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The Role of Prevention Focus Under Stereotype Threat: Initial Cognitive Mobilization Is Followed by Depletion

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Previous research has demonstrated that stereotype threat induces a prevention focus and impairs central executive functions. The present research examines how these 2 consequences of stereotype threat are related. The authors argue that the prevention focus is responsible for the effects of stereotype threat on executive functions and cognitive performance. However, because the prevention focus is adapted to deal with threatening situations, the authors propose that it also leads to some beneficial responses to stereotype threat. Specifically, because stereotype threat signals a high risk of failure, a prevention focus initiates immediate recruitment of cognitive control resources. The authors further argue that this response initially facilitates cognitive performance but that the additional cognitive demands associated with working under threat lead to cognitive depletion over time. Study 1 demonstrates that stereotype threat (vs. control) facilitates immediate cognitive control capacity during a stereotype-relevant task. Study 2 experimentally demonstrates the process by showing that stereotype threat (vs. control) facilitates cognitive control as a default, as well as when a prevention focus has been experimentally induced, but not when a promotion focus has been induced. Study 3 shows that stereotype threat facilitates initial math performance under a prevention focus, whereas no effect is found under a promotion focus. Consistent with previous research, however, stereotype threat impaired math performance over time under a prevention focus, but not under a promotion focus.

Keywords: stereotype threat, cognitive control, performance, regulatory focus

Members of stigmatized groups frequently find themselves in situations in which negative stereotypes suggest that their group's performance capacity is limited. As shown in the literature review below, there is by now considerable evidence that such *stereotype threats* impair cognitive performance. Recently, research in this area has focused on identifying the elusive process(es) that account for this phenomenon. One explanation suggests that stereotype threat impairs cognitive performance because it taxes the individual's cognitive control capacity (Schmader & Johns, 2003; Schmader, Johns, & Forbes, 2008; cf. Beilock, Jellison, Rydell, McConnell, & Carr, 2006). Another explanation put forth is that stereotype threat initiates defensive self-regulatory strategies (a prevention focus) that are unsuitable for the type of tasks in which most stereotype threat effects have been obtained (Seibt & Förster, 2004).

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Rather than offering alternative accounts of the stereotype threat phenomenon, we argue in the present article that these explanations are closely connected. Specifically, we propose that individuals generally respond to stereotype threat by adopting a prevention focus, which in turn leads to immediate recruitment of additional cognitive control resources in an attempt to avoid failure. We further argue that this response is adaptive to tackle instant threats but that the additional cognitive demands associated with working under threat eventually should deplete the individual's limited cognitive control resources. We therefore expect that stereotype threat should lead to initial benefits for cognitive control and performance on demanding cognitive tasks. Over time, however, stereotype threat should lead to cognitive control impairments. Finally, because both of these consequences of stereotype threat are attributable to the operation of the prevention focus, stereotype threat should have little effect on cognitive control and performance under a promotion focus. Before we outline the theoretical and empirical foundation for this line of reasoning, we review the literature on how stereotype threat affects cognitive performance as well as evidence linking stereotype threat to prevention-oriented self-regulation.

Stereotype Threat and Cognitive Performance

Ever since the path-breaking work by Steele and Aronson (1995), evidence has accumulated confirming the idea that negative stereotypes about the ability of one's group can impair performance in stereotype-relevant domains (e.g., Aronson, Lustina, Good, & Keough, 1999; Beilock et al., 2006; Croizet & Claire, 1998; Inzlicht & Ben-Zeev, 2000; Levy, 1996; Leyens, Désert,

Croizet, & Darcis, 2000; Marx & Goff, 2005; Schmader & Johns, 2003; Spencer, Steele & Quinn, 1999; Steele, 1997; Steele & Aronson, 1995; Stone, Lynch, Sjomeling, & Darley, 1999). How subtly such stereotype threat effects can be produced was illustrated in a study by Inzlicht and Ben-Zeev (2000) in which it was shown that women's performance on a math test can be negatively affected by the mere presence of men in the room.

After the robustness of stereotype threat effects had been established, research focused on identifying the processes through which stereotype threat impairs performance. Initially, attention was primarily directed toward the role of anxiety. For example, Steele and Aronson (1995) argued that stereotype threat induces anxiety and self-doubt and that these states may eventually interfere with task performance (Steele & Aronson, 1995). Initially, this idea received mixed support. Whereas some studies found that anxiety and negative task-related thoughts were related to performance impairments under threat (Bosson, Haymovitz, & Pinel, 2004; Cadinu, Maass, Rosabianca, & Kiesner, 2005; Ford, Ferguson, Brooks, & Hagadone, 2004), other studies failed to find such a link (Aronson et al., 1999; Spencer et al., 1999; Steele & Aronson, 1995; Stone et al., 1999).

Recently, several researchers have proposed that anxiety and stereotype-related concerns may have a more indirect effect on task performance by influencing executive functioning (Schmader & Johns, 2003; Schmader et al., 2008; cf. Beilock et al., 2006). Schmader and Johns (2003) argued that stereotype threat brings additional demands to the test situation (e.g., anxiety, stereotype-related thoughts) that tax limited working memory resources needed to solve complicated problems. In support of this notion, they demonstrated that stereotype threat reduced working memory capacity, which in turn mediated the effect of stereotype threat on math performance (Schmader & Johns, 2003; cf. Beilock, Rydell, & McConnell, 2007). Follow-up studies have demonstrated that attempts to regulate one's level of anxiety indeed contribute to the depletion of working memory resources under stereotype threat (Johns, Inzlicht, & Schmader, 2008). In addition, there is evidence suggesting that stereotype threat not only taxes working memory but also impairs the ability to regulate thoughts, emotions, and behavior more generally. For example, stereotype threat has been found to impair the ability to inhibit pre-potent responses in the Stroop color-naming task as well as physical endurance on a handgrip task (Inzlicht, McKay, & Aronson, 2006; Johns et al., 2008). As a consequence, stereotype threat effects can also spill over and negatively affect performance in domains unrelated to the stereotype, provided that performance in the unrelated domain relies on cognitive control (Carr & Steele, 2010; Inzlicht & Kang, 2010). Meanwhile, other researchers have suggested that the stereotype threat phenomenon is a consequence of the self-regulatory strategies that people adopt in response to stereotype threat, a notion to which we turn next.

The Role of Prevention Focus

According to regulatory focus theory (Higgins, 1997), there are two distinct self-regulatory orientations that people may adopt in goal pursuit: a promotion focus or a prevention focus. When people are in a promotion focus, they are concerned with their ideals and nurturance needs. This focus results in a general sensitivity to the presence versus absence of positive outcomes and is associated with eager, explorative approach-oriented information-processing strategies aimed at reaching a positive end state. A promotion focus has also been linked to a global (vs. local) perception style (Förster & Higgins, 2005) and to creative thinking (Friedman & Förster, 2001, 2002, 2005a). By contrast, people in a prevention focus are concerned with thoughts and safety needs. This focus results in a general sensitivity to the presence versus absence of negative outcomes and is associated with vigilant, risk-aversive avoidance-oriented information-processing strategies aimed at precluding a negative end state. A prevention focus has also been linked to a local (vs. global) perception style (Förster & Higgins, 2005) and to analytical thinking (Seibt & Förster, 2004).

