education sciences

Brief Report

Samantha Green vs. Peter Stevens: Reversed Gender Stereotype Threat in Online Chess

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Abstract: Previous studies have shown that exposure to gender stereotypes has a detrimental impact on women's performance. In chess, it has been demonstrated that the performance level of women is negatively influenced when they are exposed to negative stereotypes about their ability to play chess. However, it is still largely unclear whether the influence of a negative stereotype of women's ability to play chess is only limited to their level of performance, or whether it could also affect their opponent's performance. The present study investigated this reversed stereotype threat in online chess playing an unrated game. It was expected that a chess player's performance would be influenced by the gender of their opponent. However, the participants' online opponent was neither a female nor male chess player, but rather, unknown to the participants, it was a computer program that either played with a male or female nickname. The results showed that participants who played against a female nickname played less well, lost more games, and made more mistakes and blunders than participants who played against a male nickname. In sum, findings indicate that, in chess, the influence of a gender stereotype is not limited to the group the stereotype is targeted at, but also reduces the performance of the opponent's level of play, leading to a reversed stereotype threat.

Keywords: stereotyping; stereotype threat; prejudice; online chess; achievement gaps

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1. Introduction

A recent review by Pennington and colleagues revealed that over 300 studies have been published showing the effects of the stereotype threat on performance in many different domains [1]. Steele and Aronson, who were the first to show the detrimental effects of negative stereotypes, defined the stereotype threat as a situational predicament in which people are or feel themselves to be at risk of conforming to stereotypes about their social group [2]. The stereotype threat is considered to be a contributing factor to racial and gender achievement gaps, such as underperformance of Black students relative to White ones in various academic subjects [3] and underrepresentation of women in the field of mathematics [4,5].

Although most investigators agree that negative stereotypes are a potential threat to our society, the debate concerning the robustness of the effects of stereotype threats on performance is still ongoing [6]. Different explanations have been put forward to explain the drop in performance when somebody is exposed to a negative stereotype. For instance, Schmader, Johns, and Forbes argued that the awareness of the negative stereotype leads to stress arousal and monitoring processes involving negative thoughts suppression, which leads to reduced working memory capacity and, consequently, to a lower level of performance [7]. Essentially, managing the negative stereotype demands too many mental resources that cannot be used to deal with the task or problem at hand and, consequently, the level of performance drops [7,8]. It is important to note that effects of negative stereotypes are most often seen in tasks that are complex or challenging, and hence they will not be visible on all stereotype-relevant tasks. Only challenging tasks will deplete mental resources and, consequently, impair performance [6].

In contrast, the "mere effort account" suggests that participants are not negatively affected in their cognitive capacities [9,10]. This account suggests that participants are trying very hard during task performance to disprove the negative stereotype that is targeted at their group. However, by trying too hard to disprove the stereotype, their efforts can become misdirected and consequently might lead to a reduction in performance. Thus, they actually confirm a stereotype by trying too hard to refute it.

The area of research, which is also the focus of the present study, is the detrimental influence of gender-based stereotypes on cognitive tasks. The stereotype threat is often seen as a cause that can, at least partly, explain gender differences on cognitive tasks [1,11]. In particular, the present study investigates the influence of the gender stereotype threat in the game of chess. Although it is gradually changing and there are differences between countries, chess still is a largely male-dominated game in terms of number of players and in terms of the best chess players [12–15]. This is substantiated by information from the international chess federation (FIDE) that shows that, in most western countries, women's participation rate of active chess players is less than 10% [15].

An explanation for this large difference is the persistent negative stereotype that women, by nature, cannot play chess very well, even though there is no compelling evidence showing that men are innately superior chess players [16]. In 1963, during an interview, former world champion Bobby Fisher stated that women are "terrible chess players" because they lack the intellectual capacity for the game. More recently, British chess grandmaster Nigel Short wrote an article for the magazine *New in Chess* in which he stated that we should just "gracefully accept" that women are not as good as men at the game [17]. The current world champion, Magnus Carlsen, stated in an interview with *The Guardian*: "Chess societies have not been very kind to women and girls over the years. Certainly there needs to be a bit of a change in culture" [18]. A fairly recent study measured stereotype awareness and administered a questionnaire to 77 young female chess players (ages 6–11) enrolled in after school chess programs. Remarkably, even at such a young age, female chess players already agree to some extent with the idea that chess is a male activity [19].

