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Stereotype threat can enhance, as well as impair, older adults' memory

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Abstract

Negative stereotypes about aging can impair older adults' memory; however, the mechanisms underlying this are unclear. In two experiments we tested competing predictions derived from two theoretical accounts: executive control interference and regulatory fit. Older adults completed a working memory test either under stereotype threat about their memory or not. Monetary incentives were manipulated such that recall either led to gains or forgetting led to losses. The executive control interference account predicts that threat decreases the availability of executive control resources and hence should impair working memory performance. The regulatory fit account predicts that threat induces a prevention focus. Because of this threat should impair performance when gains are emphasized but improve performance when losses are emphasized. Results were only consistent with the regulatory fit account. Although stereotype threat significantly *impaired* older adults' working memory performance when remembering led to gains, it significantly *improved* performance when forgetting led to losses.

Keywords

stereotype threat; aging; memory; regulatory fit; executive control

People often associate getting older with becoming forgetful, incompetent, and senile (Kite & Johnson, 1988). Although research reveals clear age-related declines in memory functioning (see Hedden & Gabrieli, 2004), negative expectations about aging can exacerbate these deficits via *stereotype threat*. Stereotype threat is a disruptive concern that occurs when people know that poor performance on their part will confirm a negative self-relevant stereotype (Steele, 1997). Problematically, in response to this people underperform compared to their potential, thereby confirming the stereotype. For example, when older adults are confronted with negative stereotypes about age-related cognitive declines they underperform on memory tests (for a review, see Barber & Mather, in press). These stereotype threat-related memory impairments have serious clinical implications. In one study 70% of older adults scored below the clinical cut-off for dementia on a cognitive test

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when assessed under stereotype threat, compared to approximately 14% when not assessed under threat (Haslam, Morton, Haslam, Varnes, Graham, & Gamaz, 2012).

Although it is clear that stereotype threat can negatively impact older adults' memory, it is less clear why this occurs. In the current experiments we test predictions derived from two theoretical accounts of stereotype threat: regulatory fit and executive control interference. Described in more depth below, these accounts are often complementary and lead to similar predicted outcomes. However, to differentiate between them, we examined a situation in which they lead to competing predictions.

The role of regulatory fit

According to regulatory focus theory, people differ in how they pursue goals. People with a promotion focus are concerned with the presence or absence of gains whereas people with a prevention focus are concerned with the presence or absence of losses (Higgins, 1997; 1999). Although people differ in their chronic focus, acute variations within a person can occur (e.g., Freitas & Higgins, 2002; Higgins 1997). That is, situations can determine whether people are in a promotion or prevention state (e.g., Shah, Higgins, & Friedman, 1998). One such situation may be stereotype threat. In particular, stereotype threat is proposed to invoke a prevention focus whereby people become increasingly sensitive to the presence or absence of losses within their environment (Seibt & Förster, 2004).

Situational fluctuations in regulatory focus can in turn affect task performance. People tend to do better at tasks when their current regulatory state matches the tasks' reward structure, i.e., when there is *regulatory fit*. People with a promotion focus do better on tasks that emphasize gains whereas people with a prevention focus do better on tasks that emphasize losses (Maddox, Baldwin, & Markman, 2006; Shah, et al., 1998). Problematically, most stereotype threat research has assessed performance on gains-based tasks (e.g., how many hits were gained?) rather than on losses-based tasks (e.g., how many false alarms were avoided?). Thus, stereotype threat impairments in previous studies may have been due to the poor fit between the task and the threat-induced prevention focus rather than to overall impaired ability to perform (Grimm, Markman, Maddox, & Baldwin, 2009).

The regulatory fit account has not been tested in older adults, but is supported by research with younger adults. When younger adults are primed with negative stereotypes their self-reported levels of prevention focus increase (Seibt & Förster, 2004). Furthermore, for younger adults, stereotype threat effects disappear, and sometimes even reverse, when the task has a losses-based structure rather than a gains-based structure (Grimm, et al., 2009).