Seibt and Förster (2004) noted that stereotype threat effects have predominantly been demonstrated on tasks that require a flexible information-processing style and the ability to shift mental sets, such as tests of general intelligence, scholastic ability, or mathematical ability. They further argued that the risk-aversive strategies preferred by individuals in a prevention focus should be highly unsuitable for such tasks. However, because the activation of a negative stereotype makes the risk of failure salient, this should lead to the adoption of a minimal goal of avoiding failure (a prevention goal) rather than a maximal goal of achieving success (a promotion goal). They therefore proposed that stereotype threat may impair cognitive test performance in part because it induces a prevention focus. Consistent with this line of reasoning, Seibt and Förster (2004) found that the activation of a negative stereotype leads to better recall for avoidance- (vs. approach-) related statements, the adoption of cautious (vs. risky) strategies in goal pursuit, as well as to reduced creativity (but improved analytical thinking). More recent studies have confirmed that the activation of negative stereotypes indeed impairs performance on complex cognitive tasks (e.g., a math task) under a prevention focus, but not under a promotion focus (Keller & Bless, 2008).

Regulatory focus theory thus seems to offer a parsimonious account for why stereotype threat impairs performance on demanding cognitive tasks that require a flexible style of information processing. At first glance, however, regulatory focus theory seems less apt to explain why stereotype threat impairs cognitive control and the ability to regulate one's thoughts, feelings, and behavior more generally (Inzlicht & Kang, 2010; Inzlicht et al., 2006; Johns et al., 2008). After all, the ability to regulate one's behavior is required for successful prevention-oriented as well as promotion-oriented goal pursuit. Indeed, studies that have examined how different self-regulatory orientations affect executive functions have produced mixed results. Whereas some studies have found that an approach- (vs. avoidance-) oriented state is beneficial for cognitive control (Friedman & Förster, 2005b), other studies have obtained the opposite pattern of results (Koch, Holland, & van Knippenberg, 2008; Koch, Holland, Hengstler, & van Knippenberg, 2009). To resolve this issue, we argue that it is necessary to examine how a prevention (vs. promotion) focus affects cognitive control *depending on the situational circumstances*. We propose that a prevention focus (but not a promotion focus) causes the individual to recruit additional cognitive control resources under stereotype threat, because it signals a risk of imminent failure. Although adaptive to tackle an immediate threat, and beneficial for cognitive performance in the short run, exposure to a threatening environment should eventually lead to cognitive impairments under a prevention focus.

Initial Cognitive Mobilization in Response to Stereotype Threat

When individuals are under a promotion focus, they are motivated to pursue important goals primarily when they expect to succeed (Shah & Higgins, 1997; Zaal, van Laar, Ståhl, Ellemers, & Derks, 2011). By contrast, when individuals are under a prevention focus, they perceive it as a necessity to pursue important goals, and particularly when there is a high risk of failure (Shah & Higgins, 1997; Zaal et al., 2011). Because stereotype threat induces a prevention focus (Seibt & Förster, 2004) and makes the risk of failure highly salient (Steele & Aronson, 1995), it should make individuals particularly engaged in the task at hand. Furthermore, because prevention goals are construed as necessities, individuals are inclined to engage in goal pursuit at an earlier stage under a prevention focus than under a promotion focus (Freitas, Liberman, Salovey, & Higgins, 2002). This inclination, we argue, should be particularly pronounced when under stereotype threat, because the risk of failure is highly salient.

Thus, we propose that stereotype threat induces a prevention focus (Seibt & Förster, 2004), which initiates immediate recruitment of cognitive control resources in response to the salient risk of failure. In the short run, stereotype threat should therefore facilitate cognitive control. However, the stereotype threat literature suggests that managing and suppressing stereotype-relevant thoughts and feelings should eventually lead to cognitive exhaustion (e.g., Johns et al., 2008; Logel, Iserman, Davies, Quinn, & Spencer, 2009; Schmader & Johns, 2003; cf. Baumeister, Bratlavsky, Muraven, & Tice, 1998; Muraven & Baumeister, 2000). As a consequence, we expect stereotype threat to lead to immediate self-regulatory benefits, but to self-regulatory impairments over time. By contrast, stereotype threat should have little effect on recruitment of cognitive control resources when under a promotion focus, because task engagement is relatively insensitive to the risk of failure when the individual is in this self-regulatory state. As a consequence, individuals who experience stereotype threat under a promotion focus should not show any immediate self-regulatory benefits. However, due to their relative insensitivity to the risk of failure, they should also spend fewer cognitive resources attempting to regulate or suppress stereotype-relevant thoughts and feelings. Therefore, we do not expect individuals to succumb to stereotype threat effects over time under a promotion focus (cf. Keller & Bless, 2008).

As mentioned earlier, Inzlicht and colleagues (2006) as well as Johns and colleagues (2008) have examined how stereotype threat affects domain-general measures of cognitive control (e.g., Stroop performance). The findings from these studies suggested that stereotype threat had a negative effect on cognitive control. However, the cognitive control measure was presented as an unrelated pilot test in these studies, and cognitive control was assessed before the critical stereotype-relevant test. As a consequence, these studies do not speak to the present prediction that stereotype threat should facilitate immediate control *while working under threat*. Rather, the findings from these earlier studies may indicate that threatened individuals conserved their energy during the pilot test in preparation for the subsequent critical test. By contrast, we use the cognitive control task itself as the stereotype-relevant test in the present research. That way, we are able to examine how stereotype threat affects cognitive control while working on the stereotype-relevant test.

There are also studies suggesting that taking a test under stereotype threat leads to impairments in cognitive control capacity after the test (Carr & Steele, 2010; Inzlicht & Kang, 2010). Again, such findings do not reveal how stereotype threat affects cognitive control during the stereotype-relevant test. However, observations that cognitive control is impaired after the stereotype-relevant test seems consistent with our line of reasoning that working under stereotype threat should deplete the limited cognitive control resource over time. We test this implication of the resource recruitment hypothesis directly in the present research.

It is important to note that we are not suggesting that stereotype threat is beneficial for cognitive performance across the board. Indeed, the existing literature clearly demonstrates that stereotype threat generally impairs cognitive performance. However, as has been pointed out by several researchers, multiple processes contribute to stereotype threat effects on cognitive performance (e.g., Schmader et al., 2008; Seibt & Förster, 2004). For example, stereotype threat can cause the individual to select more careful strategies (Seibt & Förster, 2004), facilitate analytical thinking at the expense of creativity and flexibility (Carr & Steele, 2009; Seibt & Förster, 2004), and lead to a physiological stress response (Blascovich, Spencer, Quinn, & Steele, 2001; Murphy, Steele, & Gross, 2007). What we are suggesting in the present article is that stereotype threat also leads to immediate recruitment of cognitive control resources. We further argue that this adaptive response is attributable to the adoption of a prevention focus and that it facilitates coping with the threat in the short run.

