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Stereotype Threat Strengthens Automatic Recall and Undermines Controlled Processes in Older Adults

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Abstract

The threat of being judged stereotypically (stereotype threat) may impair memory performance in older adults, thereby producing inflated age differences in memory tasks. However, the underlying mechanisms of stereotype threat in older adults or other stigmatized groups remain poorly understood. Here, we offer evidence that stereotype threat consumes working memory resources in older adults. More important, using a process-dissociation procedure, we found, for the first time, that stereotype threat undermines the controlled use of memory and simultaneously intensifies automatic response tendencies. These findings indicate that competing models of stereotype threat are actually compatible and offer further reasons for researchers and practitioners to pay special attention to age-related stereotypes during standardized neuropsychological testing.

Keywords

stereotype threat, aging, memory, automatic and controlled processes, social cognition, stereotyped attitudes

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According to *Science Daily* ("Elderly to Outnumber Children," 2010), in just a few decades, there will be more older people than children in most parts of the world (with the exception of Africa). Therefore, more and more people will be concerned with the effects of aging on their mental faculties (e.g., memory decline) and with the possibility of getting Alzheimer's disease or other forms of dementia. This increasing concern will result in a growing demand for standardized neuropsychological testing. This demand may be exacerbated by age-related stereotypes (which predict that all people experience severe cognitive decline as they age), which ironically may also lower older adults' test scores (Hess, 2005; Hess, Hinson, & Hodges, 2009; Kit, Tuokko, & Mateer, 2008). Older adults may find neuropsychological testing, especially screenings for memory problems, very threatening for a variety of reasons, including stereotype threat.

Stereotype threat refers to the concern that one's performance may confirm a negative stereotype about the abilities of one's group (Steele, 1997). Research has demonstrated that young women (Schmader, Johns, & Forbes, 2008) and girls (Huguet & Régner, 2007, 2009) may experience stereotype threat in math tests. Previous research on older adults showed that stereotype threat impaired memory performance when the memory component of the test was emphasized (Desrichard & Köpetz, 2005; Kang & Chasteen, 2009; Rahhal, Hasher, & Colcombe, 2001), when performance differences between younger adults and older adults were highlighted (Hess, Auman, Colcombe, & Rahhal, 2003; Hess et al., 2009), and when the age-related stereotype about memory was implicitly activated using priming techniques (Levy, 1996; Stein, Blanchard-Fields, & Hertzog, 2002).

In these studies, reduced threat was usually associated with a reduced difference in performance between older participants and younger participants, and sometimes eliminated the difference altogether (Desrichard & Köpetz, 2005; Hess et al., 2003); this shows how powerful age-related stereotypes can be. Older adults seem to be more susceptible to the effects of stereotype threat on memory when they are highly educated (Hess et al., 2009), when they show high levels of stigma consciousness or perceived stereotype threat (Hess et al., 2009; Kang & Chasteen, 2009), and when they value memory ability

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(Hess et al., 2003). Thus, today there is little doubt that stereotype threat may account, at least in part, for age-related differences in performance on memory tasks.

The Present Research

Although the occurrence of stereotype threat in older adults is now well documented, the underlying mechanisms remain poorly understood. The few studies in this area have shown that this threat may operate by lowering performance expectations (Desrichard & Köpetz, 2005) or by reducing the use of memory strategies (Hess et al., 2003). As Hess et al. (2003) suggested, because strategy use requires executive-control resources such as those involved in working memory (Engle, 2002), the effects of stereotype threat on performance might reflect temporary reductions of working memory capacity. Only Hess et al. (2009) have tried to test this hypothesis in older adults, but they failed to show any reduction in working memory capacity under stereotype threat (i.e., when performance differences between younger and older adults were highlighted). According to Hess et al., this may not be surprising because the working memory task was presented as a measure of "quantitative skills" (not as a memory test).

Furthermore, studies of young adults facing stereotype threat (e.g., women taking math tests) indicate that it taxes working memory resources required for successful performance on difficult tasks (Beilock, Rydell, & McConnell, 2007; Régner et al., 2010; Schmader & Johns, 2003; Schmader et al., 2008). If stereotype threat can impair executive working memory resources in younger adults, it could do the same in older adults. Jamieson and Harkins (2007) proposed an alternative explanation, with their mere-effort hypothesis. According to their view, stereotype threat motivates individuals to do well at the task, thereby increasing activation of the prepotent response, which is often incorrect on difficult tasks (Zajonc, 1965). Schmader et al. (2008) argued, however, that the data in support of this alternative account cannot enable researchers to distinguish between the overproduction of a prepotent or automatic response and the failed inhibition of this response due to impaired working memory resources.

