The Effect of a Fabricated Stereotype Threat on Sex Differences in Object Location Memory

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ABSTRACT. Monitoring a negative stereotype coupled with the fear of conforming to it poses the risk for targeted groups to underperform when completing a relevant task. We investigated the impact of a fabricated (empirically invalidated and not socially instilled) stereotype threat on an object location memory task, which tends to show a sex difference in favor of women. The threat stated that women tend to perform worse than men; thus, we tested if a fabricated negative stereotype would decrease performance of an advantaged group. Contrary to expectations, the negative stereotype improved women’s performance: women under threat actually performed better than when not under threat ($p = .007$, $d = 1.094$). Discussion focuses on the “mere effort” account and the impact of stereotype salience.

Keywords: stereotype threat, fabricated stereotype, sex differences, object location memory

Stereotype threat occurs when a person’s awareness of a negative stereotype about their group makes them wary about confirming it (Steele & Aronson, 1995). Under some conditions, this wariness is intense enough to interfere with one’s ability to demonstrate competence on tests, in social interactions, and in other situations where performance anxiety is disruptive (Steele, 2010). For example, in early experimental tests of stereotype threat, Steele and Aronson (1995) found that African American college students performed worse on a standardized test of verbal ability when reminded of their race (and thus the stereotype of African American mental abilities), or alternatively, when led to believe a test was diagnostic of their intellectual ability (and thus capable of confirming the stereotype about intelligence). Stereotype threat has been studied for two decades and shown to be operative in a variety of situations and experienced by individuals with a range of social identities (Aronson & Dee, 2012; Inzlicht & Schmader, 2012; Reardon, Atteberry, Arshan, & Kurlaender, 2009; Rydell, Van Loo, & Boucher, 2017).

Like earlier work demonstrating the ability in test performances of poor and minority students (Katz, Epps, & Axelson, 1964; Zigler & Buttefield, 1968), Steele and Aronson’s aim was to shed light on the role of context in the IQ test score gap and the college learning gap between White and Black American students (Steele, 1997; Steele & Aronson, 1998). The logic in all of these studies is that, by making stereotypes salient or seem especially relevant, subtle cue differences in context can lead to impaired cognitive performance, learning, or social interaction of individuals to whom the stereotypes apply. As a society, we tend to assume that intellectual performance is stable from one situation to another, but stereotype threat is one of many cases that show that this is quite fragile, particularly for groups with a reputation of intellectual weakness in some domain (Aronson & Steele, 2005; Beilock & Carr, 2001).

Although studies have shown stereotype threat effects among various groups in many situations (e.g., Shapiro & Williams, 2012), the effect has been studied most extensively with women in situations involving performance in math and hard science domains. For example, in an early study,
Spencer, Steele, and Quinn (1999) found that women underperformed compared to men when solving difficult math problems but performed significantly better when assured that the test did not discriminate against women. The take-home message of all this work—from Katz’s early studies (Katz et al., 1964) to more recent ones (Pansu et al., 2016)—is that even subtle shifts in context can produce large differences in performance (Beilock, Rydell, & McConnell, 2007) or learning (Appel, Kronberger, & Aronson, 2011), most often by negating the working assumption that a person is at risk of underperforming and confirming a negative stereotype in a high-stakes situation.

The tasks in most stereotype threat situations are cognitive and rely on working memory. However, it has been shown that stereotype threat can also affect skills that are procedural in nature (Beilock & Carr, 2001). Stone, Lynch, Sjomeling, and Darley (1999) reported that, when an athletic task is explained as being diagnostic of athletic ability, White athletes underperformed, but when the same task was framed as being diagnostic of strategic ability, Black athletes underperformed. This indicates that stereotype threat can apply to a wide variety of circumstances and performances (Beilock & Carr, 2001).

Research on the causes of stereotype threat has suggested that people under threat perform more poorly due to cognitive and affective factors involving both automatic and controlled processes such as stereotype avoidance and automatic vigilance (Schmader & Beilock, 2012). Schmader and Johns (2003) proposed that the mechanism behind the impact of stereotype threat is working memory capacity. Working memory capacity was defined as “the ability to focus one’s attention on a given task while keeping task-irrelevant thoughts at bay” (p. 440). If a stereotype threat were to be present while completing an assessment, the working memory capacity for the task would be diminished because of competing demands such as focusing on the threat and fear of conforming to the threat. Schmader and Johns (2003) used a working memory capacity assessment coupled with a quantitative assessment to determine if women under threat have a reduced working memory capacity. They found that, when women were told that the quantitative assessment showed sex differences, they did indeed present lower working memory capacity compared to men (Schmader & Johns, 2003). This resulted in lower scores on the quantitative task. Further evidence has supported a causal link between working memory and stereotype threat, as described by Beilock, Jellison, Rydell, McConnell, and Carr (2006).