Overview of the Present Research

We conducted three studies to test whether individuals recruit additional cognitive control resources in response to stereotype threat and whether this effect is attributable to the prevention focus. On the basis of Seibt and Förster's (2004) findings that stereotype threat generally induces a prevention focus, we investigated in Study 1 whether stereotype threat (vs. control) improved immediate cognitive control capacity as a default. In the second study, we expanded our analysis by examining whether this effect is indeed caused by the prevention focus. Specifically, we investigated whether the positive effect of stereotype threat (vs. control) on immediate cognitive control generalized to a situation in which a prevention focus had been experimentally induced, but disappeared when a promotion focus had been induced. In both of these studies, we measured cognitive control capacity with a Stroop task. The Stroop task was particularly suitable for the present purposes because Stroop performance is regarded as a domain-general cognitive control measure (e.g., Kane & Engle, 2003). A second reason to focus on Stroop performance was to make the findings as comparable as possible with previous studies in which negative effects of stereotype threat on cognitive control have been demonstreated before as well as after a stereotype-relevant test (Carr & Steele, 2010; Inzlicht & Kang, 2010; Inzlicht et al., 2006; Johns et al., 2008).

In a third and final study, we examined the consequences of cognitive resource mobilization in response to stereotype threat for performance on a cognitively demanding math test. To the extent that stereotype threat (vs. control) initiates immediate recruitment

of cognitive control resources under a prevention focus, we should expect improved performance on a relatively short math test distributed immediately after the stereotype threat manipulation. However, if the math test is distributed after longer exposure to the threat, we should expect individuals under a prevention focus to have expended a significant portion of their cognitive control resources regulating threat-related thoughts and feelings (cf. Inzlicht & Kang, 2010; Logel et al., 2009). As a consequence, the classical negative stereotype threat effect should emerge under a prevention focus, with threat (vs. control) leading to impaired math performance.

Study 1

The purpose of Study 1 was to examine whether stereotype threat (vs. control) immediately facilitates cognitive control while working on a stereotype-related test.

Method

Participants and design. Sixty-three social science students at Leiden University, the Netherlands (50 women, 13 men, M_{age} = 22 years) were randomly assigned to a stereotype threat condition or to a control condition. The study lasted approximately 20 min, and participants received €2 (about $3 U.S.) or course credits for their time in the laboratory.

Procedure. Participants were seated in separate cubicles, and computers were used to present all stimulus materials as well as to collect the data. First, participants were asked to answer some background questions. Specifically, we assessed their gender, age, and their study major. The main purpose of asking them to indicate what subject they were studying was to make the stereotype threat manipulation credible (see below). After this, participants were informed that the study focused on understanding individual differences in performance on complex cognitive tasks. In particular, it was stated that we were interested in individual differences in controlled information-processing capacity—an important predictor of cognitive performance. This was followed by the *stereotype threat manipulation*. In the stereotype threat condition, participants were told that, aside from establishing individual differences in controlled information-processing capacity, previous research also suggests that social science students perform worse than students of the exact sciences on these types of tasks. It was stated that there was also an interest in the present research in looking into these group-based differences in more detail. Participants in the control condition did not receive any information about the relative performance of social (vs. exact) science students. All participants were then informed that, in order to examine these issues, they were going to take part in a task that assessed their controlled information-processing capacity.

Participants' current *cognitive control capacity* was measured using a simplified Stroop color-naming task suitable when responses are made using a computer keyboard (Jostmann & Koole, 2007). Participants were presented with strings of colored letters. Some of the strings were presented in red ink and others in blue ink. Letter strings were either a color word (the word *blue* or *red*) or a series of *X*s. The task was to ignore the meaning of the letter string and simply focus on the color of the ink. If the ink was red, participants were to press the *A* key on the keyboard. If the ink was blue, participants were to press the *6* key on the numeric pad of the keyboard. Participants were instructed to respond as quickly and as accurately as possible. The stimuli were presented in the center of a white screen (Arial font, size 36). Each trial was preceded by the presentation of a fixation asterisk for 1 s, followed by the presentation of a colored letter string. After the participant had responded, the screen was blank for 2 s before the fixation asterisk appeared again to prepare for the next trial. Before the real test, participants received six practice trials with feedback (i.e., correct vs. incorrect) after each trial. After that, they proceeded to the actual Stroop test. The Stroop task consisted of 60 trials in total. Trials were presented in randomized order, with 20 congruent trials (*red* in red ink or *blue* in blue ink), 20 neutral trials (*XXXX* in red or blue ink), and 20 incongruent trials (*red* in blue ink or *blue* in red ink).

Participants were thanked, fully debriefed, and paid for their time in the laboratory.

Results

Cognitive control capacity. Before analyzing the Stroop data, erroneous responses were removed, as were responses faster than 300 ms (cf. Jostmann & Koole, 2007). We performed analyses on log-transformed response times. However, the means are reported in untransformed response times (milliseconds) to facilitate comprehension of the results. First, as expected, repeated measures analyses of variance (ANOVAs) showed that responses were slower on incongruent trials (M = 542) than on neutral trials (M = 481), $F(1, 62) = 19.53$, $p < .001$, $\eta_p^2 = .24$, as well as than on congruent trials (M = 477), $F(1, 62) = 28.61$, $p < .001$, $\eta_p^2 = .32$. No difference was found between congruent and neutral trials ($F < 1$). Thus, incongruent trials caused interference as compared with congruent and neutral trials. Next, we computed interference scores by subtracting average response time on congruent trials from average response time on incongruent trials. Lower scores on this measure therefore indicate higher cognitive control capacity.

As expected, stereotype threat had a significant effect on Stroop interference, $F(1, 61) = 8.69$, $p = .004$, $\eta_p^2 = .13$. In line with our hypothesis, Stroop interference was lower in the stereotype threat condition (M = 24.0, SD = 53.63) than in the control condition (M = 103.03, SD = 133.74) (see Figure 1). To ensure that this effect was not due to a speed–accuracy trade-off, we also examined Stroop interference on the basis of errors. For each individual, we calculated an error interference score by subtracting the number of errors on congruent trials from the number of errors on incongruent trials. Stereotype threat had no effect on interference

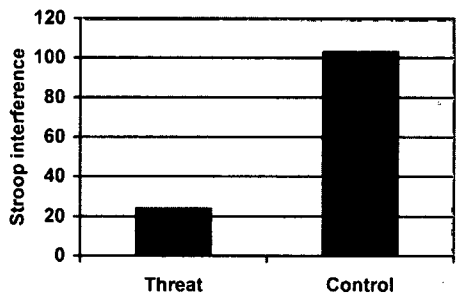

Figure 1. Stroop interference as a function of stereotype threat (Study 1).

based on errors ($F < 1$). Moreover, the effect on Stroop interference based on response times remained unchanged when controlling for interference based on errors, $F(1, 60) = 8.55$, $p = .005$, $\eta_p^2 = .13$. Thus, these findings were not due to a speed–accuracy trade-off. Rather, stereotype threat reduced Stroop interference compared with the control condition, indicating that stereotype threat facilitated cognitive control.

