

Age Differences in the Underlying Mechanisms of Stereotype Threat Effects

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Objectives. The goals of the present study were to (a) examine whether age differences exist in the mechanisms underlying stereotype threat effects on cognitive performance and (b) examine whether emotion regulation abilities may buffer against threat effects on performance.

Method. Older and younger adults were exposed to positive or negative age-relevant stereotypes, allowing us to examine the impact of threat on regulatory focus and working memory. Self-reported emotion regulation measures were completed prior to the session.

Results. Older adults' performance under threat suggested a prevention-focused approach to the task, indexed by increased accuracy and reduced speed. The same pattern was observed in younger adults, but the effects were not as strong. Age differences emerged when examining the availability of working memory resources under threat, with young adults showing decrements, whereas older adults did not. Emotion regulation abilities moderated threat effects in young adults but not in older adults.

Conclusions. The results provide support for the notion that stereotype threat may lead to underperformance through somewhat different pathways in older and younger adults. Future research should further examine whether the underlying reason for this age difference is rooted in age-related improvements in emotion regulation.

Key Words: Aging—Emotion regulation—Regulatory focus—Stereotype threat—Working memory.

STUDIES of aging that have examined stereotype threat have primarily proceeded with the goal of demonstrating that age differences in certain aspects of cognitive performance or behavior may be attributable to negative aging stereotypes associated with ability (for reviews, see Chasteen, Kang, & Remedios, 2012; Hess, 2006). There has been no research, however, directly comparing the mechanisms underlying stereotype threat effects across age groups within the same study. Aging studies typically focus on the disproportionate effects of negative stereotypes of old age on older versus younger adults, with the goal of identifying specific mechanisms that affect older adults' behavior. The fact that threat effects are not induced in the younger adults in these studies precludes direct comparisons of the mechanisms underlying and moderating threat effects across age groups. The goal of the present study was to make such comparisons.

Social psychological research has focused predominantly on the impact of stereotype threat on the availability of cognitive resources. For example, younger adults exposed to threat performed worse on a working memory task than those individuals in a control group (Schmader & Johns, 2003). Schmader and colleagues (Johns, Inzlicht, & Schmader, 2008; Schmader & Johns, 2003; Schmader, Johns, & Forbes, 2008) have hypothesized that when individuals are faced with negative stereotypes regarding their abilities, they devote resources to processes such as

self-monitoring and emotion regulation, thereby limiting the resources needed to perform difficult cognitive tasks. For example, Cadinu, Maass, Rosabianca, and Kiesner (2005) found that young adults under threat indicate worrisome task-related thoughts, and worry has been found to mediate threat-based effects in young adults (Brodish & Devine, 2009). In addition, stereotype threat has been found to increase physiological arousal (Blascovich, Spencer, Quinn, & Steele, 2001) and reduce heart rate variability, which some consider an indirect indicator of increased cognitive load (Croizet et al., 2004). Thus, it appears that the diversion of cognitive resources to nontask-related processes is one of the primary means through which negative stereotypes operate to degrade performance in young adults.

In contrast to this work with young adults, however, studies with older adults have not obtained strong or consistent evidence for the same types of mechanisms underlying threat effects on performance. For example, using a procedure that was very similar to that of Schmader and Johns (2003), Hess, Hinson, and Hodges (2009b) found no evidence that stereotype threat had a negative effect on working memory, assessed using an operation span task. A more recent study by Mazerolle, Régner, Morisset, Rigalleau, and Huguet (2012) reported contrary results, with threat negatively affecting performance on a reading span task. A potential issue in this latter study, however, relates to the

fact that the working memory task was characterized as assessing memory. [Hess and colleagues \(2009b\)](#) argued that labeling working memory tasks in this fashion is problematic in studies of aging in that the assessment of the impact of threat on working memory is potentially confounded by threat effects associated with the actual stereotyped ability.

Other studies with older adults also provide inconsistent support for the [Schmader and colleagues \(2008\)](#) perspective. For example, situation-based perceptions of threat do not seem to affect older adults' cognitive resource-consuming responses ([Chasteen, Bhattacharyya, Horhota, Tam, & Hasher, 2005](#); [Chasteen et al., 2012](#)). Similarly, threat has been shown to be inconsistently related to state anxiety, with some studies finding null effects (e.g., [Chasteen et al., 2005](#), Experiment 2; [Hess & Hinson, 2006](#); [Hess, Hinson, & Statham, 2004](#)), whereas others have found elevated levels of anxiety or negative affect associated with experimental inductions of threat (e.g., [Abrams et al., 2008](#); [Abrams, Eller, & Bryant, 2006](#); [Chasteen et al., 2005](#), Experiment 3; [Horton, Baker, Pearce, & Deakin, 2010](#); [Swift, Abrams, & Marques, 2013](#)). Importantly, little evidence has been found for anxiety mediating the effects of situational threat on performance.