In the study reported here, we found direct evidence that stereotype threat consumes working memory resources in older adults. More important, we relied on a process-dissociation procedure (Jacoby, 1991; Payne, 2008) and discovered that stereotype threat in older adults influences controlled and automatic uses of memory simultaneously.

Method

Participants

One hundred ten younger adults (mean age = 21.35 years, *SD* = 2.85 years; 81 females, 29 males) and 110 older adults (mean age = 69.01 years, *SD* = 5.67 years; 71 females, 39 males) agreed to take part in a study on general mental abilities. All knew French as their native language. Older participants were screened for cognitive impairment using the Mini-Mental State Examination (Folstein, Folstein, & McHugh, 1975). To be included in the study, an older participant had to meet or exceed a cutoff score corresponding to his or her age and educational level (Crum, Anthony, Bassett, & Folstein, 1993). For instance, 70- to 74-year-old participants with 9 to 12 years of school had to score at least 27 to be included.

Procedure

The study was run in a single session, but participants were told that there were two separate studies. In the "first study," they completed a reading span task (Daneman & Carpenter, 1980), which we said was "under construction," to minimize evaluative pressure. Participants were encouraged to do their very best (and no feedback was given). This task was used to obtain a baseline measure of working memory. We used the reading span task rather than the operation span task to avoid stereotype threat among females (no gender effect was found).

Then, in the "second study," participants were told that they were going to perform two memory tasks: a cued-recall task (see Jennings & Jacoby, 1993, Experiment 1b) and another reading span task (similar in difficulty to that used earlier for a baseline), which was presented as "fully validated and diagnostic of memory capacity." Participants were randomly assigned to two conditions. In the stereotype-threat condition (55 younger and 54 older participants), each participant was simply told before the two tasks that both younger and older adults were participating in the study. In the reduced-threat condition (55 younger and 56 older participants), the same information was given, but each participant was also told that performance on these tasks usually does not differ between younger adults and older adults (i.e., that the tests were age fair).

Measures

A French reading span task (Desmette, Hupet, Schelstraete, & Van Der Linden, 1995) was used to assess working memory. Participants read aloud 12 series of two to five sentences (3 series per length). After each series, participants were asked to recall the last word of each sentence. Each participant's working memory score was the mean proportion of words that he or she correctly recalled across the 12 series. The sentences used in the first and second reading span tasks were different, but they matched in number of words and in length, frequency, and number of syllables of the last word.

In the cued-recall task (used for Jacoby's, 1991, process-dissociation procedure), participants were given a list of 40 words and were instructed to read the words aloud and remember them for a later memory test. Each word appeared for 1.5 s on the computer screen and was followed by a 0.5-s blank screen. Then, 80 word stems (i.e., the first three letters of words) were presented one at a time, and participants were asked to complete each stem to produce either a word from the list presented earlier (inclusion condition) or a new word (exclusion condition). Word stems appeared in either blue or red and were presented in random order. Participants were told that they were to use the stems as cues to help them remember the words that had been presented earlier. If a stem appeared in blue (inclusion condition), they were to respond with the corresponding word from the earlier list, but if they could not remember it, they should respond with the first word that came to mind. If a stem appeared in red (exclusion condition), they were to respond with a word that was not presented earlier.

Because stereotype threat typically occurs on difficult tasks, participants were not informed of their errors and had no second chances (i.e., in case of error, they could not generate an alternative word). The experimenter typed participants' responses into the computer. Participants were allowed a maximum of 15 s to complete each stem, but could say "je passe" ["pass"] at any time during the 15 s if they felt they could not complete the stem.

Performance in the inclusion and exclusion conditions provided a means of estimating the contribution of controlled and automatic processes in recall. Specifically, in the exclusion condition, a studied word was produced only when it automatically came to mind and the participant failed to recollect that it had been presented earlier; thus, the probability of responding with a studied word in this condition (i.e., the exclusion score) was specified by the probability of controlled recollection (R) and the probability of automatic recollection (A) as follows: $A(1 - R)$. In the inclusion condition, a studied word was produced when the word either was recollected or came to mind automatically; thus, the probability of responding with a studied word in this condition (i.e., the inclusion score) was $R + A(1 - R)$. Therefore, the probability of controlled recollection (R) could be estimated by subtracting the exclusion score from the inclusion score, and the probability of automatic influences (A) could be estimated as follows: exclusion score/$(1 - R)$. Table S1 in the Supplemental Material available online presents the scores that we used in these formulas.