Discussion

Stereotype threat facilitated cognitive control during the stereotype-related test compared with a control condition, providing initial support for the resource recruitment hypothesis. However, we have yet to demonstrate that the prevention focus was responsible for the effect obtained. So far, our results rely on previous evidence that stereotype threat induces a prevention focus (Seibt & Förster, 2004). To directly test the presumed underlying process, we conducted a second study in which stereotype threat as well as regulatory focus were experimentally manipulated. We expected that stereotype threat (vs. control) should facilitate cognitive control as a default (as in Study 1) as well as when a prevention focus had been experimentally induced but that this effect should disappear when a promotion focus had been experimentally induced. Moreover, we expected prevention focus to facilitate cognitive control under stereotype threat, but not in the control condition.

Study 2

Method

Participants and design. One hundred eight social science students at Leiden University (82 women, 26 men, $M_{age} = 19$ years) were randomly assigned to conditions in a 2 (stereotype threat: threat/control) × 3 (regulatory focus: prevention focus/promotion focus/no focus) factorial design. The study lasted approximately 20 min, and participants received €2 (about $3 U.S.) or course credits for their time in the laboratory.

Procedure. The cover story including the stereotype threat manipulation was the same as in Study 1. Before taking the Stroop test, however, participants in the promotion and prevention focus conditions were asked to first participate in a short pilot study. In reality, this constituted the manipulation of regulatory focus. Participants in the condition in which no regulatory focus was experimentally induced did not participate in this pilot study. Participants in the prevention focus condition were asked to write down what they thought they ought to achieve in their studies. By contrast, participants in the promotion focus condition were asked to write down what they would ideally want to achieve in their studies (cf. Higgins, Roney, Crowe, & Hymes, 1994; Zaal et al., 2011). After that, participants were informed that they would take the test that assessed their controlled information-processing capacity. All participants then carried out the same Stroop task as in Study 1. Upon completion of the Stroop task, the stereotype threat manipulation was checked by asking participants to indicate on a 7-point scale their agreement with the statement "I was afraid that, if I performed badly, people would infer that it was due to my studies" (1 = *not at all*, 7 = *very much*). Finally, all participants were thanked, fully debriefed, and paid for their time in the laboratory.

Results

Stereotypic concerns. A 2 (stereotype threat) × 3 (regulatory focus) ANOVA yielded only a main effect of stereotype threat, $F(1, 102) = 8.91$, $p = .004$, $\eta_p^2 = .08$. Participants were more concerned that a negative performance would lead others to infer that it was due to their social science studies in the threat condition ($M = 2.51$, $SD = 1.71$) than in the control condition ($M = 1.68$, $SD = 1.16$). No other effects approached significance ($Fs < 1$).

Cognitive control capacity. Interference scores were prepared in the same way as in Study 1. A 2 (stereotype threat) × 3 (regulatory focus) ANOVA on Stroop interference scores yielded only the predicted interaction effect, $F(2, 101) = 3.07$, $p = .05$, $\eta_p^2 = .06$. The interaction is depicted in Figure 2. Replicating the results of Study 1, stereotype threat tended to facilitate cognitive control when no regulatory focus had been experimentally induced, $F(1, 101) = 2.80$, $p < .10$, $\eta_p^2 = .03$. As predicted, stereotype threat (vs. control) also tended to facilitate cognitive control in the prevention condition, $F(1, 101) = 3.60$, $p = .06$, $\eta_p^2 = .03$. By contrast, stereotype threat had no effect on cognitive control in the promotion focus condition, $F(1, 101) = 1.36$, $p = .24$, $\eta_p^2 = .01$. The alternative set of simple main effect analyses confirmed that the effect of regulatory focus was significant in the stereotype threat condition, $F(2, 101) = 4.39$, $p = .02$, $\eta_p^2 = .08$, but not in the control condition ($F < 1$). As a final step, we then contrasted the stereotype threat condition in which a prevention focus had been induced and the stereotype threat condition in which no regulatory focus had been induced against the other four conditions (contrast: $-2\ -2\ 1\ 1\ 1\ 1$). This contrast was highly significant, $t(101) = 3.10$, $p = .002$. Thus, strong support was obtained for our predictions.[1]

Discussion

The main goal of Study 2 was to examine whether the prevention focus was responsible for the improvements in cognitive control capacity under stereotype threat that we observed in Study 1. Importantly, the results confirmed that stereotype threat facilitates cognitive control when no focus has been experimentally induced as well as when a prevention focus has been induced, but not when a promotion focus has been induced. The fact that responses to stereotype threat were virtually identical in the condition in which no regulatory focus had been induced and in the prevention focus condition corroborates previous findings suggesting that stereotype threat generally induces a prevention focus (Seibt & Förster, 2004). Moreover, the present data provide direct evidence that regulatory focus has a *causal* effect on cognitive control under stereotype threat. Inducing a prevention (vs. promotion) focus significantly improved cognitive control under stereo-

[1] We also analyzed Stroop interference based on errors. As was the case in Study 1, no effects emerged (all $ps > .28$). Moreover, the Stereotype Threat × Regulatory Focus interaction on Stroop interference (based on response times) remained significant when controlling for interference based on errors, $F(2, 100) = 3.22$, $p = .04$, $\eta_p^2 = .06$. Thus, the findings were not due to a speed–accuracy trade-off.

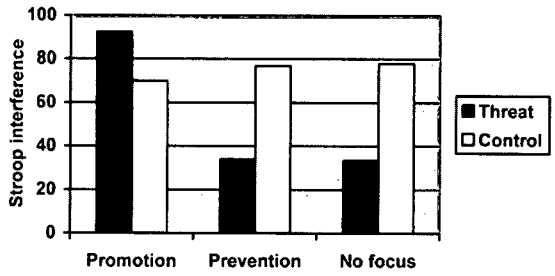

Figure 2. Stroop interference as a function of stereotype threat and regulatory focus (Study 2).

type threat. By contrast, inducing a prevention (vs. promotion) focus had no effect on cognitive control in the control condition. This demonstrates that a prevention focus does not facilitate cognitive control across the board, but only in the presence of a salient threat of failure.

Thus far, we have focused on demonstrating that stereotype threat initiates recruitment of cognitive control resources under a prevention focus. However, it is as yet unclear what the implications are of this response for performance on a stereotype-relevant task that relies heavily on the central executive, such as a math test (Beilock et al., 2007; Schmader & Johns, 2003). We argue that, because it initiates immediate recruitment of cognitive control resources, stereotype threat should facilitate math performance in the short run under a prevention focus. However, because cognitive control resources are highly limited (Muraven & Baumeister, 2000), regulating stereotype-related thoughts and feelings should rather quickly lead to a state of cognitive exhaustion (e.g., Johns et al., 2008; Logel et al., 2009). As a consequence, we expect stereotype threat to improve performance on a math test under a prevention focus, but not under a promotion focus, when the test is administered immediately after the manipulations. However, we expect individuals under a prevention focus to display the classical stereotype threat effect on the same math test when it is administered after a filler task allegedly related to math performance, because the longer exposure to the threat should have depleted their cognitive control resources. We examined these hypotheses in a third study.

