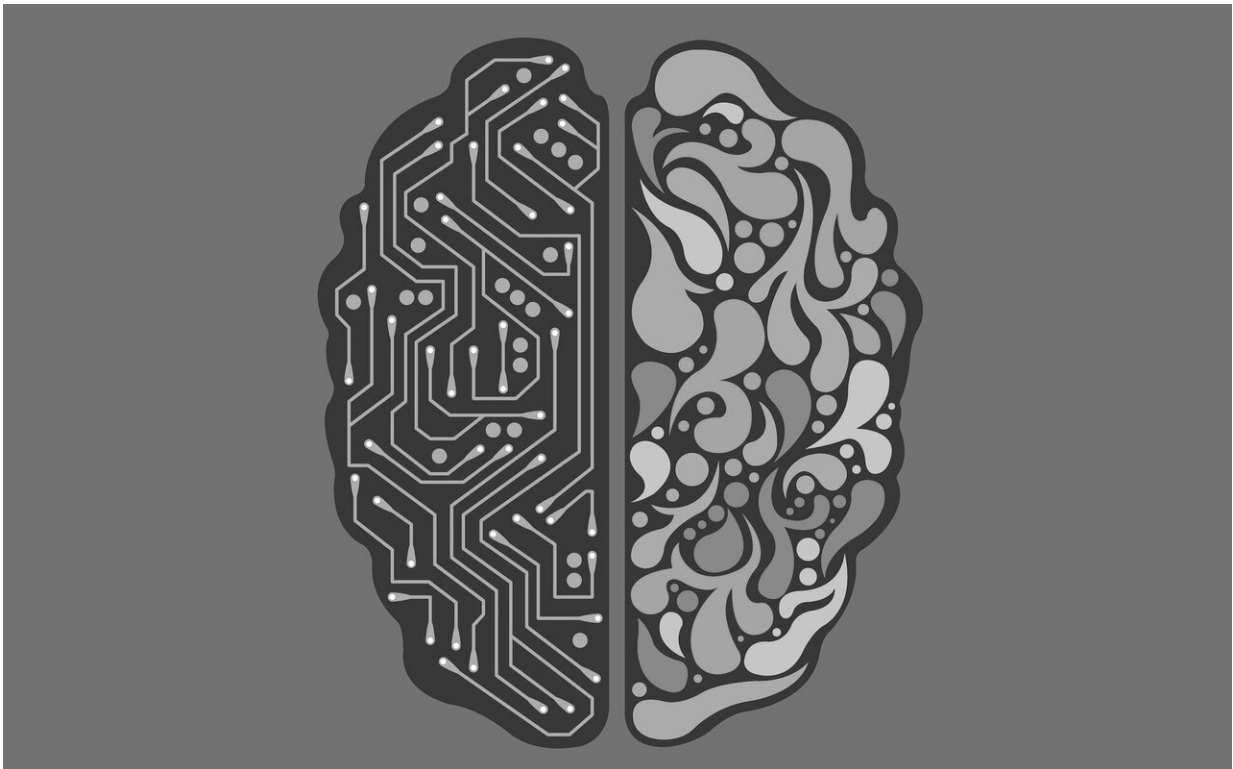


Researchers identify brain regions where word meaning is retrieved

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A new study by researchers at the Medical College of Wisconsin (MCW) reveals the areas of the brain where the meanings of words are retrieved from memory and processed during language comprehension. Previous neuroimaging studies had indicated that large portions of the

temporal, parietal, and frontal lobes participate in processing language meaning, but it was unknown which regions encoded information about individual word meanings.

"We found that word meaning [information](#) was represented in several high-level [cortical areas](#) (i.e., areas that are not closely connected to primary sensory or motor areas), including the classical 'language areas' known as Broca's area and Wernicke's area," said Dr. Leonardo Fernandino, assistant professor of neurology and biomedical engineering at MCW. "Interestingly, however, some regions not previously considered as important for language processing were among those containing the most information about word meaning."

Additionally, they also investigated whether the neural representations of word meaning in each of these areas contained information about phenomenological experience (i.e., related to different kinds of perceptual, emotional, and action-related experiences), as several researchers had previously proposed, or whether they contained primarily information about conceptual categories (i.e., natural kinds) or about word co-occurrence statistics, as other researchers have theorized.

They used functional MRI along with a technique called "representational similarity analysis (RSA) searchlight mapping" to generate a high-resolution map of the brain regions in which word meaning information was activated when participants were silently reading individual words presented on the screen (a different word was presented every few seconds). They scanned 64 participants across two different experiments. The words were all English nouns, including animals, food/plants, tools, vehicles, [body parts](#), human traits, quantities, [social events](#), verbal events, sound events, and [negative events](#).

As expected, they found that word meaning was represented in both cerebral hemispheres, although the [left hemisphere](#) was more

prominently involved. In most people, the left hemisphere is specialized for language processing while the right hemisphere specializes in processing visuo-spatial information.

"We also found that word meaning representations *in all of these regions* encode experiential information, that is, information derived from sensory, motor, and emotional experiences, even after controlling for other types of information such as semantic category and word co-occurrence statistics," said Dr. Fernandino. "The study also showed that these representations are *multimodal*, in that they combine information from multiple features of experience and from multiple sensory modalities."

The researchers found that brain areas known as the "default mode network"—which act as connection hubs for neural pathways originating in the visual, auditory, tactile, motor, and other modality-specific areas—were among the most important areas for processing word [meaning](#), which supports their previously published proposal of a hierarchical system of convergence zones for concept representation.

The study is published in the *Journal of Neuroscience*.

More information: Jiaqing Tong et al, A Distributed Network for Multimodal Experiential Representation of Concepts, *The Journal of Neuroscience* (2022). [DOI: 10.1523/JNEUROSCI.1243-21.2022](https://doi.org/10.1523/JNEUROSCI.1243-21.2022)

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