The role of executive control interference

Although the regulatory fit account has been supported in younger adults, across previous studies there are additional affective, cognitive, and motivational factors have also been implicated in modulating younger adults' stereotype threat effects. To reconcile these results, it has been proposed that *executive control interference* is the common distal mediator linking these aforementioned factors (Schmader, Johns, & Forbes, 2008). More specifically, stereotype threat is thought to induce physiological stress and to create negative

mood states that people try to suppress. Stereotype threat is also thought to increase task-monitoring, in part because of the induced prevention regulatory focus described above. Together, these factors place demands on the executive control component of working memory. This in turn leaves fewer executive control resources available to perform the critical task.

In younger adults, there is direct evidence in support of this account (e.g., Beilock, Rydell, & McConnell, 2007; Rydell, McConnell, & Beilock, 2009; Schmader & Johns, 2003; Schmader, et al., 2008). For example, younger adults' performance on a working memory task is impaired when under stereotype threat, or when measured subsequent to a task in which they experienced stereotype threat (Johns, Inzlicht, & Schmader, 2008; Schmader & Johns, 2003). Similarly, younger adults with high working memory capacities are less likely to exhibit stereotype threat effects than those with low working memory capacities (Régner, Smeding, Gimmig, Thinus-Blanc, Monteil, & Hugert, 2010). This is presumably because high capacity individuals have sufficient resources available to perform the critical task, even after experiencing declines in working memory resources as a function of stereotype threat.

Although executive control interference is generally accepted as the key factor underlying threat in younger adults, evidence has been mixed in older adults. In favor of this account, stereotype threat preferentially decreases older adults' ability to use controlled memory processes, which more heavily rely upon executive control resources (Mazerolle, Régner, Morisset, Rigalleau, & Huguet, 2012). However, counter to this account, performance on working memory measures are not impaired under stereotype threat for older adults (Hess, Hinson, & Hodges, 2009), unless they are described as a test of memory abilities (Mazerolle, et al., 2012; see also Abrams, Eller, & Bryant, 2006; Desrichard & Kopetz, 2005). The failure of stereotype threat to uniformly impair working memory (irrespective of how it is described) is problematic for the executive control interference account.

Overview of the current experiments

Across two experiments, we tested the roles of regulatory fit and executive control interference in modulating older adults' memory performance under stereotype threat. To do so, older adults completed a working memory task either under stereotype threat about their memory abilities or not. We also manipulated the reward structure of the working memory test. For half of the participants we used a gains-based reward structure. These participants received a monetary reward for each word recalled. For the remaining participants we used a losses-based reward structure. These participants lost part of an initial monetary payment for each word forgotten.

The regulatory fit account predicts that threat should induce a prevention focus and hence impair performance when gains are emphasized. In contrast, this effect should be eliminated, and perhaps even reversed, when losses are emphasized (i.e., when there is regulatory fit). In contrast, the executive control interference account predicts that threat diverts executive control resources away from the critical task (in part because of an induced prevention focus). Because of this, threat should impair working memory performance. Furthermore,

the executive control interference account predicts that this deficit should be greater for individuals with low, compared with high, baseline working memory abilities, as those with low baseline abilities should be less able to withstand interference from the threat-related processing (e.g., Régner et al., 2010). Improvements in working memory performance under stereotype threat cannot be explained by the executive control interference account.

Finally, we note that there is an increasing concern with ensuring the replicability of research results in psychological science (see the November 2012 special issue of *Perspectives on Psychological Science*). To address this, we evaluated the above hypotheses in two independent samples of older adults.

Method

Participants & Design

Experiment 1A consisted of a total of 56 older adults (61% male). Participants (18% African American, 4% Asian, 3% Biracial, 66% Caucasian, 2% Multiracial, 2% East Indian, 9% did not state ethnicity) were on average 69.29 years old (*SD* = 5.48, range = 60-79). They had completed an average of 15.77 years of education (*SD* = 2.35, range = 11-22), and had an average score of 44.02 on the Wechsler Test of Adult Reading (*SD* = 5.31, range = 31-50; Wechsler, 2001).

