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Original Research Report

Stereotype Threat Reduces the Positivity of Older Adults' Recall

Sarah J. Barber, PhD, Jordan Seliger, MA, Nicholas Yeh, MA, and Shyuan Ching Tan, MA

Department of Psychology, San Francisco State University, California.

Address correspondence to: Sarah J. Barber, PhD, Department of Psychology, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA 94132. E-mail: barber@sfsu.edu

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Abstract

Objectives: As people get older, they show a relative preference to remember positive information over negative information. In two experiments, we tested whether the positivity of older adults' memory is affected by stereotype threat about age-related cognitive declines. We also tested whether highlighting a positive aging stereotype (older adults are wise) would inoculate older adults from stereotype threat's adverse effects.

Method: In Experiments 1 and 2, we manipulated whether stereotypes about age-related cognitive decline were highlighted (stereotype threat) or mitigated (stereotype alleviation). In Experiment 2, we included a third condition (intervention + stereotype threat), which highlighted positive and negative aging stereotypes. Participants then saw emotionally evocative pictures and completed a memory test.

Results: In both experiments, stereotype threat selectively reduced older adults' memory for positive pictures but did not affect their memory for negative pictures. This eliminated the positivity effect (i.e., the Age × Valence interaction; Experiment 1). Our positive stereotype intervention did not reduce stereotype threat's adverse effect (Experiment 2).

Discussion: Our findings show that the positivity effect is more robust when testing situations minimize stereotype threat. They also suggest that health interventions designed to capitalize on the positivity effect should ensure that ageist stereotypes are mitigated in the environment.

Keywords: Ageism, Emotional memory, Positivity effect, Socioemotional selectivity theory, Stereotype threat

According to socioemotional selectivity theory (Carstensen, 1995, 2006), perceptions of time play a fundamental role in how people prioritize instrumental and emotional goals. Younger adults typically view their future time as expansive. Because of this, younger adults prioritize future-oriented goals such as expanding their knowledge and experiencing novel situations. In contrast, older adults typically view their future time as finite. Because of this, older adults shift their goal hierarchies to prioritize present-oriented goals such as maximizing their current emotional well-being. One way that emotional satisfaction can be maximized is by preferentially processing positive information (see Reed & Carstensen, 2012). This age-related trend, in which older adults' preferentially favor positive over negative information in attention and memory, is known as the *positivity effect* (see Mather, 2016; Mather & Carstensen, 2005).

Although a recent meta-analysis of 100 empirical studies confirmed that the positivity effect is robust and reliable (Reed, Chan, & Mikels, 2014), the goal of this current research was to examine how it is affected by *stereotype threat* about age-based cognitive decline. Stereotype threat occurs in situations where people are concerned that poor performance will confirm—either to themselves and/or to others—that a negative self-relevant stereotype is true. In response to stereotype threat, people often underperform compared with their potential (Steele & Aronson, 1995;

for a recent review, see Spencer, Logel, & Davies, 2016). For example, older adults are characterized as being forgetful and senile. When reminded of this stereotype, older adults can experience stereotype threat and underperform on memory and cognitive tasks (e.g., Hess, Auman, Colcombe, & Rahhal, 2003; Hess, Emery, & Queen, 2009; Mazerolle et al., 2017; for reviews, see Barber & Mather, 2014; Chasteen, Kang, & Remedios, 2011).

Although the processes underlying stereotype threat–related performance deficits for older adults are still debated (see Barber, 2017; Popham & Hess, 2016), multiple accounts of stereotype threat converge in predicting that that positive information, relative to negative information, will be particularly affected by stereotype threat. For example, one commonly cited theory is Schmader, Johns, and Forbes' (2008) executive control interference account. According to this framework, stereotype threat leads to evaluative concerns, stress, and negative affect. This sets in motion self-monitoring and emotion-regulation processes. However, because these processes require cognitive control resources, there are fewer resources available to devote to the critical task, and thus performance suffers. Of relevance to these studies, some research has shown that the positivity effect requires cognitive control resources (Knight et al., 2007; Mantantzis, Schlaghecken, & Maylor, 2017; Mather & Knight, 2005; but see Allard & Isaacowitz, 2008; Bohn, Kwong See, & Fung, 2016; Leal, Noche, Murray, & Yassa, 2016 for contradictory accounts). For instance, dividing attention reduces the relative positivity of older adults' recall (Mather & Knight, 2005). Thus, if stereotype threat reduces the availability of cognitive control resources, then it should preferentially reduce older adults' memory for positive, compared with negative, information.