One possible explanation for the apparent discrepancy in findings across age groups is that young and older adults may respond differently when exposed to threat. For example, there is some evidence that age is associated with enhanced emotion regulatory abilities ([Phillips, Henry, Hosie, & Milne, 2008](#); [Scheibe & Blanchard-Fields, 2009](#)). This may result in older adults being better able than younger adults to adaptively respond to threat, perhaps accounting for the weak associations between situation-based threat and affective responses in older adults. Additionally, although reduced working memory capacity has been used as a primary explanation of threat effects in younger individuals, alternative perspectives have been proposed, which may help shed some light on older adults' responses to threat. One such perspective is based in regulatory focus, a motivational framework that distinguishes between prevention and promotion orientations ([Higgins, 1997](#)). [Seibt and Förster \(2004\)](#) suggest that 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. This prevention focus increases vigilance in an attempt to avoid making errors. Positive stereotypes, on the other hand, set up a positive reference point for which the desired end state reflects gain and achievement (i.e., promotion focus) as opposed to loss. In terms of performance, individuals in a prevention focus are more cautious, resulting in more deliberate, less error-prone behavior. A promotion focus, by contrast, is associated with eagerness, leading to faster performance but relatively more mistakes. [Seibt and Förster](#) found evidence that negative stereotypes induce a prevention focus, as indexed by reduced speed but increased accuracy, compared with those in the positive

stereotype condition whose performance reflected a promotion focus with increased speed but reduced accuracy.

It is possible that a regulatory focus perspective might prove more useful than a working memory perspective in characterizing older adults' responses to threat. This could be due in part to age differences in emotion regulation abilities, with threat resulting in a strategic adjustment on the part of older adults as opposed to the general degradation in performance that might be characterized by working memory disruptions. There is some evidence consistent with such an explanation. For example, [Hess, Emery, and Queen \(2009a\)](#) found that when time was unlimited and thus speed was not a factor, older adults exposed to negative stereotypes performed equally well as their positively stereotyped peers on a memory task. (For a related finding, see [Fritzsche, DeRouin, & Salas, 2009](#).) In contrast, when participants had to make a memory judgment under time constraints, older adults in the negative stereotype condition exhibited poorer overall performance and exhibited a higher ratio of "know" to "remember" responses. This latter pattern has been interpreted as being consistent with an adjustment in response criteria, with more stringent criteria being set for making a positive memory response ([Dunn, 2004](#)). This suggests a more cautious approach to the task.

In the present study, we tested the hypothesis that the dominant underlying mechanisms associated with stereotype threat effects vary with age. Older and younger adults were exposed to either positive or negative self-stereotypes and then were tested on tasks designed to directly assess mechanisms hypothesized to reflect shifts in regulatory focus versus disruptions of working memory. To measure regulatory focus, speed and accuracy were assessed using a task similar to that used by [Seibt and Förster \(2004\)](#). Participants also completed an operation span test to examine working memory. We expected that older adults' performance would be influenced primarily by adjustments in situational regulatory foci, with performance in the negative stereotype condition being slower and more accurate than performance in the positive stereotype condition. Consistent with our previous work ([Hess et al., 2009b](#)), we did not expect working memory performance to vary across conditions in the older adults. In contrast, we predicted that threat effects in younger adults' performance would be based primarily in a reduction in processing resources, as indexed by worse performance on the working memory task in the negative stereotype condition. We anticipated threat would not have as strong of an impact on speed and accuracy in young adults as observed in the older adults.

We also examined the role of emotion regulation abilities in moderating threat effects. If such effects in young adults primarily reflect diversion of working memory resources by engaging in counterproductive behaviors (e.g., worry; [Cadinu et al., 2005](#)), then those individuals with better emotion regulation abilities than their peers may be able to mitigate threat-induced negative thoughts and feelings and subsequently

regain their focus for the task at hand. In contrast, if enhanced regulation abilities in later life minimize the negative consequences of affective responses, then older adults' performance may be less likely to be moderated by regulation abilities. Thus, we also tested the hypothesis that emotion regulation abilities would buffer young adults against threat effects, as reflected in working memory efficiency.

METHOD

The research was conducted as two separate studies. The study with younger adults was conducted first, with slight modifications of some aspects of the procedure being introduced for the study with older adults based on the results. The stereotype manipulation also differed for older and younger adults so that the stereotype would be relevant to each age group. The manipulation for young adults involved fabricated stereotypes regarding their college majors, whereas older adults were exposed to age-related stereotypes.

Participants

Sixty-three older adults (31 women; age range = 65–83) were recruited from the community and received an honorarium of \$30 for their participation. Sixty-four undergraduate students (37 women; age range = 18–23) participated to satisfy a course option for an introductory psychology course. Students were eligible to participate if their majors were in a discipline other than engineering. A variety of colleges were represented including Agriculture and Life Sciences (37.5%), Management (26.6%), Humanities and Social Sciences (17.2%), Education (7.8%), Design (4.7%), Natural Resources (3.1%), Physical and Mathematical Sciences (1.6%), and Textiles (1.6%).

