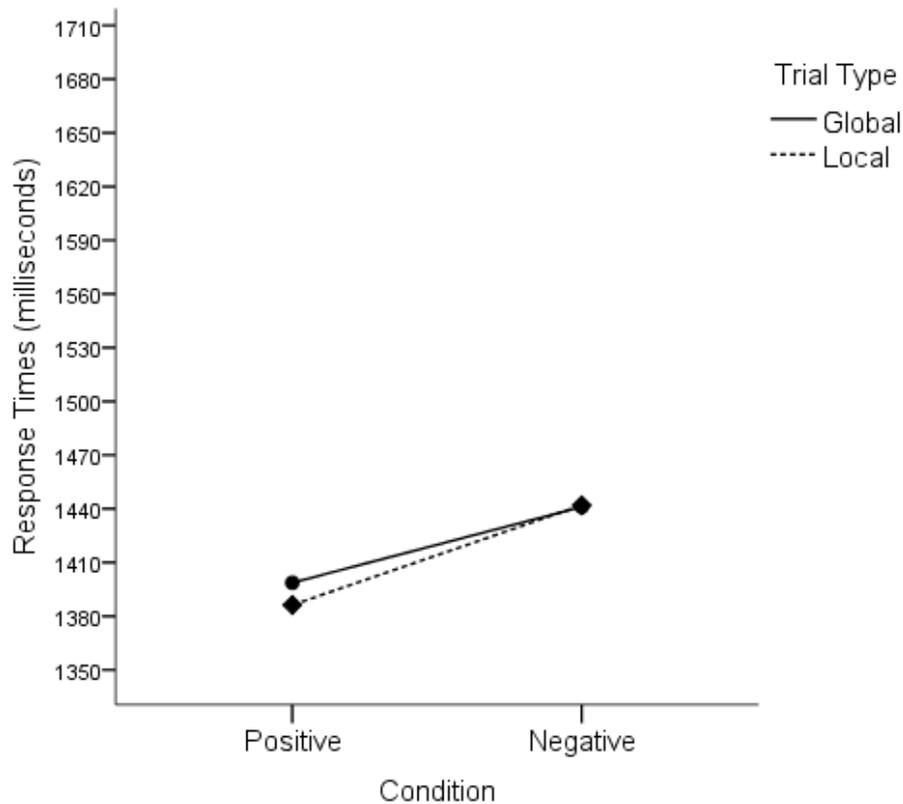


Figure 3. Younger adults' response times to global and local trials as a function of condition.

Operation span. A 2 (Age Group) x 2 (Condition) ANCOVA was conducted on the absolute span score, which was the sum of the words correctly recalled from only those sets where all the words were recalled (Schmader & Johns, 2003). The results showed no main effect of Age Group, $F(1, 111) = 1.84, p = .18, \eta^2 = .02$, or Condition, $F(1, 111) = 0.21, p = .65, \eta^2 = .00$. The 2-way interaction was also not significant, $F(1, 111) = 0.62, p = .43, \eta^2 = .01$, suggesting that, contrary to predictions, young adults under threat do not show reductions in working memory efficiency (Table 4). This was consistent, however, with the hypothesis that older adults under threat do not experience disruptions in working memory efficiency.

Table 4

Means (and SDs) on the Operation Span as a Function of Age and Condition

	Positive Condition	Negative Condition
Younger Adults	14.9 (8.0)	14.5 (7.0)
Older Adults	11.7 (5.7)	13.3 (6.6)

Note. Means are reported from the Absolute Span score.

Individual Differences in Emotion Regulation

Because stereotype threat has been shown to reduce working memory efficiency in young adults through its impact on self-regulation systems, it seems reasonable to expect that individual differences in self-regulation styles would moderate responses to stereotype threat. To investigate this possibility, I conducted exploratory analyses using ACS scores as an index of self-regulation. Because they were significantly correlated ($r = .43, p < .001$), I created a single variable of emotion regulation using the mean of the two ACS subscales. Higher scores represent greater levels of emotion regulation. I then identified the mean (younger adults = 7.36; older adults = 8.92) and standard deviation (younger adults = 2.52; older adults = 2.28) for each age group. To identify participants who were high versus low in emotion regulation, participants were categorized as high if they scored one standard deviation above the mean for their age group, and low if they scored one standard deviation below. Of the younger adults, 9 were low and 10 were high in their ability to regulate their

emotions. Of the older adults, 11 were low and 8 were high in their ability to regulate their emotions.