Both experimental and observational studies support the presence of a stereotype threat in chess [14,15,20]. Rothgerber and Wolsiefer demonstrated, using data from chess tournaments, that females performed worse than expected (based on their chess rating) when playing against a male opponent. However, if women are unaware of their opponent's gender, for instance, during online chess where identities are hidden through the use of sobriquets, their level of performance was not affected [14].

Walton and Cohen have shown that in a competitive situation, the stereotype threat can also lead to improved performance of the group that is not the target of the stereotype, resulting in a stereotype lift [21]. This lift, or improvement, in performance is a consequence of comparing ourselves with this outgroup, resulting in an increase in our self-efficacy or sense of personal worth. Interestingly, this performance boost does not only result from questioning the outgroup's ability but does even occur without specific reference to the outgroup, if, for instance, a task is ubiquitously linked to a negative stereotype (e.g., women's ability in math). In contrast, in line with Baumeister's studies on choking [22], Stafford [23] and Smerdon and colleagues [20] argued that the negative stereotype about women's chess might also backfire on their opponents. That is, women might be less affected by this stereotype than their opponents, because their opponent might underestimate them, choke, or fear being beaten by a woman. In other words, a stereotype can negatively affect the performance of both groups: a drop in performance of the group that is targeted by a stereotype (i.e., the stereotype threat) and a drop in performance of the group that is usually expected to benefit from the stereotype (i.e., the reversed stereotype threat). Consequently, the reversed stereotype threat is the opposite of the stereotype lift, the former leading to decreased performance and the latter to increased performance after being exposed to a stereotype as a non-target in a competitive situation.

It is important to note that most studies investigating the impact of stereotypes on chess performance only evaluated the game's final result and did not take the process into account. Studies only evaluated whether a game was won, lost, or ended in a draw, but the quality of the moves leading to this result have not been analyzed. By only focusing on the final result, detailed information about the impact of a stereotype threat might be missed. That is, the game outcome might not be sensitive enough to always detect the influence of stereotyping. For instance, although a player's performance might be affected by the gender stereotype (by playing bad or suboptimal moves), it will remain unnoticed if this player still beats the opponent. Therefore, in the present study, not only the final result will be analyzed, but the quality of the moves that led to this result will also be evaluated.

The Present Study

Chess players from an international online chess platform were invited to play a short, unrated game of chess. Smerdon and colleagues have shown that the effect of the stereotype threat is largest in short chess games, called rapid games (i.e., games between 10 and 60 min per player) [20]. In line with previous studies investigating the stereotype threat [1,24], the manipulation to activate a negative stereotype was subtle: participants played against an opponent with a male or female nickname. In line with the study conducted by Maass, D'Ettole, and Cadinu [14], no other information was provided to the participants. What the participants did not know, however, was that they were actually playing against a computer program or chess engine called HIARCS, a former world champion in computer chess with a rating of 3388 [25]. To prevent HIARCS from winning all the games, its strength was substantially reduced and set to the level of an average chess player. Consequently, due to its limited playing strength—and obviously not due to the stereotype threat—the chess engine would make errors and even blunders. In contrast, the gender associated with a nickname might influence the participants' level of play, at least if they hold the gender stereotype that females play less well than men. That is, given that, in the current study, the stereotype can only work in one direction (i.e., the engine's playing strength will remain the same irrespective of the experimental condition), players might underestimate their supposed female opponent and consequently make more errors, eventually leading to defeat, more than if they would have played against a supposed male opponent. In contrast to this reversed stereotype, as has been explained above, participants might also show a stereotype lift [21], and consequently perform better against a supposed female opponent than a male opponent.

2. Materials and Methods

2.1. Participants

From a large online worldwide chess platform, 100 chess players participated anonymously. The only information that was available about the participants was their nickname and their Elo rating (i.e., playing strength). The Elo rating system has been developed by Arpad Elo, and it allows us to reliably calculate the playing strength of each chess player based on the outcome of previous games and the difference between the player's own rating and that of the opponent [26]. The participants' Elo-rating was, M = 1463.67, SD = 107.77 (Range: 1111 to 1795), and most participants should therefore be classified as class C players (i.e., average chess club players with an Elo rating between 1400 and 1599) [27]. Ethical approval for this study was obtained from the departmental ethics committee (approval number #20-404).