Measures

Group identification.—To ensure that the stereotypes were relevant to individuals in each age group, participants rated the extent to which they identified with the stereotyped groups. Young adults were asked to rate on a 6-point Likert scale from 1 (*not at all*) to 6 (*very much*) “how much do you identify with your major?” Older adults were asked to indicate on an 8-point Likert scale from 1 (*not at all*) to 8 (*very much*) “how much do you identify with your age group (that is, older adults)?” Younger adults' scores were transformed to be on the same 8-point scale as that of older adults. Both older ($M = 5.79$, $SD = 1.56$) and younger adults ($M = 6.18$, $SD = 1.39$) indicated relatively high group identification, with both groups exhibiting similar levels of identification with the groups that formed the basis for the stereotype threat manipulation.

Threat and challenge.—Situational threat and challenge appraisals were assessed with the 18-item State Cognitive Appraisal Scale (SCAS; Skinner & Brewer, 2002). Eight

items referred to challenge appraisals (e.g., “I am focusing on the positive aspects of this situation”; Cronbach's $\alpha = .89$; all reported α s are based on data from the current sample) and 10 items referred to threat appraisals (e.g., “I am worried about what other people may be thinking about me”; $\alpha = .78$). Participants indicated on a scale of 1 (*not at all*) to 6 (*very much*) the extent to which each statement is true for them right now.

Letter-canceling task.—The letter-canceling task was used to measure situational regulatory foci induced by the stereotype manipulation. A series of lowercase letters were presented with no spaces in between in 11 rows on a standard sheet of white paper. Participants were instructed to cross out all of the *es*, going from left to right in order, and from the top row down, working as quickly and accurately as possible. This task allowed us to assess speed and accuracy in a manner similar to Seibt and Förster (2004) in order to characterize an individual's regulatory focus.

Operation span.—Consistent with past research (Schmader & Johns, 2003), the operation span (Turner & Engle, 1989) was used as a measure of working memory after the stereotype manipulation. Participants solved basic arithmetic problems while remembering words. The number of equation–word pairs ranged from two to five.

Emotion regulation.—Three measures were used to index self-reported emotion regulation. The Action Control Scale (ACS; Kuhl, 1994) contains 12 items that assess an individuals' ability to act on their emotions. Compared with those with a state orientation, individuals with an action orientation have the capacity to regulate their emotions and thoughts, and they do so somewhat unconsciously and effortlessly. Of interest for the present study was the downregulate scale, which measures the ability to downregulate negative affect that is evoked by a threatening situation or after a failure ($\alpha = .74$). The Cognitive Emotion Regulation Questionnaire (CERQ-short; Garnefski & Kraaij, 2006) is an 18-item scale that assesses responses after experiencing a stressful or threatening event. Questions refer to specific emotion regulation strategies, including those that are *maladaptive* (i.e., self-blame, other-blame, rumination, and catastrophizing; $\alpha = .77$), as well as those that are *adaptive* (i.e., putting into perspective, positive refocusing, positive reappraisal, acceptance, and planning; $\alpha = .74$). The 10-item Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) consists of two subscales: one measures the tendency to suppress emotions (*suppression*; $\alpha = .77$) and the other measures the tendency to reappraise situations (*reappraisal*; $\alpha = .81$).

Regulatory focus questionnaire.—The Regulatory Focus Questionnaire (RFQ; Lockwood, Jordan, & Kunda, 2002) was used to assess chronic regulatory foci, and thus goals consistent with a prevention focus ($\alpha = .80$) or a promotion

focus ($\alpha = .90$) make up the two subcomponents of the scale. RFQ scores were used as covariates in the analyses to control for chronic effects.

Ability measures.—The Vocabulary, Digit-Symbol Substitution, and Letter-Number Sequencing (LNS) subtests from the Wechsler Adult Intelligence Scale-III (WAIS-III; Wechsler, 1997) were used to assess verbal ability, processing speed, and working memory, respectively.

Health and mood.—Participants rated their physical and mental health on the SF-36 Health Survey (Ware, 1993). The Geriatric Depression Scale (GDS) was included as a measure of negative affect (Sheikh & Yesavage, 1986). The Positive and Negative Affect Schedule (PANAS) was included as a measure of mood over the last 30 days (Watson, Clark, & Tellegen, 1988).

Procedure

Approximately half of participants from each age group were randomly assigned to positive or negative stereotype conditions. A few days before their appointments, participants were sent a packet of pretesting questionnaires, which included the ACS, ERQ, CERQ, RFQ, PANAS, SF-36, GDS, and a demographic questionnaire, to complete before the session.