The hypothesis that stereotype threat should preferentially reduce older adults' memory for positive information is also consistent with the regulatory focus account of stereotype threat. This account is based on Higgins' (1997) notions of promotion and prevention regulatory focus. People with a promotion focus are concerned with achieving gains and making improvements. In contrast, people with a prevention focus are concerned with avoiding losses and meeting their obligations. It has been argued that under stereotype threat people adopt a short-term prevention focus. Rather than eagerly approaching the gains that will make them their best (i.e., a promotion focus), under stereotype threat people vigilantly avoid the losses that will confirm that they are their worst (i.e., a prevention focus; Seibt & Förster, 2004). Given that prevention focus increases sensitivity to losses and is associated with a deeper level of processing for negative information (Touryan et al., 2007), this account of stereotype threat again leads to the hypothesis that threat should preferentially reduce older adults' memory for positive, compared with negative, information.

In summary, although stereotype threat is known to reduce older adults' memory for neutral information, no previous study has examined the impact of explicit stereotype threat on older adults' memory for emotional information. However, both the executive control interference and regulatory focus accounts of stereotype threat converge in their predictions. Thus, regardless of the exact processes underlying how stereotype threat affects performance, older adults' memory impairments arising from age-based stereotype threat should be greater for positive than negative information. As a result of this, age-based stereotype threat should also reduce or eliminate the positivity effect (i.e., the age by valence interaction in which older adults' memory is relatively more positive and/or less negative younger adults' memory).

Experiment 1

Design

A 2 (Age group: Younger adult or Older adult) × 2 (Stereotype condition: Alleviation or Threat) × 2 (Picture valence: Positive or Negative) design was used. Age group and stereotype condition were between-subject factors, and picture valence was manipulated within-subject factors.

Participants

Participants in this study were 56 younger adults and 53 older adults. The older adult participants were recruited from local senior centers, from classes offered through the Osher Lifelong Learning Institute at San Francisco State University, and from a database of individuals who had previously expressed interest in volunteering for studies related to aging issues. The younger adult participants were recruited through San Francisco State University's psychology SONA participant pool. On completion of the study, participants were compensated with either $5 in cash or with credits toward their psychology course requirements. From our initial sample, we excluded data from the four participants (one younger adult and three older adults) who scored less than 26 on the Mini–Mental State Exam (MMSE; Folstein, Folstein, & McHugh, 1975). On debriefing, one older adult participant from the stereotype threat group withdrew consent for her data to be used. This left a final sample size of 55 younger adults (aged 18–31, *M* age = 22.53, 47% female) and 49 older adults (aged 57–88, *M* age = 73.33, 33% female). Within this final sample, the older adults had completed significantly more years of education ($M = 16.48$) than the younger adults ($M = 15.11$), $t(102) = 3.29$, $p = .001$. Participants in the two age groups did not significantly differ in their self-rated health, $t(102) = 0.92$, $p = .36$, or quality of life, $t(102) = 1.91$, $p = .059$. For more demographic details as a function of age group and stereotype condition, see Table 1.

Materials

A total of 30 pictures (15 positive and 15 negative) from the International Affective Picture System (IAPS;

Lang, Bradley, & Cuthbert, 2008) served as the critical stimuli. (IAPS numbers for the positive critical pictures: 1710, 1750, 2260, 2340, 2360, 2370, 2550, 5001, 5260, 5470, 5621, 5660, 5831, 7480, 8370. IAPS numbers for the negative critical pictures: 2205, 2490, 2590, 2691, 2750, 6560, 7359, 9050, 9220, 9340, 9415, 9470, 9560, 9630, 9810.) Based on the published normative data, the selected positive and negative pictures differed in their IAPS scores of emotional valence, $t(28) = 31.13$, $p < .001$, $d = 11.37$, but not in their IAPS scores of emotional arousal, $t(28) = -0.86$, $p = .40$, $d = -0.31$. An additional four neutrally valenced pictures (IAPS numbers: 7090, 7100, 7130, and 7150) were used to buffer against primacy and recency effects.

Procedure

At the beginning of the study, all participants were told that they would be completing an emotional memory test. However, prior to encoding, we manipulated whether stereotypes about age-based cognitive decline were disputed or confirmed. Participants were randomly assigned to receive either stereotype alleviation or stereotype threat instructions. More specifically, participants assigned to the stereotype alleviation condition read the following: "In general, older adults do not tend to do as well as younger adults on memory tests. However, that is not true for this particular memory test. On this picture memory test, older adults always do as well as younger adults." In contrast, participants in the stereotype threat condition read: "In general, older adults do not tend to do as well as younger adults on memory tests. In the current study, we are testing whether this age difference occurs for this particular memory test." On the computer screen, all participants then saw a series of 34 pictures (2 primacy buffers, 30 critical, 2 recency buffers) and were asked to study them in preparation for a memory test. Each picture was shown for 4 s. Order of the positive and negative critical pictures was randomized, but the same random order was used for all participants.