A 2 (Condition) X 2 (Emotion Regulation Group [high vs. low]) ANCOVA was conducted separately for each age group with the measure of working memory (i.e., the absolute span) as the dependent variable. (Separate analyses were conducted since the reduction in sample size reduced the power to detect a 3-way interaction.) For the young adults, there was a significant main effect of condition, $F(1, 13) = 8.77, p = .01, \eta^2 = .27$. More importantly, there was a significant Condition X Emotion Regulation interaction, $F(1, 13) = 4.70, p = .05, \eta^2 = .27$. To decompose this interaction, a series of follow-up univariate ANCOVAs were conducted using Bonferonni corrections to control for alpha inflation. Among younger adults who reported high emotion regulation, it was somewhat surprising that those exposed to negative stereotypes ($M = 20.8, SD = 7.5$) showed better working memory efficiency than their counterparts in the positive stereotype condition ($M = 9.2, SD = 3.8$), $F(1, 13) = 14.48, p < .001, \eta^2 = .53$. Consistent with predictions, however, among younger adults in the negative stereotype group, younger adults with high emotion regulation ability showed better working memory efficiency than younger adults who reported low ability to regulate their emotions ($M = 10.2, SD = 3.9$), $F(1, 13) = 6.02, p = .03, \eta^2 = .32$, whereas emotion regulation had no impact on working memory efficiency among younger adults in the positive stereotype group, $F(1, 13) = 0.23, p = .64, \eta^2 = .02$. Among the older adults, no significant effects were obtained. This suggests that emotion regulation plays a role in whether stereotype threat negatively affects working memory in younger adults, but not in older adults.

Discussion

The goal of this study was to examine age differences in stereotype threat, with a specific focus on the possibility that different mechanisms may account for threat effects in younger versus older adults. Research conducted with young adults has pointed to a working memory explanation of threat effects (Johns et al., 2008; Schmader & Johns, 2003). This research posits that threatened individuals divert cognitive resources to other threat-related processes and that this in turn has a negative impact on working memory, reducing its efficiency for the time being. Other studies with younger adults propose a motivation-based explanation of threat effects, suggesting that threat leads to underperformance by inducing prevention-oriented motivations which have strategic implications for the task at hand (Grimm et al., 2009; Seibt & Förster, 2004). Stereotype threat effects have also been shown with older adults and their memory performance (Hess et al., 2003; Hess et al., 2009), but at this point, a direct examination of the underlying mechanisms of such effects has not been completed. Thus, the present study endeavored to identify the mechanisms of threat effects in older and younger adults.

In the present study, the hypothesized age difference was tested by examining the impact of positive and negative stereotypes on older and younger adults. Threat was hypothesized to lead to underperformance in older adults through its impact on regulatory foci. More specifically, it was predicted that threat effects in older adults are due to maladaptive strategy use, such as being slower but more accurate, engendered by a prevention focus. On the other hand, it was predicted that older adults in the positive stereotype condition would engage in promotion-focused strategies, such as being faster but

less accurate, and that this would be beneficial for performance overall. For younger adults, threat was hypothesized to operate through its impact on working memory. That is, young adults in the negative stereotype condition were expected to show reduced working memory efficiency, compared with young adults in the positive stereotype condition who were expected to show greater working memory efficiency.

Summary of Findings

Regulatory focus. The results provided mixed support for my hypothesis that stereotype activation would influence regulatory focus in older adults. Older adults in the positive and negative conditions exhibited the predicted performance pattern for accuracy on the word selection task. That is, older adults in the negative condition made significantly fewer errors compared with their counterparts in the positive condition. As for speed on the word selection task, the prediction that older adults in the positive condition would attempt more items than those in the negative condition was not supported. Perhaps with more power a significant difference might be obtained, given that the trend was in the expected direction. For the younger adults, the activation of positive and negative stereotypes had no impact on speed and accuracy.

