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New Developments in Chess Expertise Research

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An Introduction to the Special Issue of the *Journal of Expertise*

Chess has been an ideal tool to investigate expertise for many reasons. For one, a reliable performance metric, the Elo (1978) rating system, makes possible the identification of a wide range of expertise levels, from novice players to elite players. Also, the chess environment is extremely simple: It is a 64-square chessboard with 32 pieces (16 per player) of six categories. The simplicity of the environment allows researchers to easily control variables of interest, but, at the same time, the number of possible combinations on the chessboard is immense. This affords researchers the possibility of developing a huge number of experimental stimuli (i.e., different chess positions).

The experimental study of chess expertise started in the nineteenth century with the work of Alfred Binet (1894) but really took off with the work of the psychologist—and chess master—Adrian de Groot with his study of elite chess players from 1938 to 1945. Interestingly, de Groot used as a laboratory the ship that in 1939 took European chess players to Buenos Aires, Argentina, to play what is now called the Chess Olympiad. This study was published in Dutch in 1946, and then in English, in 1965, in the seminal book *Thought and Choice in Chess* (De Groot, 1946/1965).

This work inspired Herbert A. Simon, a polymath interested in decision making, who used chess as a laboratory for testing components of his bounded rationality theory, which earned him the Nobel Prize in Economics in 1978. Simon's work with his colleague William Chase led to a trilogy of papers published in 1973: *The Mind's Eye in Chess* (Chase & Simon, 1973a), *Perception in Chess* (Chase & Simon, 1973b), and *Skill in Chess* (Simon & Chase, 1973), which popularized the experimental approach developed by de Groot and provided a theory of chess expertise—the chunking theory—which was later updated with the template theory of expertise (Gobet & Simon, 1996). The results of the experiments of de Groot, Chase, and Simon, as well as their theoretical interpretations, form the basis of the classic approach to expertise (Gobet, 2019) and have had considerable effect on expertise in domains beyond chess (Gobet, 2016).

This special issue of the *Journal of Expertise* highlights new developments in chess expertise research that continue the tradition of the work initiated by DeGroot, Chase, and Simon. Despite huge differences in technology, two studies presented in this issue are inspired by the experimental eye-movement studies conducted by de Groot in the 1960s and published in the book *Perception and Memory in Chess* (De Groot et al., 1996). Eye-tracking technology was used to investigate the eye movements of participants' behavior when they were asked to perform a chess-related task in "Chess Expertise Reflects Domain-Specific Perceptual Processing: Evidence from Eye Movements" by Eval Reingold and Heather Sheridan, and in "A Role of Peripheral Vision in Chess? Evidence From a Gaze-Contingent Method" by Joost de Winter, Toine Koelmans, Maarten Kokshoorn, Kars van der Valk, Willem Vos, Dimitra Dodou, and Yke Bauke Eisma.

The main goal of the Reingold and Sheridan study was to investigate how encoding efficiency changes as a function of chess skill. They presented a group of expert chess players and a group of novices with an array of six mini-chessboards (4 x 4 squares instead of 8 x 8 squares) in which the participants had to detect whether or not there was a double check (a chess position in which two pieces are attacking the opponent's king simultaneously). The results supported previous research (Reingold et al., 2001) which showed that expertise enhances chess players' perceptual capacity and that this enhancement is domain-specific. For example, the difference in reaction time and eye-movement behavior existed with traditional chess pieces, but not with the capital letters representing the initial letter of the name of a piece (e.g., the letter R represents a rook, the letter K represents the king, etc.). In this study, Reingold and Sheridan directly link their work to that of Chase and Simon by concurring with these authors that the most important process underlying chess expertise is immediate visual perception rather than logical-deductive thinking.

De Winter and his colleagues investigated peripheral vision in chess by presenting three groups of players (novices, intermediates, and experts) with a chess position that the players had to memorize while their eye-movements were tracked. They used an experimental paradigm that included a circular window of different sizes (i.e., a large window allowed the participant to see most of the chess board while a small window allowed them to see only a few squares). The researchers hypothesized that if chess experts use peripheral vision more than intermediates and novices, their performance would deteriorate in the trials with smaller windows. This is because weaker players see only a small number of squares at a time; thus, all they can see are the pieces encompassed within this small window, and the increase of window size does not entail better performance. On the other hand, experts use their peripheral vision, and they see more pieces in the trials with larger windows. The results supported the hypothesis of de Winter and colleagues.