Results

Working memory

We examined participants' performance on the second reading span task using a Test Instructions (threat vs. reduced threat) × Age Group (younger vs. older) analysis of covariance, controlling for performance on the first reading span task and its interaction with test instructions. (The following paragraph reports adjusted means and standard errors; for unadjusted means and standard deviations, see Table S1 in the Supplemental Material.)

As would be expected, the younger participants (M = .78, SE = .01) performed better than their older counterparts (M = .75, SE = .01), $F(1, 214) = 8.52$, $p < .004$, $\eta^2 = .04$. In addition, participants performed better in the reduced-threat condition (M = .77, SE = .01) than in the threat condition (M = .75, SE = .01), $F(1, 214) = 4.57$, $p < .04$, $\eta^2 = .02$. More important, this analysis also showed a Test Instructions × Age Group interaction, $F(1, 214) = 4.85$, $p < .03$, $\eta^2 = .02$ (Fig. 1). The older participants performed less well in the threat condition (M = .73, SE = .01) than in the reduced-threat condition (M = .77, SE = .01), $F(1, 214) = 9.42$, $p < .002$, $\eta^2 = .04$, whereas the younger participants performed equally well in the two conditions (threat condition: M = .78, SE = .01; reduced-threat condition: M = .78, SE = .01; $F < 1$). In addition, the older participants performed less well than the younger participants in the threat condition, $F(1, 214) = 12.87$, $p < .001$, $\eta^2 = .06$, whereas the two age groups performed equally well in the reduced-threat condition ($F < 1$).

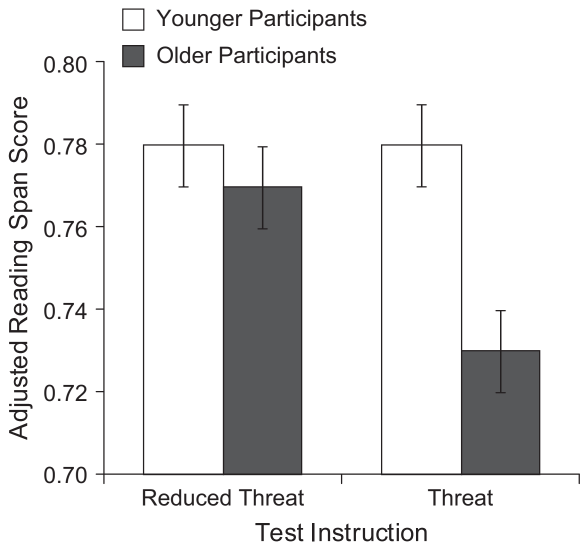

Fig. 1. Reading span score (adjusted for covariates) as a function of instructions condition and age group. Error bars indicate standard errors of the mean.

Estimates of controlled recollection and automatic influences on cued recall

As described earlier, we estimated controlled recollection as the probability of responding with a studied word in the inclusion condition minus the probability of responding with a studied word in the exclusion condition. A 2 (test instructions) × 2 (age group) analysis of variance on this measure showed a main effect of age group, $F(1, 216) = 50.34$, $p < .001$, $\eta^2 = .19$; younger participants (M = .17, SD = .14) showed higher controlled recollection than their older counterparts (M = .05, SD = .12). This analysis also revealed the expected interaction, $F(1, 216) = 5.39$, $p < .03$, $\eta^2 = .02$ (Fig. 2a). The older participants showed lower controlled recollection in the threat condition (M = .02, SD = .13) than in the reduced-threat condition (M = .08, SD = .10), $F(1, 216) = 6.83$, $p < .01$, $\eta^2 = .03$, whereas the younger participants performed equally well in the two conditions (threat condition: M = .18, SD = .14; reduced-threat condition: M = .16, SD = .14; $F < 1$).