When participants arrived for their individual testing sessions, they signed an informed consent form before completing the questions regarding identification with the stereotyped group. The stereotype manipulation was next. Older adults in the negative stereotype condition were read the following: “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.” Older adults in the positive stereotype condition were read the following: “We are investigating verbal and analytical reasoning skills throughout the lifespan. Successful performance on these tasks is dependent upon extensive life experience and strong word knowledge; therefore, research shows the older adults tend to do better than younger adults on these tasks.” The stereotype manipulation for the younger adults was related to college majors. Young adults in the negative condition were read the following: “We are interested in seeing how the differential abilities of college students who are majoring in different disciplines influence their performance on these tasks, because Engineering students usually do very well on these tasks, whereas students majoring in other disciplines usually do badly.” Young adults in the positive condition were read the following: “We are interested in seeing how the differential abilities of college students who are majoring in different disciplines influence their performance on these tasks, because Engineering students usually do badly

on these tasks, whereas students majoring in other disciplines usually do very well.” As a manipulation check, older and younger adults indicated challenge and threat appraisals using the SCAS.

Participants then completed a sample section of the letter-canceling task to familiarize them with the procedure. Older adults then indicated their age and younger adults indicated their major to reactivate the stereotype. Younger adults were given 30 s to get as far as possible on the letter-canceling task. Older adults were allowed 40 s to accommodate for age-related slowing. (The different times for older and younger adults were determined based on pilot testing. The additional time allocated to older adults allowed for similar levels of variability in scores to those seen in the young adults.) The instructions emphasized that accuracy and speed were equally important. Following this, participants again indicated their age or major to ensure that the stereotype was activated prior to completing the operation span task. This task was not explicitly labeled as assessing memory in the instructions given to participants in order to minimize potential threat effects in older adults associated with the stereotype as opposed to the mechanisms underlying threat effects on performance. Following Cadinu and colleagues (2005), we also asked participants to list their thoughts regarding the working memory task. Nothing of interest emerged from these thought listings, however, and thus these data are not considered further. Subsequently, participants were debriefed to diminish any remaining effects of the manipulation, and they then completed the ability measures.

RESULTS

Analytic Plan

Given the different threat manipulations used across age groups, initial analyses were conducted separately within age groups to examine age-specific effects and mechanisms. We also conducted analyses that included both age groups, with the results being consistent with the within-group analyses (e.g., when a stereotype effect was observed in one group but not the other, a significant Age \times Stereotype interaction was obtained). Thus, we adopt a conservative approach and present only the within-age group analyses.

Participant Characteristics

Table 1 displays participant characteristics as a function of age and stereotype condition. Independent samples *t* tests within age groups indicated that there were no significant effects of condition on participant characteristics.

Stereotype Effects on Performance

Speed and inaccuracy.—Performance on the letter-canceling task was examined to test hypotheses relating to the impact of threat on regulatory focus. Speed was indexed

Table 1. Means (*SDs*) as a Function of Age and Stereotype Condition

	Older adults		Younger adults	
	Positive	Negative	Positive	Negative
Age	70.8 (4.2)	71.1 (3.7)	19.4 (1.0)	19.4 (1.0)
Education (years)*	16.6 (2.4)	16.3 (1.9)	13.2 (1.2)	13.0 (1.0)
WAIS digit-symbol*	62.6 (13.2)	68.0 (12.6)	84.0 (12.2)	84.0 (14.5)
WAIS vocabulary*	52.6 (7.7)	52.1 (7.4)	46.3 (7.1)	47.5 (6.7)
WAIS letter-number sequencing*	10.7 (2.1)	10.5 (2.6)	11.7 (2.8)	12.5 (2.1)
SF-36 physical health*	45.8 (9.2)	45.8 (6.6)	54.8 (8.8)	55.2 (5.9)
SF-36 mental health	58.2 (4.0)	56.4 (4.4)	54.0 (7.5)	58.8 (7.4)
RFQ prevention focus*	3.6 (1.2)	3.8 (1.4)	5.6 (1.4)	5.3 (1.3)
RFQ promotion focus*	5.9 (1.8)	5.3 (1.4)	7.2 (1.1)	7.3 (1.1)
PANAS negative affect*	1.3 (0.3)	1.4 (0.3)	2.0 (0.8)	1.8 (0.6)
PANAS positive affect	3.8 (0.6)	3.4 (0.7)	3.3 (0.8)	3.4 (0.6)

Notes. PANAS = Positive and Negative Affect Schedule; RFQ = Regulatory Focus Questionnaire; *SD* = standard deviation; WAIS = Wechsler Adult Intelligence Scale.

*Age group difference significant ($p < .05$).

by the number of *es* that were crossed out (out of 75 available *es*) within the allotted time, whereas inaccuracy was indexed by a ratio of the number of *es* that were skipped divided by the number of *es* that were viewed (i.e., crossed out plus skipped *es*), thereby controlling for speed. Digit-symbol score was also entered as a covariate to control for individual differences in speed.

