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Narrative review article

GENDER DIFFERENCES IN CHESS PERFORMANCE

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Abstract. *Women are underrepresented and underperformanced in chess at the top level. An explanation for the small number of female chess players because chess is an intellectually demanding activity would support the view of biological gender differences in intellectual abilities. However, despite different theories, there is no scientific evidence for sex specific intellectual performance differences. Furthermore, memory is heavily implicated in chess performance and is also often used to explain sex differences. Many novel findings are emerging and complementing cognitively-oriented research on chess. Sex stereotypes can have a greatly debilitating effect on female players leading to a sharp decline in performance when competing with males in chess. Women generally score lower than men both on aggressiveness and dominance and at the same time during a chess game, mental fatigue occurs earlier in women. This is usually explained by the fact that in the female body glycogen content is lower compared to males due to hormonal conditions and therefore unable to meet the demands for fast energy. Women also seem disadvantaged because they approach chess competitions with less confidence and with a more cautious attitude than their male counterparts. A motivational perspective may be better suited for understanding the underperformance of women as chess players. Studies of psychology, physiology and biochemistry of chess players should be used to improve the practice and pedagogy for male and female chess players.*

Key words: *chess, gender, biological differences, intellectual performance*

INTRODUCTION

Chess is equivalent to classical sport with regard to physical, mental and neuronal activity, effects on conservation and promotion of mental and physical health as well as on professional, educational and recreational aspects (Bart, 2014; Golf, 2015). Chess players may be particularly susceptible to stereotyping, considering that chess requires a remarkable

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memory capacity that is already pushed to the limits by the competitive nature of the chess competition. Women are underrepresented in chess at the top level. Practically, all grandmasters are male, except only one female, Judith Polar (eighth in the 2005 FIDE rating list with a peak rating of 2735). Various explanations have been proposed for female chess players being underrepresented at the top level and in science areas.

However, there is an additional explanation stating that stereotypes may affect the quality of chess playing, namely by making women less confident and reducing the likelihood that they will play aggressively (Maass, D'Ettole & Cadinu, 2008). No gender specific differences exist in intellectual performance in humans concerning chess playing despite several opposing opinions (Howard, 2005; Bilalić, Smallbone, McLeod, & Gobet; Chabris & Glickman, 2006). Women chess players represent less than 5% of registered tournament players worldwide and only 1% of the world's grandmasters (Maass, et al., 2008). This underrepresentation of women is unlikely to be caused by discrimination, because chess ratings objectively reflect competitive results (Chabris & Glickman, 2006). Using data on the ratings of more than 250,000 tournament chess players over 13 years it has been established that girls have lower chess ratings than boys and that they are numerically underrepresented among the chess population (Chabris & Glickman, 2006). It has been hypothesized that women may be less willing to devote their time mono-thematically to chess, leading to higher drop-out rates (Maas et al, 2008), but a recent study conducted in the United States has found equal drop-out rates in matched samples of males and females (Chabris & Glickman, 2006). Although memory is heavily implicated in chess performance, it is not a plausible explanation when trying to explain gender differences. New findings emerge that complement cognitively-oriented research on chess (Aciego, García, & Betancort, 2012). Most importantly, sex stereotypes can have a greatly debilitating effect on female players leading to a 50% performance decline when playing chess with males. However, this disadvantage is completely removed when chess players are led to believe that they are playing with a woman. Considering that women score generally lower than men on aggressiveness and dominance (Halpern, & LaMay, 2000), it can be assumed that women will encounter a disadvantage in a chess game. Another view attributes it to such social factors as socialization practices, lack of female role models, glass ceilings and male gatekeepers downplaying female achievement (Howard, 2014). A motivational perspective may be better suited to understanding the underperformance of women in the ultimate intellectual sport such as chess (Vaci & Bilalic, 2017).