Study 3

To examine the consequences of experiencing stereotype threat under a prevention focus for math performance over time, we had half the (female) sample complete a short math test immediately following the manipulations of stereotype threat and regulatory focus, and the other half after a delay. Due to their immediate recruitment of cognitive control resources, we expected individuals in the prevention focus condition to improve their math performance under stereotype threat (vs. control) on the immediate math task. After the math task, these participants completed a filler task that served to extend exposure to the threat in the other condition (see below).

To examine the implications of stereotype threat under a prevention focus over a longer period of time, we let the other half of the sample carry out a filler task prior to completing the math task. To ensure that participants remained threatened while working on the filler task, participants in the stereotype threat (vs. control) condition were informed that the task assessed automatic cognitive processes thought to contribute to math performance (vs. working memory). We reasoned that participants in the stereotype threat condition should spend considerable cognitive control resources regulating or suppressing stereotype-related thoughts and feelings while working on the filler task (Logel et al., 2009). We therefore expected that being exposed to stereotype threat during the filler task prior to the math task should be sufficient to deplete cognitive control resources among individuals under a prevention focus. We opted for a typing task as a filler task because typing does not rely heavily on executive control (e.g., Rieger, 2004). Varying the order in which participants completed the math task therefore allowed us to examine whether our effect was indeed restricted to tasks that rely heavily on executive control. Specifically, because the math task relies on executive control, we expected different interaction effects between stereotype threat and regulatory focus to emerge on math performance depending on whether the task was completed before the filler task (then threat should facilitate performance under a prevention focus) or after the filler task (then threat should impair performance under a prevention focus). Because the filler task does not rely on executive control resources, we did not expect any effects of our experimental manipulations on performance on this task, irrespective of task order. Finally, consistent with Study 2, as well as previous research (Keller & Bless, 2008), we expected no effects of stereotype threat on math performance in the promotion focus condition.

Method

Participants and design. One hundred sixty-four female students (M_{age} = 19) at Leiden University were randomly assigned to conditions in a 2 (stereotype threat: threat/control) × 2 (regulatory focus: promotion/prevention) × 2 (task order: math task first/math task last) factorial design.

Procedure. Upon arrival to the lab, participants were led to separate cubicles containing a computer. All instructions were presented on the computer screen. First, participants were asked to participate in a short typing task to get a baseline assessment of their typing skills (speed and accuracy). Then the cover story containing the stereotype threat manipulation was introduced. Participants in the stereotype threat (vs. control) condition were informed that the study focused on understanding differences in mathematical ability (vs. working memory capacity). In particular, it was explained, the study focused on how certain cognitive processes contribute to mathematical capacity (vs. working memory capacity). Therefore, it was stated, participants would take part in two tests: a test of automatic cognitive processes thought to be relevant for math performance (vs. working memory) and a direct test of their mathematical ability (vs. working memory). This cover story was used to ensure that participants in the stereotype threat condition thought of both tasks as relevant to math ability and thereby ensuring that they remained in a state of stereotype threat throughout the experiment. To further strengthen the stereotype threat manipulation, participants in the threat condition were also informed that one of the goals of the studies was to examine gender differences in mathematical ability and its underlying processes. No information about gender differences was presented to participants in the control condition.

Participants were then told that, before taking on the different tasks, they would participate in a short pilot study. They were instructed to turn over a piece of paper found next to the computer and to follow instructions. The piece of paper contained the regulatory focus manipulation in the form of a maze task (Friedman & Förster, 2001). In the prevention condition, a mouse was depicted in the middle of a maze, and a predator bird was depicted hovering above it. The instruction was to use their pencil to lead the mouse to the safety of its home outside the maze. In the promotion condition, the predator bird was replaced by a piece of cheese lying outside of the maze, and the instruction was to use their pencil to lead the mouse to the cheese.

Upon completion of the regulatory focus manipulation, participants were informed that they would now start taking the tests. Depending on task order condition, participants either completed the math task followed by the typing task, or the other way around. Math performance was assessed by means of a *modular arithmetic task*. We opted for this measure for two different reasons. First of all, modular arithmetic has previously been linked to working memory capacity (e.g., Beilock & Carr, 2005). Thus, performance on this task should be highly sensitive to fluctuations in executive function. Second, modular arithmetic should not require the flexible, creative processing style associated with being in a promotion focus. Therefore, measuring math performance by means of a modular arithmetic task should reduce the risk that our predicted effects were cancelled out by creativity-related processes frequently involved in solving cognitively demanding math problems (Seibt & Förster, 2004).

Participants were asked to assess the validity (true or false) of modular arithmetic problems such as "36 $\equiv$ 18 (Mod 4)." To solve this problem, the middle number is subtracted from the first number (i.e., 34 – 18), after which the difference is divided by the last number (i.e., 16 ÷ 4). The problem is considered true only if the division results in a whole number. To ensure that the task was sufficiently cognitively demanding, problems always contained a borrowing operation, and all numbers used were higher than 10 (cf. Beilock & Carr, 2005; Beilock et al., 2007). Before the test, participants carried out three practice trials. The actual test consisted of a total of 20 modular arithmetic problems of which 50 % were "true." Participants were instructed to solve each problem as quickly and as accurately as possible by indicating whether the problem was true or false. Consistent with previous research on stereotype threat effects on math performance, the primary interest was in the percentage of correct responses on the test. However, to ensure that any effects obtained were not due to a speed–accuracy trade-off, response times were also examined.

The *typing task* was identical to the one used to measure their baseline typing skills, except that it lasted for 4 min rather than for 1 min. Participants spent 4 min typing words presented on the screen as quickly and as accurately as possible. The words were presented on the screen one at a time to ensure that participants did not spend cognitive control resources maintaining strings of words in working memory. Typing performance was measured both by the number of words typed as well as the number of typing mistakes made.

Results

Math performance (percentage of correct responses). Before analyzing the data, we removed six outliers (scoring more than 3 *SD* from the mean). After that we performed a 2 (stereotype threat) × 2 (regulatory focus) × 2 (task order) ANOVA on the percentage of correctly solved math equations. This analysis revealed a Regulatory Focus × Task Order interaction, $F(1, 150) = 5.56$, $p = .02$, $\eta_p^2 = .04$, qualified by the predicted three-way interaction, $F(1, 150) = 13.30$, $p < .001$, $\eta_p^2 = .08$.

In order to break down the significant three-way interaction, we examined the Stereotype Threat × Regulatory Focus interaction within each task order condition. As illustrated in Figure 3, these analyses revealed that the interaction was significant when the math task was presented first, $F(1, 150) = 9.15$, $p = .003$, $\eta_p^2 = .06$. In this condition, individuals in the prevention focus condition performed better under stereotype threat ($M = 95\%$, $SD = 0.06$) than in the control condition ($M = 87\%$, $SD = 0.08$), $t(150) = 3.02$, $p = .003$. By contrast, in the promotion focus condition, performance did not differ between the stereotype threat condition ($M = 87\%$, $SD = 0.08$) and the control condition ($M = 90\%$, $SD = 0.07$), $t(150) = -1.28$, $p = .20$. Additional analyses demonstrated that regulatory focus had an effect on math performance in the stereotype threat condition, $t(150) = 3.06$, $p = .003$, but not in the control condition, $t(150) = -1.28$, $p = .20$. Thus, we found support for the notion that, in the short run, stereotype threat can facilitate math performance when under a prevention focus.

