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When stereotype threat does not impair performance, self-affirmation can be harmful

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Abstract

When an individual is threatened by a negative stereotype, they are motivated to disconfirm the stereotype to protect self-integrity. When the task is simple and short, this motivation enables threatened individuals to counter the harmful effects of stereotype threat. Two theoretical accounts could explain this effect. First, performance is facilitated by a correct prepotent response according to the mere effort account. Second, the threatened individuals adopt a prevention focus that has a beneficial effect if the task demands few cognitive resources. The present article tested the hypothesis that protecting self-integrity via self-affirmation reduces the motivation to disconfirm the stereotype and could therefore harm performance. Across two experiments, threatened participants performed worse on simple and short math (Study 1) and mental rotations (Study 2) tests when self-affirmed compared to control. When stereotype threat leads to motivated engagement with a task, self-affirmation can reduce that motivation by boosting self-integrity.

Keywords: self-affirmation, stereotype threat, motivation, mere effort, prevention focus.

When stereotype threat does not impair performance, self-affirmation can be harmful

Individuals experience frequent threats to self-integrity (Sherman & Cohen, 2006), including the fear of confirming a negative stereotype about one's group in a particular domain. According to self-affirmation theory, stereotype threat (Steele & Aronson, 1995) jeopardizes the perception of oneself "as adaptively and morally adequate, that is, competent, good, coherent, unitary, stable, capable of free choice, capable of controlling important outcomes…" (Steele, 1988, p. 262). Stereotype threat is typically inferred from underperformance during an assessment situation in the stereotyped domain (Croizet, Désert, Dutrévis, & Leyens, 2001; Steele, 1997; Steele & Aronson, 1995). For example, women are stereotyped as being inferior to men in math, and when this stereotype is made salient during an evaluation, women perform worse than men on math tests (Spencer, Steele, & Quinn, 1999). Having individuals reflect on their core values (self-affirmation) can eliminate the negative effects of stereotype threat (Martens, Johns, Greenberg, & Schimel, 2006; Shapiro, Williams, & Hambarchyan, 2013). Following the logic of self-affirmation theory (Sherman & Cohen, 2006; Steele, 1988), stereotype threat motivates individuals to preserve self-integrity by trying to disconfirm the negative stereotype. Threatened individuals try to reduce the cognitive imbalance between wanting to perceive oneself as competent (by attaining a goal) and the risk of failure (not attaining a goal) (Schmader, Johns, & Forbes, 2008). The current studies tested whether self-affirmation could reduce the motivational state induced by stereotype threat and therefore harm task performance.

Arousal of Stereotype Threat: A Motivational State

The motivation to disconfirm a negative stereotype is at the core of theoretical

explanations of how stereotype threat reduces performance. According to the integrated process model (Johns, Inzlicht, & Schmader, 2008; Schmader et al., 2008), stereotype threat creates a conflict between the desire to succeed and the risk of failure that interferes with executive functions (e.g., working memory, inhibition). In regulatory focus theory, stereotype threat induces a prevention focus that motivates people to avoid losses, and the prevention focus is mismatched with the performance goal (Chalabaev, Major, Sarrazin, & Cury, 2012; Grimm, Markman, Maddox, & Baldwin, 2009; Seibt & Förster, 2004). Finally, following the mere effort account, the motivation to disconfirm leads threatened individuals to make an effort that increases the likelihood of the prepotent, or default response (Jamieson & Harkins, 2007, 2010; Seitchik & Harkins, 2015). To date, experimental evidence of stereotype threat does not eliminate any of these explanations. These theories provide explanations for why self-affirmation might reduce stereotype threat effects, but none explains what would happen if the motivation to disconfirm the stereotype were reduced. This possibility is indirectly testable in a stereotype threat situation that does not lead to underperformance. Previous research describes situations in which performance is facilitated or unaffected by stereotype threat. The motivation to disconfirm a stereotype can compensate for the harmful effect of threat. We describe three such situations below.

Arousal of the Prepotent Response

When a performance task is relatively easy or well-learned, stereotype threat does not affect performance. Threatened individuals may even outperform unthreatened ones (Ben-Zeev, Fein, & Inzlicht, 2005; Keller, 2007; O'Brien & Crandall, 2003; Seitchik & Harkins, 2015). Other studies showed that performance was similar between threatened and unthreatened individuals (Blascovich, Spencer, Quinn, & Steele, 2001; Spencer et al., 1999).

According to the mere effort account (Jamieson & Harkins, 2007, 2009; Seitchik & Harkins, 2015) based on social facilitation (Zajonc & Sales, 1966), the motivation to disconfirm the stereotype increases the likelihood of individuals choosing a dominant or prepotent response[1], also known as the default response: the most frequent response for a specific task.

When the task is relatively simple, the prepotent response is often correct. As a result, stereotype threat can improve accuracy on simple tasks (e.g., O'Brien & Crandall, 2003). Sometimes accuracy is not improved but the processing speed is boosted (Bond & Titus, 1983; for a meta-analysis, see Huguet, Galvaing, Monteil, & Dumas, 1999). Threatened individuals perform better because they process input more quickly and attempt to solve more items within a limited time (Ben-Zeev et al., 2005).