Gender physiological differences of chess players

Because of the specific characteristics of a chess game, the personality of chess players became the subject of psychological and physiological research. In chess and classical sport, the energy needed for brain activity is first derived from glycogen stores in the brain, muscles and liver and later from adipose tissue. Chess and classical sport rely on shared energy from glycogen and fat. When the brain needs additional energy, the muscles and liver share energy with the brain. When muscles need additional energy, the brain complies with the request of the muscles. Energy expenditure, O2 uptake and CO2 production during chess games are similar to those obtained during a marathon. Mental and physical fatigue begins with similar metabolic states: deprivation of glycogen. During competitive chess, athletes must be in good physical condition (Golf, 2015). Important changes were established in

metabolic energy processes and hormone - biochemical status of chess players, and because of that, these physiological processes can be comparable with sports disciplines (athletics, tennis, motorcycling). Since both women and men use glycogen from the brain, liver and muscle for fast energy during physical stress and during chess playing, mental fatigue occurs earlier in women, because their body glycogen content is lower compared to men due to hormonal conditions, while the chess demand for fast energy for women is equal to that of men (Tarnopolsky, 1995). Brain glycogen turns over rapidly and contributes significantly to normal brain energy metabolism. The brain commands everything: in chess equally as in other sports, the cellular receptors (baron-, lactate-, glucose-, metabo-, chemo-, thermo-, respiratory-) "send" signals via eyes or metabolic changes to the brain (Hänggi, Brütsch, Siegel, & Jäncke, 2014). This would indeed lower the speed of conflict control at an earlier time for women during a chess game. In chess no gender-specific excellence exists; glycogen availability, however, is less developed in female chess players (Golf, 2015). A popular explanation for the small number of women at the top level of intellectually demanding activities from chess to science appeals to biological differences in the intellectual abilities of men and women. (Bilalić, Smallbone, McLeod & Gobet, 2009).

Age and practice predicted sex differences in Elo chess ratings only for females. The findings paralleled those concerning gender differences in cognitive ability, and supported the claim that biosocial factors rather than divergences in participation rates of males and females in the domain are the cause of the extreme gender differences in Elo ratings (Blanch, Aluja, & Cornado, 2015).

The German database is one of the best longitudinal datasets available for use in psychological research (7,789 female and 123,358 male players). It opens new possibilities for the investigation of the multiple factors underlying expertise and skill acquisition with an archival approach (Howard, 2008). The gender variable was used to investigate the differences in rating scores and performance between sexes, but also to investigate possible reasons behind the differences in participation counts (Vaci & Bilalic, 2017). Also, the social factors behind chess performance can also be measured and extracted from this type of dataset. Information about players can be used to investigate topics such as gender differences (Dolenc, 2015; Vaci & Bilalic, 2017).

Gender differences in mental profile of chess players

The mental processes of chess include intelligence, expertise, perception, attention, memory, anticipation, mental imaging, judgement and decision making (Bar-Eli & Raab, 2006). Specific characteristics of chess players are mental stability, willpower, power of concentration, quality of judgment and mental endurance. Dominant aspects of chess intelligence are memory, visualization, organization and imagination. In chess and in classical sports, the brain, spinal cord, nerves and muscles cooperate in complete harmony. Considering the existence of pervasive gender differences, mental rotation appears as a reason for explaining the poorer chess performance of women (Maass et al., 2008). Expertise in chess enables the player to perform as an expert in a cognitive domain (Reingold, Charness, Pomplun & Stampe, 2001), which taps many cognitive processes (Vasyukova, 2012) that are associated with intelligence, mental speed, spatial abilities, working memory (Howard, 2005), anticipation and transfer, perception, motivation, attention and recognition (Trinchero, 2013, Irwing & Lynn, 2005).

Women choose a more defensive style when playing with men. Self-confidence and a win-oriented promotion motivation contribute positively to the chess performance of women (Gobet & Charness, 2006). Since women show lower chess-specific self-esteem and a more cautious playstyle than males, it maybe possibly be a consequence of widely held gender stereotypes. This may explain worldwide underrepresentation of women and underperformance of women in chess. Women seem disadvantaged not because they are lacking cognitive or spatial abilities, but because they approach chess competitions with less confidence and with a more cautious attitude than male chess players (Maas, 2008). A motivational perspective may be better suited to understand the lower performance of women in chess (Maass et al., 2008; Csikszentmihalyi & Wong, 2014). Four major motivational factors contributing to chess performance have been identified: chess ability (tactical), chess-specific verbal knowledge (opening-, middle-, endgame knowledge and imagery), memory (recall for positions), and motivation (fear of failure and desire to win) (Van der Maas & Wagenmakers, 2005).