The Stereotype Threat × Regulatory Focus interaction was significant also when the math task was presented after the filler task, $F(1, 150) = 4.32$, $p = .04$, $\eta_p^2 = .03$. As illustrated in Figure 4, however, the opposite pattern was found. Individuals in the prevention focus condition performed slightly worse under stereotype threat ($M = 84\%$, $SD = 0.12$) than in the control condition ($M = 89\%$, $SD = 0.08$), $t(150) = -1.71$, $p = .09$. Again, in the promotion focus condition, performance did not differ between the stereotype threat condition ($M = 92\%$, $SD = 0.07$) and the control condition ($M = 89\%$, $SD = 0.09$), $t(150) = 1.26$, $p = .21$. Furthermore, regulatory focus once again had a significant effect in the stereotype threat condition, $t(150) = -2.94$, $p = .004$, but not in the control condition ($t = 0$).

Math performance (response times). We also examined math performance in terms of speed. Examining speed of responding is important in order to show that the effect obtained on math performance was not due to a speed–accuracy trade-off. Before analyzing the data, we removed four outliers (more than 3 *SD* from the mean). A 2 (stereotype threat) × 2 (regulatory focus) × 2 (task

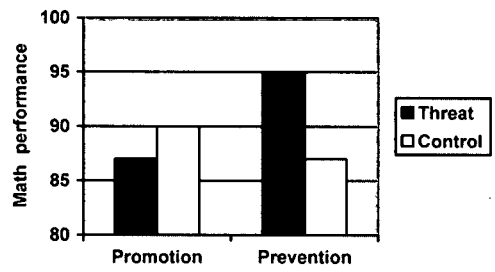

Figure 3. Percentage of correctly solved math problems prior to the filler task as a function of stereotype threat and regulatory focus (Study 3).

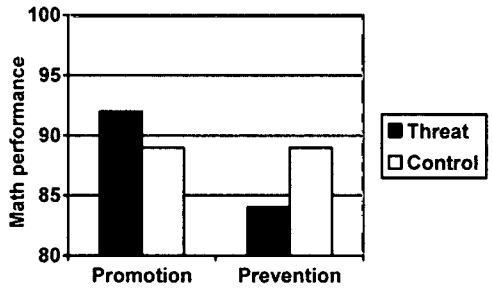

Figure 4. Percentage of correctly solved math problems after the filler task as a function of stereotype threat and regulatory focus (Study 3).

order) ANOVA on the average response time for the 20 math items yielded only a significant three-way interaction, $F(1, 152) = 4.87$, $p = .03$, $\eta_p^2 = .03$. As can be seen in Table 1, when the math task came first, participants in the prevention focus condition solved the problems faster under threat (vs. control), whereas participants in the promotion focus condition needed more time to solve the problems under threat (vs. control). However, the Stereotype Threat × Regulatory Focus interaction did not reach significance in this task order condition, $F(1, 152) = 1.92$, $p = .17$, $\eta_p^2 = .01$. The opposite pattern of results was obtained when the math task was presented after the typing task. However, the Stereotype Threat × Regulatory Focus interaction only reached marginal significance in this task order condition, $F(1, 152) = 3.11$, $p = .08$, $\eta_p^2 = .02$. Most important for the present purposes, these findings clearly show that the effect obtained on the percentage of correct responses was not due to a speed–accuracy trade-off.[2]

Typing performance. Because typing performance does not rely heavily on cognitive control, we did not anticipate any effects of stereotype threat or regulatory focus on typing performance, irrespective of task order condition. We performed a 2 (stereotype threat) × 2 (regulatory focus) × 2 (task order) analysis of covariance on typing speed as well as on typing accuracy (controlling for baseline typing speed and accuracy). Not surprisingly, baseline typing speed was significantly associated with typing speed on the test, and baseline typing accuracy was related to typing accuracy on the test. However, no effects involving any of our experimental manipulations emerged on typing speed (all Fs < 1) or on typing accuracy (all ps $> .20$). Most notably, the three-way interaction did not approach significance on either of the typing performance measures (both Fs < 1). Thus, whereas task order determined how stereotype threat and regulatory focus affected performance on the math task that relies on cognitive control, this was not the case for the typing task that does not rely heavily on cognitive control (Rieger, 2004).

Discussion

This study demonstrated that stereotype threat (vs. control) can improve performance on a math test when under a prevention focus—provided that the math test was presented immediately following the stereotype threat manipulation. This is consistent with the argument that individuals respond to stereotype threat by recruiting cognitive control resources when under a prevention focus. When the math test was administered after a stereotype-relevant filler task, however, individuals under a prevention focus performed *worse* under stereotype threat than in the control condition. This is consistent with the notion that regulating or suppressing stereotype-related thoughts and feelings eventually should lead to cognitive exhaustion. Consistent with results from Study 2, regulatory focus affected (short-term and long-term) performance in the stereotype threat condition, but not in the control condition. Furthermore, performance was again unaffected by the stereotype threat manipulation (irrespective of task order condition) when under a promotion focus.

Notably, these results cannot be explained by different tactical preferences for fast versus accurate responding (e.g., Seibt & Förster, 2004; cf. Scholer, Stroessner, & Higgins, 2008; Scholer, Zou, Fujita, Stroessner, & Higgins, 2010). Instead, analyses of response times to the math problems indicated that the effect on processing speed was similar to that on correct responding (albeit weaker). This suggests that the effects obtained on correct responding were attributable to differences in cognitive control capacity rather than to tactical preferences. Finally, it should also be noted that the manipulations had no effects at all on the stereotype-relevant task that did not rely heavily on cognitive control (the typing task), providing additional support for the resource recruitment hypothesis.

General Discussion

The present research provides new insights into how stereotype threat affects cognitive performance in general, and how these effects are connected to prevention-oriented self-regulation in particular (cf. Keller & Bless, 2008; Seibt & Förster, 2004). Previous work has demonstrated that stereotype threat can induce a prevention focus, which in turn affects the cognitive strategies adopted in goal pursuit (Seibt & Förster, 2004). In particular, a prevention focus can cause the individual to prioritize accuracy at the expense of speed and bolster analytical thinking at the expense of creativity. The fact that individuals adopt a prevention focus can therefore help explain why stereotype threat impairs performance on cognitive tasks that rely on a flexible style of information processing (Seibt & Förster, 2004). However, this explanation is insufficient to account for findings suggesting that stereotype threat impairs the capacity to regulate one's thoughts and behavior more generally (Inzlicht et al., 2006; Schmader & Johns, 2003). After all, the ability to self-regulate should be of critical importance for promotion-oriented as well as prevention-oriented goal pursuit. Furthermore, because the primary purpose of the prevention focus is to tackle threatening situations, it seems implausible that a prevention focus should *impair* self-regulation under the very circumstances it has evolved to deal with (i.e., when a threat is present). Rather, it seems more plausible that the prevention focus should *improve* self-regulation under such circumstances. Consistent with this line of reasoning, other studies on regulatory focus suggest that individuals under a prevention focus are particularly motivated to engage in a task when the risk of failure is high (Shah & Higgins, 1997; Zaal et al., 2011) and that they are inclined to do so as quickly as possible (cf. Freitas et al., 2002).