Multivariate analyses of covariance conducted on speed (Figure 1A) and inaccuracy scores (one younger participant in the positive condition was excluded from this analysis because the Grubbs' test revealed that their inaccuracy score was a statistical outlier, $p < .05$; Figure 1B) revealed that the stereotype manipulation had a significant impact on the performance of both older adults, $F(2,56) = 10.93$, $p < .001$, $\eta^2 = .28$, and young adults, $F(2,57) = 3.16$, $p = .05$, $\eta^2 = .10$, although the effect size was much larger for the older adults than for the young adults. (When we conducted a multivariate analysis of covariance with speed and inaccuracy, the Age \times Stereotype interaction was only marginally significant, $F(2,117) = 2.85$, $p = .06$, $\eta^2 = .05$, indicating that, inconsistent with expectations, the manipulation did not have a significantly greater effect on older adults' regulatory focus performance than that of younger adults. The follow-up analysis, however, indicated the presence of interactions.) Follow-up univariate analyses of variance (ANOVAs) revealed that, as predicted, older adults exposed to negative stereotypes were significantly slower (i.e., crossed out fewer *es*), $F(1,57) = 5.87$, $p = .02$, $\eta^2 = .09$, but made significantly fewer mistakes, $F(1,57) = 19.53$, $p < .001$, $\eta^2 = .26$, than older adults exposed to positive stereotypes. This pattern of performance is suggestive of heightened vigilance in response to stereotype threat. The same general pattern was observed in young adults, although weaker. In addition, the impact of stereotypes on performance was significant for speed, $F(1,59) = 5.66$, $p = .02$, $\eta^2 = .09$, but not for inaccuracy, $F(1,58) = 2.87$, $p = .10$, $\eta^2 = .05$.

Working memory.—We next examined performance on the operation span task to test the hypothesis that threat would negatively affect working memory, as indexed by the total number of recalled words on this task. Because we wanted to test for group-level differences in working memory as a function of stereotype condition first before examining our hypotheses related to individual differences in emotion regulation, we entered measures of emotion regulation derived from ACS, ERQ, and CERQ scales as covariates to control for emotion regulation. Consistent with expectations, young adults exposed to the negative stereotype ($M = 31.6$, standard error [*SE*] = 0.7) experienced reductions in working memory compared with their counterparts who were exposed to the positive stereotype ($M = 34.4$, $SE = 0.7$), $F(1,58) = 6.92$, $p = .01$, $\eta^2 = .11$. As predicted, the stereotype manipulation did not affect working memory scores of older adults, $F(1,57) = 1.55$, $p = .22$, $\eta^2 = .03$: negative $M = 31.2$, $SE = 0.9$; positive $M = 29.5$, $SE = 0.9$. (Due to a procedural issue, LNS scores were unavailable for about one third of the younger adult sample, and thus could not be used to control for dispositional working memory ability with the full sample. However, threat effects similar to those in the full-sample analyses were obtained in the young adults, $F(1,38) = 6.21$, $p = .02$, $\eta^2 = .14$, and older adults, $F(1,59) = 1.82$, $p = .18$, $\eta^2 = .03$, when LNS scores were entered as covariates.)

The differential impact of threat on working memory efficiency across age groups can also be seen when a dispositional measure of working memory—WAIS-III LNS score—is correlated with operation span performance for each group as a whole. A significant correlation between these measures was observed for the old group ($r = .53$, $p < .001$), but not the young group ($r = .28$, $p = .08$), suggesting that the situational influences (i.e., the threat manipulation) had less of an impact in the old group than in the young group.

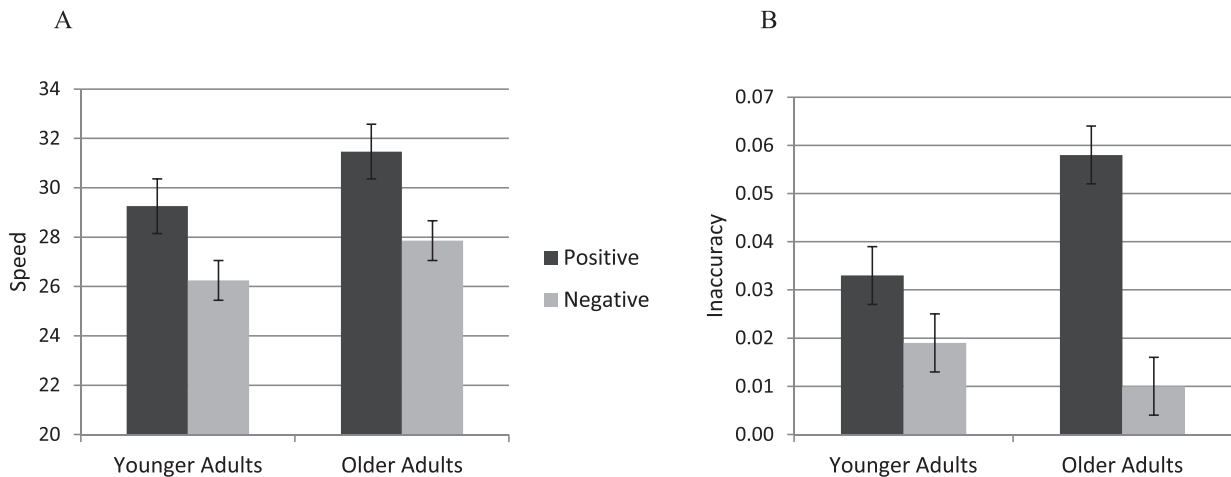


Figure 1. Speed as a function of age group and stereotype condition (A). Inaccuracy as a function of age group and stereotype condition (B). Error bars represent ± 1 SE.