Gender differences of professional chess players

Chess is one of the few sports in which men and women enter in direct competition. The prevalence of men in international chess remained approximately constant. Only 1% of the world's chess grandmasters are women. The male chess players start with a rating of around 700 points when they are 10 years old, as compared to women, who start with approximately 650 points (Chabris & Glickman, 2006). Around the age of 20, both groups increase to 1300 points, after which their scores improve to approximately 1600 points by around the age of 30. This increase is more pronounced for men. Both women and men increase considerably in their skills when they are young; thus, at this age the skill acquisition period does not change between genders. In contrast, the previously identified window of expertise, which occurs between the end of the 20s and late 30s, changes between genders. Women need a smaller amount of activity (number of played games per year) to reach this window. Compared to men, who need around 43 games played per year to reach DWZ ratings of 2000, women need approximately 33 games per year (Vaci & Bilalic, 2017). Chabris (Chabris & Glickman, 2006) concluded that the greater number of men at the highest levels in chess can be explained by the greater number of boys who enter chess at the lowest levels (Chabris & Glickman, 2006). The game count and participation rate differences are not responsible. Elite male chess players tend to be introverts, but the pattern is different for elite women players, who are rather extroverted (Vollstädt-Klein, Grimm, Kirsch, & Bilalić, 2010). Males on average may have some innate advantages in developing chess skill due to previous differing evolutionary pressures on the sexes. However, women may have a greater talent on average in other domains. If the male predominance in chess was due just to social factors, it should have greatly lessened or disappeared by now. Some researchers recognize that many psychological sex differences are due to complex interactions between genetics, epigenetics and environmental conditions (Becker, McClellan, Reed, 2017).

CONCLUSION

Males dominate the top level in chess. There are no gender specific differences in intellectual performance for chess playing, despite some opposing theories. Women chess players show lower chess-specific self-esteem and choose a more defensive style when playing with males. Females seem disadvantaged not because they are lacking cognitive or spatial abilities, but because they approach chess competitions with less confidence and with a more cautious attitude than their male opponents. A motivational perspective may be better suited to understanding and improving the performance of women in chess. Psychological sex differences are due to complex interactions between genetics, epigenetics and environmental conditions. Studying of psychology, physiology and biochemistry of male and female chess players should be used improve the practice and pedagogy of the game of chess.

REFERENCES

Aciego, R., García, L., & Betancort, M. (2012). The benefits of chess for the intellectual and social-emotional enrichment in schoolchildren. *Spanish Journal of Psychology*, 15(2), 551-559.

Bar-Eli M., Raab, M. (2006). Judgment and decision making in sport and exercise: Rediscovery and new visions. *Psychology* of *Sport and Exercise*, (7), 6-10.

Bart, W. (2014). On the effect of chess training on scholastic achievement. *Frontiers in Psychology*, 12(5), 762-768.

Becker, J.B., McClellan, ML., Reed, B.G.(2017). Sex differences, gender and addiction. *Journal of Neuroscience Research*, 95(1-2), 136-147.

Bilalić, M., Smallbone, K., McLeod, P., & Gobet, F. (2009). Why are (the best) women so good at chess? Participation rates and gender differences in intellectual domains. *Proceedings of the Royal Society B*, 276, 1161–1165.

Blanch, A., Aluja, A., & Cornado, M.P. (2015). Sex differences in chess performance: Analyzing participation rates, age, and practice in chess tournaments. *Personality and Individual Differences*, 86, 117-121.

Chabris, F., & Glickman, M.E. (2006). Sex differences in intellectual performance: analysis of a large cohort of competitive chess players. *Psychological Science*, 17, 1040-1046.

Csikszentmihalyi, M., & Wong, M.M.H. (2014). Motivation and academic achievement: The effects of personality traits and the quality of experience. In *Applications of flow in human development and education* (pp.437-465). Springer Netherlands.

Dolenc, P. (2015). Physical self-concept in Slovenian adolescents: differences by gender and sports participation. *Facta Universitatis Series Physical Education and Sport*, 13(1), 57-66.

Gobet, F., & Charness, N. (2006). *Expertise in chess. Cambridge handbook on expertise and expert performance*, (pp. 523-538). Cambridge: Cambridge University Press.

Golf, S. (2015). Biochemistry and psychology of chess and classical physical exercise: Concurring or conflicting evidence? *Journal of Sport and Exercise Psychology*, 5 (2), 160.