Immediately after viewing the pictures, participants completed a self-paced free recall test. This test began by restating the instructions just described (i.e., that the test was age-fair or that it was designed to examine age differences in memory). In the stereotype threat condition, participants were also asked to list their age prior to beginning the free recall test. However, due to experimenter error, one older adult participant in the stereotype threat condition was not asked to list her age prior to starting the memory test. Participants then wrote descriptions of each picture that they recalled. Participants were instructed that their descriptions could be short but must contain enough details for an independent reader to match it to one of the studied pictures (for similar procedures, see Barber, Castrellon, Opitz, & Mather, 2017; Barber, Opitz, Martins, Sakaki, & Mather, 2016; Charles, Mather, & Carstensen, 2003). Following picture recall, all participants completed a demographic questionnaire and we administered the MMSE (Folstein et al., 1975).

Recall Test Scoring

A primary coder (S.B.) scored whether or not each free recall written response matched one of the studied pictures. A second coder (J.S.) independently scored all of the older

Table 1. Experiment 1 Participant Demographic Characteristics as a Function of Age Group and Stereotype Group

	Younger adults		Older adults	
	Stereotype alleviation ($n = 28$)	Stereotype threat ($n = 27$)	Stereotype alleviation ($n = 24$)	Stereotype threat ($n = 25$)
Age (years)	22.18 (2.87)	22.89 (2.89)	72.42 (6.72)	72.24 (7.10)
Gender	24 women	23 women	18 women	15 women
	4 men	4 men	6 men	10 men
Ethnicity	12 Hispanic	8 Hispanic	2 Hispanic	1 Hispanic
	13 Non-Hispanic	18 Non-Hispanic	19 Non-Hispanic	22 Non-Hispanic
	1 declined to state	1 declined to state	3 declined to state	2 declined to state
Race	7 Caucasian	7 Caucasian	18 Caucasian	18 Caucasian
	5 Asian	6 Asian	3 Asian	4 Asian
	2 African American	3 African American	0 African American	0 African American
	2 Biracial/Multiracial	6 Biracial/Multiracial	1 Biracial/Multiracial	1 Biracial/Multiracial
	7 "Other"	5 "Other"	2 "Other"	0 "Other"
	5 declined to state	0 declined to state	0 declined to state	2 declined to state
Education (years)	14.93 (1.12)	15.30 (0.72)	16.40 (2.49)	16.56 (3.33)
Self-rated health	3.64 (0.68)	3.81 (0.88)	3.88 (0.95)	3.88 (0.83)
Self-rated quality of life	5.18 (1.06)	5.41 (1.12)	5.54 (1.35)	5.92 (1.22)
MMSE score	28.96 (1.00)	28.89 (0.89)	28.54 (1.14)	28.40 (1.26)

Note: MMSE = Mini–Mental State Exam. Numbers in parentheses represent *SD*. Self-rated health was answered on a 1 (poor) to 5 (excellent) scale. Self-rated quality of life was answered on a 1 (very poor) to 7 (excellent) scale.

adult participants' responses; there was 98.86% agreement with the primary coder. A third coder (K.T.) independently scored all of the younger adult participants' responses; there was 97.64% agreement with the primary coder. Scores from the primary coder were used in all subsequent analyses. Only 37 of the 1,243 written responses could not be matched by the primary coder to a specific picture; the majority of these were descriptions that were too general to match to any one picture (e.g., "*water*" or "*friends*"). The distribution of unmatched responses did not vary as a function of age group or stereotype group: 8 responses came from older adults in the stereotype alleviation group, 9 responses from older adults in the stereotype threat group, 6 responses from younger adults in the stereotype alleviation group, and 13 responses from younger adults in the stereotype threat group.

Results and Discussion

We hypothesized that older adults' memory impairments arising from age-based stereotype threat would be greater for positive information than negative information and that this in turn would reduce or eliminate the positivity effect in recall (i.e., the Age × Valence interaction in which older adults' memory is relatively more positive and/or less negative as compared to younger adults' memory). To evaluate these predictions, we first conducted a 2 (Age group) × 2 (Stereotype condition) × 2 (Picture valence) analysis of variance (ANOVA) on the proportion of critical pictures recalled (buffer pictures were excluded from all analyses). Within this analysis, there were only three significant effects. First, there was a main effect of age group, $F(1, 100) = 5.41$, $MSE = 0.03$, $p = .022$, $\eta_p^2 = 0.051$, which reflected the fact that younger adults had higher recall than older adults. Second, there was an interaction between age group and picture valence, $F(1, 100) = 5.25$, $MSE = 0.01$, $p = .024$, $\eta_p^2 = 0.050$. This replicates the standard positivity effect. However, these previous effects were qualified by a significant three-way interaction between age group, stereotype condition, and picture valence, $F(1, 100) = 4.33$, $MSE = 0.01$, $p = .040$, $\eta_p^2 = 0.041$ (see Figure 1).

