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Explicit and implicit activation of gender stereotypes additively impair soccer performance and learning in women

PRISCILA CARDOZO, LEON FLÔRES CIBEIRA, LUIZ CARLOS RIGO, & SUZETE CHIVIACOWSKY

Escola Superior de Educação Física, Universidade Federal de Pelotas, Pelotas, Brasil

Abstract
Studies involving the manipulation of instructions regarding the negative characteristics of a group or comparisons with members of another group (explicit activation of stereotypes) have shown that age, weight, and gender stereotypes can be harmful to motor performance and learning. To date, however, no study has observed whether implicit stereotype threats, such as the sex of the coach or experimenter, can also influence the acquisition of motor skills. In the present study, the individual and combined impact of implicit and explicit influences of gender stereotype on women's soccer performance and learning was examined. In a 2 × 2 design, 60 women were divided into four groups according to the presence or absence of explicit (ES) and implicit (IS) stereotypes: ES/IS, ES, IS, and control. The groups with implicit activation practiced in the presence of a male experimenter. The groups with explicit activation received instructions activating the gender negative stereotype. The control group practiced without stereotype activations. The results showed that both explicit and implicit activation additively impaired soccer performance and learning, with both main effects being significant for practice and retention. The ES/IS group showed lower scores on the task relative to the other groups, while the ES and IS groups showed worse scores compared with the control group. The findings suggest that stigmatised populations may be forced to cope with more than one social identity threat while learning sport motor skills and indicate the importance of further studies testing strategies to minimise the deleterious effects of negative stereotypes.

Keywords: *Stereotype threat, motor performance, motor learning, motivation, gender, sport*

Highlights
- We investigate the effects of implicit and explicit gender stereotypes in women.
- Both implicit and explicit gender stereotypes decrease the learning of a soccer task.
- Implicit and explicit gender stereotypes have additive negative effects for skill learning.

Introduction

Stereotype threat occurs when an individual perceives himself or herself to be negatively judged while doing something in a situation where a negative stereotype applies, usually resulting in reduction in performance (Steele & Aronson, 1995) as well in learning (e.g. Heidrich & Chiviacowsky, 2015). This threatening situation of being negatively stereotyped involves the fear of being treated differently, or of feeling the perspective of confirming the stereotype (Steele, 1997). A concern about confirming the legitimacy of the negative characterisation of a certain stereotype has been shown to undermine women's performance in distinct domains, for example in math (Spencer, Steele, & Quinn, 1999), chess (Maass, D'ettole, & Cadinu, 2008), car driving (Yeung & Von Hippel, 2008), balancing and force tasks (Chalabaev, Brisswalter, et al., 2013; Chiviacowsky, Cardozo, & Chalabaev, 2018), and also in sport contexts such as tennis (Hively & El-Alayli, 2014), golf (Stone & McWhinnie, 2008), basketball (Hively & El-Alayli, 2014), and soccer (Chalabaev, Sarrazin, Stone, & Cury, 2008).

The resulting reduction in performance appears to materialise via different pathways, such as by directing attention to conscious control of movement (Beilock, Jellison, Rydell, McConnell, &

Correspondence: Suzete Chiviacowsky, Escola Superior de Educação Física, Universidade Federal de Pelotas, Rua Luís Camões, 625 – CEP 96055-630, Pelotas, RS, Brasil. E-mail: suzete@ufpel.edu.br

Carr, 2006); increasing anxiety (Stone, Lynch, Sjomeling, & Darley, 1999); reducing working memory (Beilock & McConnell, 2004), perceived competence (Cardozo & Chiviacowsky, 2015; Heidrich & Chiviacowsky, 2015; Maass et al., 2008), and intrinsic motivation (Moè, Cadinu, & Maass, 2015); and also by the use of prevention focus as a regulatory strategy (Chalabaev, Sarrazin, et al., 2008; Maass et al., 2008; Stone & McWhinnie, 2008).