Other factors can account for the effect of stereotype threat by offering an explanation of performance differences across a variety of situations and could eventually be used to alleviate the impact of stereotype threat. These include, but certainly are not limited to, anxiety, individuation tendencies, evaluation apprehension, performance expectation, explicit stereotype endorsement, self-efficacy, and motivation (Pennington, Heim, Levy, & Larkin, 2016). Considering motivation, for example, it has been suggested that the presence of a stereotype threat incentivizes individuals to improve their performance on a task at hand, strengthening their prepotent response (the most likely response to be produced; Jamieson & Harkins, 2007). This can be beneficial to individuals if the prepotent response is successful. However, it can also be detrimental to performance if the prepotent response is incorrect. It seems that a stereotype threat is particularly beneficial in motivating if the person is engaged in a difficult task with which they do not strongly identify (Keller, 2007).

To our knowledge, nearly all of the published research on stereotype threat involves a stereotype with some accuracy. For example, in the race studies by Steele and Aronson, national statistics confirm that Black students graduate with grades two-thirds of a letter grade lower than their White counterparts (American Council on Education, 1990). National test score data likewise indicate that Asians score better than their White counterparts on tests of mathematics, and that White male students perform better than White female students on tests of calculus and other measures of advanced mathematics (Benbow & Stanley, 1983). Thus, the stereotypes can be thought to be threatening because they are both salient and, to some extent, accurate, which magnifies the risk of behavior or performance.

In the present study, we examined the influence of stereotype threat without this confirmation of a known, and, somewhat accurate stereotype. Specifically, we asked about the effects of a fabricated stereotype—an allegation of a group difference previously unknown to a target. We use “fabricated” to refer to a stereotype that is not socially instilled, meaning that it is not a stereotype that the participants in the study would be aware of or identify with. This concept of a fabricated threat has, to the best of our knowledge, been untested in stereotype threat research. However, it is an important issue because not every cultural group is aware of stereotypes targeting them, and when changing cultural environment, the potential threat of a stereotype might
hinge not only on its negative connotation, but also on how instilled it is in the specific person. For example, when immigrants enter a new nation, there may be pre-existing stereotypes held by the cultures they are entering that they are not aware of (Deaux et al., 2007). It is important to know if immigrants can be impacted by the stereotypes targeting them when held by others in their new social context. If this is the case, then their performance in various domains could be diminished upon first exposure to a negative stereotype in the new environment.

Can a stereotype that suggests an ability difference undermine performance if it is created de novo in a laboratory, or must a stereotype contain some level of accuracy and be salient within a society? If the competition for working memory resources is at the core of the stereotype threat, then there should be a similar effect between a salient and a fabricated stereotype. Unlike the socially instilled stereotypes used in most of the literature, the targeted group in the present study was unfamiliar with the fabricated stereotype. However, if they were made aware of the group difference with an explicit statement, the existence of the stereotype, and the fear of conforming to it, should still occupy some of the finite working memory capacity that could be dedicated to the task at hand. Therefore, in the present study, it was reasoned that a fabricated threat would have the same impact of a typical stereotype threat: impaired performance of the targeted group.

The assessment chosen for this study was novel in that, to the best of our knowledge, it had not been used in stereotype threat research before. The assessment was an object location memory task, as described by Voyer, Postma, Brake, and Imperato-McGinley (2007). This task involves encoding the location of an array of objects on a piece of paper and, after a distractor, recognizing whether any of their locations had been changed or not. This task was chosen for two main reasons. First, unlike most spatial abilities, which tend to show no consistent sex differences or a male advantage (Voyer, Voyer, & Bryden, 1995), object location memory presents a sex difference in favor of women, as found in a meta-analysis that accounted for 86 studies (mean weighted $d$ of 0.269; Voyer et al., 2007). In general, most of the literature on stereotype threat deals with assessments that favor men (e.g., mental rotation, advanced mathematics; see McGlone & Aronson, 2006; Moë, 2009), so it is important to add evidence from an opposite group difference. Furthermore, the sex difference in object location memory is not as commonly known in society because other group differences that have been considered previously, such as quantitative assessment; this allowed us to create a novel threat with little preconceived notion.