[2] The predicted three-way interaction on the percentage of correctly solved math problems remained unchanged when controlling for math performance in terms of speed, $F(1, 149) = 13.20$, $p < .001$, $\eta_p^2 = .08$.

Table 1
Response Time to Math Problems as a Function of Stereotype Threat, Regulatory Focus, and Task Order (Study 3)

		Task order			
		Math task first		Math task last	
Dependent variable	Regulatory focus	Promotion focus	Prevention focus	Promotion focus	Prevention focus
Response time	Stereotype threat				
	M	9.64	8.31	7.99	9.27
	(*SD*)	(2.77)	(2.32)	(2.42)	(2.51)
	Control				
	M	8.89	9.13	9.24	8.43
	(*SD*)	(2.60)	(2.76)	(2.92)	(2.69)

Building on this work, we have argued in the present article that individuals respond to stereotype threat by adopting a prevention focus, which in turn leads to immediate recruitment of additional cognitive control resources in an attempt to avoid failure. This response, we have argued, should have short-term benefits for the individual's cognitive control capacity and can thus be viewed as an adaptive response to an imminent environmental threat. However, because cognitive control resources are limited, and because stereotype threat brings additional cognitive demands to the performance situation (Schmader & Johns, 2003), stereotype threat should eventually lead to impaired cognitive performance (under a prevention focus).

A set of studies in which we used different manipulations of stereotype threat, as well as different manipulations of regulatory focus, provided convergent evidence in support of this line of reasoning. In the first study, we demonstrated the basic phenomenon that stereotype threat facilitates immediate cognitive control. Study 2 provided direct experimental evidence that the prevention focus is responsible for this effect. Specifically, stereotype threat facilitated immediate cognitive control as a default as well as when a prevention focus had been induced, but not when a promotion focus had been induced. Importantly, this study also demonstrated that a prevention focus is not beneficial for cognitive control across the board. Rather, a prevention focus facilitated cognitive control under stereotype threat, but not in the control condition.

Finally, in Study 3, we examined the implications of adopting a prevention (vs. promotion) focus in response to stereotype threat for math performance over time. Consistent with our resource recruitment account, stereotype threat improved performance on a math test administered immediately after the threat manipulation under a prevention focus. As expected, however, the benefits of adopting a prevention focus under stereotype threat proved to be limited. When exposed to stereotype threat for a longer period of time prior to the math task, stereotype threat (vs. control) instead impaired math performance among individuals under a prevention focus. Consistent with findings from Study 2, stereotype threat had no effects on performance under a promotion focus, and regulatory focus only affected performance under threat, and not in the control condition. Taken together, these studies strongly suggest that individuals respond to stereotype threat by adopting a prevention focus, which in turn leads to recruitment of cognitive control resources. Although this response has short-term benefits for cognitive control exertion in threatening performance situations, it unfortunately cannot prevent these threatening situations from impairing cognitive performance over longer periods of time.

Consistent with the theoretical account put forth by Seibt and Förster (2004), the present work further demonstrates that stereotype threat effects on cognitive performance are attributable to the prevention focus. However, moving beyond previous work, our findings suggest that stereotype threat does not (only) affect cognitive performance because individuals adopt a careful, noncreative style of cognitive processing that is unsuitable for many cognitive tasks. If that was the case, we should have found a main effect of regulatory focus on cognitive control and math performance in the present studies. Specifically, to the extent that the tasks required analytical (vs. flexible) cognitive processing, a prevention (vs. promotion) focus should have facilitated performance. However, our studies consistently show that adopting a prevention focus only affected the individual's cognitive control capacity and math performance when there was a salient risk of failure (i.e., under stereotype threat). These findings are consistent with our line of reasoning that, because stereotype threat signals a high risk of failure, it leads to recruitment of additional cognitive control resources when under a prevention focus. When there is no salient risk of failure (in the control condition), the prevention focus does not lead to recruitment of cognitive control resources. When under a promotion focus, by contrast, stereotype threat does not lead to recruitment of cognitive control resources, because individuals are not sensitive to the risk of failure when in a promotion-oriented state. Rather, when under a promotion focus, individuals are sensitive to opportunities for gains (Higgins, 1997). As a consequence, we speculate that salient *positive* stereotypes may lead to recruitment of cognitive control resources when under a promotion focus. Such a response could potentially contribute to (short-term) stereotype boost effects on demanding cognitive tasks and be associated with choking-under-pressure phenomena over time (cf. Keller & Bless, 2008).

In light of the present evidence that stereotype threat can facilitate immediate cognitive control and math performance, provided that the threat induces a prevention focus, a relevant question is why these initial cognitive benefits have not previously been reported in the stereotype threat literature. After all, stereotype threat studies generally do not include stereotype-relevant filler tasks prior to the critical assessment of the individual's cognitive performance (as we did in Study 3). Yet, the literature consistently shows that stereotype threat impairs cognitive performance. We believe this, at least in part, has to do with the types of tests generally used in the stereotype threat literature. As pointed out by Seibt and Förster (2004), studies demonstrating stereotype threat effects have generally used highly complex cognitive tests. Apart

from sufficient cognitive control resources, successful completion of these types of tests generally requires creative thinking, the ability to generate various alternative solutions, and the flexibility to shift from one problem-solving strategy to another. Notably, such creative and flexible cognition is associated with the promotion focus rather than the prevention focus (Crowe & Higgins, 1997; Friedman & Förster, 2001, 2002; Liberman, Molden, Idson, & Higgins, 2001). As a result, the initial cognitive benefits of adopting a prevention focus in response to stereotype threat may frequently be cancelled out by the absence of creative processes required to solve these complex problems. In the present research, by contrast, we selected a modular arithmetic task to measure math performance precisely because it should not rely on creative thought, while it remains sensitive to fluctuations in working memory capacity (Beilock & Carr, 2005). Thus, the modular arithmetic task used in the present research was highly suitable to pick up on subtle changes in executive control.

Related to this, there are some prior studies in which stereotype threat has been related to performance on tasks requiring cognitive control (Carr & Steele, 2010; Inzlicht & Kang, 2010; Inzlicht et al., 2006; Johns et al., 2008). These studies have revealed that stereotype threat can lead to suboptimal cognitive control on tasks that are completed in anticipation of the stereotype-relevant task, or on tasks that follow up on stereotype-relevant tasks. As we have explained in the introduction, this might well indicate conservation of cognitive resources in anticipation of the stereotype-relevant task and cognitive depletion following performance on the stereotype-relevant task. It does not directly speak to our prediction that stereotype threat induces a prevention focus, which leads individuals to recruit additional cognitive control resources *while working on* the stereotype-relevant test.