According to the mere effort account, underperformance during stereotype threat arises because the task is difficult and the prepotent response is incorrect (particularly of women performing math). Jamieson's and Harkins' (2009) research on standardized math problems from the Graduate Record Examinations qualified the negative effects of stereotype threat in women. Their research showed that the motivation to disconfirm the gender stereotype about women in math arouses the prepotent response to compute the solution from

[1] "Prepotent response" was the term used in the mere effort account (Harkins, 2006) to describe the most likely response in an evaluation situation. This concept is close to the "dominant response" introduced by drive theory in the social facilitation field (Zajonc & Sales, 1966). In this account, the presence of others arouses a nonspecific drive enhancing the probability of the dominant response. In the mere effort account, the drive is aroused by the motivation to disconfirm the stereotype in an evaluation context.

a formula or an algorithm learned in class. This is a good method for solving problems but a poor method for comparing problems. Women exposed to gender stereotype threat underperformed on comparison problems (prepotent response is false) but performed better and attempted to solve more problems (prepotent response is correct) compared to the control conditions (men and unthreatened women).

Controlled Inhibition of Prepotent Response

According to the mere effort account (Jamieson & Harkins, 2007), leading individuals to a prepotent response does not necessarily harm performance. Individuals trying to disconfirm a stereotype can resist the prepotent response if they realize the response is incorrect and have time to correct it. In an antisaccade task, participants were instructed to inhibit a reflex response (look at a cue on a side of the screen) by looking at the opposite direction. Stereotype threat spurred individuals to look at the cue (the prepotent response). Because the prepotent response was obviously wrong, threatened participants compensated the reflexive saccade to the cue by initiating a faster corrective saccade to the target. When the delay of exposure to the target was short (150 milliseconds), participants made more mistakes in recognizing the direction of the target because the target had disappeared by the time gaze reached the target site. However, when the delay of exposure to the target was longer (250 milliseconds), threatened participants were just as accurate as non-threatened participants. This result shows that some performance detriments due to stereotype threat can be overcome by motivated participants with enough time.

Recruitment of Cognitive Control Resources

Stereotype threat also increases prevention focus (Seibt & Förster, 2004). Prevention focus motivates individuals to avoid failure (i.e., disconfirming the stereotype), which can

sometimes lead to better performance through the recruitment of additional cognitive control resources. This strategy demands cognitive resources and therefore is only effective when cognitive resources are available (Ståhl, Van Laar, & Ellemers, 2012). In this study, when the task demanded cognitive control resources and was short (less than four minutes), threatened participants with a prevention focus solved 95% of math problems compared to 87% in the control condition. In addition to this boost in accuracy, threatened participants with a prevention focus solved the math problems more quickly. However, the classic stereotype threat impairment was observed if the cognitive control resources had been exhausted.

This brief review of stereotype threat shows that threat arises from a motivation, the effects of which can either facilitate or impair performance depending on the context. The present research tests the effect of self-affirmation where stereotype threat does not impair performance.

Self-Affirmation

Reflecting on one's cherished beliefs or values can provide a sense of one's adequacy, which protects self-integrity and reduces the need to respond defensively (Cohen & Sherman, 2014). Stereotype threat effects on performance can be eliminated by protecting self-integrity through self-affirmation prior to the threat (Critcher, Dunning, & Armor, 2010; Silverman & Cohen, 2014). For example, threatened women performed better on a math or mental rotation test if they first explained why a top-ranked value among a list was important for them and gave an example (values-affirmation; Martens et al., 2006). Self-affirmed participants who were later threatened performed similarly to non-stigmatized people or stigmatized people not threatened by a stereotype (Martens et al., 2006; Schimel, Arndt, Banko, & Cook, 2004; Shapiro et al., 2013). The threatened identity dominates the content of the working self-

concept during the experience of threat (Critcher & Dunning, 2015). Individuals therefore overestimate how much the threatened domain defines their self-concept. Self-affirmation enables individuals to expand the content of their working self-concept and to retrieve self-related cognitions in memory more quickly (Voisin, Girandola, David, & Aim, 2016, Study 3). When more self-related cognitions are accessible, individuals realize their self-concept is not limited to the threatened domain (Sherman, 2013). This broadening of perspective could potentially harm performance because individuals may experience reduced motivation to attain domain-specific goals. Self-affirmation could lead to abandoning a goal that is no longer necessary to maintain adequate self-integrity.

This reduction of motivation through self-affirmation was tested in one study outside the stereotype threat field. The desire to attain a performance goal can also depend on a past failure in an evaluation situation. Participants who failed to move twenty pieces of rice with chopsticks were more motivated to try again than participants who had not failed (Vohs, Park, & Schmeichel, 2013). The failure threatened self-integrity and led to the motivation to try again. However, self-affirmed participants perceived the task differently. Affirmed individuals were less motivated to attain the performance goal for that specific task because the failure was less threatening. Understanding when and how self-affirmation affects motivation would help explain how stereotype threat affects performance across diverse contexts. The current paper indirectly tests whether self-affirmation under stereotype threat could lower motivation.