In "Templates But Not Emotions Facilitate the Information Flow Between Long-Term and Working Memory: A Sternberg Study With Chess Experts," Philippe Chassy, Rick Lahaye, and Fernand Gobet used a well-established experimental task in cognitive psychology—the Stenberg memory scanning paradigm (Sternberg, 1966)—to investigate components of the template theory (Gobet & Simon, 1996), an extension of the chunking theory (Chase & Simon, 1973). Specifically, Chassy and his colleagues investigated the relationship between cognitive structures, such as templates and emotions. The task involved presenting a series of chess positions to a group of intermediate chess players and a group of expert chess players. This series was followed first by a picture with different emotional valence (positive, negative, and neutral), and then a probe chess position. The participants had to indicate whether or not the probe was in the initially initially presented. Derived from template theory, the hypothesis that there would be a difference in performance between skill groups was supported by the results. On the other hand, the emotional valence of the images did not affect the participants' performance.

Three studies in this special issue studied the question of gender differences in chess. Two studies—one by Angel Blanch and Carles Comas and one by Philippe Chassy—took advantage of Big Data, a recent development in research methodology. In the third, Andrea Brancaccio and Fernand Gobet conducted a systematic review of the question.

Blanch and Comas used archival data of the international chess rating of the top-100 male players and the top-100 female players in 24 Eurasian countries. The novelty of their study, "A Spatial Analysis of Sex Differences in Chess Expertise Across 24 Countries in Eurasia," is that relative to previous research, to explain the gender differences in chess rating Blanch and Comas focus on a different aspect—geographical location. The main finding is that countries geographically close to one another tended to have similar gender differences in chess rating. For example, the gender differences in chess rating in Slovenia, Croatia, Serbia, Bulgaria, and Greece are similar. Another country having similar gender differences, Lithuania, while not geographically close to these countries, shares with them the characteristic of being small in size. Although it remains unclear what factors may explain these results, this study adds another component to the literature aiming at an explanation of gender differences in chess.

In "Gender Differences: The Chess Delusion," Chassy studied an archival dataset: the 2019 FIDE rating with more than 140,000 active players. Chassy went beyond the previously proposed explanations of the gender differences in chess expertise; i.e., biological, sociological, and statistical explanations. On top of these, he predicted that, given that men and women display different cognitive and emotional dispositions, male superiority is not constant across life span. The data show that the proportion of women in the chess rating list varies with age, reaching a peak of more than 25% between the age of 10 and 15 and then gradually reducing to close to 0% at the age of 55.

Drawing a parallel with research on STEM disciplines, in "Scientific Explanations of the Performance Gender Gap in Chess and Science, Technology, Engineering and Mathematics (STEM)," Brancaccio and Gobet conducted a review of the gender differences in chess, surveying studies from 1960 to 2022. Researchers in this field try to explain the fact that men are overrepresented in the elite of chess; for example, only one woman belongs to the top 100 chess players. Brancaccio and Gobet grouped the main explanations in four categories: statistical, based on individual differences, socio-cultural, and biological.

The statistical explanations focus on the shape of players' rating distribution and participation rates. Explanations based on individual differences try to explain the gender gap with differences in intelligence, personality, and motivation. The socio-cultural explanations include deliberate practice, stereotype threat, and the social environment. Finally, biological explanations—rarely studied in chess research—focused on hormonal differences.

The review found that the gender gap in chess is explained only in part by statistical differences and artifacts, and that there are important discrepancies compared to the STEM disciplines. Personality traits seem to be the most promising avenue of research; within the socio-cultural explanations, deliberate practice and stereotype threat seem to lack explanatory power. A considerable amount of research has used database analysis, but Brancaccio and Gobet argue that studies using experimental manipulations—only one in their review! —would be more promising for uncovering the mechanisms behind the gender gap in chess.