2.2. Procedure

Players were invited to play a friendly (unrated) game of chess. In contrast to rated games, winning or losing unrated games does not affect the player's current rating or ranking. Half of the games were played with a female nickname (Samantha Green) and the other half with a male nickname (Peter Stevens). Besides the nickname, no other information was provided to the participants [14]. Unknown to the participants, their opponent was not a human chess player, but the chess program HIARCS Chess Explorer, with a current Elo rating of 3388 [25]. However, the playing strength of this program was substantially reduced to the level of a Class C player (i.e., an average chess club player) [27]. because, otherwise, HIARCS would easily win all games. Games were played with a 12-min time control. This is a form of rapid chess where each player has, maximally, 12 minutes to play the entire game. HIARCS played only once against an opponent, and half of the games were played with the white pieces and half with black pieces. There are three ways to lose a game: a player uses too much time (i.e., more than 12 min), through resignation, or checkmate. Games can also end in a draw, but in online rapid chess this rarely occurs (less than 5% of blitz games played on Freechess.org since 1999; Ficsgames.org, n.d.).

2.3. Analysis

The moves and outcome of each game were stored for analysis in another chess program called Stockfish (stockfishchess.org), one of the strongest chess engines currently available, with an Elo rating of 3745 [25] and much stronger than any human chess player. Stockfish analyzed all games, move by move, to evaluate the quality of play. The program calculated a score for each move that indicated how much better the position of one player was compared to the other player in terms of material and by weighing positional factors. A centipawn, equal to 1/100th of a pawn, was the unit of measure used in chess to represent the advantage. A good move will lose zero centipawns (i.e., it matches the optimal move identified by the computer), but a lesser move will result in losing centipawns (i.e., deviates from the most optimal move or moves). The fewer centipawns that are lost per move, the stronger the play, and hence this value can be used as an indicator of the quality of play [28]. Based on the widely used categorization of chess moves in the chess literature [29], three types of errors were identified by the chess engine: inaccuracies (losing between 50 and 100 centipawns), mistakes (losing between 100 and 300 centipawns), and a blunder (losing at least 300 centipawns). A blunder can, if detected by an opponent, have a decisive influence on the outcome of the game (e.g., mate in one), which is less true for the other types of errors.

The resulting data were analyzed with SPSS using (M)ANCOVA, with number of moves as covariate (longer games increase the likelihood of errors), followed by a series of follow-up tests on each error type (i.e., inaccuracy, mistake, and blunder). Gender (male vs. female nickname) was the between-subjects variable. As indicated, the computer can win a game (1 point), lose a game (0 points), or it can end in a draw ($\frac{1}{2}$ point). However, none of the games played led to a draw, and hence these data were analyzed using a binomial test. An alpha level of 0.05 was used for all statistical tests.

3. Results

The analysis of the final result of each game, win or lose (1 or 0 points), showed that the participants lost more games (37 games, 74%) playing against a female nickname than when playing against a male nickname (27 games, 54%), χ^2 (1, n = 100) = 4.34, p = 0.037 (see Table 1).

Table 1. Games won or lost by participants as a function of Gender.

Gender	Won	Lost	*n*
Female	13	37	50
Male	23	27	50
Total	36	64	100

More importantly, in the present study, the quality of all moves that led to a particular result was also evaluated. First, the overall score in centipawns' loss for each game in both conditions was analyzed (see Table 2). Levene's test and normality checks were carried out and the assumptions were met. On average, participants scored higher (i.e., worse performance) in the female nickname condition than in the male nickname condition. Controlling for games' length, this difference was statically significant, F(1.97) = 6.617, $p = 0.012$, $\eta p^2 = 0.064$.

Table 2. Means (M) and standard deviations (SD) for centipawns loss as a function of Gender.

Gender	*M*	*SD*	*n*
Female	74.88	37.58	50
Male	58.06	32.99	50
Total	66.47	36.18	100

Next, a follow-up analysis was conducted that focused on the three types of errors (i.e., inaccuracies, mistakes, and blunders). Table 3 shows the mean number and standard deviation for the three types of errors as a function of Gender. There was a statistically significant difference between both gender conditions on the combined dependent variables after controlling for game length, F(4.94) = 8.279, $p < 0.001$, Wilks'Λ = 0.739, $\eta p^2 = 0.261$. Univariate testing showed, however, that there was no statistically significant effect for Inaccuracies between conditions, F(1, 97) = 1.044, $p = 0.309$, $\eta p^2 = 0.011$, but there was a statistically significant effect for Mistakes F(1.97) = 8.929, $p = 0.004$, $\eta p^2 = 0.084$, and Blunders F(1.97) = 4.037, $p = 0.047$, $\eta p^2 = 0.040$. Accordingly, participants made more mistakes and blunders when they played against a female nickname than against a male nickname.

Table 3. Mean number (M) and standard deviations (SD) for each type of error as a function of Gender.