Another potential mechanism is linked with learners' affective levels. Motor learning studies have reported lower levels of positive affect when the experimenter did not support the learners' needs for autonomy (Lemos, Wulf, Lewthwaite, & Chiviacowsky, 2017), competence (Pascua, Wulf, & Lewthwaite, 2015), and social relatedness (Gonzalez & Chiviacowsky, 2018), relative to conditions supporting the learners' needs. Positive affect has been linked with dopamine release (Dreisbach & Goschke, 2004) and dopamine is central to the way we value our goals or desires, guiding our behaviour, choices, and thoughts (Montague, Hyman, & Cohen, 2004). It plays an important role in facilitating working memory (Ashby, Isen, & Turken, 1999) and contributing to the encoding of new motor memories when present during practice (Kawashima et al., 2012). Thus, there is a possibility that stereotype threat can also affect performance and learning by degrading learners' positive affect.

Such mechanisms may vary, however, in relation to the way in which the stereotype threat is manifested and the domain of interest. For example, stereotype threat may arise from explicit information evidencing the negative stereotype of the group regarding inferiority in performance based on task-related characteristics (e.g. "in soccer, power and speed do not reflect female abilities"; Chalabaev, Sarrazin, et al., 2008), and from comparisons with members of another group (e.g. "women have worse strength performance compared to men"; Chalabaev, Brisswalter, et al., 2013). Yet, stereotype threat can also be transmitted more subtly or implicitly (e.g. sex of the experimenter) (Stone & McWhinnie, 2008), becoming salient through automatic and/or subconscious mechanisms (Nguyen & Ryan, 2008; Stone & McWhinnie, 2008). In a study by Stone and McWhinnie (2008), for example, the accuracy of women's golf performance was impaired in the presence of an experimenter of the opposite sex (subtle threat). Similar results were found in the context of cognitive performance in Sekaquaptewa and Thompson's (2003) study, which observed decreased performance in woman in solo status, that is, when being the only woman present in a group of men. Of further interest is the result of a meta-analysis in the cognitive domain suggesting that implicit threats may have a greater effect than explicit threats (Nguyen & Ryan, 2008).

Although few studies to date have investigated the effects of the stereotype threat in motor learning, three experiments provide evidence that overweight (Cardozo & Chiviacowsky, 2015), age (Chiviacowsky et al., 2018) and gender stereotypes (Heidrich & Chiviacowsky, 2015) degrade motor learning in women. When verifying the impact of gender stereotypes, for example, participants instructed that "soccer's dribbling task involves speed and power in which women typically perform worse than men" took longer to complete the task and had decreased perceived competence compared to a group instructed that "the task involved coordination and agility in which women usually perform similarly to men" (Heidrich & Chiviacowsky, 2015). One aspect common to all previous motor learning experiments is that the induction of the different negative stereotypes was carried out using explicit instructions that highlighted the characteristics of the group related to the task and/or by comparison with members of another group (Cardozo & Chiviacowsky, 2015; Chiviacowsky et al., 2018; Heidrich & Chiviacowsky, 2015). Thus, it remains unknown whether subtle forms of stereotype threats (e.g. sex of the coach, instructor, or experimenter), observed to affect immediate performance (e.g. Sekaquaptewa & Thompson, 2003; Stone & Mcwhinnie, 2008), can also impact more relatively permanent changes in motor performance; that is, motor learning (for a review on performance-learning distinction see Kantak & Winstein, 2012). Testing the effects of stereotype threat on learning is important for many reasons, including the fact that stereotype effects cannot always be observed through immediate performance, but only by learning tests (e.g. Chiviacowsky et al., 2018).

The objective of the present study was therefore to verify the individual and combined impact of implicit and explicit influences of gender stereotypes on women's performance and learning of a soccer task and to explore positive affect as a potential underlying mechanism of gender stereotype effects on motor learning. Stereotypes whereby women are physically and biologically inferior to men have gone through generations through education, community, media, and parents (Harrison, Lee, & Belcher, 1999). In some countries, such as in Brazil, despite being a popular sport, women were forbidden from playing soccer until 1979 (Rial, 2013). The idea of women's incompetence in sport is based on biological differences, and soccer is in fact still treated as a male domain (Chalabaev, Sarrazin, Fontayne, Boiché, & Clément-guillotin, 2013; Goellner, 2005; Teixeira & Caminha, 2013).

