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How the human brain works during simultaneous interpretation

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Researchers at the Centre for Bioelectric Interfaces and the Centre for Cognition & Decision Making of the Higher School of Economics utilized electroencephalogram (EEG) and the event-related potential (ERP) technique to study neural activity during simultaneous interpretation of continuous prose.

Using event-related potentials as an index of depth of attention to the sounding fragment, the researchers assessed the competition between memory and auditory perception during simultaneous interpretation. The results of the study were published in the journal *PLoS ONE*.

According to the "Efforts Model" proposed by the French linguist Daniel Gile, during simultaneous interpretation, the brain performs three concurrent mental operations: It perceives and processes current fragments of the message in the original language, stores previously heard information in memory, and finally, generates an equivalent message in the target language. HSE researchers decided to use EEG and the ERP method to test whether these three operations are performed simultaneously or whether there is dynamic redistribution of a limited resource of attention between them.

Millions of neurons in the human brain are constantly exchanging information through short electrical impulses. The activity of large populations of neurons can be recorded from the surface of the head using electroencephalography (EEG). EEG is a powerful method of studying cognitive processes and is used in many research fields.

As nine professional simultaneous interpreters translated the speech from a U.N. Security Council meeting from Russian into English and back, their brain activity was recorded. Task-irrelevant probe stimuli with a duration of 50 milliseconds were played in parallel with the original speech. They were also processed by the brain and elicited event-related potentials. The EEG recording was then divided into segments, the beginning of which corresponded to the onset of the task-irrelevant probes. By averaging these EEG segments the researchers determined the brain's systematic response to the probes, i.e. event-related potential. The results obtained allowed the authors to quantify how the interpreter's auditory attention changed throughout the interpretation.

The data suggested that simultaneous interpreters work in the mode of dynamic redistribution of attention. In particular, as the backlog from the speaker increases, the depth of processing information currently heard by the interpreter decreases. In other words, the more the interpreter lags from the speaker, the more cognitive resources are engaged by working memory to hold and process previous information, and the less resources are available to process new information.

"The art of simultaneous interpreting has little to do with word-for-word translation. Rather, it is to know when to slow down, abstract from the speaker's words to be able to produce an elegant translation based on a larger context constructed from the speaker's previous discourse and common sense." "At the same time, it is important not to fall behind the speaker a lot," explains Roman Koshkin, author of the article and a professional simultaneous interpreter. "I hope that our research will help our colleagues find the perfect number of words that allows them to understand and convey the meaning of what was said to the audience without missing important details due to memory overload."

"Our results will help us to design a method of ranking simultaneous interpreters and finding their optimal 'working point,'' says Alex

Ossadtchi, Leading Research Fellow at the HSE Centre for Cognition & Decision Making and one of the study's authors.

More information: Roman Koshkin et al, Testing the efforts model of simultaneous interpreting: An ERP study, *PLOS ONE* (2018). DOI: 10.1371/journal.pone.0206129

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