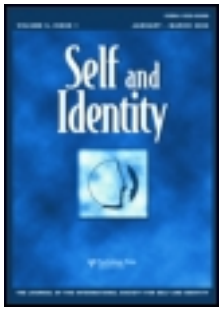

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L'eggo My Ego: Reducing the Gender Gap in Math by Unlinking the Self from Performance

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Stereotype threat can vary in source, with targets being threatened at the individual and/or group level. This study specifically examined the role of self-reputational threat in women's underperformance in mathematics. A pilot study showed that women report concerns about experiencing self-reputational threat that are distinct from group threat in the domain of mathematics. In the main study, we manipulated whether performance was linked to the self by asking both men and women to complete a math test using either their real name or a fictitious name. Women who used a fictitious name, and thus had their self unlinked from the math test, showed significantly higher math performance and reported less self-threat and distraction, relative to those who used their real names. Men were unaffected by the manipulation. These findings suggest that women's impaired math performance is often due to the threat of confirming a negative stereotype as being true of the self. The implications for understanding the different types of threats faced by stereotyped groups, particularly among women in math settings, are discussed.

Keywords: Gender; Math performance; Stereotype threat; Self; Self-threat.

A growing literature has shed light on the nature of stereotype threat including its causes and consequences. One recent conceptual advance has been the observation that stereotype threat can come in different varieties. Shapiro and Neuberg (2007) argued that in some cases the basis of the threat is a concern that one's negative performance will taint the image of the group (i.e., group-reputation threat), whereas in other cases the threat comes from a concern that one will be seen stereotypically (i.e., self-reputation threat). Although research has generally been mute on which type of threat is operating in any given situation or for any group of individuals (but see Shapiro, 2011), Shapiro and Neuberg's identification of different kinds of threat calls for investigation of the type of threat people experience. The goal of the present study was to examine the role of self-reputation threat in one's experience of stereotype threat. One of the most commonly examined situations of stereotype threat is when women face possible gender differences in mathematical ability. We tested the hypothesis that women taking a diagnostic math test experience stereotype

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threat as a threat to their self. If the threat to self-image is an essential part of their experience of threat, then women's math performance should be improved when the self is symbolically disconnected from the task.[1]

Claude Steele initially conceptualized stereotype threat as resulting from a "jeopardy of double devaluation," where a poor performance might pose a simultaneous threat to both one's self (a concern about being seen as a competent individual) and one's group (a concern about the reputation of one's group; Steele, 1997). Since then, research has examined stereotype threat as a form of social identity threat stemming from often subtle contextual reminders of one's membership in a socially devalued group (Steele, Spencer, & Aronson, 2002). Consistent with the notion that stereotype threat is a threat to women's gender identity, research has shown that these effects are more pronounced for women who are highly identified with their gender (Schmader, 2002; Wout, Danso, Jackson, & Spencer, 2008).

Apart from the threat to a social identity, there is suggestive evidence that many situations of stereotype threat share in common an underlying concern with how the self is viewed through the lens of a negative stereotype—what Shapiro and Neuberg label self-reputation threat. For example, while academic contexts motivate individuals to present themselves as being intellectually competent, situations that bring to mind negative stereotypes cue a sense of self-doubt and jeopardize a target's ability to project an image of competence (Steele & Aronson, 1995). These effects have been broadly demonstrated among women stereotyped as being inferior in math (Beilock, Gunderson, Ramirez, & Levine, 2010; Cadinu, Maass, Rosabianca, & Kiesner, 2005; Schmader, Forbes, Zhang, & Mendes, 2009). Such findings suggest that situations of stereotype threat not only threaten one's sense of group identity, but also pose a threat to the self.