As indicated by the results of the global-local task, stereotype activation did not influence global and local processing in the predicted way. Because promotion focus is associated with global processing and prevention focus is associated with local processing (Förster & Higgins, 2005), I had anticipated that older adults in the positive condition would more easily detect global aspects of the stimuli, whereas older adults in the negative condition would more easily detect local aspects. Contrary to expectations, all of the older

participants responded more quickly to global than local trials, regardless of condition, whereas younger participants had similar response times for both trials. A possible explanation for this age discrepancy might be that, in general, the global aspects of the stimuli were more easily detected than local aspects due to the size of the stimuli, and that because of age-related declines in eyesight, older adults struggled more with the local trials. It could also reflect a general global focus in older adults' processing that was unaffected by stereotype condition.

The questions related to eagerness and vigilance were used as a self-report measure of regulatory focus. I had hypothesized that negative stereotypes would induce vigilance and positive stereotypes would induce eagerness motivation in older adults. I expected that young adults would not report different levels of vigilance and eagerness between conditions, and this was found to be the case. Even though older adults in the negative condition showed heightened accuracy, which would reflect a prevention focus, they did not report higher levels of vigilance compared with older adults in the positive condition. Consistent with expectations, however, older adults indicated greater eagerness after exposure to positive stereotypes compared with those exposed to negative stereotypes.

Overall, the results of this study point to a prevention focus mechanism of threat effects in older adults, although not all of the evidence was consistent. No such mechanism was found in younger adults. Building upon findings from previous studies where threat increased cautiousness (Hess, Emery, & Queen, 2009) and disrupted relational processing (Hess et al., 2003), both which may reflect a prevention focus, the present study directly tested for evidence of promotion and prevention-focused strategies induced by positive and

negative stereotypes, respectively. The results of the word selection task demonstrate that older adults exposed to negative stereotypes were vigilant to ensure against false alarms which increased their accuracy, whereas older adults exposed to positive stereotypes showed the opposite pattern. Although speed was not significantly different between older adults in positive and negative conditions, it was in the expected direction.

Working memory. Consistent with past research (Hess et al., 2009), older adults under stereotype threat did not experience impaired working memory efficiency. Inconsistent with expectations and with past research, young adults under threat did not experience decrements in working memory either. Given the extensive research of Schmader and colleagues (Johns, Inzlicht, & Schmader, 2008; Schmader, 2010; Schmader & Johns, 2003; Schmader, Johns, & Forbes, 2008), the lack of a threat effect on working memory in the present study seems to suggest that young adults either were not induced into threat or that the strength of the threat was relatively weak.

Despite the fact that threat did not reduce working memory efficiency in younger adults, it did have an impact when individual differences in emotion regulation were taken into account. Whereas young adults who reported low emotion regulation ability showed the expected detrimental threat effect on working memory, young adults with high emotion regulation ability were spared such negative effects. This seems to suggest that stereotype threat elicits negative emotions in young adults, and that it is only those young adults who struggle the most with emotion regulation whose working memory resources are depleted by threat. In contrast, for older adults under threat, individual differences in emotion regulation did not influence working memory. This finding could be viewed as further evidence that

emotion regulation is less taxing of cognitive resources in older adults (Emery & Hess, 2011; Scheibe & Blanchard-Fields, 2009) or that different mechanisms underlie threat effects across age groups. It is not clear, however, that older individuals under threat were indeed engaging in emotion regulation. It could be that older adults view the activation of negative age-related stereotypes as more of a challenge than a threat, and therefore the stereotype may not elicit a negative emotional response in the first place. To the contrary, in a study by Gaillard et al. (2001) older adults under threat expressed more worry about their performance than older adults in the positive stereotype condition.