In "Where to Compete?: On the Scope of the Home-Field Advantage," Uri Zak used Big Data—the outcomes of more than 100,000 chess games played in official Israeli chess leagues—to investigate another component of chess expertise: whether playing at home or away has an effect on performance in chess tournaments. In sports, playing at home leads to an advantage. This advantage may be related to public cheering in favor of the home team, with larger supporting crowds for the home team. This may affect the players' performance or the referee's behavior. But does playing at home or away have an effect on performance in chess? There are few spectators—typically other players who are also competing—who remain silent, and the referee's role is a minor one. Alternatively, it may be that the home advantage is related to time spent travelling to the tournament venue. The finding in Zak's study is that the home advantage did not exist in these archival data and that this applies to all levels of expertise.

For many years now, the game of chess has been used in cognitive research. The selection of articles in this issue of the *Journal of Expertise* reflects a combination of new and old methodologies for study of the game, and of old and new research questions. It demonstrates that chess expertise is an active domain of research that will remain productive for many years.

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References

Binet, A. (1894). *Psychologie des grands calculateurs et joueurs d'échecs*. Paris: Hachette.

Blanch, A., & Comas, C. (2023). A spatial analysis of sex differences in chess expertise across 24 countries in Eurasia. *Journal of Expertise*, *6*(1), 56-67.

Brancaccio, A., & Gobet, F. (2023). Scientific explanations of the performance gender gap in chess and science, technology, engineering and mathematics (STEM). *Journal of Expertise*, *6*(1), 81-107.

Chase, W. G., & Simon, H. A. (1973a). The mind's eye in chess. In W. G. Chase (Ed.), *Visual information processing* (pp. 215-281). New York: Academic Press.

Chase, W. G., & Simon, H. A. (1973b). Perception in chess. *Cognitive Psychology*, *4*, 55-81.

Chassy, P. (2023). Gender differences: The chess delusion. *Journal of Expertise*, *6*(1), 68-80.

Chassy, P., Lahaye, R., & Gobet, F. (2023). Templates facilitate the information flow between long-term and working memory: A Sternberg study with chess experts. *Journal of Expertise*, *6*(1), 37-55.

De Groot, A. D. (1965). *Thought and choice in chess*. The Hague: Mouton. (Original edition in Dutch: 1946).

De Groot, A. D., Jongman, R. W., & Gobet, F. (1996). *Perception and memory in chess*. Assen: Van Gorcum.

De Winter, J. C. F., Koelmans, T., Kokshoorn, M., van der Valk, K., Vos, W., Dodou, D., & Eisma, Y. B. (2023). *Journal of Expertise*, *6*(1), 23-36.

Elo, A. (1978). *The rating of chess players, past and present*. New York: Arco.

Gobet, F. (2016). *Understanding expertise: A multidisciplinary approach*. London: Palgrave.

Gobet, F. (2019). The classic expertise approach and its evolution. In P. Ward, J. M. Schraagen, J. Gore, & E. Roth (Eds), *Oxford handbook of expertise: Research and application* (pp. 35-55). Oxford: Oxford University Press.

Gobet, F., & Simon, H. A. (1996). Templates in chess memory: A mechanism for recalling several boards. *Cognitive Psychology*, *31*, 1-40.

Reingold, E. M., Charness, N., Pomplun, M., & Stampe, D. M. (2001). Visual span in expert chess players: Evidence from eye movements. *Psychological Science*, *12*, 48-55.

Reingold, E. M., & Sheridan, H. (2023). Chess expertise reflects domain-specific perceptual processing: Evidence from eye movements. *Journal of Expertise*, *6*(1), 5-22.

Simon, H. A., & Chase, W. G. (1973). Skill in chess. *American Scientist*, *61*, 393-403.

Sternberg, S. (1966). High-speed scanning in human memory. *Science*, *153*(3736), 652-654.

Zak, Uri (2023). Where to compete?: On the scope of the home-field advantage. *Journal of Expertise*, *6*(1), 108-120.

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