Short Report

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Individual Differences in Working Memory Moderate Stereotype-Threat Effects

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Research on stereotype threat has shown that negative stereotypes hinder stigmatized individuals' performance on difficult tasks (Schmader, Johns, & Forbes, 2008; Steele & Aronson, 1995; for stereotype threat among children, see Huguet & Régner, 2007, 2009). Stereotype threat typically affects those who excel in—and are strongly identified with—the stereotyped domain being evaluated and who have much to lose by confirming the negative characterization of their group in this domain (Schmader et al., 2008; Steele, 1997; Steele, Spencer, & Aronson, 2002; Walton & Cohen, 2003). This threat appears to lower performance by reducing working memory (WM) capacity (Beilock, Rydell, & McConnell, 2007; Rydell, McConnell, & Beilock, 2009; Schmader & Johns, 2003), an executive resource used to perform complex tasks (Kane, Conway, Hambrick, & Engle, 2007). Recently, Schmader et al. (2008) raised the crucial question of whether stigmatized individuals with a dispositionally high WM capacity resist stereotype threat. On the basis of the idea that WM involves an executive-control mechanism that is recruited to combat interference (Conway, Kane, & Engle, 2003), Schmader et al. (2008) suggested that high-WM individuals should therefore be better equipped to cope with stereotype threat than low-WM individuals are. Not only does this hypothesis remain untested, but it is challenged by research on "choking under pressure" (Beilock & Carr, 2005; Beilock & DeCaro, 2007; Gimmig, Huguet, Caverni, & Cury, 2006), in which suboptimal performance under strong evaluative pressure has been shown to be limited to high-WM individuals. It appears that pressure is likely to consume the resources that high-WM individuals rely on to achieve superior performance.

To determine if stereotype threat is limited to either low- or high-WM individuals, we selected outstanding students in their last or second-to-last year (out of 5 years) at highly selective engineering schools. This selection criterion ensured that the participants' identification with engineering and their intention to pursue an engineering career were unquestionable. In a pretest (consisting of self-assessments and importance ratings) on a group of students similar to those participating in the experiment, we confirmed that logical reasoning is an ability with which engineers identify strongly. Because women are typically assumed to reason less well than men (Davies, Spencer, Quinn, & Gerhardstein, 2002), we thought that women might experience stereotype threat in this domain. The question here is whether women with a high WM capacity are more able than their low-WM counterparts to resist stereotype threat.

Method

The participants were 117 fourth- and fifth-year French engineering students (64 males, 53 females; mean age = 21 years, *SD* = 1.54 years).

Working memory

The French version of the reading span task (Desmette, Hupet, Schelstraete, & van der Linden, 1995) was used to assess dispositional WM. Participants read aloud 12 series of sentences containing two to five sentences (3 series per length). They had to decide whether each sentence made sense before memorizing a letter. After each series, they were to recall the letters they had seen. WM scores were equal to the mean proportion of letters correctly recalled in a series. To minimize evaluative pressure, we told participants that this test simply estimated the validity of a memory task, and no feedback was delivered. We used the reading span task rather than the operation span task to avoid stereotype threat (no gender effect was found). Participants were encouraged to do their very best (M = .83, SD = .09).