Hypotheses and Overview

Until recently, self-affirmation was tested in situations with difficult tasks where stereotype threat lowered performance (Martens et al., 2006; Schimel et al., 2004; Shapiro et

al., 2013). Previous research in stereotype threat situation have not addressed whether self-affirmation would affect motivation. We present the first test of self-affirmation in a stereotype threat situation when the motivation to disconfirm the stereotype would not reduce performance. We hypothesized that self-affirmation could reduce the motivation to disconfirm a stereotype because affirmed individuals no longer need to achieve the goal to maintain adequate self-integrity. When affirmed, threatened individuals would not implement a defensive response (e.g., the arousal of prepotent response and/or a prevention focus), and therefore performance could be harmed.

Study 1

We tested the performance of threatened women on relatively simple multiplication problems with time pressure. This methodology was chosen for two reasons. First, solving multiplication problems creates a facilitation effect (Allport, 1920; Dashiell, 1930; Grant & Dajee, 2003). Given that the prepotent response was correct, threat was expected to improve performance via the facilitation effect. The procedure for multiplying a one-digit number by a two-digit number[2] is well-learned during elementary school (Tronsky, 2005). Second, stereotype threat induces a prevention focus (Grimm et al., 2009; Seibt & Förster, 2004). This

[2] Several strategies are available to compute a multiplication according to Tronsky (2005): the standard right-to-left algorithm, retrieval, addition, decomposition, tens method and an undetermined category. The right-to-left algorithm (e.g., 3 × 17) consists in multiplying the one-digit number by the unit-digit (3 × 7 = 21), then multiplying the one-digit number by the tens-digit (3 × 10 = 30) and adding the product of both multiplications (21 + 30 = 51).

focus has a beneficial effect on performance only if the assessment time is short (Ståhl et al., 2012). For this reason, we designed a one-minute test. These two conditions were expected to increase performance under stereotype threat. Self-affirmed participants were expected to resolve fewer multiplications compared to unaffirmed participants under stereotype threat due to the hypothesized reduction in motivation to disconfirm the negative stereotype.

Population and Experimental Design

One hundred sixty-seven female undergraduate students (M_{age} = 21.10 years old, SD_{age} = 3.89), class years 1-3 in psychology or sociology at the University of Bordeaux, participated in the online experiment. Participation was incentivized with a lottery to win three 30-euro retail vouchers. Participants were randomly assigned to one of three experimental conditions: no stereotype threat (*control*), *stereotype threat*, and stereotype threat with self-affirmation (*self-affirmation*). Four participants were excluded because they did not try to solve any of the multiplication problems, and ten other participants were excluded because they confessed to using a calculator (five in control, five in stereotype threat, and four in self-affirmation). The final sample consisted of 153 women.

We computed an expected effect size of self-affirmation from six laboratory experiments on stereotype threat (Martens et al., 2006: Cohen's d = .94 in Exp. 1 and Cohen's d = .52 in Exp. 2; Schimel et al., 2004: Cohen's d = .59 in Exp. 2; Shapiro et al., 2013: Cohen's d = 1.62 in Exp. 3 and d = .86 in Exp. 4; Taillandier-Schmitt, Esnard, & Mokounkolo, 2012: Cohen's d = .44)*:* average Cohen's d = .83. We then estimated the number of participants to observe a self-affirmation effect of this size using G*Power (Faul & Erdferlder, 1992), which revealed 19 participants per cell were needed for .80 statistical power. Given that the experiment consisted of three conditions and the effect size for this

design is unknown, we aimed for twice as many participants as the above estimate ($n \geq 36$ per cell).

Procedure

Participants were invited by email to participate in two supposedly independent experiments. Participants were informed that a first study involved writing an essay, and the second study involved completing an exercise and responding to questions.

Self-affirmation procedure. The experiment began with a common values affirmation procedure (McQueen & Klein, 2006; Sherman, Nelson, & Steele, 2000). All participants ranked eleven values from most important to least important. Then, two different instructions were given depending on whether the self-concept was affirmed. In the no self-affirmation conditions (control and stereotype threat conditions), women were asked to write about why their value ranked in last position might be important and significant in the daily life of a typical student. In the self-affirmation condition, the women were asked to write about why the value ranked first was personally important and significant and they gave an example how it is used in their everyday life.

Induction of stereotype threat. In the stereotype threat condition, the participants were informed that the test would assess their ability in math: "In today's session we want to get a measure of math ability for male and female students by having you take a standardized arithmetic test. This test will be used to help us establish a clear idea of women's natural mathematical ability." These participants also indicated their gender to strengthen the threat. Control participants were informed the test would be used to "evaluate their impression of problems."

Math task. All participants were asked to solve ten moderately simple multiplication

problems (e.g., 81 × 9) in a one-minute period. Before starting the test, the experimenter stressed they should try as hard as they could to complete the task. During the test, all multiplications were vertically presented at the same time. The participants could solve the multiplications in any order by writing down a number in each answer box. We considered each number in an answer box to be an attempt, and the empty boxes were considered unattempted.