The stereotype threat was elicited by verbally stating: “Women tend to perform worse than men on this type of assessment.” Therefore, the group difference presented was in the opposite direction from what literature had indicated (i.e., female advantage). As such, the goal of the present study was to explore whether a fabricated stereotype threat could decrease (rather than increase) a group difference by weakening the performance of the advantaged (rather than the disadvantaged) group, thus extending knowledge on the full possible impact of a stereotype. We hypothesized that, if a fabricated (empirically invalidated and not socially instilled) stereotype is sufficient to contend for working memory capacity with the task at hand, a stereotype threat should be elicited; this should result in women under threat performing more poorly than their unthreatened counterparts.

**Method**

**Participants**
A total of 60 undergraduate students from a small, public, Midwestern university were recruited for this study via convenience sampling. Participants were recruited in the Physical Science Building, meaning that most participants were enrolled in psychology, physics, or chemistry courses. Participants volunteered without any incentive as they walked around the building after class and were asked to complete a very brief study. Participants were only told that they would be completing a spatial task. Half of the participants were assigned to the control (not under threat) condition (10 men and 20 women); the other half to the experimental (under threat) condition (13 men and 17 women). All procedures were approved by the Eastern Illinois University IRB and followed the APA ethical standards for human research.

**Materials**
Testing occurred in a medium sized classroom on the first floor of the building. The assessment used was an object location memory task similar to the one developed by Silverman and Eals (1992). It consisted of a letter size sheet with an array of 30 objects; this is referred to as the encoding sheet (see Appendix). These images were random open source images. The test sheet contained the
same 30 objects, but 16 objects were in a different location. Participants had to circle the objects that had moved (see Appendix). The assessment was scored in the following manner: any object correctly circled (i.e., that had moved with respect to the encoding sheet) counted as +1 point, while any object incorrectly circled counted as -1 point. There were 16 objects that moved, so the maximum score that could be achieved was 16. The minimum score that could be obtained was -14.

A sheet for the distractor task was also used. This task was a maze that participants had to solve; it was generated from www.mazegenerator.net.

**Testing Groups**

Data were collected over the course of 4 days. Participants were tested in groups of different size and composition, and this was approximately balanced between the under-threat and control condition (see Table 1 for details on group composition). Each group was randomly assigned to either the control or under-threat condition. When a group entered the testing room, those participants were instructed to take a seat such that they would not be directly next to another participant. This meant that participants could sit in a vertical row (one behind the other), or they could sit a desk apart in a horizontal row.

**Procedure**

After participants entered the room and were seated, they read a brief information sheet with a summary explaining the procedure of the assessment. When they had finished, they read and signed the informed consent form before we proceeded with the assessment. The experimenters remained at the front of the room throughout the session, only going by the participants to exchange sheets for the assessment as necessary. There were always two experimenters present in any session to keep time and to exchange sheets. Two teams of experimenters, which alternated randomly throughout data collection, ran the study: one team was composed of two female experimenters, and the other team of a female and a male experimenter.

The assessment process began with one experimenter briefly re-explaining the procedure to the participants. Crucially, when a group of participants was in the under-threat condition, the experimenter ended the explanation by stating: “It’s been shown that women actually perform worse than men on this type of assessment.” Participants in the control condition were not presented with this statement and simply continued to the next step. This was the only difference between the conditions.

The participants were handed the encoding sheet (see Appendix) and given 60 seconds to study the encoding sheet before the researcher replaced the encoding sheet with a distractor task. Participants worked on the maze for 90 seconds. Next, they were given the test sheet (see Appendix) and reminded to circle any objects they thought had moved. After 60 seconds, the test sheets were collected.

At the end of the session, a debriefing statement was handed to the participants explaining the purpose of the study. The overall session took, on average, approximately 10 minutes.