Research also suggests that stigmatized students recognize these distinct types of threat. For example, Cohen and Garcia (2005) found that academically stigmatized minority college students reported distinct concerns about being viewed stereotypically (i.e., the stereotype is a threat to the self-reputation) and about confirming the group stereotype (i.e., the stereotype is a threat to group reputation). In more recent research, groups stigmatized on the basis of ethnicity, religion, weight status, or disability differ in their reported experience of threat to their specific group identity (gender groups were not included in this study), but they all report relatively high levels of self-reputation threat (Shapiro, 2011). It would seem that regardless of whether group identification is high or low, negative stereotypes often present a threat of being personally judged in terms of that stereotype. Thus, based on both past theory and evidence, a stereotype's ability to threaten the self can be distinguished from its threat to group identity. Does this imply, however, that a situation that reduces the potential threat to the self would alleviate stereotype threat, at least as it is most often studied among women in the math domain?

If self-reputation threat is a key ingredient of the threat women feel in math, then manipulations that target this type of threat should be particularly effective. For example, Ambady, Paik, Steele, Owen-Smith, and Mitchell (2004) found that women who completed an individualization manipulation (listing their favorite movie, book, hobbies, and food) before completing a high threat math test no longer showed performance detriments. Furthermore, research on self-affirmation has shown that stereotype threat effects can be mitigated by having stigmatized individuals reflect on core values related to the self (e.g., Martens, Johns, Greenberg, & Schimel, 2006). More recently, researchers have demonstrated that self-affirmation interventions can lead to long-term grade improvement for stigmatized students (Cohen, Garcia,

Apfel, & Master, 2006; Cohen, Garcia, Purdie-Vaugns, Apfel, & Brzustoski, 2009; Miyake et al., 2010). Together, the past research suggests that efforts to affirm or individuate the self are successful remedies to stereotype threat. In the present work, we examined whether unlinking the self entirely from the performance situation might be a useful means to reduce the psychological threat associated with a negative stereotype.

To date, only a couple of studies comparing different types of threats offer insight into this question. Wout and colleagues (2008) manipulated self versus group threat by informing participants that they would grade their own diagnostic math test and be the only person who would know their test score (self-threat) or that researchers would only compare the average score of female to male participants (group-threat). When these conditions were compared to standard non-diagnostic and diagnostic test instructions, performance was similarly impaired both in a standard condition emphasizing test diagnosticity and in a condition that allowed only for self-threat. Emphasizing average scores (and thus disconnecting the self from performance) did not decrease performance relative to the non-diagnostic condition, except among women highly identified with their gender. In research by Jamieson and Harkins (2010), an explicit mention of gender differences in math performance did not impair women's performance if they believed their performance was completely anonymous, but did impair performance if they believed their score would contribute to an average score of women to be compared against men.

Together, these studies provide some evidence that self and group threats are distinct routes by which negative stereotypes can impair women's math performance. However, there are a few limitations worth mentioning. First, in Wout et al. (2008), the manipulation of the target of threat (self or group) is confounded with the source of threat (private or public; see Shapiro & Neuberg, 2007), which could add some ambiguity in interpreting the effects. In addition, the studies reviewed above aimed to reduce a sense of self-threat by stressing examination of group averages. Such instructions lower one's sense of personal accountability while also stressing comparison between the genders. Thus, removing the threat to the self is sometimes confounded with inducing a threat to a social identity. This is likely why this manipulation, compared with a non-threatening condition, sometimes impairs performance (Jamieson & Harkins, 2010) and sometimes does not, as moderated by group identification (Wout et al., 2008). In the present research we sought to focus only on public forms of stereotype threat and more directly isolate the performance inhibiting effects of self-reputation threat, specifically.

In addition, researchers have long known that individuals feel less threat of personal evaluation when their individual efforts are combined with those of others (Latané, Williams, & Harkins, 1979), and this anonymity can actually free them to perform better on difficult or complex tasks (Jackson & Williams, 1985). Because neither of the past studies (i.e., Jamieson & Harkins, 2010; Wout et al., 2008) included men as a comparison group or a manipulation of stereotype threat, it's difficult to know whether general effects of evaluation apprehension also played a role in the previous effects.