Dependent measures. Multiplication attempts and correct answers were calculated. Next, participants answered the following questionnaire measures. Two items rated from 1 (*very bad*) to 7 (*very good*) were used to verify knowledge of the negative stereotype regarding women's math abilities: "How do people perceive women's abilities in math?" and "How do people perceive men's capabilities in math?" A final item measured perceived effort at the math task: "To what extent do you think you made an effort to solve the multiplications?" from 1 (*no effort*) to 7 (*every effort possible)*.

Results

Manipulation checks

Knowledge of gender stereotype. To determine the participants' awareness of the stereotype of women's underperformance in math, we conducted a mixed-design ANOVA with perceived ability in math by gender as a within-subjects factor and experimental conditions as a between-subjects factor. Participants believed that most people thought women's capabilities in math (M = 2.68, SD = 1.05) were worse than men's *(*M = 5.52, SD = 0.90), $F(1, 150) = 429.28$, $p < .001$, $\eta^2_p = .74$. There was also a significant interaction, $F(2, 150) = 3.93$, $p = .022$, $\eta^2_p = .050$. We decomposed the interaction by computing the likelihood maximum as estimator with the package *Phia* in R (De Rosario-Martinez, 2015).

Planned comparisons revealed that the difference in the perception in men's and women's math abilities were greater in the control condition (M_{men} = 5.69, SD = .92 vs. M_{women} = 2.40, SD = 1.05) compared to the stereotype threat condition (M_{men} = 5.26, SD = .88 *vs.* M_{women} = 2.92, SD = .96) and compared to the self-affirmation condition, respectively $\chi^2(1) = 11.24$, $p < .001$ and $\chi^2(1) = 5.81$, $p = .016$. The significant interaction effect was unexpected. The women might have decreased the stereotyped perception of the task in order to decrease threat. The difference between the perception in men's and women's math abilities between the self-affirmation (M_{men} = 5.62, SD = .88 *vs.* M_{women} = 2.66, SD = 1.12) and stereotype threat conditions was not significant, $\chi^2(1) = 1.33$, $p = .24$.

Effort. A one-way ANOVA showed that participants in the three experimental conditions reported the same effort during the math task, $F(2, 150) = .92$, $p = .40$.

Math performance. ***Multiplications attempted.*** A one-way ANOVA yielded a significant effect of the experimental condition on multiplications attempted, $F(2, 150) = 3.22$, $p = .043$, $\eta^2_p = .041$. To observe if the participants in the stereotype threat situation were more motivated compared to the other two conditions, we ran three pairwise comparisons on the number of attempted multiplications with the maximum of likelihood as estimator (De Rosario-Martinez, 2015). The pairwise comparisons revealed that the threatened participants attempted more (M = 4.06, SD = 1.86) than the participants in the control condition (M = 3.32, SD = 1.72), $\chi^2(1) = 4.90$, $p = .027$, and more than the self-affirmed participants (M = 3.29, 1.57), $\chi^2(1) = 4.63$, $p = .031$. A third pairwise comparison yielded no difference in problems attempted between the control and self-affirmation conditions, $\chi^2(1) = 0.01$, $p = .905$.

Accuracy. We also computed an accuracy index (e.g., Inzlicht & Ben-Zeev, 2000;

Steele & Aronson, 1995) of the correct multiplications divided by attempted multiplications. This checks whether or not the individuals used different cognitive strategies to solve the multiplications. A one-way ANOVA revealed no differences between the three experimental conditions, $F(2, 150) = 1.24$, $p = .29$ (see Table 1 for descriptive data).

Multiplications solved. A one-way ANOVA on math performance yielded a marginal effect of experimental condition, $F(2, 150) = 2.67$, $p = .072$, $\eta^2_p = .034$. To decompose the main effect of the experimental variable, we conducted three pairwise comparisons between the three conditions. As expected, the threatened participants solved more multiplication problems ($M = 2.85$, $SD = 1.99$) than those in the control condition ($M = 2.19$, $SD = 1.38$), $\chi^2(1) = 4.45$, $p = .034$. The difference between the threatened and self-affirmed ($M = 2.16$, $SD = 1.72$) participants was marginally significant, $\chi^2(1) = 3.40$, $p = .065$. Finally, control and self-affirmation conditions had similar accuracy, $\chi^2(1) = 0.01$, $p = .920$.

Discussion

This is the first experiment showing that self-affirmation can reduce performance in a stereotype threat situation when the task is simple and short. Threatened, unaffirmed women performed better due to more task motivation and engagement than threatened, affirmed women and unthreatened, unaffirmed women. Accuracy was equivalent between the three experimental conditions, but the threatened participants attempted more multiplication problems and therefore solved more problems than self-affirmed and unthreatened participants. This is consistent with both the social facilitation effect for a simple task (Bond & Titus, 1983) and the self-regulatory approach. The prepotent response and/or the recruitment of cognitive control resources facilitated solving the math problems. This suggests that stereotype threat motivated individuals to perform well. In both cases, worse

performance in the self-affirmation condition compared to the stereotype threat condition could be explained by a reduction of the motivation caused by the arousal of the stereotype threat.