Hänggi, J., Brütsch, K., Siegel, A.M., & Jäncke, L. (2014). The architecture of the chessplayer's brain. *Neuropsychologia*, 62,152-162.

Halpern, D.F., & LaMay, M.L. (2000). The smarter sex: A critical review of sex differences in intelligence. *Educational Psychology Review*, 12, 229–246.

Howard, R.W. (2014). Gender differences in intellectual performance persist at the limits of individual capabilities. *Journal of Biosocial Science*, 46, 386–404.

Howard, R.W. (2008). Linking extreme precocity and adult eminence: A study of eight prodigies at international chess. *High Ability Studies*, 19(2), 117-130.

Howard, R.W. (2005). Are gender differences in high achievement disappearing? A test in one intellectual domain. *Journal of Biosocial Science*, 37, 371-380.

Irwing, P., & Lynn, R. (2005). Sex differences in means and variability on the progressive matrices in university students: a meta-analysis. *British Journal of Psychology*, 96, 505-524.

Maass, A., D'Ettole, C., & Cadinu, M. (2008). Checkmate? The role of gender stereotypes in the ultimate intellectual sport. *European Journal of Social Psychology*, 38, 231-245.
Reingold, M., Charness, N., Pomplun, M., & Stampe, M. (2001). Visual span in expert chess players: evidence from eye movements. *Psychological Science*, 12, 48-55.
Tarnopolsky, M.A., Atkinson, S.A., Phillips, S.M., MacDougall, & J.D. (1995). Carbohydrate loading and metabolism during exercise in men and women. *Journal of Applied Physiology*, 78, 1360-1368.
Trinchero, R. (2013). *Can chess training improve pisa scores in mathematics? An experiment in Italian primary school*. Paris: Kasparov Chess Foundation Europe.
Vaci, N., & Bilalic, M. (2017). Chess databases as a research vehicle in psychology: Modeling large data. Behavior *Research Methods*, 49(4), 1227–1240.
Van Der Maas, H. L., & Wagenmakers, E. J. (2005). A psychometric analysis of chess expertise. *The American Journal of Psychology*, 29-60.
Vasyukova, E. (2012). The nature of chess expertise: knowledge or search? *Psychology in Russia* 5, 511-528.
Vollstädt-Klein, S., Grimm, O., Kirsch, P., & Bilalić, M. (2010). Personality of elite male and female chess players and its relation to chess skill. *Learning and Individual Differences*, 20, 517–521.

RODNE RAZLIKE U ŠAHOVSKIM PERFORMANSAMA

Žene su nedovoljno zastupljene u šahovskom svetu. Popularno objašnjenje za mali broj žena na najvišim šahovskim pozicijama su intelektualni zahtevi šahovske igre, dok naučno objašnjenje bazira na biološkim razlikama u intelektalnom potencijalu izmedju muškaraca i žena. Uprkos različitim mišljenjima, ne postoje dokazi o bitnim kognitivnim razlikama izmedju polova kod šahista. Mada je pamćenje u velikoj meri zaslužno za šahovske performance, malo je verovatan razlog za objašnjenje rodnih razlika u šahovskoj igri. Brojna nova otkrića dopunjuju kognitivna istraživanja rodnih razlika kod šahista. Rodni stereotipi mogu imati značajan uticaj na žene šahiste i redukcije njihovih performansi za 50% kada igraju protiv muškaraca, što se eliminiše pri saznanju da igraju protiv žena šahista. Muškarci su agresivniji i dominantniji u šahovskoj igri u odnosu na žene šahiste. Kod žena se brže razvija mentalni zamor usled energetskih zahteva šahovske igre. Hormonske razlike uslovljavaju manji sadržaj i dostupnost glikogena kod žena u odnosu na muškarce šahiste. Žene šahisti su u nepovoljnijem položaju zato što pristupaju šahovskim takmičenjima opreznije i sa manjim poverenjem u odnosu na muške protivnike. Intenzitet motivacije može objasniti slabije performance žena šahista u inteletualnom sportu kao što je šah. Buduća istraživanja u oblasti fiziologije, psihologije i biohemije mogu doprineti poboljšanju rodne šahovske igre.

Ključne reči: *šah, rodne razlike, biološke karakteristike, intelektualne performanse*