Experiment 1B consisted of a second sample of 56 older adults (20% male), with no one from Experiment 1A included. These participants (34% African American, 9% Asian, 5% Biracial, 48% Caucasian, 5% Multiracial, 2% ‘Other’, 2% did not state ethnicity) were on average 65.61 years old (*SD* = 5.18, range = 59-78). They had completed an average of 15.85 years of education (*SD* = 2.35, range = 12-20), and had an average score of 40.36 on the Wechsler Test of Adult Reading (*SD* = 9.25, range = 17-50; Wechsler, 2001).

In both studies, participants were recruited through a list of research volunteers obtained via newspaper and online ads, fliers at senior centers and public places, and letters to University of Southern California alumni. Stereotype threat (threat vs. no-threat) and reward structure of the working memory task (gains-based vs. losses-based) were manipulated between-subjects. Participants were paid $15 per hour in addition to a performance-based monetary reward.

The sample size used in these experiments was based on an a priori power analysis conducted in G*Power 3.1 (Faul, Erdfelder, Lang, & Buchner, 2007). Assuming an effect size of Cohen’s *d* = 0.79 (derived from relevant previously published studies), an alpha of . 05, 4 groups, and 1 covariate, we determined that a total sample size of 52 participants (n = 13 per group) would provide 80% power to detect effects. In order to exceed this criterion and achieve greater than 80% power we recruited 56 participants (n = 14 per group).

Procedure

The task and threat procedure was identical across the two studies. As a baseline measure of working memory capabilities, participants completed a sentence span task (modeled after Turner & Engle, 1989). During this task, participants read groups of sentences that either

syntactically and semantically made sense (e.g., 'A hen pecks in a bowl and next to it crouches a coyote') or did not make sense (e.g., 'A cat sits on a cage and a flutters her above sparrow'). Nonsense sentences were constructed by rearranging the order of the last four to six words within the sentence. For each sentence participants indicated on the keyboard whether or not it made sense. Concurrent with this, participants were also asked to remember the last word from each sentence. After reading two to six sentences, participants were prompted to report out loud the last words from the most recently viewed sentences to the experimenter (e.g., coyote, sparrow). Set size gradually increased throughout the task. Participants completed four blocks with two sentences (i.e., set size two), three blocks at set size three, and two blocks each at set sizes four, five, and six. Within each set size an equal number of sentences made sense as were nonsense. Working memory performance was scored as the total number of words correctly recalled.

We next manipulated stereotype threat by asking participants to read fictitious news articles taken from Hess, Auman, Colcombe, and Rahhal (2003). In the stereotype threat condition the articles described research confirming that memory declines with age. In the nothreat condition the articles described preservation and improvements in memory with age. Participants were told the current study was designed to test these findings. In the stereotype threat condition participants were also asked to state their age aloud.

Participants then completed a second sentence span task (with sentence sets counterbalanced between baseline and this task). This was identical to the baseline sentence span task with one key exception – here participants were given a performance-based monetary reward. The reward structure was modeled after Grimm, et al. (2009). For half of the participants the reward was gains-based. Participants gained two poker chips for each word correctly recalled. Each chip was worth five cents, and corresponded to an actual monetary payment given to participants at the end of the task. For the other half of the participants the reward was losses-based. Participants were initially given one hundred poker chips, with each chip again worth five cents. Here, participants lost three poker chips for each word forgotten. Any chips remaining at the end of the study corresponded to an actual monetary payment given to participants.