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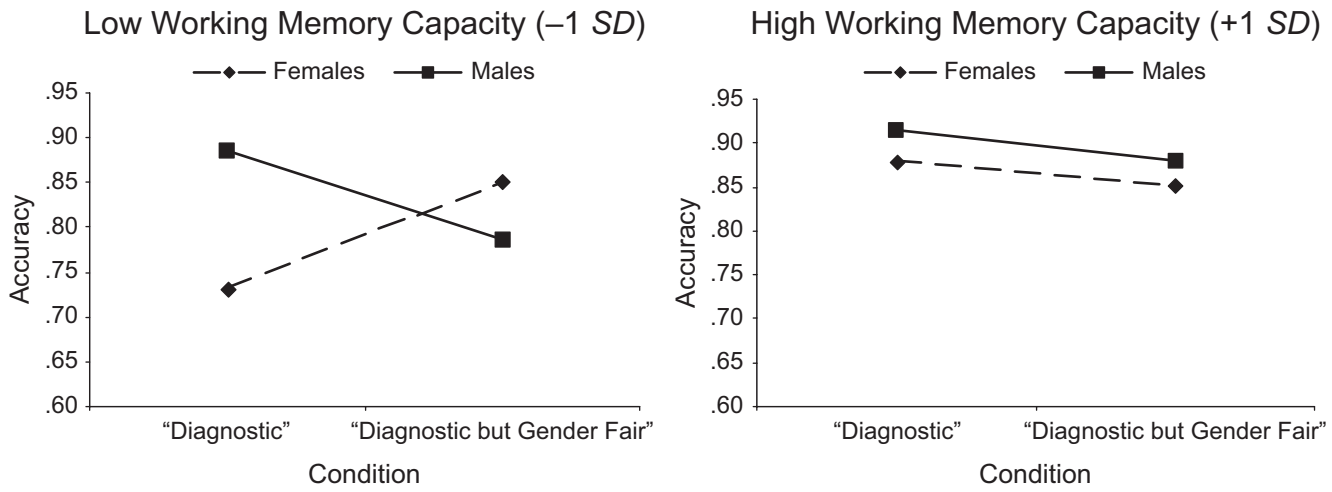

Fig. 1. Accuracy scores on Raven's Advanced Progressive Matrices (Raven, Raven, & Court, 1998) as a function of threat condition and gender, for participants high (right panel) and low (left panel) in working memory.

Reasoning ability and stereotype threat

Reasoning ability was assessed using Raven's Advanced Progressive Matrices (Raven, Raven, & Court, 1998). Participants had 30 min to solve 36 three-cell × three-cell matrices, each containing eight figures (one per cell), with the bottom right cell empty. Participants had to choose the missing figure from eight possible answers. They were told that the task was either "diagnostic" of logical reasoning ability or "diagnostic but gender fair," and were randomly assigned to one of these two conditions. Following past stereotype-threat studies (e.g., Inzlicht & Ben-Zeev, 2000; Schmader & Johns, 2003), we computed accuracy scores by dividing the number of correct items by the number of attempted items.

Results and Discussion

We regressed the reasoning scores on gender (male: 1, female: –1), threat (test labeled "diagnostic but gender fair": 1, test labeled "diagnostic": –1), WM (mean-centered), and their interactions. The WM effect was significant, $b = 0.36$, $t(109) = 3.53$, $p < .001$. More important, the classic Gender × Threat interaction was significant, $b = –0.02$, $t(109) = –1.99$, $p < .05$, and was moderated by WM, $b = 0.37$, $t(109) = 3.67$, $p < .001$. This three-way interaction was examined by computing simple slopes (Preacher, Curran, & Bauer, 2006) for low and high WM capacities. In line with the suggestion of Schmader et al. (2008), a stereotype-threat pattern occurred only among low-WM students (Fig. 1). Whereas low-WM women underperformed relative to low-WM men when participants were told that the test was diagnostic, $b = 0.08$, $t(109) = 4.51$, $p < .001$, they performed as well as men when participants were told that the test was diagnostic but gender fair, $b = –0.03$, $t(109) = –1.52$, $p = .13$. Low-WM women in the gender-fair condition outperformed those in the diagnostic condition, $b = 0.06$, $t(109) = 3.34$, $p < .001$. This stereotype-threat pattern did not emerge among high-WM students, who performed at equally high levels in all conditions. Controlling for participants' prior performance on standard tests of math and physics (using scores taken from school records) did not change the findings.

The fact that high-WM women resisted stereotype threat is the first direct evidence that stereotype threat differs from choking under pressure, perhaps because the performance focus is different in the two cases (the focus in stereotype threat is on failure expectations, whereas the focus in choking is on pressure to succeed; Beilock et al., 2007; Schmader et al., 2008). Because Raven's task rules out the use of routines, stereotype threat cannot be attributed to the pernicious effect of allocating attention to automated processes. The availability of fewer WM resources is a more likely explanation of our findings, because success on this task relies heavily on WM capacity (Unsworth, Brewer, & Spillers, 2009). Our findings thus indicate that stigmatized individuals who excel academically may or may not experience stereotype threat, depending on WM availability.

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.

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