To examine self-reputation threat experienced by women in math and to address some of the limitations of prior research, we carried out two studies. The first was a pilot study modeled after Cohen and Garcia (2005) examining women's and men's explicit reports of self- and group-based stereotype threat in the math domain. The second was an experiment that manipulated the degree to which the self was likely to be linked or disassociated with participants' math performance in a stereotype

threatening context. If self-threat is indeed a prominent part of women's experiences that lead to their underperformance, then unlinking the self from a math test should improve women's math performance, irrespective of any direct link to group identity.

A Pilot Study of Women's Self-threat Concerns in Math

To establish that women report an experience of threat to their self-image in math that is at least comparable if not greater than their experience of group reputation threat, we conducted a pilot study of college students' conscious reports of self-reputation and group-reputation concerns in math using items adapted from Cohen and Garcia (2005).

Methods

In a survey of 1,001 college students (387 men and 614 women), participants rated their self-reputation threat with the item: "When it comes to doing math, I am concerned that people will draw conclusions *about my personal ability to do math*, based on what they think about my gender group." They also rated group-reputation threat with the item: "When it comes to doing math, I am concerned that people will draw conclusions *about my gender group's math abilities* based on my personal math performance." In addition, participants' gender identification was measured with a 4-item modification of Crocker and Luhtanen's (1990) identity importance subscale ($\alpha = .73$, e.g., "Being a member of my gender group is an important reflection of who I am"). Participants also completed a 5-item math identification measure ($\alpha = .84$, e.g., "Being good at math is an important part of who I am"). All ratings were made on Likert scales from 1 (*Strongly disagree*) to 7 (*Strongly agree*).

Results

We first conducted a mixed-model analysis of variance (ANOVA) with Participants' Gender as a between-subject factor and the Type of Threat Concerns as a within-subject factor.[2] As expected, women reported higher levels of threat concerns than did men, $F(1, 990) = 10.35$, $p = .001$. In addition, among both men and women, self-reputation threat was higher than group reputation threat, $F(1, 990) = 20.13$, $p < .001$. The interaction between gender and threat concerns was not significant, $p > .30$.

In addition, participants' self- and group-reputation threats were significantly correlated, $r = .62$, $p < .001$, sharing 38% of their variance in common. Although this correlation suggests some overlap between these two concepts, past research showing similar levels of correspondence has revealed distinct correlates of these different types of threat (Cohen & Garcia, 2005; Shapiro, 2011). To identify the unique effects of self- versus group-reputation threats, we conducted two hierarchical regression analyses to predict participants' self- or group-reputation threats from predictor variables after controlling for the other type of threat. Specifically, the covariate, either the group- or self-reputation threat, was entered in the regression model in the first step, and then three predictors: participants' gender, math identification, and gender identification, and the two-way interactions between these predictors were entered in two consecutive steps in the model. The results showed

that when predicting self-reputation threat after controlling for group-reputation threat ($\beta = 0.61$, $p < .001$), math identification and gender were both significant predictors, significant $\Delta F(3, 998) = 4.81$, $p < .01$. Women reported higher self-reputation threat than did men, $\beta = -0.06$, $p < .02$, and highly math-identified participants reported more self-reputation threat, $\beta = 0.08$, $p = .002$. No other predictors, including the interaction between gender and math identification ($\beta = 0.01$, $p > .80$) were significant, $ps > .50$. In the analysis predicting group-reputation threat (controlling for self-reputation threat, $\beta = 0.62$, $p < .001$), only gender identification was a marginal predictor, $\beta = 0.04$, $p = .06$. No other predictors were significant, $ps > .20$, including the gender by gender identification interaction.

Taken together, these results suggest that although self-reputation and group-reputation threats are relatively highly correlated, they were uniquely related to different psychological variables. Interestingly, although women show higher levels of self-reputation threat, among both men and women, it is self- and not group-reputation threat that is predicted by higher levels of math identification. Being invested in math seems to elevate anyone's concerns about how they are evaluated in that domain; but as gender stereotypes uniquely impugn women's sense of competence, reminders of these stereotypes could systematically cue self-reputation threat among women rather than men.

