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Conceptual representation in the brain: Towards mind-reading

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Your measured brain signals can reveal whether you are thinking about an animal or a tool. That's what neuroscientist Irina Simanova discovered during her PhD at Radboud University, where she investigated the conceptual representation of words and objects in the human brain. This knowledge is useful for the development of tools that convert brain signals into speech.

Our memory for word meaning is compartmentalised. When you think of a non-living object like a tool, a specific population of neural cells becomes active. In contrast, when you think of something living, such as an animal, that thought is processed by a different set of neurons. Irina Simanova's examination of the neural networks behind this categorisation offers insight into how we perceive objects, understand words, and produce language.

Using EEG and fMRI, Simanova was the first to investigate whether the same neurons process different representations of one object – an image of a cat and the word 'cat'. This proved to be true. 'This shows that there is a common neural component for images and words within one category', Simanova explains. 'That is interesting knowledge for scientists who develop tools to convert brain signals into speech.'

Predicting speech

She also tried to predict the category of a word that the test subject still

had to pronounce by using magnetoencephalography (MEG), a technique that makes it possible to track the brain signal accurately in time. She succeeded in approximately 65 percent of the cases. 'A nice result, especially because this was such an explorative study. Of course, ideally we aim for 100-percent correct predictions.' Her next step is to study more objects within a single category. 'In the current study, we used very mainstream objects, for instance cats and dogs. Now I want to find out if the same principles apply for exotic species, like naked cats.'

Provided by Radboud University Nijmegen

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