In the present experiment, participants were divided into four groups according to the gender of the evaluator (male or female evaluator) and the presence or absence of explicit instructions inducing the threat, in order to verify the effects of explicit and implicit stereotype threats. After pre-testing and prior to the practice phase, participants from explicitly threatened condition (ES/IS, ES) received instructions similar to those in a previous study (Chalabaev, Stone, Sarrazin, & Croizet, 2008), stating that the task involved comparing dribbling and accuracy ability between women and men, where women often have problems in controlling the ball and being accurate while kicking compared with men. Participants in the implicit threat condition (ES/IS, IS) practiced in the presence of a male experimenter. Participants in the control group practiced in the presence of a female experimenter and did not receive stereotype threat explicit instructions. We anticipated that participants exposed to explicit and implicit threats would exhibit significant disadvantages in motor performance and learning relative to the control group practicing without stereotype activations. There is also a possibility that explicit and implicit stereotype threats exert additive harmful effects on learning. The extent of positive affect the participants experienced during practice was also measured. We hypothesised that positive affect levels would be decreased as a result of stereotype threat conditions.

Materials and methods

Participants

Sixty (M = 22.9 years, SD = 4.53) female university students without soccer systematized experience in extracurricular activities, clubs, or schools, and naïve as to the specific purpose of the experiment, participated in the study. Calculation of the sample size was carried out using G*Power 3.1, for a 2 × 2 between-subject design, with an α level of 5%, effect size (f) of .37, and power of 80%, based on effect sizes previously reported in studies with similar motor learning design (e.g. Wulf, Chiviacowsky, & Cardozo, 2014; Wulf, Chiviacowsky, & Drews, 2015). The volunteers consented to participate through the Informed Consent Form, and the Ethics Committee of the university approved the experiment.

Task and apparatus

Participants were required to perform a soccer task that involved conducting the ball with the preferred foot through the soccer course (10 m) and kicking it into a target (a mini goal measuring 100 cm wide × 50 cm high) using as few ball touches as possible (Figure 1). Within the mini goal, a composite EVA target was positioned vertically to determine precision scores (Figure 1). Adapted from the study by Stone and Mcwhinnie (2008), the centre of the goal was worth one point, the first two left and right flanks two points, and the other two outer sides and the crossbar three points were awarded. Driving that did not reach the target was awarded four points. The number of ball touches needed to complete each trial was summed to the kicking score punctuation to generate an overall performance score. Therefore, the fewer passes made and the greater the accuracy, the better the result.

Procedure

The experimental sessions were conducted individually and data collection took place on a soccer field. After signing the consent form, all participants received general instructions about the purpose of the task and that the task should be performed with the dominant foot. In addition, participants were informed about the scoring system for ball conduction (number of ball touches) and kick accuracy (target punctuation scores, ranging from 1-better to 4-worse). Participants were informed that the number of ball touches needed to complete each trial would be summed to the kicking score punctuation, and that the lower the total score the better the performance.

In a 2 × 2 design, the 60 women were divided into four groups and randomised to one of the four groups according to the presence or absence of explicit (ES) and implicit (IS) stereotypes: ES/IS, ES, IS, and control. The groups with explicit activation received specific instructions activating the gender negative stereotype. The groups with implicit activation practiced in the presence of a male experimenter. The control group practiced without stereotype activations. After one pre-test trial, the groups with explicit stereotype threat activation (ES, ES/IS) received the following instructions:

> The goal of the experiment involves comparing ball conduction ability and kick accuracy between men and women. Previous studies have shown that women have trouble conducting the ball and in being accurate compared to men, and we are trying to understand why they have these difficulties.

Participants in the IS and control groups received information only regarding the task goal and the punctuation score system.