Primary Study

Having established that women report a greater concern with how gender stereotypes threaten their self-identity, our primary experiment sought to test the hypothesis that unlinking the self from a performance context would alleviate stereotype threat effects on women's math performance. To examine this, we had college students take a challenging math test described as measuring gender differences in math ability. We primed a link between *self* and performance by having participants write their first and last name on the test. In this condition, designed to mimic a typical test-taking environment, we expected women to perform more poorly than men. Two other conditions were designed to prime a disassociation of self with performance by assigning participants a fictitious name as an identity mask. Depending on condition, the assigned name was either male or female. This allowed us to test two competing predictions. If priming a disconnect of self from performance alleviates stereotype threat, then women but not men should perform better in the identity mask conditions regardless of the gender of the name they use.

Alternatively, other research has demonstrated that even members of non-stereotyped groups perform in a stereotype consistent way if an out-group identity is primed to be self-relevant (Demarree, Wheeler, & Petty, 2005; Wheeler, Jarvis, & Petty, 2001). If these same processes are operating here, then men and women should exhibit poorer test performance when assigned to adopt a female name than a male name. The failure to see these effects, however, would suggest that in prior studies, the use of an active perspective taking manipulation (write about a day in the life of Tyrone Walker), as opposed to the passive priming technique used here, is necessary to achieve stereotype assimilation. Finally, because math but not gender identification was significantly predictive of self-reputation threat in our pilot data, we included a measure of math identification as a possible covariate and moderator.

Method

Participants

Participants were 199 undergraduate students (120 women, 79 men). Seventeen participants were excluded because they either correctly guessed the purpose of the study or failed to follow instructions, resulting in a final sample of 110 women and 72 men. All participants had previously rated their math identification on a 7-point scale "Being good at math is an important part of who I am" on a mass survey.

Procedure

A male experimenter ran the study with mixed-gender groups of two to seven participants.[3] Participants were told that this was a pilot study examining convergent thinking and divergent thinking. To create stereotype threat among women (Spencer, Steele, & Quinn, 1999), the experimenter mentioned in all sessions that gender differences have been found on convergent thinking as reflected by math performance. He then introduced the math test, which consisted of two sections of 15 multiple-choice questions drawn from practice tests for the Graduate Record Examination. Participants were given 15 minutes to complete each section and performance was scored as the total number of questions answered correctly out of the number of items attempted across all 30 questions.[4]

Manipulation to link/unlink the self to performance. Identity primes were used to manipulate whether the self was linked or unlinked to math performance with varied instructions on how participants should label their exam for coding purposes. Those randomly assigned to the *own-name* condition were asked to fill out the test date, their real names, and indicate their gender on the cover sheet of the math test booklet, which should prime the idea to participants that their self was linked to their math performance. Participants randomly assigned to the *identity-mask* conditions only filled in the test date as the booklets already had one of four fictitious names and its associated gender filled in. They were told that for coding purposes and due to confidentiality concerns, participants would be using the name already provided on test. There were four names selected based on piloting testing: "Jacob Tyler," "Scott Lyons," "Jessica Peterson," and "Kaitlyn Woods." Same-sex names were matched on their rated femininity/masculinity and all four names were rated equivalently on their associations with math, intelligence, novelty of the name, and comfortableness of use. Using these four fictitious names as identity masks, participants were primed with the idea that the self was *publicly* unlinked to performance. To reinforce the identity manipulation, participants were instructed to write down the name they were using (either their own or the assigned name) on each page of the math test.

Final Questionnaire

After completing the math test, participants rated the following items[5] on a scale from 1 (*Strongly disagree*) to 7 (*Strongly agree*).

Self-reputation threat. This was assessed by two items: "I am concerned that the researcher will think I have less ability if I did not do well on the math test that I took in this session" and "I am concerned that I will be judged as a person based on my performance on the math test that I took in this session." ($r = .62$, $p < .001$).