Ruling out Alternative Explanations

Although we believe that the present findings provide strong support for our resource recruitment account, there are two possible alternative explanations for our findings that have yet to be considered and that we discuss here in some detail. First, there is the regulatory fit account of stereotype threat put forth by Grimm and her colleagues (Grimm, Markman, Maddox, & Baldwin, 2009). The principle of regulatory fit states that performance benefits from a match between one's regulatory focus and the way in which one is pursuing a goal (Higgins, 2000, 2005). Individuals with a promotion focus experience regulatory fit when working on a task that is framed in terms of possible gains (e.g., when correct responses are rewarded), whereas individuals with a prevention focus experience regulatory fit when working on a task that is framed in terms of avoiding losses (e.g., when mistakes are punished). Consistent with the principle of regulatory fit, it has been demonstrated that making a negative stereotype salient (and thereby inducing a prevention focus) impairs performance when the task has an explicit or implicit gain frame. By contrast, making a negative stereotype salient can improve performance when the task has an explicit or implicit loss frame (Grimm et al., 2009).

Could the principle of regulatory fit account for the present findings? For several reasons, we do not believe this is the case. First of all, the task instructions in these studies did not include any explicit reference to rewards or punishments. Rather, we merely instructed participants to respond as quickly and as accurately as possible. Furthermore, even if we assume that the instructions somehow resulted in an implicit loss frame, the findings from Study 2 and Study 3 are inconsistent with a regulatory fit account. Specifically, if regulatory fit was responsible for our findings, we should have obtained a *main* effect of experimentally induced regulatory focus on performance in these studies, not a Regulatory Rocus × Stereotype Threat interaction. After all, regulatory focus was induced after the stereotype threat manipulation in these studies and should thus cancel out the prevention focus induced by the stereotype threat manipulation. However, regulatory focus was unrelated to performance in the control condition. This clearly demonstrates that task instructions did not generate regulatory fit under a prevention focus, or a regulatory mismatch under a promotion focus. Instead, a prevention focus only facilitated immediate performance *under stereotype threat.* This pattern of findings is not consistent with a regulatory fit account, but provides strong support for the resource recruitment hypothesis.

Second, to the extent that task instructions fit a prevention focus, any evidence of impaired performance in the prevention focus condition would speak against a regulatory fit interpretation. Notably, we demonstrated that a prevention focus could improve as well as impair performance on the very same math test under stereotype threat, merely as a function of task order (while task instructions remained the same). Meanwhile, performance on the math task was unaffected by stereotype threat as well as task order in the promotion focus condition.

Finally, regulatory fit theory states that regulatory fit has a positive effect on task enjoyment (e.g., Freitas & Higgins, 2002; Freitas, Liberman, & Higgins, 2002). Notably, we included an item measuring task enjoyment in Study 2. None of the manipulations had an effect on enjoyment of the Stroop task (all $ps > .18$). Indeed, the Regulatory Focus × Stereotype Threat interaction on cognitive control remained significant when controlling for differences in task enjoyment ($p < .05$). Taken together, we are therefore convinced that regulatory fit cannot account for the present findings.

A second possible alternative explanation for the findings that should be considered is the "mere effort" account put forth by Jamieson and Harkins (2007). According to Jamieson and Harkins, stereotype threat increases effort, which in turn potentiates prepotent responses and intensifies attempts to correct initial mistakes. This generally leads to impaired performance on complex tasks, but to improved performance on simple tasks. Can a mere effort account for the present findings? Again, we do not believe this is the case. First of all, the fact that stereotype threat reduced Stroop interference suggests that it had the very opposite effect than that suggested by Jamieson and Harkins. Stereotype threat facilitated inhibition of the prepotent response, rather than potentiating the prepotent response. However, Harkins and colleagues have also argued that mere effort can reduce Stroop interference, provided that the response window is not too short (McFall, Jamieson, & Harkins, 2009). Because we did not use a short response window in the present studies, the results from the first two studies could be interpreted as consistent with a mere effort account.

However, the findings from the third study cannot be explained in terms of mere effort. In particular, if mere effort was driving these effects, why were no effects obtained on the stereotype-related filler task? After all, typing is easy and does not require inhibition of a prepotent response. Typing speed and accuracy

should therefore be highly sensitive to variations in effort. Nevertheless, the effects on performance were isolated to the math test in Study 3. This pattern of results is not consistent with a mere effort account. However, it is highly consistent with the resource recruitment hypothesis, because typing does not rely on executive control resources, whereas performance on the modular arithmetic test does (Beilock & Carr, 2005; Beilock et al., 2007). Related to this, a mere effort account does little in explaining why the effect of stereotype threat on math performance suddenly reversed after the filler task, whereas task order had no effect on performance on the typing task. Again, this pattern of results is consistent with the notion that exposure to stereotype threat taxes limited cognitive control resources. Being exposed to stereotype threat over a longer period of time should eventually impair performance on a math test that relies on control, but not on a typing task that does not rely on control. In conclusion, the resource recruitment hypothesis is the only explanation that can account for all of the findings from the present research.

Concluding Remarks

Previous research has demonstrated that stereotype threat can affect performance on demanding cognitive tasks by inducing a prevention focus as well as by impairing central executive functions. The present research provided evidence that these two consequences of stereotype threat are related. Individuals who experience stereotype threat adopt a prevention focus and consequently mobilize their cognitive control resources in an attempt to avoid failure. Stereotype threat therefore facilitates cognitive control in the short run, which implies that the spontaneous tendency to adopt a prevention focus under stereotype threat can be viewed as an adaptive response to an imminent environmental threat. Due to the limited capacity of the central executive, however, this response cannot prevent stereotype threat from impairing cognitive performance over time.

The primary contribution of the present work is clearly that it demonstrates the direct link between self-regulation accounts (Seibt & Förster, 2004) and limited resource accounts (e.g., Inzlicht & Kang, 2010; Schmader & Johns, 2003) of stereotype threat. However, the present findings also have some practical implications for how to reduce stereotype threat effects in test situations. Seibt and Förster (2004) suggested that more relaxed time constraints in test situations may make the tests more fair, because it would enable threatened individuals to take full advantage of their careful, prevention-oriented strategies. Although we acknowledge this possibility, the present research suggests that more relaxed time constraints could at best offer an incomplete solution to problems associated with stereotype threat. Although this solution may help to reduce stereotype threat effects that are attributable to slow, careful strategies, it is unlikely to reduce effects that are due to cognitive exhaustion. In fact, it may even exacerbate such effects.

In light of this, we believe a more promising avenue is to develop interventions that effectively reduce the threat experienced in the test situation. The literature points to several ways in which this goal can be achieved. For example, merely teaching individuals subject to threat about the stereotype threat phenomenon can enable them to attribute their anxiety to external causes, which has proved sufficient to eradicate effects on performance (Johns, Schmader, & Martens, 2005; cf. Stone et al., 1999). Stereotype threat effects have also been alleviated by introducing a simple self-affirmation exercise prior to taking the test (Cohen, Garcia, Apfel, & Master, 2006; Martens, Johns, Greenberg, & Schimel, 2006). On the basis of the present research, yet another way to reduce the threat in test situations could be to develop interventions that induce a promotion focus prior to taking the test. Although individuals subject to threat would not reap the initial cognitive benefits associated with adopting a prevention focus, this type of intervention should reduce the level of threat they experience (cf. Keller & Bless, 2008) and decrease the likelihood that the test situation depletes their cognitive resources over time.

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