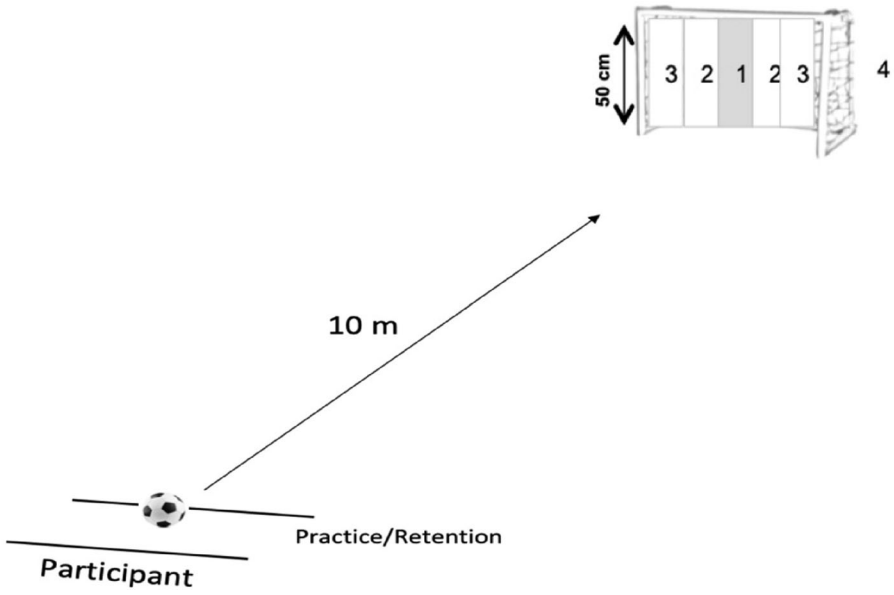

Figure 1. Experimental set-up.

Participants then performed a pre-test followed by a practice phase, which consisted of 4 blocks of 10 trials with a 1-min rest period between blocks. After the second block, participants in the ES/IS and ES groups received a reinforcement of the explicit threat. Specifically, they were informed as follows: "Remember, studies have shown that women have problems in dribbling and being accurate in comparison to men, and we are trying to understand why they have these difficulties". On day 2, participants performed a retention test consisting of five trials, with no stereotype instructions provided.

After the pre-test and the practice phase and prior to the retention test, participants completed a visual analogue rating scale (VAS) in which they were asked to indicate their positive affect levels while performing the task by placing a tick mark on a 200-mm line with endpoints labelled "not at all happy" and "very happy". VAS is considered a simple, reliable, and valid technique to measure subjective experience (Wewers & Lowe, 1990), and is used to assess variables including subjective age (Hughes, Geraci, & De Forrest, 2013), feelings (Aitken, 1969), and positive affect (Lemos et al., 2017).

After all data collection had been completed, participants were debriefed.

Data analysis

The number of ball touches needed to complete each trial summed with the kicking score punctuation produced the main performance dependent variable. Accuracy scores on the pre-test and averaged scores of the retention and transfer tests were analysed in a 2 (ES: yes, no) × 2 (IS: yes, no) analysis of variance (ANOVA). The practice data were averaged across blocks of 10 trials and analysed in a 2 (ES) × 2 (IS) × 4 (block) ANOVA with repeated measures on the last factor. Positive affect after the pre-test, the practice phase, and prior to the retention test was determined by measuring the distance (mm) between the left endpoint and the participant's tick mark, and analysed in a one-way ANOVA. In addition, we conducted simple linear regression analyses to determine possible relations between positive affect, end-of practice (4th block) performance, and retention performance.

Alpha was set at .05 for all analyses.

Results

Punctuation scores

Pre-test. There were no differences among groups in the pre-test (Figure 2). The main effects of ES, F (1, 56) = .308, p = .581, and IS, F (1, 56) = 2.083, p = .155, were not significant. Furthermore, the ES × IS interaction was not significant, F (1, 56) = .012, p = .912.

Practice. Trial score accuracy generally improved across blocks during practice (Figure 2). While the ES/IS group tended to have worse scores, the control group showed the best scores during practice. The ES and IS groups had intermediate similar scores. The main effects of block, F (3, 168) = 4.121, p = .008 η_p^2 = .069, ES, F (1, 56) = 6.878, p