Group-reputation threat. This was assessed by two items: "I am concerned that people of my gender, as a whole, will be judged based on my performance on the math test that I took in this session" and "People of my gender, as a whole, will be thought to have less ability on these kinds of tasks if I did not do well" ($r = .84$, $p < .001$).

Self-related distraction. This was assessed by two items: "I had difficulty concentrating on this task" and "I was distracted by thoughts about myself during the test" ($r = .66$, $p < .001$). Participants who used fictitious names also rated their assigned name on dimensions such as perceived femininity/masculinity of the name on a scale from 1 (*Extremely masculine*) to 7 (*Extremely feminine*).

Results

Manipulation Checks on Identity Masks

A 2 (Participant Gender) × 4 (Fictitious Name) ANOVA on the perceived femininity/masculinity of the assigned names yielded only an effect of name, $F(3, 114) = 358.71$, $p < .001$. As expected, "Jessica" and "Kaitlyn" were rated to be equally feminine (feminine Ms = 6.48, 6.42), and significantly different from "Scott" and "Jacob" (equally masculine Ms = 2.22, 1.93), ps $< .001$. No significant effects were found with other perceived name characteristics that might account for the interaction we predict. These results demonstrated that the female and male fictitious names were distinguished by gender but not by other variables relevant to performance. Thus, we collapsed across the two male names and the two female names in all subsequent analyses.

Analytic Strategy

Variables were analyzed with moderated regression analyses in which Step 1 included a contrast coded variable representing participant gender (1 = male, − 1 = female), two orthogonal contrast coded variables to represent the three-level identity prime manipulation (Cohen & Cohen, 1983), and a mean-centered measure of math identification. All two-way interactions between these predictors were entered on Step 2, and the three-way interaction was entered on Step 3. The first contrast (own name vs. fictitious name) was coded as: own name = −2/3, male fictitious name = 1/3, female fictitious name = 1/3, and tested the difference between using one's own name and either of the fictitious names. The second contrast (male vs. female fictitious name) was coded as: own name = 0, male fictitious name = 1/2, female fictitious name = −1/2, and tested the difference between using a male or female fictitious name.

Math Test Performance

Attempts. Analysis of the number of items attempted revealed that women attempted somewhat fewer math problems ($M = 24.90$) than did men ($M = 26.26$), $\beta = 0.15$, $p < .06$. In addition, the contrast of male versus female fictitious name was significant, $\beta = -0.16$, $p < .05$, indicating that participants (regardless of their own gender) using a female fictitious name attempted significantly more items ($M = 26.58$) than those using a male fictitious name ($M = 24.78$). No other main effects or interactions were significant, ps $> .20$. These patterns are themselves not meaningful, but because there was some systematic variation in the number of

questions answered, we focused on accuracy (i.e., the number of correct answers out of the number attempted) as our primary measure of performance.

Accuracy. Women's and men's accuracy scores (along with other dependent variables of interest) for each condition are presented in Table 1. Regression analyses of accuracy yielded a main effect of gender, $\beta = 0.22$, $p < .01$ (men outperformed women), and a main effect of own versus fictitious name contrast, $\beta = 0.22$, $p < .02$, which was qualified by the predicted interaction between gender and own versus fictitious name contrast: $\beta = -0.17$, $p < .03$. Specifically, women who used their own name were less accurate ($M = 0.44$) than men who used their own name ($M = 0.61$), $\beta = 0.31$, $p = .001$. However, women who were assigned a fictitious name ($M = 0.51$) performed significantly better than those using their own name, $\beta = 0.17$, $p < .05$, and equivalently to men in the fictitious name conditions ($M = 0.60$), $\beta = 0.10$, $p > .20$. Men's performance was unaffected by the use of a different name, $\beta = -0.07$, $p > .30$.

