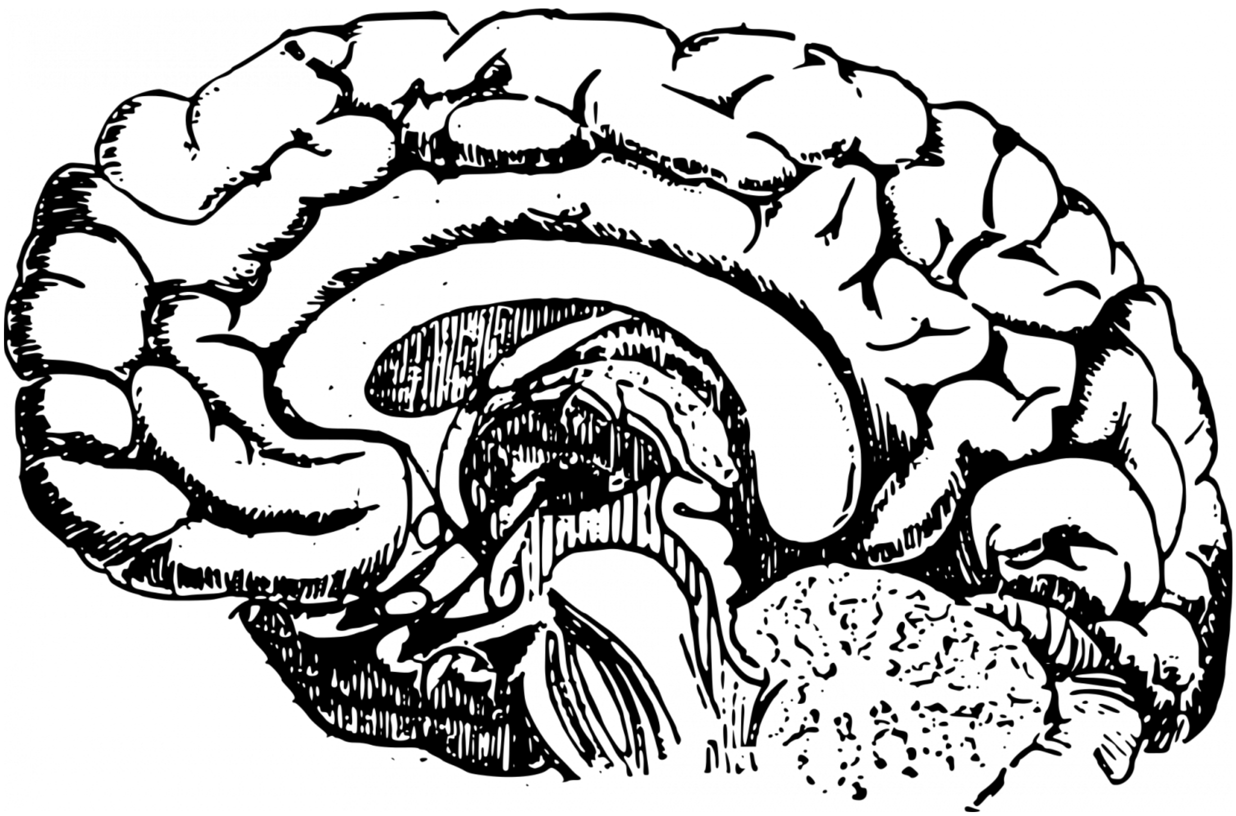
Researchers learn more about maximizing brain use

September 19 2017



Credit: CC0 Public Domain

Neuroscientists from Higher School of Economics and Charité University Clinic in Berlin have come up with a new multivariate method for predicting behavioural response to a stimulus using information about the phase of preceding neuronal oscillations recorded with EEG. The method may eventually find practical application in fields such as competitive sports, education and patient treatment. The study's findings are published in a paper titled "On optimal spatial filtering for the detection of phase coupling in multivariate neural recordings" in *NeuroImage*.

Even a resting human brain continuously generates complex patterns of neuronal oscillations that can be detected with EEG. These oscillations occur at different frequencies—e.g. alpha at 10 Hz, beta at 20 Hz and theta at 7 Hz—and are registered by instruments as changes in the electric field generated by neurons in the brain. According to a popular hypothesis, the ability to respond to sensory stimuli and process information depends on the amplitude and phase of neuronal oscillations at the moment a stimulus occurs.

"Imagine that someone needs to remember words presented to them. Interestingly, how well they can remember a particular word depends on the characteristics of the neuronal signal in their brain immediately preceding the moment they hear the word. As another example, Olympic 100-metre runners' time of response to the starting pistol can vary by tens of milliseconds, which is a fairly large spread, given the importance of these milliseconds at the finishing line. Even the same athlete's reaction time can vary significantly, depending on the current state of their brain.

We tend to respond faster when our brain is in the optimal state for processing information and slower when it is not. In turn, the optimal state leading to fast responses is associated with specific parameters of neuronal oscillations," explains Vadim Nikulin, study co-author and leading research fellow at the HSE Centre for Cognition and Decision Making.

Scientists already know that a person's response to a stimulus depends on a variety of factors, including the phase of low-frequency oscillations in the brain at the time of the stimulus. But this time, the researchers have designed a new multi-dimensional method for maximising the relationship between the phase of neuronal oscillations and the subsequent behavioural response (e.g. reaction time to stimulus, memorisation of a sensory stimulus, etc.) They recorded human brain activity using 90 electrodes, and unlike earlier studies, analysed it, taking into account the multidimensional distribution of neuronal oscillation parameters for a more accurate prediction of the reaction time.

The subjects were asked to respond to a tactile stimulus as soon as possible. A sensor attached to the index finger of their dominant hand recorded the muscular activity in response to a somatosensory stimulus applied to the index finger of the other hand. At the same time, an EEG was used to record their brain's neuronal oscillations, which are always present but show wide variability over time. The authors showed that the reaction speed depended on the phase of the low-frequency (

Citation: Researchers learn more about maximizing brain use (2017, September 19) retrieved 25 April 2024 from https://medicalxpress.com/news/2017-09-maximizing-brain.html