<p>| Table 1 |</p>
<table>
<thead>
<tr>
<th>Group Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Threat</td>
</tr>
<tr>
<td>Individually tested</td>
</tr>
<tr>
<td>Homogenous Groups – All men (M)</td>
</tr>
<tr>
<td>Homogenous Groups – All women (F)</td>
</tr>
<tr>
<td>Heterogeneous Groups</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

*Note: Number and sex of participants in each group for the control (no threat) and under threat condition; each group is separated by a comma. For example, some participants were tested in groups which happened to be all women (Homogenous Groups – All females). Three such groups were tested in the “No Threat” condition (two women, two women, and three women); and four such groups in the “Under Threat” condition (two women, two women, two women, and four women). The total column/row reports the total number of participants collapsed.

**FIGURE 1**

Mean Scores on Spatial Location Memory Assessment

![Figure 1](image-url)
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Results

A 2 (condition: under threat or control) x 2 (sex) between-subjects factorial Analysis of Variance (ANOVA) was used with participants’ scores as the dependent variable (see Figure 1). There were no significant main effects for condition, $F(1, 56) = 1.99, p = .164, \eta^2_p = .034$, or for sex, $F(1, 56) = 0.73, p = .397, \eta^2_p = .013$. However, there was a significant interaction, $F(1, 56) = 4.19, p = .045, \eta^2_p = .070$. A post-hoc power analysis was also completed, and the statistical power of the interaction was .52. See Table 2 for means and standard deviations of the participant groups and Table 3 for an ANOVA summary table.

Analysis of the simple effects (F-tests with the omnibus ANOVA error term) revealed that women ($M = 11.00; SD = 1.87$) performed significantly better than men ($M = 8.69; SD = 4.44$) when under threat ($p = .040, d = .662$), but the two sexes (Women: $M = 8.25; SD = 3.02$; Men: $M = 9.20; SD = 1.81$) did not perform significantly differently in the control condition ($p = .413, d = .394$). Furthermore, female participants performed significantly better when under threat ($M = 11.00; SD = 1.87$) than when not under threat ($M = 8.25; SD = 3.02; p = .007, d = 1.094$) and, as expected, there was no significant difference between the scores of male participants exposed to the threat condition ($M = 8.69; SD = 4.44$) and those in the control condition ($M = 9.20; SD = 1.81; p = .687, d = .150$).

Discussion

Women’s scores in the object location memory task were significantly higher when confronted with a fabricated threat. Women led to believe that they generally performed worse on the task scored significantly better than those given no stereotyped expectation. Additionally, women performed significantly better than men when both sexes were presented with the stereotype.

These results did not support our hypothesis that a fabricated stereotype would act like a salient stereotype and undermine performance of the targeted group by contending for working memory capacity with the task at hand. As expected, men were not affected by the stereotype manipulation, as their social identity was not threatened. However, contrary to predictions, women performed significantly better—not worse—under the threat compared to controls. Interestingly, women’s oft reported advantage in object location memory (Voyer et al., 2007) appeared under threat, but not in the control condition. This was unexpected, although it should be emphasized that the female advantage in this ability has not been reported in every individual study considered in the meta-analysis (Voyer et al., 2007). For our purpose, more remarkable is the fact that women’s scores in the task improved significantly under threat. Considering that most of the literature on stereotype threat indicates a detrimental effect on the performance of the stereotyped individual, this result is noteworthy. Our findings suggest that a fabricated stereotype had the opposite effect—it improved performance.

One possible explanation for these findings is the “mere effort account” (Jamieson & Harkins, 2007), based on which motivation to do well is the major mediator in the impact of stereotype threat. When an individual knows that there is a potential for evaluation, there is additional motivation to perform the task, and the prepotent response is strengthened. If individuals are given the chance to practice the task or the task is simple, their prepotent response will improve their performance; otherwise their performance might be impaired. According to Jamieson and Harkins (2007), when stereotype threat is present, it operates similarly to an evaluation: individuals knows that their
performance will be monitored according to their social identity threatened by the stereotype, and it motivates them to do well on the task at hand. Evidence in support of this theory has been found in different contexts, from solving GRE quantitative problems (Jamieson & Harkins, 2009) to rhythmic motor tasks (Huber, Seitchik, Brown, Sternad, & Harkins, 2015). For example, in a simple visual motor (antisaccade) task, it was found that the presence of a stereotype threat improved performance. However, as the task became more and more difficult, the participant was no longer able to improve and instead the performance diminished under threat (Jamieson & Harkins, 2007). In order for the mere effort account to explain our results, it has to be assumed that the women performing the spatial memory assessment already had some skills in this task, or that the task was not difficult, meaning that their prepotent response would improve their performance. This could well be the case. First, in general, the task that participants completed in this study seems to be fairly easy: the average score for each condition fell between +8 and +11, with the possible range being from -14 to +16. Furthermore, in line with the sex difference in this type of spatial ability (Voyer et al., 2007), women might have found this task easier than men. Consequently, women could have been motivated by the presence of the stereotype threat, which in turn activated their prepotent response improving their performance in the task. Related to this, Keller (2007) found that an important moderator for the stereotype threat was domain identification. In that study, if the women solving a difficult math problem did not identify with math, they tended to perform better under threat than in a no-threat condition. This was ascribed to a motivating role of the threat without the disruption related to increased arousal/stress that one would expect if the participant actually identified with the task. A similar situation could have applied to our study. Women might not have particularly identified with the general domain of spatial skills. In this sense, the threat might have motivated them to succeed in the task without fear of not meeting expectations.