Emotion Regulation

We next examined whether individual differences in self-reported emotion regulation behaviors influenced the strength of the observed stereotype effects on performance. To simplify our analyses, we obtained composite measures of emotion regulation by conducting a principal axis factor analysis on (a) CERQ maladaptive and adaptive strategy scores, (b) ERQ reappraisal and suppression scores, and (c) the ACS downregulation score. An oblique rotation (i.e., direct oblimin) was used to allow the factor loadings to correlate with one another. The analysis extracted a two-factor solution (Table 2), which accounted for 61.0% of the overall variance. Factor 1 appears to represent *emotional control*, with high scores representing the ability to easily act on one's emotions when confronted with a negative situation or event, whereas low scores represent emotional stagnation or rumination such that one feels paralyzed by the unpleasant feelings and thoughts surrounding a negative situation or event. Factor 2 was labeled *cognitive refocusing*, with high scores representing the ability to use cognitive strategies to modify one's view of a negative situation or event to make it less unpleasant. We then used median splits based on factor scores within age groups to identify high and low groups relating to emotional control and cognitive refocusing abilities. These groups were then entered as an additional factor in separate analyses to determine potential moderating effects on stereotype influences on performance.

Emotional control.—An initial age group comparison revealed that older adults had significantly higher emotional control scores than did younger adults ($M_s = 0.48$ vs -0.48), $F(1,123) = 19.47$, $p < .001$, $\eta^2 = .14$. A 2 (Stereotype Condition) \times 2 (Emotional Control) analysis of covariance was then conducted on working memory within each age group separately. In young adults, the

Table 2. Principal Axis Factor Analysis of Emotion Regulation Measures

Measures	Loadings	
	Factor 1	Factor 2
ACS downregulate	.74	.24
ERQ reappraisal	.10	.66
ERQ suppression	-.15	.11
CERQ adaptive strategies	-.02	.64
CERQ maladaptive strategies	-.71	.02

Notes. ACS = Action Control Scale; CERQ = Cognitive Emotion Regulation Questionnaire; ERQ = Emotion Regulation Questionnaire. Loadings presented in bold represent the measures selected to define each factor. Factor 1 is emotional control. Factor 2 is cognitive refocusing.

predicted two-way interaction (Figure 2A) was significant, $F(1,58) = 5.52$, $p = .02$, $\eta^2 = .09$. Follow-up analyses were conducted with Bonferroni corrections, revealing that the negative stereotype had a detrimental impact on working memory in younger adults who were low in emotional control, $F(1,58) = 11.08$, $p = .002$, $\eta^2 = .16$, but not in young adults who were high in emotional control, $F(1,58) = 0.01$, $p = .97$, $\eta^2 = .00$. As predicted in older adults, the two-way interaction (Figure 2B) was not significant, $F(1,57) = 0.85$, $p = .77$, $\eta^2 = .00$.

An identical analysis was conducted on the speed and inaccuracy measures to examine whether the moderating effect of emotional control was exclusive to working memory or not. There was no main effect of emotional control on speed ($p = .91$), but a marginal main effect of emotional control on inaccuracy was obtained, $F(1,56) = 3.91$, $p = .05$, $\eta^2 = .06$, such that young adults with lower emotional control scores made more errors ($M = 0.04$, $SE = 0.01$) than their peers ($M = 0.02$, $SE = 0.01$). However, the two-way interaction was not significant in young adults for either inaccuracy, $F(1,56) = 1.30$, $p = .26$, $\eta^2 = .02$, or speed, $F(1,57) = 1.07$, $p = .31$, $\eta^2 = .02$. In older adults, there were