Results

Within each experiment, we examined performance on the second sentence span task via a 2 (threat condition) × 2 (reward structure) analysis of covariance, controlling for baseline sentence span performance. Inclusion of baseline performance as a covariate is common in the stereotype threat literature and allowed us to adjust for the large amount of variance in older adults' memory performance; baseline scores ranged from 14 to 42 in Experiment 1A (M = 22.66, SD = 6.01) and from 9 to 38 in Experiment 1B (M = 22.84, SD = 6.75). The following analyses report adjusted means and standard errors. An identical pattern of results was obtained when change scores were used as the unit of analysis. An $\alpha = .05$ significance level was used for all analyses.

The role of executive control interference

The executive control interference account predicts that stereotype threat should be associated with an overall reduction in working memory performance. However, results did not support this. Within a 2 (threat condition) × 2 (reward structure) ANCOVA on critical sentence span performance there was no main effect of stereotype threat group in Experiment 1A; participants in the stereotype threat condition performed equivalently (M = 28.21) to those in the no-threat condition (M = 28.25), $F < .01$. This pattern was replicated in Experiment 1B; there was no overall difference in performance between participants in the stereotype threat condition (M = 27.60) and those in the no-threat condition (M = 27.90), F = .07.

The executive control interference account also predicts that stereotype threat effects should vary as a function of baseline working memory performance (Régner, et al., 2010). More specifically, high capacity individuals should have sufficient resources available to perform the critical task, even after experiencing declines in working memory resources as a function of stereotype threat. Because of this, high capacity individuals should be less affected by stereotype threat than low capacity individuals. To test this prediction we collapsed across experiment and used a median split to classify each participant as having either low or high baseline working memory abilities, before threat was induced in either group. We then repeated the 2 (threat condition) × 2 (reward structure) ANCOVA separately in each of the working memory abilities group. Within these analyses, neither participants with lower baseline working memory performance (threat: M = 29.00; no-threat: M = 29.14), F = .00, nor participants with higher baseline working memory performance (threat: M = 26.99; no-threat: M = 27.00), F = .01, showed an overall reduction in working memory performance as a function of stereotype threat.

The role of regulatory fit

We next evaluated the role of regulatory fit in modulating older adults' stereotype threat effects. In contrast with the executive control interference account, which predicts an overall reduction in working memory performance, the regulatory fit account predicts an interaction between stereotype threat condition and task reward structure. Threat should lead to a reduction of performance when gains are emphasized, but this should be absent (or even reversed) when losses are emphasized. Looking first at Experiment 1A, results were consistent with this. Within a 2 (threat condition) × 2 (reward structure) ANCOVA there was a significant, and large, interaction between stereotype threat and reward structure, F (1, 51) = 12.35, MSE = 16.07, η_p^2 = 0.20. As can be seen in Figure 1, when gains were emphasized, stereotype threat significantly *impaired* performance (threat: M = 24.21; no-threat: M = 27.87), F (1, 25) = 6.02, MSE = 15.21, η_p^2 = .19. In contrast, when losses were emphasized, stereotype threat significantly *improved* performance (threat: M = 32.17; no-threat: M = 28.68), F (1, 25) = 4.29, MSE = 16.80, η_p^2 = 0.15. Furthermore, performance for participants in the no-threat condition did not significantly vary as a function of reward structure, F (1, 25) = 2.63, MSE = 17.86, p = .12, η_p^2 = .10. In contrast, participants under threat did significantly better when losses were emphasized rather than gains, F (1, 25) = 10.82, MSE = 14.92, η_p^2 = .30.

As can be seen in Figure 1, this pattern of results was replicated in Experiment 1B. Within this independent sample there was once again a significant interaction between stereotype threat and task reward structure, F (1, 51) = 11.77, MSE = 18.35, η_p^2 = .19. As in Experiment 1A, stereotype threat significantly impaired performance when gains were emphasized (threat: M = 24.85; no-threat: M = 28.93), F (1, 25) = 5.97, MSE = 19.11, η_p^2 = .19, but significantly improved performance when losses were emphasized (threat: M = 30.64; no-threat: M = 26.57), F (1, 25) = 6.39, MSE = 17.05, η_p^2 = .20. Furthermore, whereas performance for participants in the no-threat condition did not vary as a function of reward structure, F (1, 25) = 2.11, MSE = 23.04, p = .16, η_p^2 = .08, participants under stereotype threat did significantly better when losses were emphasized rather than gains, F (1, 25) = 13.12, MSE = 14.35, η_p^2 = .34.