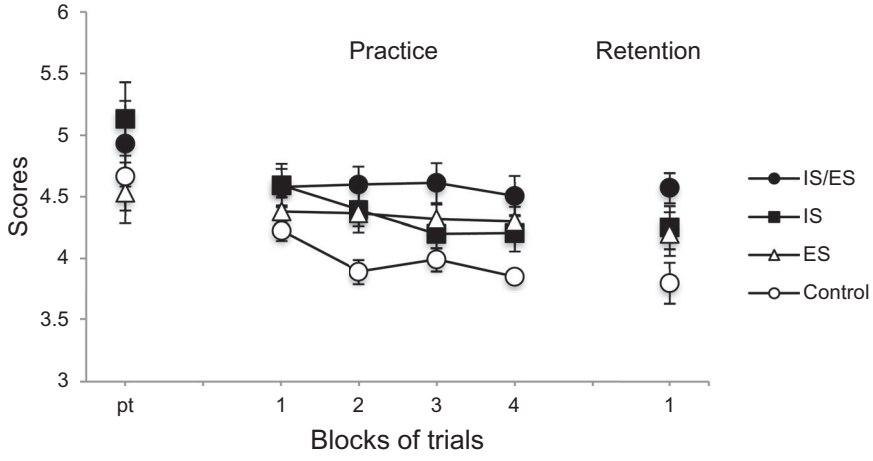

Figure 2. Performance scores of the four groups on the pre-test, during practice (Day 1), and on the retention test (Day 2). Note: Error bars indicate standard errors.

= .011, η_p^2 = .109, and IS, F (1, 56) = 7.200, p = .010 η_p^2 = .114, were significant. There was no interaction between ES and IS, F (1, 56) = .315, p = .577, η_p^2 = .006.

Retention. On the retention test, the ES/IS group showed worse punctuation scores whereas the control group produced better scores. The ES and IS groups had slightly different intermediate scores, with worse punctuation for the IS group relative to the ES group (Figure 2). The main effects of both ES, F (1, 56) = 4.357, p = .041, η_p^2 = .072, and IS, F (1, 56) = 5.743, p = .020, η_p^2 = .093, were significant. There was no interaction between ES and IS, F (1, 56) = .054, p = .817, η_p^2 = .001.

Positive affect

Before practice. There were no differences among groups in positive affect. The main effects of ES, F (1, 56) = .085, p = .772, η_p^2 = .002, and IS, F (1, 56) = 2.895, p = .094, η_p^2 = .049, were not significant. The ES × IS interaction was also not significant, F (1, 56) = .397, p = .531, η_p^2 = .007.

After practice. At the end of practice, the IS and ES/IS groups showed lower levels of positive affect relative to the ES and control groups. The effect of IS was significant, F (1, 56) = 4.704, p = .034, η_p^2 = .077. The effect of ES, F (1, 56) = .012, p = .912, η_p^2 = .000, and the interaction ES × IS, F (1, 56) = .057, p = .8122, η_p^2 = .001, were not significant.

Before retention. Prior to retention, there were no differences among groups in positive affect. The ES, F (1, 56) = .000, p = .984, η_p^2 = .000, IS, F (1, 56) = 0.641, p = .427, η_p^2 = .004, and the ES × IS interaction, F (1, 56) = 0.203, p = .654, η_p^2 = .004 effects, were not significant.

Linear regressions

End-of practice performance marginally predicted positive affect after practice, F (1, 58) = 3.862, p = .054, adjusted R^2 = .046, β = .250, but not before the retention test, F (1, 58) = .910, p = .344, adjusted R^2 = .002, β = .124. Positive affect after practice, F (1, 58) = 1.802, p = .185, adjusted R^2 = .013, β = .174, and before retention, F (1, 58) = 2.872, p = .096, adjusted R^2 = .031, β = .217, did not predict retention performance. Finally, end-of-practice performance predicted retention test performance, F (1, 58) = 17.993, p < .001, adjusted R^2 = .224, β = .487, explaining 23.7% of the variance.

Discussion

The present study examined the individual and combined effects of implicit and explicit stereotype threats on the performance and learning of a soccer motor task. While previous studies have shown that explicit activation of negative age (Chiviacowsky et al., 2018), weight (Cardozo & Chiviacowsky, 2015), and gender (Heidrich & Chiviacowsky, 2015) stereotypes led women to confirm the stereotype threat by showing impaired motor learning, no study to date has verified whether implicit threats or the combination of both could additively impact the acquisition of motor skills. The results show that gender stereotype threat can indeed affect performance and learning in two different ways in women: by the presence of the opposite sex experimenter

(implicit or subtle threat) and by instructions highlighting a negative stereotype about women's poor ability to play soccer-specific motor skills (explicit threat). When performing in the presence of a male experimenter, the participants had worse scores, being less efficient in the task on both days relative to participants performing in the presence of a female experimenter. Thus, not surprisingly these participants reported further lower levels of positive affect.

