Cognitive performance: Better than our predecessors

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"A paradigmatic example of a cognitively complex task": Data derived from chess games played in professional tournaments is used to assess the long-term pattern of change in cognitive capacity. Credit: imago images/Andreas Gora

We employ our cognitive skills daily to assimilate and process information. A new empirical study shows that we do better at this task than those born a century ago. But cognitive capacity still begins to stagnate at around the age of 35.

Every day our brains are continuously called upon to meet high-level cognitive challenges. When we write, play games or watch films on our computers, drive a car or carry on a telephone conversation, neurons are constantly transmitting and evaluating the electrical impulses that enable us to filter the incoming sensory information, process it, and decide on and execute the appropriate response. It is now accepted that the ability to perform cognitively demanding tasks and adapt to rapidly changing demands is becoming increasingly important—especially in the workplace.

Perhaps surprisingly, relatively little is known about how an individual's cognitive performance changes over the course of a lifetime. Most research on this topic has been done by psychologists, who have mainly been interested in probing concepts such as the relative contributions of innate and acquired intelligence. But the test procedures employed in this work suffer from two serious shortcomings. First, the tests themselves are usually based on abstract tasks, which have little to do with everyday situations and are therefore unfamiliar to those being tested. Secondly, such experiments provide only a snapshot of each subject's performance level, and therefore have little to say about how a person's cognitive performance changes with age.

Chess as a data source

The authors of the new study—Anthony Strittmatter (University of St. Gallen), Uwe Sunde (Ludwig-Maximilians-Universitaet (LMU) in Munich) and Dainis Zegners (Rotterdam School of Management) - have chosen a very different approach to assess the long-term pattern of change in cognitive capacity with age. "In our empirical model, we have used data derived from chess games played in professional tournaments, since chess is a paradigmatic example of a cognitively complex task," Sunde explains.

In fact, the choice of chess as a data source has a number of significant advantages. Detailed data are available that record all the moves made by current and former world champions (and their opponents) over the past 125 years. This makes it possible to gauge the cognitive skills of each player by comparing his actual moves with those suggested by a modern chess computer, which can calculate the optimal move in each configuration that arises during a game. With the aid of mathematical analyses, the resulting data can be converted into a continuous record of each player's level of performance over the course of his entire career. Moreover, because the data cover a period of 125 years, one can also ask whether and how the cognitive abilities of professional chess-players have changed over the course of more than a century.

The empirical model employed by Sunde and his colleagues draws on data for over 24,000 chess games played in professional tournaments between the years 1890 and 2014, which record more than 1.6 million individual moves. When these data are analyzed for 'age cohorts' - groups defined by the birthdates of the players—the following conclusions can be drawn:

Cognitive performance follows an age-dependent trajectory. It increases steadily at first, before reaching a plateau at around the middle of the fourth decade.

The form of this profile has changed over the past 125 years. On average, those born later during this time-span exhibit a higher level of cognitive ability than their predecessors at the same age, as indicated by the relative increase in the choice of optimal moves during a game.

However, as Sunde explains, one must take one feature of the data into account when interpreting these results. "The problem arises from the fact that professional chess-players stop participating in tournaments at some stage, because they are no longer good enough to be competitive.

This factor opens up the possibility that what are called 'selection effects' might distort the quantitative analysis of the data, which would reduce confidence in the interpretation of the model. This effect is expected to set in from the age of 50 or so.

"If players continued to play regularly in public tournaments throughout their lives, the impact of the selection effect would be lower, and the trajectory of the curve for overall cognitive performance would probably fall off at a somewhat faster rate." For this reason, Sunde explains, the performance curve may not apply to the general population, but rather represents an upper bound.

Professor Sunde and his co-authors also provide a possible rationale for their finding the mean cognitive capacity of today's 30-year-olds is higher than that of the corresponding age group 100 years ago. "Our results suggest that the conditions under which people grow up these days—which of course include the rapid growth of digital technology—have a decisive impact on the development of their cognitive abilities," he says. However, he adds, the model has nothing to say about whether this trend is likely to continue.

At all events, those of us who have already passed the 35-year threshold need no longer worry about its looming approach. - And if one continues to exercise one's gray matter regularly, there's a good chance that the brain will return the favor by remaining sprightly for longer.

More information: Anthony Strittmatter et al, Life cycle patterns of cognitive performance over the long run, *Proceedings of the National Academy of Sciences* (2020). DOI: 10.1073/pnas.2006653117

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