To decompose this three-way interaction, we next examined how our stereotype condition manipulation affected both the younger and the older adults. Looking first at the younger adults, we conducted a 2 (Stereotype condition) × 2 (Picture valence) ANOVA on the proportion of critical pictures recalled. Within this analysis, there was a significant main effect of picture valence, $F(1, 53) = 5.97$, $MSE = 0.01$, $p = .018$, $\eta_p^2 = 0.101$. This reflected the fact that younger adults had higher recall of the negative pictures (stereotype threat: $M = 0.40$, $SD = 0.18$; stereotype alleviation: $M = 0.39$, $SD = 0.13$) than of the positive pictures (stereotype threat: $M = 0.37$, $SD = 0.14$; stereotype alleviation: $M = 0.32$, $SD = 0.12$). However, younger adults' memory was not affected by our stereotype manipulation. There was no significant main effect of stereotype condition, $F(1, 53) = 0.60$, $MSE = 0.03$, $p = .442$, $\eta_p^2 = 0.011$, and no significant interaction between stereotype condition and picture valence, $F(1, 53) = 0.88$, $MSE = 0.01$, $p = .352$, $\eta_p^2 = 0.016$.

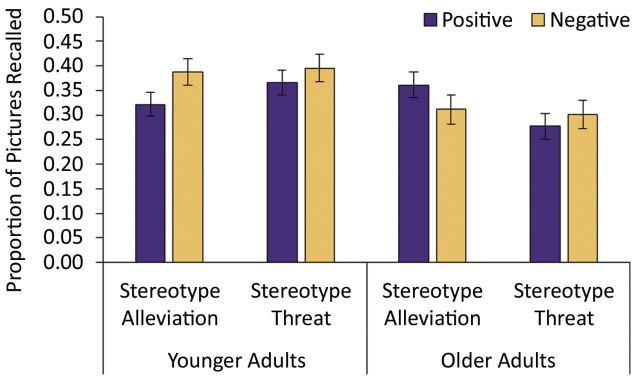

Figure 1. Mean proportion of pictures recalled as a function of age group, stereotype group, and picture valence. Error bars represent *SEM*.

Having established that the younger adults' memory was not affected by our stereotype manipulation, we next examined its impact on the older adult participants' memory performance. Novel to this study, we found that the detrimental effect of stereotype threat on older adults' memory was valence specific. Within a 2 (Stereotype condition) × 2 (Picture valence) ANOVA on the proportion of critical pictures recalled by the older adult participants, there was no significant main effect of stereotype condition, $F(1, 47) = 1.95$, $MSE = 0.03$, $p = .169$, $\eta_p^2 = 0.040$, or picture valence, $F(1, 47) = 0.55$, $MSE = 0.01$, $p = .464$, $\eta_p^2 = 0.011$. However, consistent with our predictions, there was a significant interaction between stereotype condition and picture valence, $F(1, 47) = 4.43$, $MSE = 0.01$, $p = .041$, $\eta_p^2 = 0.086$. Follow-up independent-sample t tests showed that older adults in the stereotype threat condition recalled significantly fewer positive pictures ($M = 0.28$, $SD = 0.13$) than older adults in the stereotype alleviation condition ($M = 0.36$, $SD = 0.14$), $t(47) = -2.20$, $p = .032$, $d = -0.375$. However, older adults in the stereotype threat and stereotype alleviation conditions did not significantly differ in their recall of the negative pictures (stereotype threat: $M = 0.30$, $SD = 0.15$; stereotype alleviation: $M = 0.31$, $SD = 0.11$), $t(47) = -0.26$, $p = .796$.

Because the effects of our stereotype manipulation were age and valence specific, it also affected the likelihood that a positivity effect was observed. Looking first at participants in the stereotype alleviation condition, we conducted a 2 (Age group) × 2 (Picture valence) ANOVA on the proportion of critical pictures recalled. Within this analysis, there was no significant main effect of either age group, $F(1, 50) = 0.37$, $MSE = 0.02$, $p = .546$, $\eta_p^2 = 0.007$, or picture valence, $F(1, 50) = 0.27$, $MSE = 0.01$, $p = .607$, $\eta_p^2 = 0.005$. However, there was a significant interaction between age group and picture valence, $F(1, 50) = 13.15$, $MSE = 0.01$, $p = .001$, $\eta_p^2 = 0.208$. Follow-up independent t tests showed that after receiving stereotype alleviation

instructions, older adults recalled significantly fewer negative pictures (M = 0.31) than the younger adults (M = 0.39), $t(50) = -2.34$, $p = .023$, $d = -0.655$. However, recall of the positive pictures did not significantly differ between the older and younger adults (M = 0.36 and M = 0.32, respectively), $t(50) = 1.09$, $p = .280$. Thus, a positivity effect emerged when participants received the stereotype alleviation test instructions.