Another explanation is that inducing the threat motivated women to do better without the added threat of contending with stereotype accuracy. For example, Deaux and colleagues (2007) found that first-generation Black immigrants were less susceptible to stereotype threat effects than second-generation Black immigrants in the laboratory—in fact, their performance improved compared to their nonthreatened counterparts—because, although aware that Americans view Black people as less intelligent, the stereotype failed to resonate (and thus threaten them). Because they did not grow up with it, the threat felt fabricated. This is much like the stereotype presented in our study. However, second-generation immigrants who grew up in America and who were subject to American stereotypes about race from an early age did indeed underperform under stereotype threat conditions, as expected (Deaux et al., 2007). The improvement in performance for first-generation immigrants was theorized to be due to stereotype lift, a theory proposed by Walton and Cohen (2003), where performance improvement results when individuals are aware that an outgroup is being negatively stereotyped. In this case, the outgroup were the Black individuals in America, which is why the threat did not resonate with the immigrants. Our study presented a stereotype threat that, similarly, would not resonate with participants because it was fabricated: the sex difference in object location memory is not socially instilled. Although the threat was not about an outgroup, it raises an interesting question of whether a similar stereotype lift can occur when individuals are negatively stereotyped, as long as the threat does not resonate with the participants.

Admittedly, there are limitations to this study. First is the relatively small sample size and a low power (.52); future studies should try to replicate our findings with larger groups of participants. Second, the testing group composition and experimenters’ sex composition were not consistent throughout the study. However, importantly, the testing group composition was approximately balanced between the two conditions (see Table 1), and the two teams of experimenters (two women in one team; a woman and a man in the other team) alternated randomly. Therefore, these procedures did not cause a systematic difference between conditions and their effects were approximately equal in the two conditions; for this reason, the difference in performance obtained is unlikely due to this. Third, we lacked a systematic manipulation check on the participants. However, anecdotally, responses of many participants indicate the activation of the stereotype. At the end of the experimental session, many women unsolicitedly reported to the experimenters that, upon hearing the fabricated threat, their initial thoughts were “I’m going to have to prove that wrong” or similar, which imply that they took it as a challenge. This suggests that the
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A fabricated stereotype targeting women did not impair their performance on the task. Previous studies have indicated that a salient stereotype can diminish the performance of a vulnerable group. Conversely, here we addressed whether a fabricated, negative stereotype would weaken the performance of a group with an existing advantage in the task; our findings show that, on the contrary, it improved the performance of said group. This suggests that a stereotype threat has to resonate with the threatened individual in order to diminish their performance. When this is not the case, they are actually motivated to perform better on the task at hand, thus resulting in higher performance than their nonthreatened counterparts. However, our findings can be explained also by the mere effort account and by domain identification. To distinguish among these possibilities, future research should use a fabricated stereotype with tasks of different difficulty levels and with different levels of identification with the task. The effect of a fabricated stereotype can allow us to better understand how stereotype threat operates and whether a threat must be known and salient to undermine performance. Stereotypes are not always equally salient in different cultural groups, so this is a question worthy of further exploration.

References


APPENDIX

Encoding Sheet and Test Sheet

Encoding Sheet

Test Sheet

Out of 30 objects, 16 had moved in the test sheet with respect to their position in the encoding sheet. The assessment consisted in circling the objects that had moved.
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