Limitations

While the results of this study contribute to our understanding of how stereotype threat operates in older adults, there are a few limitations worth noting. A regulatory focus explanation of threat effects in older adults was only partially obtained. The predicted performance pattern was found for accuracy, with older adults in the negative condition making fewer errors than those in the positive condition, suggesting a threat-induced prevention focus. In contrast, speed was not significantly different between older adults in the positive and negative conditions. Perhaps this was due to insufficient variance in speed for the older participants, as some were able to complete all items within the time limit. Or perhaps differences in speed would have been detected with a larger sample size. Either way, without the predicted effect on speed, it is not completely certain whether the activation of positive and negative stereotypes induced regulatory foci in the predicted way in older adults.

Although there was some evidence that the stereotype manipulation successfully induced specific regulatory foci in older adults, there could be concerns about whether the

negative stereotype induced threat. More specifically, participants in the negative condition did not perform worse on any particular task compared with those in the positive condition. This could call into question whether threat was in fact induced, given that the primary indicator that stereotype threat has occurred is underperformance. Nevertheless, I am fairly convinced that the older adults were indeed induced into threat because their performance was influenced in the predicted way based on past research. As for the younger adults, I am more cautious about indicating that they were successfully induced into threat. If one accepts Schmader and colleagues' hypothesis that threat degrades working memory efficiency, then the lack of a working memory effect seems to suggest that young adults may have not been very threatened. Perhaps young adults in their daily lives are rarely exposed to unfavorable comparisons between older adults and people of their own age. The strength of threat was probably stronger for older adults who are most likely regularly exposed to negative aging stereotypes and age discrimination. It seems plausible that the younger adults may not have been very threatened, and that this was the reason for not finding working memory decrements in the younger adults in the stereotype threat condition. It was only when extreme individual differences in emotion regulation were examined at the high and low end that threat seemed to have any sort of impact on the younger participants. This examination of individual differences reduced the sample size dramatically and, thus, should be interpreted with extreme caution.

Conclusion and Future Directions

Despite the aforementioned limitations, this study contributes to the stereotype threat literature because, to my knowledge, no study has demonstrated a threat-induced prevention

focus mechanism underlying stereotype-based effects in older adults. The results of this study—although not all were consistent—suggest that the activation of negative aging stereotypes in older adults sets up a negative reference point, leading to a motivational shift to a prevention focus. In contrast, positive aging stereotypes set up a positive reference point, motivating older adults to engage in promotion-focused strategies. Future research should attempt to replicate this regulatory focus finding. It is particularly important for follow-up studies to demonstrate not only higher accuracy among older adults in the negative condition but also reduced speed. Along the same lines, the present study's examination of a regulatory focus explanation in older adults would have been stronger if I would have been able to show performance declines for those under threat. To demonstrate that older adults in the negative condition were indeed threatened, future studies should consider including a control, non-threat group for performance comparison purposes.

Additionally, I feel this study contributes to our understanding of aging. The results presented here may be viewed as additional support for the notion that emotion regulation abilities are enhanced with age. This study replicates a finding from a previous study (Hess et al., 2009) showing that older adults do not experience working memory deficits under threat, unlike younger adults (Schmader & Johns, 2003). I argue here that this may be due to aging-related changes in emotion regulation, but this remains to be empirically tested. I believe this is a valuable avenue worth pursuing. Some stereotype threat studies conducted with young adults have tested for evidence of emotional suppression and subsequent resource depletion (e.g., Johns et al., 2008). These studies could be replicated with older adults. Assuming that threat leads to emotion regulation in older adults, my hypothesis would be that the strategies

they are selecting are either inherently less cognitively taxing for everyone (e.g., reappraisal) or are the same strategies selected by young adults but older adults use them more efficiently (e.g., suppression). The finding in the young adults that individual differences in emotion regulation moderated whether a threat effect on working memory occurred should be explored further. It makes intuitive sense that those who are better at regulating their emotions should be better able to handle the extraneous thoughts and evaluative concerns that arise with threat.