However, a different pattern of results was obtained when examining participants who received the stereotype threat test instructions. In a 2 (Age group) × 2 (Picture valence) ANOVA on the proportion of critical pictures recalled by participants in the stereotype threat conditions, we observed only a significant main effect of age group, $F(1, 50) = 6.49$, $MSE = 0.03$, $p = .014$, $\eta_p^2 = 0.115$. Within this analysis, there was no significant effect of picture valence, $F(1, 50) = 1.59$, $MSE = 0.01$, $p = .213$, $\eta_p^2 = 0.031$, and no significant interaction between age group and picture valence, $F(1, 50) = 0.02$, $MSE = 0.01$, $p = .895$, $\eta_p^2 < .001$. Follow-up independent t tests showed that after receiving stereotype threat instructions, older adults recalled significantly fewer negative pictures (M = 0.30) than the younger adults (M = 0.40), $t(50) = -2.03$, $p = .048$, $d = -0.565$. They also recalled significantly fewer positive pictures (M = 0.28) than the younger adults (M = 0.37), $t(50) = -2.43$, $p = .019$, $d = -0.675$.

In summary, the results of Experiment 1 supported our hypotheses. Age-based stereotype threat significantly impaired older adults' memory for the positive pictures but did not significantly affect their memory for the negative pictures. In contrast, there was no effect of the stereotype manipulation on younger adults' memory. This was expected because the stereotype was not relevant to them. Because the effects of age-based stereotype threat were both age and valence specific, it also affected the likelihood of observing a positivity effect (i.e., an interaction between age and valence). Although a positivity effect was observed when participants received the stereotype alleviation instructions, it was eliminated when participants received the stereotype threat instructions. This result adds to our understanding about when the positivity effect is most likely to be observed. In a prior meta-analysis, it was reported that the positivity effect is most likely to emerge when processing is unconstrained and when there is a large age gap between the younger and older adult participants (Reed et al., 2014). Adding to this, our study suggests that the positivity effect is most likely to be observed when stereotype threat is reduced.

Experiment 2

In Experiment 2, we had two goals. The first was to demonstrate the replicability of the key Experiment 1 finding (i.e., that age-based stereotype threat selectively reduces older adults' memory for positive pictures as compared to negative pictures). Although replications have traditionally been rare occurrences (Makel, Plucker, & Hegarty, 2012), there is an increased acknowledgement of their importance (see Asendorpf et al., 2013; Earp & Trafimow, 2015; Schmidt, 2009). To this end, we undertook a direct replication of our key Experiment 1 effect.

Our second goal was to test whether age-based stereotype threat can be removed by reminding older adults of a positive aging stereotype, namely that aging brings wisdom (e.g., Hummert, 1990). Although wisdom is multifaceted (e.g., Baltes & Staudinger, 2000), cognitive expertise is a necessary (but not sufficient) quality for obtaining it. Likewise, declines in working memory or senility may lead to the loss of wisdom (see Baltes & Staudinger, 2000; Jeste et al., 2010). Thus, if an older adult is respected for their wisdom, it implies an absence of senility or severe memory declines. We reasoned that highlighting this positive stereotype (older adults are wise) may attenuate concerns about a negative age stereotype (older adults are senile). Supporting this, some prior research with younger adults has shown that activating a positive stereotype (which is both self-relevant and domain-relevant) can eliminate the adverse effects of stereotype threat (Rydell & Boucher, 2010; Rydell, McConnell, & Beilock, 2009). These prior studies have focused on the adverse effects of gender-based stereotypes (i.e., women are bad at math) in affecting undergraduate women's math performance. When this negative gender stereotype is made salient, women tend to experience stereotype threat and underperform on math tests. However, this adverse effect is eliminated when a positive stereotype is simultaneously activated (i.e., that college students are good at math).

Design

A 3 (Stereotype condition: Alleviation or Threat or Intervention + Threat) × 2 (Picture valence: Positive or Negative) design was used. Stereotype condition was manipulated between subjects, whereas picture valence was manipulated within subjects.

Participants

Participants were 90 older adults who ranged in age from 60 to 79 (M age = 70.07). Within this sample, there were 50 women and 40 men. They had completed an average of 15.61 years of education and all scored 26 or higher on the MMSE. For more demographic details as a function of stereotype condition, see Table 2. The participants were recruited from a list of volunteers from the San Francisco area who had previously expressed interest in participating in research studies related to aging issues.