Importantly, the other contrast comparing a male versus a female fictitious name was not significant, $p > .90$, and the gender by male/female name contrast yield only a marginal trend, $\beta = -0.12$, $p = .099$. Pairwise comparisons suggested that women performed worse than men when using a fictitious female name, $p = .04$, but they did not perform significantly worse than other women ($p > .10$) or men ($p > .70$) who used a fictitious male name. Men's performance did not differ between using a female or male fictitious name, $p > .20$. Given these marginal patterns, we cannot conclude that using a female name is less effective than using a male name. Rather, the overall pattern of results more clearly

TABLE 1 Means and Standard Deviations of Math Accuracy (%), Reported Distraction, Self-threat, and Group-threat of Women and Men Taking a Math Test Identified with Different Names

	Own name		Fictitious name	
	Female or male ($n_{women} = 35$; $n_{men} = 23$) *Mean* (*SD*)	Female ($n_{women} = 42$; $n_{men} = 24$) *Mean* (*SD*)	Male ($n_{women} = 33$; $n_{men} = 25$) *Mean* (*SD*)	Female or male ($n_{women} = 75$; $n_{men} = 49$) *Mean* (*SD*)
Accuracy (%)				
Women	44% (18%)	48% (21%)	55% (19%)	51% (21%)
Men	61% (18%)	63% (17%)	56% (24%)	60% (21%)
Distraction				
Women	3.61 (1.51)	3.17 (1.85)	3.18 (1.50)	3.17 (1.70)
Men	2.26 (1.27)	3.42 (2.10)	3.04 (1.71)	3.22 (1.90)
Self-threat				
Women	3.64 (1.34)	3.38 (1.48)	3.27 (1.70)	3.33 (1.57)
Men	2.46 (1.25)	2.58 (1.55)	2.98 (1.37)	2.79 (1.46)
Group-threat				
Women	2.85 (1.40)	2.96 (1.75)	2.94 (1.61)	2.95 (1.68)
Men	2.52 (1.54)	2.20 (1.33)	2.62 (1.50)	2.42 (1.42)

provides evidence that using any identity mask can buffer women from suffering the consequences of stereotype threat.

The regression analysis on accuracy also yielded a main effect of math identification ($\beta = 0.19$, $p < .02$) that was qualified by the interaction between math identification and the own versus fictitious name contrast, $\beta = 0.20$, $p < .01$. Simple slope analysis indicated that at higher levels of math identification (i.e., above 1 *SD*), participants performed better with an identity mask than with their own name, $\beta = 0.30$, $p = .001$, whereas low math-identified individuals (i.e., below 1 *SD*) did not differ by whether they used a mask or not, $\beta = -0.02$, $p > .80$. As the three-way interaction was not significant, it seems that these effects might be present regardless of participant gender and could constitute a general reduction of evaluation apprehension by priming a disconnection of self from a challenging task in a valued domain, consistent with past research (Jackson & Williams, 1985).

Self-report Measures

Analysis of self-related distraction yielded only a significant interaction between participant gender and the own versus fictitious name contrast that paralleled performance, $\beta = 0.22$, $p < .01$. Simple slopes analyses revealed that women reported more distraction ($M = 3.61$) than did men ($M = 2.26$) when using their own names, $\beta = -0.24$, $p < .01$, but not when using a fictitious name ($M_{\text{women}} = 3.17$, $M_{\text{men}} = 3.22$), $p > .60$. Meanwhile, women's reported levels of distraction did not differ between using their own names and using a fictitious name, $p > .10$. However, men reported more distraction when using a fictitious name compared with using their own name, $\beta = 0.18$, $p < .05$.

