# How language proficiency correlates with cognitive skills

February 18 2020



Credit: CC0 Public Domain

An international team of researchers carried out an experiment at HSE University demonstrating that knowledge of several languages can improve the performance of the human brain. In their study, they registered a correlation between participants' cognitive control and their proficiency in a second language.

It is widely believed that bilinguals and multilinguals are better equipped to deal with multiple tasks and that they have a better attention than those who speak only one language. This would seem reasonable: bilinguals and multilinguals have to constantly switch their attention between languages they speak, and alternate between words and grammar structures that are quite different from one another. As a result, their cognitive control function—action-monitoring and decision-making systems—works more efficiently than that of monolinguals.

Meanwhile, the scientific evidence regarding this phenomenon is rather controversial, as not all of the findings demonstrating this "bilingual advantage" effect have been replicated. According to Nikolay Novitskiy, the paper's first author, one study comparing bilingual children from the Basque Country with Spanish monolingual children found little evidence for the bilingual advantage effect. Similarly, this effect has not been observed in another study comparing the cognitive abilities of senior speakers in the region, while earlier studies had demonstrated the opposite.

Several researchers maintain that the bilingual advantage has only been seen in a subset of studies, which used limited participant samples and did not rigorously control for a variety of variables including the participants' socio-economic status (SES). In other words, the reported findings may reflect imbalances in the selection of participants rather than a genuine bilingual advantage effect as bilinguals are often recruited from immigrant or ethnic minority populations whose SES may often be quite different from that of the monolingual population. When group studies use participants widely varying in their education level, income, and other factors, the observed differences in their cognitive abilities may reflect these and other uncontrolled variables rather than their language skills.

"Imbalanced parameters in group experiments is a common problem in

behavioral studies," said Yury Shtyrov, Professor at Aarhus University and an invited leading scientist at the HSE Institute of Cognitive Neuroscience. He also notes: "It is virtually impossible to control all potentially relevant parameters in a group design, and many factors including social ones may influence the results of individual studies."

In order to avoid the problem of respondents' heterogeneity, the team's study analyzed the effect of bilingualism on executive control in a homogeneous group of participants. The authors selected 50 unbalanced bilinguals for their study, all HSE University students, who did not speak their second language (English) from early childhood (unlike balanced bilinguals), but started learning it later—during their school years.

As a result, the participants' proficiency in English varied, and the researchers suggested that the relative level of proficiency in second language might correlate with an individual's cognitive control efficiency.

In order to test this hypothesis, they measured the students' English proficiency and also asked them to perform on a cognitive control task. "Our working hypothesis was that a higher second language proficiency would correlate with how often participants have to use it," said Andriy Myachykov, Associate Professor at Northumbria University and a leading research fellow at the HSE Centre for Cognition & Decision Making, adding: "Therefore, the more often they must switch their attention between their mother tongue, Russian, and the second language, English, the stronger bilingual advantage effect on their cognitive control efficiency we should find."

Cognitive control efficiency was tested with the help of the so-called Attention Network Test, which measures the efficiency of an individual's attention by comparing response times in conditions requiring different degree of focusing and switching attention from one

stimulus to another. As such, the task measures the efficiency of main 'attention networks': alertness (readiness for the stimulus), orientation (directing attention to the stimulus), and executive control (switching attention from one stimulus to another).

The results of the study demonstrated a correlation between the performance on the attention network test and language proficiency: The better the students knew the second language, the better they could perform on the executive control task.

First, this study demonstrates that an approach taking into account relative levels of the respondents' second language skills rather than a group design may help researchers better understand a complex interplay between language and cognition at the level of individual speakers. Second, the study used an objective method (translation task) in order to evaluate second language proficiency while many other studies are based largely on subjective language proficiency self-evaluation and associated measures, such as the nominal length of learning a second language.