Discussion

The current experiments tested two potential mechanisms underlying stereotype threat in older adults: regulatory fit and executive control interference. According to the regulatory fit account (Seibt & Förster, 2004; Grimm, et al., 2009), stereotype threat induces a transitory prevention motivational state. Because people tend to do better at tasks when their regulatory state matches the tasks' reward structure (i.e., when there is regulatory fit), stereotype threat should lead to better performance on losses-based tasks than on gains-based tasks. Consistent with this, within two independent samples, stereotype threat *impaired* older adults' working memory performance when gains were emphasized, but *improved* older adults' performance when losses were emphasized.

In contrast, results did not support the executive control interference account. According to this model, stereotype threat reduces the amount of executive control resources available to perform the critical task, and hence performance suffers (Schmader, et al., 2008). Furthermore, the executive control interference account predicts that this should be especially true for individuals with lower executive control abilities, as they are less equipped to deal with stereotype-threat related reductions in executive control resources (Régner, et al., 2010). However, our results did not support these predictions. In the current experiments stereotype threat did not uniformly impair older adults' working memory performance and the pattern of effects did not depend upon baseline levels of executive control abilities. Of note, although other research has also failed to support the executive control interference account of stereotype threat in older adults (e.g., Hess, et al., 2009), the current results are the first to directly contradict it. Within the current experiments, stereotype threat actually *improved* working memory performance when losses were emphasized. This finding is incompatible with the executive control interference account and supports the conclusion that executive control interference is not the key factor underlying older adults' stereotype threat effects.

The conclusion that executive control interference is not the key factor underlying older adults' stereotype threat effects is important for many reasons. First, it changes when and how we should predict stereotype threat effects to emerge for older adults. For instance, based on the executive control interference account one would predict larger stereotype threat effects for tasks that more heavily rely on executive control resources (e.g., greater

effects of stereotype threat on recollection tasks requiring specific context memory than on simple memory tasks that rely on familiarity or schematic knowledge; Davidson & Glisky, 2002; Mather, Johnson, & De Leonardis, 1999). Our results suggest that this difference will not emerge. Furthermore, our results also suggest the novel theoretical concept that the mechanisms underlying stereotype threat vary with age. Although previous work has suggested that the mechanisms of threat effects vary as a function of who is being threatened (i.e., ones' group or ones' self; Shapiro & Neuberg, 2007), no one has yet examined the intriguing possibility that they also vary as a function of age. Given that executive control interference clearly plays a strong role in modulating younger adults' stereotype threat effects (e.g., Beilock, et al., 2007; Régner, et al., 2010; Rydell, et al., 2009; Schmader & Johns, 2003; Schmader, et al., 2008), but does not seem to modulate older adults' stereotype threat effects, we propose that there are age differences in stereotype threat's mechanisms. These age differences may arise from age-related improvements in emotion regulation abilities. Previous research shows that conducting emotion regulation while performing a cognitive task leads to performance decrements for younger, but not older, adults (Scheibe & Blanchard-Fields, 2009). Therefore, if stereotype threat induces negative affective states that people try to regulate, regulating these negative emotional states may be more cognitively costly for younger adults.