Procedure

At the beginning of the study, all participants completed the emotional memory test that was used in Experiment 1. Instructions for this test varied as a function of stereotype group. For participants randomly assigned to the

stereotype alleviation and stereotype threat groups, the instructions and procedures were identical to those used in Experiment 1. New to this study, participant in the intervention + stereotype threat first read the following prompt:

> Old age can bring wisdom. As people get older, they accumulate a lifetime of experiences. This allows older people to make better practical decisions and increase their emotional well-being. By taking the time to reflect upon their knowledge, older people are often more successful in navigating the important challenges of social life. As "experts" on living, older adults are a valuable source of advice for the younger generations.

After reading this prompt, participants in the intervention + stereotype threat group received the same instructions as participants in the stereotype threat group; they were told that older adults do not tend to do as well as younger adults on memory tests and that the goal of the current study was to examine whether this age difference would occur in memory for pictures. As in the stereotype threat group, these participants were also asked to list their age prior to beginning the free recall test.

Following picture recall, participants next completed the 30-item Fear of Alzheimer's Disease Scale, which consists of three subscales: General Fear, Physical Symptoms, and Catastrophic Attitudes (French, Floyd, Wilkins, & Osato, 2012). For demographic characteristics as a function of stereotype group, see Table 2. Participants also completed a demographics questionnaire and the MMSE (Folstein et al., 1975). Participants were also asked to provide a saliva sample, which was subsequently used in genotype analyses. However, these analyses will not be discussed further here. On completion of the study, participants were compensated at a rate of $15/hr.

Recall Test Scoring

Two coders (S.B. and J.S.) independently scored whether or not each free recall written response matched one of the studied pictures. There was 98.18% agreement between the coders. Scores from the primary coder (S.B.) were used in all subsequent analyses. Only 32 of the 1,264 written responses were not matched by the primary coder to a specific picture. These tended to be general descriptions that could pertain to multiple pictures (e.g., "*family*"). The distribution of responses that could not be matched to specific pictures did not vary as a function of stereotype group: 12 came from participants in the stereotype alleviation group, 10 from the stereotype threat group, and 10 from the intervention + stereotype threat group.

Results and Discussion

There were two aims to this study. First, we aimed to replicate the Experiment 1 finding that older adults' memory impairments arising from age-based stereotype threat would be greater for positive information than negative information. Second, we tested the efficacy of a wisdom intervention in ameliorating this deficit. To evaluate these aims, we conducted a 3 (Stereotype condition) × 2 (Picture valence) ANOVA on the proportion of critical pictures

Table 2. Experiment 2 Participant Demographic Characteristics as a Function of Stereotype Group

	Stereotype alleviation (n = 30)	Stereotype threat (n = 30)	Intervention + stereotype threat (n = 30)
Age (years)	70.17 (4.62)	70.27 (4.41)	69.78 (5.08)
Gender	14 women, 16 men	17 women, 13 men	19 women, 11 men
Ethnicity	1 Hispanic	0 Hispanic	0 Hispanic
	29 Non-Hispanic	30 Non-Hispanic	29 Non-Hispanic
	0 declined to state	0 declined to state	1 declined to state
Race	23 Caucasian	22 Caucasian	23 Caucasian
	5 Asian	5 Asian	6 Asian
	0 African American	1 African American	0 African American
	0 Biracial/Multiracial	1 Biracial/Multiracial	1 Biracial/Multiracial
	1 "Other"	1 "Other"	0 "Other"
	1 declined to state	0 declined to state	0 declined to state
Education (years)	15.40 (5.95)	17.20 (2.04)	14.36 (7.16)
Self-rated health	7.43 (0.97)	7.98 (0.95)	7.72 (0.85)
Fear of AD: General fear	38.47 (11.15)	36.43 (10.97)	37.80 (13.55)
Fear of AD: Physical symptoms	8.90 (2.01)	9.53 (2.60)	9.13 (2.96)
Fear of AD: Catastrophic attitude	11.77 (4.55)	14.07 (5.39)	13.03 (5.46)
MMSE score	29.20 (1.54)	28.97 (0.81)	28.37 (1.03)

Note: MMSE = Mini–Mental State Exam. Numbers in parentheses represent *SD*. Self-rated health was answered on a 1 (poor) to 9 (excellent) scale. One participant in the stereotype threat condition did not provide self-rated health.

recalled (buffer pictures were excluded from all analyses). Within this analysis, there was no main effect of stereotype condition, $F(1, 87) = 1.42$, $MSE = 0.03$, $p = .247$, $\eta_p^2 = 0.032$. However, there was a main effect of valence, $F(1, 87) = 16.67$, $MSE = 0.01$, $p < .001$, $\eta_p^2 = 0.161$, which was driven by the fact that participants tended to recall more of the negative pictures than the positive pictures. Importantly, the main effect of picture valence was qualified by its significant interaction with stereotype condition, $F(2, 87) = 3.95$, $MSE = 0.01$, $p = .023$, $\eta_p^2 = 0.083$.