Because self-reputation and group-reputation threat were moderately correlated ($r = .59$, $p < .001$), our analyses of each type of threat included the other as a covariate. An analysis of self-reputation threat (controlling for group-reputation threat) revealed a similar pattern to that found for distraction: a main effect of gender ($\beta = -0.17$, $p < .01$), qualified by a significant interaction between gender and own versus fictitious name contrast, $\beta = 0.17$, $p < .01$. Again, women showed more self-reputation threat ($M = 3.57$) than their male counterparts when using their own names ($M = 2.58$), $\beta = -0.28$, $p < .001$, but not when using a fictitious name ($M_{\text{male}} = 2.97$, $M_{\text{female}} = 3.21$), $p > .50$. The female versus male fictitious name contrast and its interaction with gender were not significant in either analysis, ps $> .50$, again suggesting that the gender association of the fictitious name used did not moderate these effects.

In addition, the interaction of math identification by own versus fictitious name contrast predicting self-reputation threat was also significant, $\beta = -0.16$, $p = .01$, and yielded a similar pattern as the accuracy finding. For those high in math identification (+1 *SD*), using an identity mask led to lower self-reputation threat concerns compared to using one's own name, $\beta = -0.22$, $p < .01$; but among those low in math identification (−1 *SD*), this manipulation had no effect, $p > .90$. Again, the three-way interaction was not significant suggesting a general reduction of evaluation apprehension among domain-identified participants when performance seems more anonymous.

Our analysis of group-reputation threat (including self-reputation threat as a covariate) yielded no significant effects apart from the covariate. Thus, our data suggests using a fictitious name exempts women from worrying about their personal identities under stereotype threat.

Mediational Analyses

Finally, we explore whether self-related distraction and self-reputation threat mediated the effect of gender by own versus fictitious name contrast interaction found on math accuracy. These two mediators were weakly but significantly correlated with one another, $r = .27$, $p < .001$. To test the possible mediated moderation effect, we conducted a series of regression analyses specified by Muller, Judd, and Yzerbyt (2005). Results showed that the interaction between gender and own versus fictitious name contrast significantly predicted distraction ($\beta = 0.22$, $p < .01$) as well as self-reputation threat ($\beta = 0.17$, $p < .01$). When the two mediators were also included in the regression model with gender, identity prime conditions, math identification, and their interactions to predict math accuracy, the gender by own versus fictitious name contrast interaction that had been a significant predictor ($\beta = -0.17$, $p < .03$), was no longer significant ($\beta = -0.11$, $p > .10$), while distraction ($\beta = -0.25$, $p = .001$) and self-threat concerns ($\beta = -0.17$, $p < .05$) were significant predictors of math accuracy. These results suggest that using an identity mask alleviates stereotype threat by reducing self-threat concerns and distractions.

Discussion

Since Steele's (1997) original conceptualization of stereotype threat, the nature of the threats faced by stereotyped individuals has been refined. While the original theory stressed the importance of a stereotyped individual's social identity, more recent research has recognized the need to differentiate between the target and the source of threat (Shapiro & Neuberg, 2007). Our work sought to examine the role of self-reputation threat (when controlling for group-reputation threat) in women's experience of stereotype threat. While research by Wout et al. (2008) and Jamieson and Harkins (2010) has demonstrated that both self- and group-threats are distinct routes by which negative stereotypes can impair performance, the methods used in the past studies sometimes confounded public evaluation and personal accountability with self versus group as the target of threat. Using a more passive identity priming paradigm, the present research confirms the prominent role that self-reputation threat plays for women confronting gender stereotypes in math.

Specifically, our results demonstrated that disassociating personal identity from performance (by using someone else's name) led women to report fewer distractions and self-evaluation concerns while taking a math test, which consequently led to better performance on the test. In contrast, men's performance on the test was largely unaffected by the name they used. By using a manipulation that does not necessarily confound increasing potential for group-threat with decreasing the potential for self-threat, and by including other measures of threat, we were able to isolate the important role that self-reputation threat plays in women's underperformance in math. Consistent with recent research by Shapiro (2011), our findings suggest that concerns about self-reputation are a prominent component of stereotype threat among a general sample of women in math, and largely drive women's underperformance in situations that cue gender stereotypes. Interestingly, our pilot data revealed that math identification also predicts self-reputation threat concerns for both men and women, and that the anonymity obtained with a fictitious name can guard against this more general evaluation threat for highly math identified individuals, regardless of their gender. Negative stereotypes, however, are likely to systematically trigger these concerns more frequently for those who are targeted by them.

