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Bilingualism comes naturally to our brains, new study shows

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The brain uses a shared mechanism for combining words from a single language and for combining words from two different languages, a team of neuroscientists has discovered. Its findings indicate that language switching is natural for those who are bilingual because the brain has a mechanism that does not detect that the language has switched, allowing for a seamless transition in comprehending more than one language at

once.

"Our brains are capable of engaging in multiple languages," explains Sarah Phillips, a New York University doctoral candidate and the lead author of the paper, which appears in the journal *eNeuro*. "Languages may differ in what sounds they use and how they organize words to form sentences. However, all languages involve the process of combining words to express complex thoughts."

"Bilinguals show a fascinating version of this process—their brains readily combine words from different languages together, much like when combining words from the same language," adds Liina Pylkkänen, a professor in NYU's Department of Linguistics and Department of Psychology and the senior author of the paper.

An estimated 60 million in the U.S. use two or more languages, according to the U.S. Census. However, despite the widespread nature of bi- and multilingualism, domestically and globally, the neurological mechanisms used to understand and produce more than one language are not well understood.

This terrain is an intriguing one; bilinguals often mix their two languages together as they converse with one another, raising questions about how the brain functions in such exchanges.

To better understand these processes, Phillips and Pylkkänen, who is also part of the NYU Abu Dhabi Institute, explored whether bilinguals interpret these mixed-language expressions using the same mechanisms as when comprehending single-language expressions or, alternatively, if understanding mixed-language expressions engages the brain in a unique way.

To test this, the scientists measured the neural activity of Korean/English

bilinguals.

Here, the study's subjects viewed a series of word combinations and pictures on a computer screen. They then had to indicate whether or not the picture matched the preceding words. The words either formed a two-word sentence or were simply a pair of verbs that did not combine with each other into a meaningful phrase (e.g., "icicles melt" vs. "jump melt"). In some instances, the two words came from a single language (English or Korean) while in others both languages were used, with the latter mimicking mixed-language conversations.

In order to measure the study subjects' brain activity during these experiments, the researchers deployed magnetoencephalography (MEG), a technique that maps neural activity by recording magnetic fields generated by the electrical currents produced by our brains.

The recordings showed that Korean/English bilinguals, in interpreting mixed-language expressions, used the same neural mechanism as they did while interpreting single-language expressions.

Specifically, the brain's left anterior temporal lobe, a brain region well-studied for its role in combining the meanings of multiple words, was insensitive to whether the words it received were from the same language or from different languages. This region, then, proceeded to combine words into more complex meanings so long as the meanings of the two words combined together into a more complex meaning.

These findings suggest that language switching is natural for bilinguals because the brain has a combinatory mechanism that does not "see" that the language has switched.

"Earlier studies have examined how our brains can interpret an infinite number of expressions within a single language," observes Phillips. "This

research shows that bilingual brains can, with striking ease, interpret complex expressions containing words from different languages."

More information: Composition within and between languages in the bilingual mind: MEG evidence from Korean/English bilinguals, *eNeuro* (2021).

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