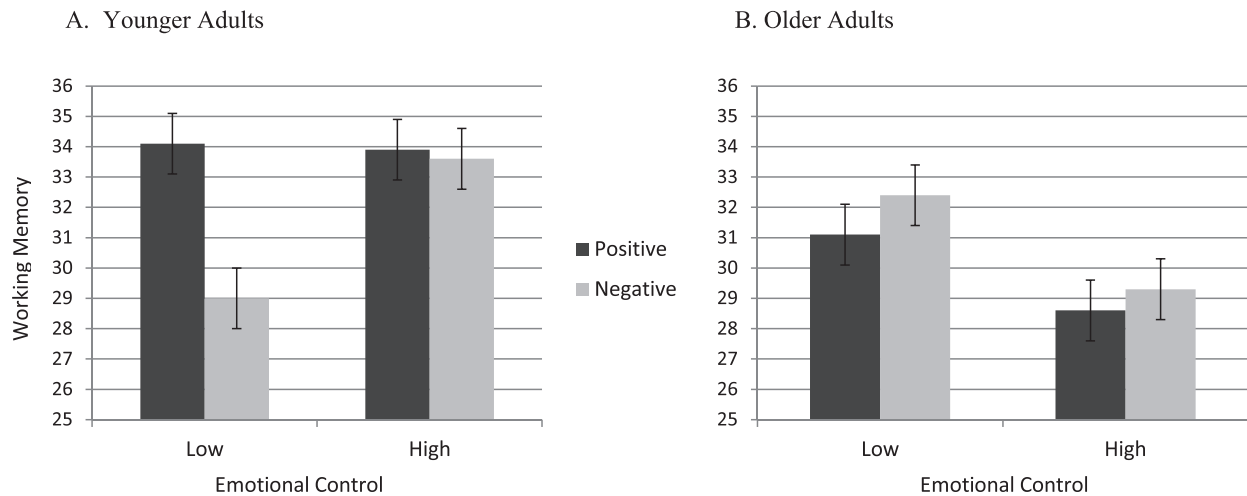


Figure 2. Working memory as a function of stereotype condition, age group, and emotional control. Error bars represent ± 1 SE.

no significant effects of emotional control on performance ($ps > .19$). Thus, these results suggest that emotion regulation tendencies moderate threat effects in younger adults, but not older adults, and that the effects are specific to working memory.

Cognitive refocusing.—Similar analyses with cognitive refocusing revealed no age differences ($p = .10$) and no significant effects relating to this factor within age groups.

Task Appraisals

We then conducted a $2 \times 2 \times 2$ repeated-measures ANOVA to examine the degree to which task appraisals (threat vs challenge) varied as a function of stereotype condition, age, and emotion control. We were interested in examining whether there were age differences in the affective responses to the task and whether these responses were moderated by regulation abilities. An Age \times Task Appraisal interaction was observed, $F(1,119) = 26.50$, $p < .001$, $\eta^2 = .18$. This reflected the fact that, relative to younger adults, older adults felt more challenge ($M = 4.60$ [$SE = 0.09$] vs $M = 4.32$ [$SE = 0.09$]), $F(1,119) = 4.59$, $p = .03$, $\eta^2 = .04$, and less threat ($M = 1.70$ [$SE = 0.09$] vs $M = 2.33$ [$SE = 0.10$]), $F(1,119) = 22.23$, $p < .001$, $\eta^2 = .16$. There was also a significant Stereotype \times Task Appraisal interaction, $F(1,119) = 4.43$, $p = .04$, $\eta^2 = .04$. Follow-up tests revealed that positively stereotyped individuals indicated more challenge ($M = 4.61$, $SE = 0.09$) than their negatively stereotyped peers ($M = 4.31$, $SE = 0.09$), $F(1,119) = 5.40$, $p = .02$, $\eta^2 = .04$. Threat appraisals, however, were unaffected by the stereotypes, $F < 1$. An Emotion Control \times Task Appraisal interaction was also observed, $F(1,119) = 6.22$, $p = .01$, $\eta^2 = .05$, but this was qualified by an Age \times Emotion Control \times Task Appraisal interaction, $F(1,119) = 4.15$, $p = .04$, $\eta^2 = .03$. Follow-up analyses revealed that younger adults with poor emotion control experienced more threat

($M = 2.71$, $SE = 0.14$) than their high emotion control counterparts ($M = 1.95$, $SE = 0.14$), $F(1,119) = 15.54$, $p < .001$, $\eta^2 = .11$, whereas older adults experienced similar levels of threat whether they were low ($M = 1.74$, $SE = 0.14$) or high ($M = 1.64$, $SE = 0.13$) in emotion control, $F < 1$.

DISCUSSION

We investigated the hypothesis that the dominant mechanism through which negative stereotypes operate to influence performance may differ between older and younger adults. Specifically, we contrasted predictions based on reductions in working memory resources (Schmader et al., 2008) versus shifts in regulatory focus (Seibt & Förster, 2004), with the expectation that the former would be more characteristic of younger adults and the latter of older adults. The results were generally supportive of our expectations.

Consistent with past research (Schmader & Johns, 2003), young adults under threat experienced decreased availability of cognitive resources, as indexed by relatively poor performance on a test of working memory. In contrast, and replicating our earlier work (Hess et al., 2009b), threat did not have an appreciable effect on older adults' working memory performance. When older adults' response to our threat manipulation was examined, their performance appeared more consistent with a regulatory focus explanation. Exposure to negative self-stereotypes was associated with a more deliberate approach to performance than observed following exposure to positive self-stereotypes, with those in the threat condition exhibiting slower performance but higher rates of accuracy. This pattern of performance suggests an induction of a prevention focus and replicates effects observed by Seibt and Förster (2004). Younger adults exhibited some aspects of behavior consistent with shifts in regulatory focus as well, but the effects were not as strong as those observed with older adults.