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APPENDICES

Appendix A

Word Selection Task

1. pond stream **meadow** creek lake
2. bronze copper gold **diamond** silver
3. poultry **dairy** pork fish beef
4. oxygen hydrogen helium **ethanol** carbon dioxide
5. pliers hammer **nail** screwdriver saw
6. clogs **belt** boots sneakers high heels
7. **ruler** yard inch mile centimeter
8. ladle spatula **pan** spoon tongs
9. satin linen **sheets** cotton flannel
10. gymnastics **ballet** volleyball tennis track
11. vanity **bath tub** dresser ottoman nightstand
12. eggplant squash peas **plum** spinach
13. panther tiger **elephant** lion cat
14. pamphlet journal magazine **newsstand** newspaper
15. rose **bush** pansy carnation lilac

Note: Correct words are presented in bold font.

Appendix B

Global-Local Task

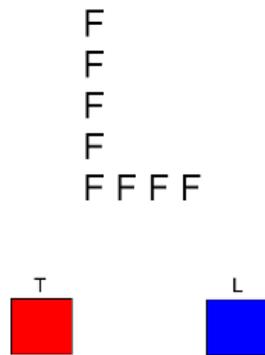


Figure 4. Example of a global trial.

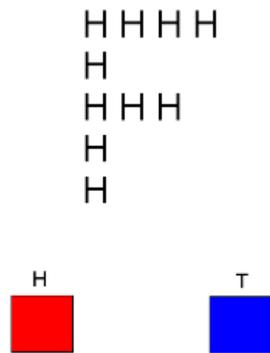


Figure 5. Example of a local trial.

Note: After seeing a global or local trial on the computer screen, participants selected a letter by pressing a blue or red button.

Appendix C

Regulatory Focus Questionnaire

Using the scale below, please write the appropriate number in the blank beside each item.

- | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|-----------------------|
| Not at
all true
of me | | | | | | | | Very
true of
me |
| 1. ____ | | | | | | | | |
| In general, I am focused on preventing negative events in my life. | | | | | | | | |
| 2. ____ | | | | | | | | |
| I am anxious that I will fall short of my responsibilities and obligations. | | | | | | | | |
| 3. ____ | | | | | | | | |
| I frequently imagine how I will achieve my hopes and aspirations. | | | | | | | | |
| 4. ____ | | | | | | | | |
| I often think about the person I am afraid I might become in the future. | | | | | | | | |
| 5. ____ | | | | | | | | |
| I often think about the person I would ideally like to be in the future. | | | | | | | | |
| 6. ____ | | | | | | | | |
| I typically focus on the success I hope to achieve in the future. | | | | | | | | |
| 7. ____ | | | | | | | | |
| I often worry that I will fail to accomplish my goals. | | | | | | | | |
| 8. ____ | | | | | | | | |
| I often think about how I will achieve success. | | | | | | | | |
| 9. ____ | | | | | | | | |
| I often imagine myself experiencing bad things that I fear might happen to me. | | | | | | | | |
| 10. ____ | | | | | | | | |
| I frequently think about how I can prevent failures in my life. | | | | | | | | |
| 11. ____ | | | | | | | | |
| I am more oriented toward preventing losses than I am toward achieving gains. | | | | | | | | |
| 12. ____ | | | | | | | | |
| My major goal right now is to achieve my lifelong ambitions. | | | | | | | | |
| 13. ____ | | | | | | | | |
| My major goal right now is to avoid becoming a failure. | | | | | | | | |
| 14. ____ | | | | | | | | |
| I see myself as someone who is primarily striving to reach my “ideal self”—to fulfill my hopes, wishes, and aspirations. | | | | | | | | |
| 15. ____ | | | | | | | | |
| I see myself as someone who is primarily striving to become the self I “ought” to be to fulfill my duties, responsibilities, and obligations. | | | | | | | | |
| 16. ____ | | | | | | | | |
| In general, I am focused on achieving positive outcomes in my life. | | | | | | | | |
| 17. ____ | | | | | | | | |
| I often imagine myself experiencing good things that I hope will happen to me. | | | | | | | | |
| 18. ____ | | | | | | | | |
| Overall, I am more oriented toward achieving success than preventing failure. | | | | | | | | |