Study 2

The second experiment was designed to test our hypothesis that self-affirmation reduces the motivation to disconfirm the stereotype. Also, Study 1 could not distinguish between self-affirmation altering the prepotent response or the recruitment of cognitive control resources. The mere effort and focus prevention accounts imply the motivation to disconfirm the negative stereotype could influence three cognitive processes: the arousal of prepotent response, the controlled inhibition of prepotent response, and the recruitment of cognitive control resources. To determine which process is susceptible to the self-affirmation effect, we chose a task that could test for all three processes: mental rotation.

First, a mental rotation task is an appropriate domain to study the effect of stereotype threat in women (Kanoy, Brownlow, & Sowers, 2012; Moè & Pazzaglia, 2006; Wraga, Duncan, Jacobs, Helt, & Church, 2006; Wraga, Helt, Jacobs, & Sullivan, 2007) and the beneficial effect of self-affirmation under stereotype threat (Martens et al., 2006).

Second, during a mental rotation task individuals may decide whether two figures differently oriented around an upright axis were identical (Provost & Heathcote, 2015). Individuals start the task by encoding information. They mentally rotate the figure (analogous to perceiving a physical object rotating) by storing and updating information using working memory capacity. The task concludes with a decision and motor response.

Third, this mental rotation task was chosen because there is a prepotent response. Early cognitive psychology studies on mental rotation process revealed a response bias in

favor of choosing 'identical' (Just & Carpenter, 1976; Provost & Heathcote, 2015; Shepard & Metzler, 1971). The prepotent response is correct if both figures are identical and incorrect if both figures are different. When individuals compare two identical figures, there is an arousal of the prepotent response that facilitates the process and individuals must use working memory capacity to mentally rotate the figure. When non-identical figures are compared, individuals must implement a compensatory strategy to inhibit the prepotent response. We expected that identical comparisons would be quicker and more accurate than non-identical comparisons (Hypothesis 1).

The arousal of the prepotent response

In line with Study 1, self-affirmation was expected to decrease the arousal of the prepotent response. According to the mere effort account, the potential for evaluation in a stereotype threat situation motivates individuals to perform well to disconfirm a stereotype, and this arouses the prepotent response. In Study 2, it is possible to test for a reduction in prepotent responses but it is not possible to test whether this change is attributable to the motivation to disconfirm a stereotype. For example, the mere presence of another person can also arouse the prepotent response (Zajonc, 1965; Zajonc & Sales, 1966) without the motivation to perform well. In Study 2, the experimenters stood close to the participants. Thus, even in the no threat situation the prepotent response could have been aroused. However, Study 2 can still test for a reduction of the prepotent response via self-affirmation.

The arousal of the prepotent response in a mental rotation task is observed by a difference of accuracy and/or speed between the comparisons of identical and non-identical figures. When both figures are identical, the prepotent response is correct and performance is improved. As suggested by Study 1, self-affirmation may increase the prepotent response,

leading to an interaction between self-affirmation and the type of comparison (Hypothesis 2). Therefore, the performance difference between identical and non-identical comparisons would be smaller in self-affirmed compared to not affirmed individuals.

The recruitment of cognitive control resources

Based on the prevention focus perspective, the negative effect of stereotype threat on performance results from a deficiency of executive functions: stereotype threat interferes with controlled inhibition and working memory capacity (Ståhl et al., 2012). The mental rotation task requires working memory for both comparisons (identical or non-identical). In line with the prevention focus, self-affirmation may reduce the recruitment of cognitive control resources. Therefore, accuracy and/or speed on mental rotations would decrease when individuals are threatened and self-affirmed compared to threatened but unaffirmed (Hypothesis 3). That is, a two-way interaction on performance is expected between self-affirmation and stereotype threat.

The controlled inhibition of prepotent response

In contrast, the mere effort account denies that reduced performance is due to impairments in executive functions such as working memory capacity (Seitchik & Harkins, 2015). Instead, stereotype threat affects the controlled inhibition of the prepotent response. According to Jamieson and Harkins (2007), when the prepotent response is incorrect, a response time that is too short can cause errors. However, when time allows, threatened participants are motivated to inhibit false prepotent responses. In other words, individuals are predisposed to answer 'identical' (prepotent response). When the objects are not identical, individuals have to inhibit the prepotent response. Jamieson and Harkins (2007) observed that threatened individuals inhibited the prepotent response because they were motivated to

perform well and to disconfirm the negative stereotype. Threatened and unthreatened participants had similar performance when time pressure was low (Jamieson & Harkins, 2007, Study 2). All previous stereotype threat studies with a mental rotation task used time pressure. A limited time was given to complete each trial (Wraga et al., 2006, 2007) or the overall trials (Martens et al., 2006, Study 2; Moè & Pazzaglia, 2006). In the absence of time pressure, according to the mere effort account (Jamieson & Harkins, 2007; McFall, Jamieson, & Harkins, 2009), we hypothesized that threatened individuals would be motivated and therefore could inhibit the prepotent response and perform as well as non-threatened individuals. Unlike the above studies, the current experiment used no time pressure so that threatened individuals could inhibit the prepotent response when motivated. Self-affirmation may reduce inhibition. It follows that self-affirmation would only decrease threatened individuals' performance when the figures are non-identical (Hypothesis 4). In other words, we expect a three-way interaction between self-affirmation, stereotype threat, and type of comparison.