Importantly, the results provided no strong evidence that the gender of the fictitious name moderates effects. Although there are some hints in the data that a female name might be somewhat less effective at reducing stereotype threat than using a male name, these results did not reach significance and thus would require further confirmation. Instead, the more reliable pattern was that the use of any fictitious name can effectively reduce women's likelihood of experiencing distraction and self-reputation threat and elevate performance.

At the same time, we observed no strong evidence of stereotype assimilation whereby adopting another's identity would lead to stereotype-congruent performance among both men and women. Consistent with DeMarree et al.'s (2005) active-self framework of stereotype priming, it seems that assimilating an out-group into the self requires a more active process of taking on the identity of an out-group than merely passively using an out-group name.

The findings from the current research offer possible ways to alleviate stereotype threat. At the most practical level, they speak to the benefits of using non-name identification procedures in testing. But more generally, they suggest that coping strategies that allow stigmatized individuals to disconnect their self from a threatening situation can be an effective tool to disarm negative stereotypes. Consistent with this idea, Nussbaum and Steele (2007) found that for negatively stereotyped students, temporarily detaching the self from an evaluative situation facilitated motivation and persistence on a diagnostic task. Future research is needed to determine the effectiveness of such disengagement coping strategies in more naturalistic environments.

Although the findings of this study speak to the prominent role of self-reputation threat for women's experience in math, they do not rule out the possibility that women, particularly those who are highly identified with their gender, experience group-reputation threat (Wout et al., 2008). This idea could have implications for the interventions employed to reduce threat. For example, in a different domain (women stereotyped to be bad drivers), Derks, Scheepers, van Laar, and Ellemers (2011) showed that women who report low levels of gender identification exhibit cardiovascular patterns of challenge following self-affirmation (but not gender affirmation). In contrast, among women who are highly group identified, this same context elicits physiological challenge only when participants' gender identity, but not their individual identity, is affirmed.

Finally, we agree with Shapiro (2011) who argues that there are important differences in people's experience of stereotype threat that depend on the group to which they belong. Future research should directly test the role of group-reputation concerns in the experience of stereotype threat and explore the unique experiences that different stereotyped groups face when under stereotype threat. By elucidating these experiences, interventions can better target the type of threat that prevents individuals from performing at their true potential.

Notes

1. Shapiro and Neuberg's model also takes into account the source of the threat being the self and in-group or out-group other. Our focus here is on perceived evaluation from an out-group evaluator.
2. When gender identification (median split) is included in the model, it does not significantly interact with gender or threat type, $ps > .08$.

3. The gender composition of each session varied based on participant sign-ups but this was not confounded with condition (e.g., there were 3–4 sessions in each condition where men outnumbered women during the test).
4. Performance was highly correlated across the two sections ($r = .74$, $p < .001$).
5. We also measured participants' gender identification at the end of the post-test questionnaires using the same measure included in the pilot study. Responses on this measure were not different by condition. Exploratory analyses treating gender identification as a moderator yielded a complex pattern of findings across dependent variables that are difficult to interpret given the measurement of gender identification after performance. For example, a marginal gender by gender identification by identity prime interaction on both accuracy and self-reputation threat suggests that men outperformed women only if they were high (but not low) in gender identification and using their own (but not a fictitious) name. This pattern could suggest that gender identification (like domain identification) increases susceptibility to the self-reputational threat that is the focus of this paper. However, it is equally plausible that high performing men and low performing women rate themselves higher in gender identification after exhibiting stereotype consistent performance on a test linked to their personal identity. Because the interpretation of these effects is unclear and tangential to our central question, we do not provide a full discussion of the results here. However, readers interested in these effects can contact the first author for additional information.

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