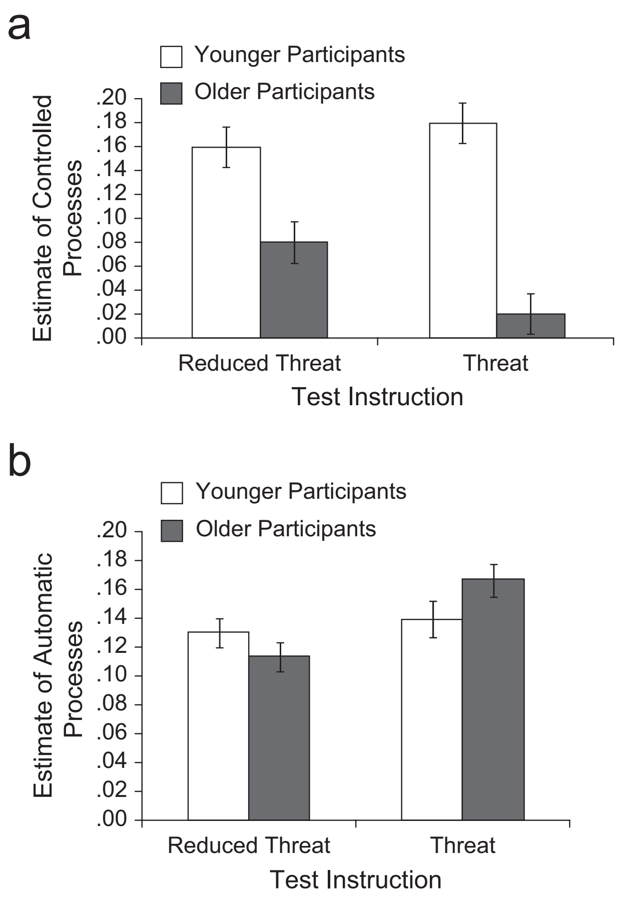

Fig. 2. Estimates of (a) controlled processes and (b) automatic processes in cued recall as a function of instructions condition and age group. Error bars indicate standard errors of the mean.

Automatic influences were estimated as the probability of responding with a studied word in the exclusion condition divided by the difference 1 minus R (with R calculated as inclusion score – exclusion score). A 2 (test instructions) × 2 (age group) analysis of variance on the measure of automatic processes in cued recall showed a main effect of test instructions, $F(1, 216) = 8.57$, $p < .004$, $\eta^2 = .04$; the automatic use of memory was greater in the threat condition ($M = .15$, $SD = .08$) than in the reduced-threat condition ($M = .12$, $SD = .08$). Again, the interaction was significant, $F(1, 216) = 4.49$, $p < .04$, $\eta^2 = .02$ (Fig. 2b). The older participants showed greater automatic use of memory in the threat condition ($M = .17$, $SD = .07$) than in the reduced-threat condition ($M = .11$, $SD = .08$), $F(1, 216) = 12.73$, $p < .001$, $\eta^2 = .06$, whereas younger participants' automatic use of memory did not differ between the two conditions (threat condition: $M = .14$, $SD = .08$; reduced-threat condition: $M = .13$, $SD = .08$; $F < 1$). In addition, in the threat condition, the older participants tended to show greater automatic use of memory than did their younger counterparts, $F(1, 216) = 3.51$, $p < .06$, $\eta^2 = .02$.

Discussion

Stereotype threat impaired older adults' working memory capacity, and that impairment is consistent with earlier findings for younger adults facing stereotype threat (Schmader et al., 2008). Hess et al. (2009) did not find an effect of stereotype threat on older adults' working memory capacity, but attributed this failure to the way the working memory task was characterized (as a "test of quantitative skills"). Our finding strengthens the view that stereotype threat operates in older adults performing working memory tasks, provided that the age-related stereotype about memory is made relevant to the testing situation.

More important, Jacoby's (1991) process-dissociation procedure revealed that stereotype threat simultaneously undermined older adults' use of controlled memory processes and intensified their use of automatic memory processes. This finding helps clarify a major debate about the respective contributions of executive working memory resources and prepotent responses to performance deficits due to stereotype threat. There is ample evidence that working memory is involved in the control of attention and deployment of inhibitory processes (Engle, 2002; Unsworth & Engle, 2007). Therefore, the reduced contribution of controlled memory processes in older participants in the stereotype-threat condition is consistent with the reduction of their working memory capacity.

Taken together, our working memory and cued-recall findings provide further evidence that stereotype threat causes a transitory reduction in executive-control resources. Stereotype threat simultaneously strengthened automatic influences on cued recall, and this finding supports the alternative view that stereotype threat may be rooted in the overproduction of a prepotent response (Jamieson & Harkins, 2007). It is also consistent with many social-psychology findings indicating that when people are apprehensive of being evaluated, their dominant responses are strengthened, which may facilitate or impair their performance depending on whether those responses are correct or incorrect (Guerin, 1993; Zajonc, 1965). In sum, our findings strongly suggest that competing models of stereotype threat are actually compatible.

Finally, it is noteworthy that all manifestations of stereotype threat in our research were obtained by simply informing older participants about the presence of younger participants (without mentioning any expected age-related differences in performance). This fact indicates that age-related stereotypes need to be nullified to ensure valid standardized neuropsychological testing.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

Supplemental Material

Additional supporting information may be found at http://pss.sagepub.com/content/by/supplemental-data

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