Population and Experimental Design

One hundred sixty-six female undergraduate students (M_{age} = 20.59, SD_{age} = 2.87) from the University of Reims Champagne-Ardenne (8.4% students in psychology) participated in the experiment, and none were excluded. They were randomly assigned to one experimental condition in a 2 (self-affirmed vs. no affirmation) × 2 (stereotype threat: no threat vs. threat) between-participant factorial design. The sample size was also based on the typical effect size for self-affirmation (see Study 1 Methods). Because that method ignores the effect size of the interaction, we aimed for double the participants needed in each cell for .80 power ($n \geq 36$).

Procedure

Participants completed the study on a computer beginning with the self-affirmation procedure described in Study 1 (affirmation or control). Next, half of participants were induced with stereotype threat by being told that men perform better than women on the mental rotation task due to a genetic reason. The instructions continued: "In today's session, we want to get a measure of mental rotation ability using a standardized test. Your performance on this test will be used to help us establish your personal mental rotation ability. After the test, we will provide you with feedback about your performance relative to other students. " The other half of participants in the no threat condition read that the achievement on a mental rotation task depended on motivation (motivation-based evaluation), and for this reason, they were asked to do their best. The instructions finished for all participants by asking them to make an effort and to be as accurate and quick as possible.

Participants compared two objects presented on the left and right of the computer screen. The participants had to decide quickly and accurately whether the objects were identical. They responded "yes" (they pressed the A-key of a French keyboard) if they judged both objects to be identical and "no" (P-key) if they judged the objects to be different. Three objects from the Shepard's and Metzler's list (1971) were rotated in increments of 40°, 80°, and 180° around the vertical axis and were compared with the identical object and a different object[3] (see Figure 1).

When participants responded to all figures, they then repeated the trials in a random

[3] In the non-identical condition, the figure was shown alongside a mirrored version (non-identical).

order with the response keys reversed to avoid a dominant hand effect. Each response item was preceded by a fixation cross for one second and the comparison lasted as long as they needed. Participants made 36 decisions with an equal number of "yes" (18 identical objects) and "no" (18 non-identical objects). On average, the participants completed the mental rotations in $M = 232$ seconds, $SD = 110$. As in Study 1, we measured the knowledge of gender stereotypes about mental rotation with two items. Perceived effort was measured with a single Likert-type item from 1 (*no effort*) to 7 (*every effort possible)*.

Results

Manipulation Checks

Knowledge of gender stereotype. A 2 (between-participant: no affirmation vs. self-affirmed) × 2 (between-participant: no threat vs. stereotype threat) × 2 (within-participant: men's skills vs. women's skills) mixed ANOVA yielded a main effect of gender knowledge. The all-female participants reported that most people think men are more capable of doing mental rotations ($M = 5.12$, $SD = 1.12$) than women ($M = 2.93$, $SD = 1.26$), $F(1, 162) = 234$, $p < .001$, $\eta^2_p = .592$. The effect was qualified by a two-way interaction between stereotype threat and gender knowledge, $F(1, 162) = 21.2$, $p < .001$, $\eta^2_p = .116$: the difference between perceived men's and women's abilities was greater in the stereotype threat condition ($M_{men} = 5.48$, $SD = 1.0$ vs. $M_{women} = 3.24$, $SD = 1.27$) than in the no threat condition ($M_{men} = 4.77$, $SD = 1.13$ vs. $M_{women} = 2.62$, $SD = 1.17$). There was no interaction between knowledge of gender stereotype and self-affirmation, nor a three-way interaction, both Fs < 1.

Effort. We checked whether the participants put in more effort depending on the experimental condition. We ran a 2 (no affirmation vs. self-affirmed) × 2 (no threat vs. threat) ANOVA on perceived effort. The analysis yielded no main effect of stereotype threat nor of

self-affirmation, respectively $F(1, 162) = .30$, $p = .586$ and $F(1, 162) = 1.83$, $p = .18$. There was no interaction between self-affirmation and stereotype threat, $F(1, 162) = 1.12$, $p = .29$.

Mental rotation performance

To test the four hypotheses on mental rotation, we conducted two ANOVAs on the accuracy (score) and speed (reaction time) on a 2 (between participants: self-affirmed vs. no affirmation) × 2 (between participants: no threat vs. threat) × 2 (within participants: identical comparison vs. non-identical comparison) mixed factorial design.