To decompose this interaction, we next examined whether our three stereotype groups significantly differed in their recall of either negative or positive pictures. Looking first at memory for the negative pictures, a single-factor (Stereotype condition) ANOVA showed no significant group differences, $F(2, 87) = 0.10$, $MSE = 0.02$, $p = .907$, $\eta_p^2 = 0.002$. As shown in Figure 2, participants in the three conditions performed equivalently in their memory for the negative pictures (stereotype alleviation: $M = 0.44$, $SD = 0.11$, stereotype threat: $M = 0.43$, $SD = 0.18$ intervention + stereotype threat: $M = 0.45$, $SD = 0.11$). However, a different pattern was observed for memory of the positive pictures. In a single-factor (Stereotype condition) ANOVA, there was a significant effect of stereotype condition, $F(2, 87) = 4.48$, $MSE = 0.02$, $p = .014$, $\eta_p^2 = 0.093$. Follow-up independent-sample t tests showed that participants in the stereotype alleviation condition recalled significantly more positive pictures ($M = 0.43$, $SD = 0.15$) than participants in both the stereotype threat condition ($M = 0.36$, $SD = 0.11$), $t(58) = 2.09$, $p = .041$, $d = 0.539$, and the intervention + stereotype threat condition ($M = 0.33$, $SD = 0.13$), $t(58) = -2.72$, $p = .009$, $d = 0.702$. There was no significant difference in recall of positive pictures between participants in the stereotype threat and intervention + stereotype threat conditions, $t(58) = 0.86$, $p = .395$.

In summary, these results replicate the pattern reported for the older adult participants in Experiment 1. As shown in Figure 2, the effects of age-based stereotype threat about cognitive decline were valence specific. Stereotype threat impaired older adults' memory for positive pictures but did not affect their memory for the negative pictures. However, because Experiment 2 did not include younger adults, these results cannot directly address the impact of stereotype threat on the positivity effect, which is defined as an interaction between age and valence.

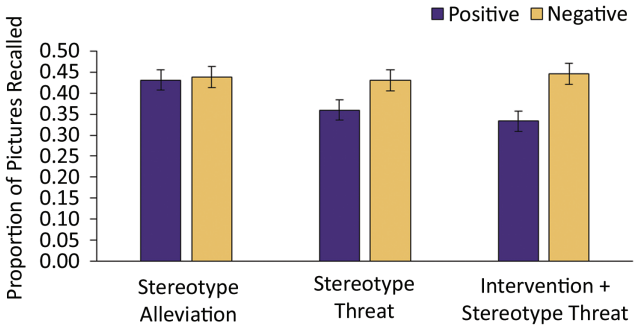

Figure 2. Mean proportion of pictures recalled by older adult participants as a function of stereotype group and picture valence. Error bars represent *SEM*.

Results of Experiment 2 also showed that our intervention was not effective. In fact, the adverse effects of stereotype threat on memory for negative pictures were numerically strongest in this condition. This has some similarities to younger adult studies showing that making salient positive stereotypes salient can sometimes lead to "choking" under the pressure of high expectations (e.g., Cheryan & Bodenhausen, 2000). It is also possible that our positive stereotype intervention was ineffective because it highlighted a positive stereotype (i.e., older adults are wise) that pertained to the same self-identify as the negative stereotype (i.e., older adults are senile). This is in contrast to the prior studies by Rydell and colleagues, in which the highlighted positive stereotype (i.e., college students are good at math) pertained to a different self-identity than the negative stereotype (i.e., women are bad at math). As described in the Multiple Self-Aspects Framework (McConnell, 2011), a person's self-concept is a collection of multiple, context-dependent selves, which can be organized in a network of distributed nodes. For instance, people can think of themselves in terms of their social roles (e.g., husband or mother), gender identity, racial/ethnic identity, occupational roles, religious affiliations, political affiliations, and so on. The extent to which any of these selves is activated depends on the context. However, activating any one aspect of the self-concept (e.g., college student) should temporarily suppress accessibility of other aspects of the self-concept (e.g., woman). Consistent with this, Rydell and colleagues (2009) found that their positive stereotype intervention (i.e., women are good at math) increased the accessibility of women's college student self-identity while simultaneously inhibiting the accessibility of their gender identity. Thus, positive stereotype interventions may only be effective when they highlight a different aspect of the self-identity than the one implicated in the negative stereotype. Future research is needed to test this hypothesis.