Type Error	Gender	*M*	*SD*	*n*
Inaccuracies	Female	2.92	1.805	50
	Male	2.58	1.655	50
	Total	2.75	1.731	100
Mistakes	Female	3.20	2.424	50
	Male	2.00	1.738	50
	Total	2.60	2.184	100
Blunders	Female	1.40	1.262	50
	Male	0.96	0.880	50
	Total	1.18	1.104	100

4. Discussion

The present study investigated the influence of gender stereotypes on performance within the game of chess. In contrast to most previous studies, the present study did not focus on the group that primarily experiences the detrimental effects of a gender stereotype (i.e., females), but investigated the opponents' performance: a group that is expected to be unaffected by a gender stereotype or might even benefit from it (i.e., stereotype lift) [21]. On the other hand, if the stereotype threat can also reverse, then the opponents' performance might also be affected. In this case, participants are expected to play less well (i.e., more centipawns loss) in the female nickname condition compared to the male condition.

Findings are largely in line with these expectations. The participants lost more games playing against a female nickname (74%) than when they played against a male nickname (54%). Therefore, a change from a male to a female nickname let to an increase of 20% of lost games, even though the playing strength of the chess engine was the same for both conditions. Note, the finding that, in the male condition, participants had roughly a 50–50 chance of beating the engine, is in line with the a priori probability of winning or losing of a chess match between human players of equal strength. Furthermore, playing against a female nickname led to an overall increase in centipawn loss of 29% compared to the male condition. Focusing on the different types of errors, the mean number of inaccurate moves increased by 13% in the female condition, but this increase was not statistically different. However, the mean number of mistakes in the female condition did show a statistically significant increase of 60% and of 46% for blunders.

In general, what these findings show is that an online chess player's perception concerning the opponent's gender can influence their level of performance. That is, on average, opponents tend to play less well and consequently lose more games when they assume that they are playing against a female than against a male, at least when they are playing an unrated game. As indicated, most previous studies on gender stereotypes did not investigate this issue, because the focus was mainly on female performance [1]. Moreover, the focus was on the final result of a chess game and not on the moves of both players that led to a particular result. Since the chess engine's performance was fixed and was not affected by playing with a female nickname, it became possible to demonstrate that the impact of a gender stereotype is not limited to the group that is being stereotyped in chess (i.e., females), but it also hurts the performance of their opponents.

The present study has some limitations that should be addressed by future studies. For instance, the present study did not make a distinction between male and female opponents as this information was not registered on this online chess platform. However, based on the very low participation rates of women in chess around the world [12–15], it is reasonable to assume that almost all participants were men. Furthermore, it would have been interesting to investigate whether similar findings would have emerged if the participants had an even shorter time to think about their moves, such as in bullet games, where each player has three minutes or less per game. That is, if players have little time to think about their moves, they have to focus fully on what is happing on the chess board and, hence, might be less susceptible to the influence of stereotypes [20]. On the other hand, Dilmaghani has shown that female chess players tend to underperform while playing male opponents in fast chess games [30]. These findings indicate that the female performance gap becomes larger as the time constraint is tightened. Further research is necessary to disentangle this issue. Another potential limitation of the current study is the fact that all games were unrated, and hence losing or winning a game does not have any impact on ranking or rating. Thus, playing a chess game primarily for recreational purposes might lead to a different outcome than playing a serious chess game that can influence the player's ranking or rating. However, it is important to note that the number of severe mistakes (i.e., blunders) is low (overall $M = 1.18$ per game). In addition, the number of games that are won in the male condition is in line with the a priori probability of winning or losing a chess match (i.e., 50–50) between players of equal strength. Consequently, there is not much support for the assumption that our participants did not take the games seriously even though they were unrated. Finally, although players from all levels could have accepted the challenge to play, the strongest player that accepted the challenge had an Elo rating of 1795. Therefore, it would be interesting to investigate whether even stronger players, or even professional chess players (i.e., chess masters and grandmasters), would show similar results as the current sample of average club players.

In sum, the present study shows, outside the context of a laboratory, that a subtle manipulation of only providing a female nickname while playing a friendly online chess game seems to be sufficient to influence the level of performance of chess players. Although the debate concerning the impact of gender stereotypes on performance continues [31–33], the present study provides support that this effect might not be limited to the group the stereotype is targeting. It shows that we should be careful, especially in competitive contexts, about exposing people to negative stereotypes because we may—unintentionall–y—influence their performance level or enjoyment even when they are not the target of a negative stereotype.

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Data Availability Statement: The data of this study are available upon reasonable request.

Conflicts of Interest: The author declares no conflict of interest.

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