The participants practicing with explicit stereotype threat induction also showed worse performance and learning compared with participants practicing without the explicit threat. Positive affect was not, however, influenced by the explicit threat, suggesting that underlying mechanisms affecting performance and learning may vary in relation to the way in which the stereotype threat is manifested. Of note, performance and learning under explicit or implicit stereotype threat conditions did not differ, showing similar deleterious effects. Lastly, the group practicing under both implicit and explicit threat conditions showed greater disadvantages in performance and learning compared with the other groups, indicating that gender explicit and implicit stereotype threats can additively affect learning.

Our findings are in line with experiments showing that explicit activation of negative gender stereotypes can adversely impact motor performance (Chalabaev, Sarrazin, et al., 2008; Heidrich & Chiviacowsky, 2015; Hermann & Vollmeyer, 2016) as well as learning (Heidrich & Chiviacowsky, 2015) in women. Some studies verifying the effects of explicit negative gender stereotypes on performance have suggested that participants tend to adopt a prevention focus strategy (Chalabaev, Sarrazin, et al., 2008; Maass et al., 2008; Stone & Mcwhinnie, 2008). Such a strategy of avoiding making mistakes in order to discredit the characterisation of the negative stereotype, thus putting individuals under pressure to perform successfully, can disrupt fluid and automatic processes that allow the task to be performed successfully (Stone & Mcwhinnie, 2008). The presence of a person of the opposite sex in a position to assess the group's performance and learning seems also to distract the learners, most likely by representing a source of evaluation apprehension. Concerns about being analysed by the opposite sex may drive part of the learner's cognitive and emotional resources to reduce this bias, affecting working memory capacity and thus reducing task performance (Schmader & Johns, 2003; Stone & Mcwhinnie, 2008).

Practice under a gender stereotype threat has also been observed to result in decreased perceived competence, degrading motor performance and learning (Heidrich & Chiviacowsky, 2015). Competence is considered a basic psychological need for an individual to be intrinsically motivated (Deci & Ryan, 2000). The "low perceived confidence/reduced motor learning" relationship has also been observed in other types of experimental manipulations that delivered information to participants decreasing expectancies for performance, such as the explicit activation of weight stereotypes (Cardozo & Chiviacowsky, 2015), the provision of feedback after worse instead of better trials, negative relative to positive comparative feedback, or feedback inducing a fixed instead of malleable conception of ability (for a review see Chiviacowsky, 2020), all of which have been shown to impair the learning of motor skills.

The present experiment also showed reduced levels of positive affect among participants practicing under an implicit stereotype threat (presence of a male experimenter), with the regression analysis showing marginally significant predicting performance effects. Positive affect is implicated in dopamine release and has been observed to impact cognitive performance (Ridderinkhof et al., 2012) and to contribute to the consolidation of motor memories (Sugawara, Tanaka, Okazaki, Watanabe, & Sadato, 2012; Wise, 2004). Thus, the presence of an implicit stereotype threat may impair learning by reducing positive affect levels, limiting the constitution of effective neural connections that facilitate learning.

In conclusion, our findings provide the first evidence that implicit and explicit stereotype threats can individually and additively decrease women's performance and learning of a soccer motor task. The results also highlight positive affect as an important mechanism underlying implicit stereotype deleterious effects on motor performance and learning. Future studies could verify whether such results would extend to other populations, contexts, and types of sports or tasks. The findings also have implications for practical situations. Given that several countries, including Brazil, discursively incorporate soccer into their national identity (Goellner, 2005) and that women in soccer do not enjoy the same social recognition compared to their male counterparts (Teixeira & Caminha, 2013), the presence of women in coaching positions and teaching-learning spaces could minimise the effects of gender stereotypes. Instructors or coaches in general could also develop practice environments in which learners can experience freedom from social gender stereotypes. Such practice contexts may have the potential to enhance positive affect, perceived competence, enjoyment, interest, and perhaps persistence in the long run, as well as motor performance and learning.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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