General Discussion

Older adults are often stereotyped as being hopeless, despondent, and depressed. However, old age is often associated with enhanced emotional well-being. As people get older, they tend to become emotionally more positive and less negative (see Charles & Carstensen, 2010). They also tend to display positivity effects by preferentially favoring positive over negative information in attention and memory (see Mather, 2016). Although positivity effects are reliable and robust (Reed et al., 2014), the current results suggest that they are less likely to appear in the presence of ageist stereotypes. Across two experiments, we found that when the testing situation emphasized age-related cognitive declines, older adults recalled fewer positive pictures.

In contrast, stereotype threat did not significantly affect older adults' recall of the negative pictures. In Experiment 1, we also found that stereotype threat did not affect younger adults' recall of either positive or negative picture. Because of this, the positivity effect in Experiment 1 (which is defined as an interaction between age and valence) was only present in our stereotype alleviation condition and was absent in our stereotype threat condition.

The fact that stereotype threat preferentially reduced older adults' recall of positive, relative to negative, pictures is consistent with both the theory that stereotype threat reduces the availability of cognitive control resources (Schmader et al., 2008) and the theory that stereotype threat induces a prevention regulatory focus (Seibt & Förster, 2004). Because these two accounts converged in their predictions, in the current studies we did not attempt to disentangle them or identify their relative contributions to these effects. Although prior results from our lab have tended to support the regulatory focus account (see Barber, 2017), future research should examine this issue within the context of emotional memory, for example, by including measures of cognitive control and regulatory focus or by varying the tasks' reward structure.

There are also limitations that will need to be addressed in future research. For instance, in the current studies we did not include a control condition. Rather, our memory test instructions were designed to either amplify or alleviate older adults' performance concerns about age-related memory decline. This was done to clearly separate the amount of threat experienced across the conditions. However, it leaves open the question of whether our stereotype threat instructions decreased the positivity of older adults' recall, whether the stereotype alleviation instructions increased the positivity of older adults' recall, or whether both effects simultaneously occurred. Although some prior research has suggested that older adults' memory performance is statistically similar in control and alleviation conditions (see Hess et al., 2003), future research is needed to test this within the context of emotional memory performance. Another limitation is that we limited our critical stimuli to positive and negative pictures. However, in a previous study by Krendl, Ambady, and Kensinger (2015), subliminally priming older adults with ageist stereotypes selectively increased false alarms to neutral words, but not to positive or negative emotional words. Although the processes underlying subliminal priming differ from those underlying stereotype threat (see Barber & Mather, 2014), it is possible that stereotype threat–related memory impairments for older adults may also be greatest for neutral, compared with emotional, information.

In the current studies we also used a blatant manipulation of stereotype threat. It is unclear whether a more subtle manipulation would have changed the magnitude of our results. One meta-analysis examined age based stereotype threat effects across multiple performance domains and found smaller effects sizes when blatant, rather than subtle, manipulations were used (Lamont, Swift, & Abrams, 2015). However, a more recent meta-analysis found that within the domain of episodic memory there were larger effect sizes when blatant manipulations were used as compared to when subtle manipulations were used (Armstrong, Gallant, Li, Patel, & Wong, 2017). Future research is needed that more directly examines how these methodological variations affect the magnitude of age based stereotype threat effects.

We also did not include assessments of mood, anxiety, or arousal. However, we do note that changes in affective responding cannot readily account for the observed effects. Prior studies have shown that older adults tend to engage in mood-incongruent processing; they attend more to positive pictures when in a negative mood state (Isaacowitz, Toner, Goren, & Wilson, 2008; Isaacowitz, Toner, & Neupert, 2009; for a review, see Isaacowitz, 2012). Thus, if stereotype threat induced a negative mood, older adults would probably have responded by increasing the amount of attention paid toward the positive stimuli. Presumably, this would have increased (rather than decreased) the positivity of their recall.

More generally, the conclusion that ageist stereotypes can selectively reduce the memorability of positive information for older adults has important implications for health interventions. Capitalizing on the robust nature of the positivity effect, health interventions for older adults often use positively framed, rather than negatively framed, messages (see Reed & Carstensen, 2015). However, some older adults report feeling concerned that their health care provider was negatively evaluating them because of their age (Abdou, Fingerhut, Jackson, & Wheaton, 2016; Phibbs & Hooker, 2017). Because of this, the current results suggest that positively framed messages may not be beneficial in promoting the desired health changes. To best capitalize on the positivity effect, testing/intervention environments should aim to mitigate older adults' concerns about ageist evaluations and stereotypes.

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Conflict of Interest

None reported.

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