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Chess

Chess has perhaps generated more scientific research than any other field of expertise, to the point that it has been called the Drosophila of cognitive psychology. There are several reasons for this state of affairs: competitive chess players' skill levels are precisely measured by the Elo rating, there is a large population of chess players, the chess environment enables elegant experimental manipulations, and research on chess psychology has benefited from cross-fertilisation with research on computer chess and artificial intelligence.

Most chess players consider world champions such as Bobby Fischer, Garry Kasparov and Viswanathan Anand to be more gifted than their less successful peers. However, there are relatively few scientific studies on the link between talent and chess. Rather, research has focused on the mechanisms and the time needed to reach master and grandmaster level. Classical works by Adriaan De Groot in 1946 and William Chase and Simon in 1973 have highlighted the fact that chess players have acquired large amounts of domain-specific knowledge (both declarative and procedural). This knowledge is perceptual in nature and is mediated by perceptual chunks – units of both perception and meaning. Neuroimaging evidence suggests that chunks are stored within neural networks located in the inferior temporal cortex, networks that do not appear to be particularly lateralised. The knowledge acquired by chess players is highly domain-specific, and, accordingly, studies have failed to find evidence that abilities acquired when playing chess transfer to other domains, such as mathematics and language. Thus, contrary to popular belief, a chess grandmaster is not necessarily good at mathematics.

While De Groot, Chase, and Simon emphasised the role of practice to acquire domain-specific knowledge, they were open to the possibility of individual differences with respect to talent. By contrast, Anders Ericsson and his colleagues have taken a more extreme position and argued that, with the exception of motivational differences, there is no such thing as talent for cognitive activities like chess. Instead, top-level performance is determined by the amount of deliberate practice that individuals devote to their domain of choice. Deliberate practice is characterised by goal-directed and repetitive activities for which immediate feedback is available. These activities, performed individually, require a considerable amount of effort and are usually not enjoyable. Anecdotal evidence about chess masters' practice activities as well as controlled studies using retrospective questionnaires about the amount and type of dedicated practice shown by chess players of various skill levels have supported the assumption that it takes a large amount of practice (about 10,000 hours on average) to reach master level. However, deliberate practice is only part of the explanation: it accounts for less than 40% of the variance in skill, there exist vast individual differences in the amount of deliberate practice necessary to reach high levels of skill, and skill level does not increase monotonically with the number of hours of practice.

Research on intelligence has produced mixed results. Some studies have shown a correlation between skill level and IQ while others have failed to find such a correlation. Surprisingly, visuo-spatial memory does not predict skill. However, there exists some direct empirical evidence supporting the role of talent in chess. A possible marker of chess talent is handedness: chess players are less likely to be right-handed than the population at large, and their degree of handedness is weaker. Another potential marker is month of birth: chess players are more likely to be born in late

winter and in spring than non-chess players. Personality differences have been identified as well; for example, children taking up chess as a hobby score higher with respect to Intellect/openness and Energy/extraversion than children not playing chess. Finally, starting age has also been shown to be a predictor of the likelihood to reach master level. A plausible hypothesis is that, just as with first language acquisition, there is a critical period for starting playing and practicing chess. The presence of this critical period may be due to a decrease of neural plasticity with development. In this respect, it is interesting that the age at which players obtain their first grandmaster results has declined in the last decades, with a player like Magnus Carlsen (currently seventeen years old and number five in the world) having obtained the grandmaster title at the age of thirteen years and four months.

Another (indirect) argument supporting the hypothesis of talent in chess is that, chess being highly competitive, it is likely that top players optimise their practice activities, which should lead to a levelling of the playing field. However, half a dozen players currently dominate the chess arena. In addition to the markers of talent just mentioned, it should also be pointed out that the "Matthew effect" may be at play as well: small differences at the beginning of a player's career – be it differences due to environmental and coaching facilities, to talent (e.g., in the speed of acquiring new chunks), or to sheer luck – may result in significant differences years after. Finally, the substantial individual differences between women and men (there is only one female player among the 150 best players in the world at the time of writing these lines) seem to be explained by differences in participation rates (there is only 1 female player for every 20 male players in the rating list of the International Chess Federation), although the reason for this difference in participation rates is open to debate.

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See also Brain hemispherity; Cognition; Decision making; Expertise; Imagery; Intelligence; Problem solving.

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