Performance accuracy (number of correct answers). As expected, individuals correctly identified more identical figures ($M = 13.86$, $SD = 2.46$) than non-identical figures ($M = 10.50$, $SD = 3.67$), $F(1, 162) = 117$, $p < .001$, $\eta^2_p = .42$. This supports Hypothesis 1, which stated that there would be a prepotent response in the mental rotation task. Then, we sought to test Hypothesis 2: whether self-affirmation reduced prepotent responses. This hypothesis was not supported for accuracy. We did not observe a main effect of self-affirmation $F(1, 162) = .12$, $p = .73$. As expected for cognitive control resources, we observed a two-way interaction between self-affirmation and type of stereotype threat, $F(1, 162) = 6.75$, $p = .010$, $\eta^2_p = .04$. To test whether self-affirmation affected overall performance (both types of figures) according to threat, we conducted two pairwise comparisons. The first analysis revealed that self-affirmed participants had poorer performance ($M = 11.14$, $SD = 4.07$) than the participants in the no affirmation condition ($M = 12.46$, $SD = 3.44$) if they were threatened, $\chi^2(1) = 6.83$, $p = .009$. However, there was no difference between the self-affirmed and not affirmed participants in the no threat condition (respectively $M = 12.82$, $SD = 2.90$ and $M = 12.29$, $SD = 3.53$), $\chi^2(1) = 1.11$, $p = .29$. The two-way interaction was qualified by a three-way interaction between self-affirmation, stereotype threat, and type of

figure, $F(1, 162) = 9.54$, $p = .002$, $\eta^2_p = .06$. We decomposed this three-way interaction using maximum likelihood by analyzing two interaction contrasts between self-affirmation and stereotype threat when the figures were identical and different. The first contrast revealed no interaction between self-affirmation and threat on identical figures, $\chi^2(1) = .01$, $p = .93$. The second contrast revealed an interaction on non-identical figures, $\chi^2(1) = 15.93$, $p < .001$. Finally, we decomposed this interaction effect on non-identical figures by analyzing the simple effects of self-affirmation across threat conditions. The first contrast on non-identical figures showed that self-affirmed participants had poorer performance ($M = 8.73$, $SD = 3.56$) compared to the unaffirmed participants ($M = 10.90$, $SD = 3.55$) when the situation was threatening, $\chi^2(1) = 10.46$, $p = .001$. The second contrast on non-identical figures showed that self-affirmed participants performed better ($M = 11.98$, $SD = 3.25$) than unaffirmed participants ($M = 10.38$, $SD = 3.68$) when unthreatened, $\chi^2(1) = 5.78$, $p = .016$.

Speed. We carried out a second mixed ANOVA on the reaction times of correct answers. The expected effect was observed for figure type, $F(1, 162) = 41.31$, $p < .001$, $\eta^2_p = .203$. The non-identical comparisons ($M = 6.23$s, $SD = 3.07$) required more time than the identical comparisons ($M = 5.61$s, $SD = 2.60$), suggesting a prepotent response (Hypothesis 1). In addition, there was an interaction between self-affirmation and figure type, $F(1, 162) = 7.80$, $p = .006$, $\eta^2_p = .046$. Specifically, the participants in the self-affirmation condition had less reaction time difference between identical ($M = 5.49$s, $SD = 2.43$) and non-identical ($M = 5.88$s, $SD = 2.77$) figures compared to the no-affirmation condition (identical $M = 5.61$s, $SD = 2.60$ vs. non-identical $M = 6.58$s, $SD = 3.32$). This observation supports Hypothesis 2 on processing speed. Neither the interaction between the type of comparison and stereotype threat nor the three-way interaction were significant, $F(1, 162) = .55$, $p = .46$, and $F(1, 162) =$

.07, $p = .79$, respectively. Hypotheses 3 and 4 were not supported regarding reaction time.

Discussion

The Study 2 results suggest that self-affirmation can reduce the motivation to disconfirm a negative stereotype. Self-affirmation decreased performance when comparing non-identical figures under stereotype threat. However, there was no difference across experimental conditions on the accuracy of identical figures. This differential effect of self-affirmation under stereotype threat according to figure type is consistent with the controlled inhibition of the prepotent response: that the self-affirmed individuals were less motivated to counter the prepotent response. In contrast, when participants were threatened but not affirmed, their motivation to disconfirm the stereotype was sufficient to counter the detrimental effect of stereotype threat. The absence of an interaction on accuracy between self-affirmation and stereotype threat on identical comparisons suggests that self-affirmation does not undermine the recruitment of cognitive control resources among threatened women.

Self-affirmation reduced response time differences between figure types when the participants were threatened and unthreatened. This suggests that self-affirmation decreases the influence of the prepotent response aroused by the evaluative situation. This general reduction in the prepotent response, not specific to stereotype threat, does not seem related to the motivation to disconfirm the in-group stereotype. Like the research in social facilitation, this reduction may be due to the situation being perceived as less evaluative (McFall et al., 2009). The individuals would be less motivated to perform well, and the prepotent responses would be less aroused.

An unexpected effect was observed in the no-threat condition. Self-affirmed participants performed better on the comparisons of non-identical figures than unaffirmed

participants. This result could mean that self-affirmation untethers individuals from the prepotent response. This would be consistent with findings that self-affirmation can increase the capacity of executive functions (Hall, Zhao, & Shafir, 2014; Harris, Harris, & Miles, 2017; Koole, Smeets, Van Knippenberg, & Dijksterhuis, 1999; Koole & Van Knippenberg, 2007). Indeed, to correctly identify non-identical figures the prepotent response must be inhibited. This supplementary inhibition requires additional cognitive effort. Our results suggest that self-affirmation reduced the influence of the prepotent response while preserving the motivational state to perform well. Self-affirmation would therefore have differential effects according to the individual's perception of the task. Affirmed individuals might be less oriented toward prevention focus in their motivations, and the task might appear less threatening because the threatened individuals are less concerned by failure. The task would no longer generate a fear of failing the in-group. Future research could investigate participant experiences to identify the psychological mechanisms of how self-affirmation could decrease motivation or increase promotion focus.