The absence of threat effects on working memory replicates the null findings of [Hess and colleagues \(2009b\)](#) but appears to be inconsistent with the results of [Mazerolle and colleagues \(2012\)](#). One possibility for the discrepancy in results relates to the manner in which the working memory assessment was labeled in these studies. If this task is explicitly depicted as a memory task, then assessment of the mechanisms underlying threat might be contaminated by the fact that the task is depicted as measuring the stereotyped trait. In [Hess and colleagues \(2009b\)](#) and the present study, the memory aspect of this task was not emphasized in the instructions, whereas this did not appear to be the case in [Mazerolle and colleagues \(2012\)](#), perhaps accounting for the discrepancies in findings. Support for such a contamination effect in the assessment of working memory is supported by examination of the results of [Schmader and Johns \(2003\)](#). In two separate studies, they found that performance on a working memory task was associated with stereotype threat related to mathematical ability in girls. The strength of this effect, however, was about 40% larger when the working memory assessment was explicitly linked to the negatively stereotyped skill through use of an operation span task than when a more math-neutral, word-based span test was used.

What might account for the apparent age differences in underlying mechanisms? One possibility relates to the ability to regulate emotional responses to threat. Stereotype threat implies an affective response, which as [Schmader and colleagues \(2008\)](#) have argued may lead to the diversion of processing resources to regulate threat-related feelings and thoughts. We therefore hypothesized that perhaps the ability to effectively regulate one's emotional responses may enable individuals to cope with the evaluative concerns and demands of the situation. Consistent with evidence to suggest enhanced emotion regulation abilities in later life, older adults in our study had higher levels of self-reported emotional control than did younger adults. This higher level of control may result in older adults being less likely to engage in the self-monitoring and worry-related thinking observed in younger adults. Their focus, instead, may be on adjusting their approach to the task to minimize errors in response to the negative stereotype. The age and individual differences in task appraisals, where young adults with poor emotional control perceived more threat when compared with older adults and high emotional control younger adults, also appear consistent with this interpretation. Older adults' emotional coping resources may have empowered them to approach the situation with challenge rather than threat, regardless of the stereotype condition. Such a perception of the task may have precluded the need to engage in self-regulatory efforts. Or, from a slightly different perspective, challenge responses may have actually been the outcome of successful emotion regulation efforts, if the older adults were, for instance, using reappraisal. These

possibilities seem consistent with the growing consensus that later life is characterized by enhanced emotion regulation skills and abilities ([Phillips et al., 2008](#); [Scheibe & Blanchard-Fields, 2009](#)).

If variations in emotion regulation underlie the observed age effects, it might also be expected that individual differences in such abilities in younger adults might moderate the impact of threat. In support of this assertion, we found that younger adults who were relatively low in emotional control were most susceptible to perceived threat, regardless of stereotype condition, and to threat effects on working memory. This implies that younger adults reporting more effective emotion regulatory processes may be less likely to engage in the type of counterproductive thought that negatively affects performance through the diversion of cognitive resources.

Although emotional control was found to moderate threat effects on working memory as well as threat appraisals in younger adults, another regulation factor thought to capture cognitive refocusing did not. Upon examination, refocusing appears to be reflective of cognitive strategies for coping with a negative situation, whereas control relates to the ability to act automatically on one's emotions in a demanding situation. Cognitive strategies such as refocusing are likely beneficial in situations where individuals have some time to critically evaluate the situation, to see the silver lining, and to develop a more positive perspective. In a stereotype threat context, however, the ability to automatically act on one's emotions without much contemplation may be more important for minimizing distraction while performing the current task.

LIMITATIONS AND CONCLUSIONS

Although our results are generally supportive of our hypotheses, a couple caveats should be mentioned. The first relates to the fact that different stereotype manipulations were used to induce threat in the young and older groups. It is possible that the strength and nature of threat effects across age groups might be confounded with the specific stereotype being activated. We believe that several factors mitigate this concern. First, participants in both age groups exhibited moderately high levels of identification with their stereotyped groups. In addition, the stereotype manipulations influenced cognitive performance in both groups and had similar effects on task appraisals. Finally, meta-analyses of threat effects in young and older adults ([Meisner, 2012](#); [Nguyen & Ryan, 2008](#)) have revealed similar moderate-sized effects across age groups associated with blatant threat manipulations similar to those used in the present study.

Second, although we observed interesting effects associated with our emotion regulation measures, it must be recognized that these were self-reports. Thus, caution must be exercised in extrapolating from them to actual strategies

used in our study. Objective behavioral or physiological assessments are essential for verifying our conclusions regarding the roles of regulatory behaviors.

In conclusion, the present findings provide additional insight into the processes that underlie stereotype threat effects. Our results suggest that older and younger adults may respond differently to stereotype threat, perhaps due to age-related increases in self-reported emotion regulation abilities, which in turn influences the mechanisms responsible for underperformance. Thus, emotion regulation abilities may buffer against some, but not all, of the pathways through which stereotypes impair performance. Our results also suggest that, in some cases, older adults' responses to threat reflect changes in motivation underlying performance as opposed to impairments.

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