What chess players can teach us about intelligence and expertise

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British Chess Championship. Credit: Pat Baker from Gloucester, England/wikipedia, CC BY-SA

Are experts more intelligent than non-experts or do they just work harder? And why do some people reach high levels of expertise, while others just remain amateurs? These are some of the questions that cognitive scientists have tried to answer for more than a century. Now our new research on chess players has started untangling the problem.

Some researchers believe that becoming an expert in disciplines such as music and scientific research is just a matter of "an awful lot of … effort" – to quote American Olympic gold medallist Jesse Owens. The romantic idea that all of us can achieve great results by deliberate practice, commitment and abnegation is deeply rooted in our culture. In his popular science book "Outliers" Malcolm Gladwell suggests that 10,000 hours of practice will achieve expertise in virtually any skill. Rocky, in the famous series of boxing film montages, spent hours and hours of training to overcome fearsome adversaries and eventually succeed.

Other researchers, however, are convinced that the amount of practice alone cannot account for individual differences in expert performance. They believe superior cognitive ability such as general intelligence or memory is fundamental to achieve mastery in one's field of expertise.

To evaluate the role of cognitive ability in expert performance, we recently carried out two reviews of the scientific literature about the role of cognitive ability in the acquisition of chess skill. We chose chess because it is one of the few fields that has a quantitative and reliable measure of skill (the Elo rating). It is, therefore, an ideal environment for studying expert performance and skill acquisition.

In fact, the study of chess players' memory and perception has contributed to our understanding of expertise in many other fields, such as music and computer programming. According to Nobel Prize Winner Herbert Simon, the impact of chess on cognitive science is comparable to that of Drosophila (fruit fly) for the field of genetics.

Clear results

We tried to answer two simple questions about chess. First, is intensive training all you need to become a chess master? Or do you need to be

smarter than the average person to get there? Second, are chess players more intelligent than people not playing the game? The answers are important beyond chess and address fundamental questions in psychology and education.

The first review, published in Intelligence, spans 19 studies and more than 1,700 participants. For this paper we searched for all the results concerned with chess players' performance on cognitive tasks.

We calculated the overall correlations between chess skill and four cognitive abilities: fluid intelligence (the ability of solving new problems and adapting to novel situations); processing speed (for example reaction time); short-term memory; and comprehension knowledge (knowledge and skills assimilated through experience, such as vocabulary and reading comprehension).

The results showed that chess skill correlated significantly with all the measures of cognitive ability. Put simply; the "smarter" the player, the higher the level of chess skill.

In the second review (including nearly 500 participants), also published in Intelligence, we included all the studies comparing chess players' and non-chess players' ability to solve cognitive tasks. Then, we calculated the overall difference between chess players and non-chess players. Chess players' performance was significantly superior in cognitive abilities such as processing speed, planning, fluid intelligence and memory than in study participants who didn't play chess.

Nature versus nurture?

Our findings support the hypothesis that cognitive ability is a crucial element for the acquisition of chess skill. Of course, we have to be careful when establishing the direction of causality. It could be that

intelligent people are more attracted to intellectual activities such as chess compared to the general population, or that they learn quicker.

But it could also be the case that practising cognitively demanding tasks makes people smarter. However, the latter possibility seems more unlikely, as recent research has found no causal relationship between chess instruction and cognitive ability. Interestingly, the same lack of relationship has been found for music training.

While practice remains a necessary component of success in chess and other fields, it is just not sufficient to get to the top. If individuals with superior cognitive ability have better chances to achieve mastery in chess , it is likely that the same applies to other domains such as music, the professions, and science.

Practice helps us to improve, but our improvements are strictly bounded to our cognitive ability. Sadly, good will is not enough.

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