In sum, self-affirmation among threatened women seems to improve the controlled inhibition of a prepotent response consistent with the mere effort account (Jamieson & Harkins, 2007) rather than any decrease in cognitive control resources (Ståhl et al., 2012).

General Discussion and Conclusion

The current literature on self-affirmation largely presents it as beneficial when self-integrity is threatened, notably in situations of stereotype threat (e.g., Martens et al., 2006; Schimel et al., 2004; Shapiro et al., 2013). However, our results suggest self-affirmation can also decrease performance under stereotype threat. We observed a small-to-medium effect of self-affirmation across both studies on multiplications and mental rotations (non-identical

figures) solved in a threatening situation (average Cohen's d = .49: in Study 1, Cohen's d = .37 and in the Study 2, Cohen's d = .61). We explain this discrepancy by showing that self-affirmation decreases the motivation to disconfirm the negative stereotype because self-integrity is reinforced. When self-affirmation reduces motivation in a stereotype threat situation, the risk of failure may not represent a threat and the internalized stereotype may be less relevant to self-integrity.

The individuals threatened by a negative stereotype are under pressure to succeed and are motivated to disconfirm the stereotype (Jamieson & Harkins, 2007; Schmader et al., 2008; Spencer, Logel, & Davies, 2016). The results of two experiments supported the hypothesis that self-affirmation can reduce the motivation to disconfirm a stereotype and result in worse task performance. Overall, self-affirmation may have this effect by changing the perception of the task: self-affirmed individuals can perceive the situation as less threatening to self-integrity and revert to the less effortful prepotent response. This effect was most clear in Study 1 where affirmed participants attempted fewer multiplication problems despite the stereotype threat, and in Study 2 where self-affirmation led to greater response time differences between identical and non-identical comparisons. Study 2 also revealed that the self-affirmed and threatened participants were less motivated to inhibit the prepotent response when they compared non-identical figures. Taken together, these results suggest that affirmed individuals may lose motivation to perform well in a threatened domain.

Theoretical Implications

Vohs et al. (2013) showed that self-affirmation can reduce goal pursuit when individuals think about a past failure. Our studies extend this finding to stereotype threat situations where failure is only a potential risk. Integrating these findings, the threat of past

and future failures may reduce motivation in affirmed individuals depending on the perception of the threat.

Self-affirmation may harm performance on some tasks by increasing the prepotent response. The motivation to disconfirm a stereotype may increase performance if the task is simple, short, or well-learned. In the most threatening situations, despite the motivation to disconfirm the stereotype, individuals lack the executive resources to perform well on a long cognitive task (Schmader et al., 2008). During long tasks, the beneficial effect of self-affirmation by suppressing the motivation to disconfirm a stereotype could stem from the freeing of cognitive control resources needed for task execution. This account is supported by our Study 2 results for self-affirmation in the no threat condition. Those participants were not motivated to disconfirm a stereotype. Our results showed that self-affirmation increased processing speed and accuracy when individuals were not threatened (Study 2). Without the threat of evaluation, self-affirmation appears to increase cognitive capacities and inhibit the prepotent response. This is consistent with recent studies showing that self-affirmation boosts various executive functions (Hall et al., 2014; Harris et al., 2017; Koole et al., 1999; Koole & Van Knippenberg, 2007; Logel & Cohen, 2012; Wen, Butler, & Koutstaal, 2013).

Limitations and Future Directions

The current two experiments suggested that self-affirmed and threatened individuals are less motivated to disconfirm the negative stereotype than unaffirmed and threatened individuals. A reduction in momentary performance motivation is not the same as chronically reduced motivation in the threatened domain. For example, Sherman et al. (2013) showed self-affirmed Latino students perceived a threatening situation with a higher construal level. By seeing the threat from a broader perspective (Critcher & Dunning, 2015), self-affirmed

students could reconstruct their experience and see academic success less as a competition. Their goal could shift from performance to mastery when their motivation was to understand, acquire new knowledge, and develop skills. This shift would not imply a decrease in general motivation, but a motivational shift that would impact automatic task processing. Self-affirmed individuals would perceive the threatening situation with a higher level of construal. Decreasing this automatic processing could have beneficial long-term effects on task performance related to a negative stereotype.

Previous research shows that self-affirmation often has beneficial effects when individuals are confronted with a threat to self-integrity. Yet, self-affirmation can also harm performance (Blanton, Cooper, Slkurnik, & Aronson, 1997; Critcher et al., 2010; Prewitt-Freilino & Bosson, 2008; Vohs et al., 2013; Voisin et al., 2016). We recommend future research continue to identify the moderating contextual factors that determine whether self-affirmation helps or harms task motivation and performance.

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