Finally, it is worth noting that understanding the mechanisms underlying older adults' stereotype threat effects has important clinical implications. In one study 70% of older adults scored below the clinical cut-off for dementia on a cognitive test when assessed under stereotype threat about age-related cognitive declines, compared to approximately 14% when not assessed under threat (Haslam, et al., 2012). Given that the number of older Americans is expected to double, from 43.1 million to 92.0 million, by 2060 (US Census, 2010), and given that annual dementia screenings are now covered by Medicare, it will become increasingly important to ensure that diagnostic assessments for dementia are resistant to stereotype threat induced performance deficits. Our results suggest one easy way to do this. Most cognitive tasks (including clinical diagnostic tools) have either an implicit or explicit gains structure. For example, memory tests typically emphasize recalling (gaining) items rather than avoiding mistakes. Our results suggest that by reframing these assessments to emphasize losses, regulatory fit can be obtained, and stereotype threat effects can be eliminated, or perhaps even reversed.

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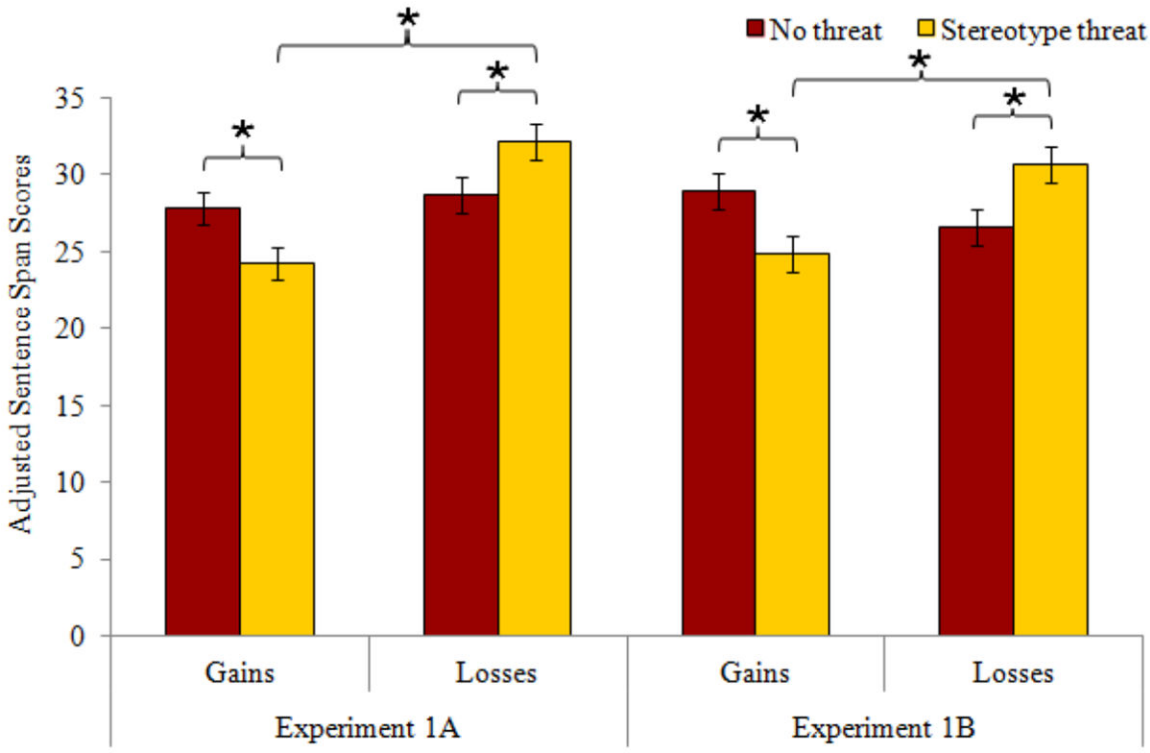

Figure 1.

Sentence span scores (adjusted for baseline performance) as a function of stereotype threat condition and task reward structure in both Experiment 1A and Experiment 1B. In both experiments, stereotype threat significantly impaired performance when remembering led to gains, but significantly improved performance when forgetting led to losses. Error bars represent the standard errors of the adjusted means. An * indicates $p < .05$ for the specific contrast between two conditions.