

Recognizing the basic structure of language is not unique to the human brain

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Credit: Rice University

A team led at Newcastle University, UK, has shed light on the evolutionary roots of language in the brain.

Publishing in *Nature Communications*, the team led by Dr Ben Wilson and Professor Chris Petkov explain how using an imaging technique to explore the [brain](#) activity in humans and monkeys has identified the [evolutionary origins](#) of cognitive functions in the brain that underpin language and allow us to evaluate orderliness in sequences of sounds.

This new knowledge will help our understanding of how we learn - and lose - language such as in aphasia after a stroke or in dementia.

Scanning the brains of humans and macaque monkeys, the research team has identified the area at the front of the brain which in both humans and monkeys recognises when sequences of sounds occur in a legal order or in an unexpected, illegal order.

Professor Petkov said: "Young children learn the rules of language as they develop, even before they are able to produce language. So, we used a 'made up' language first developed to study infants, which our lab has shown the monkeys can also learn. We then determined how the human and monkey brain evaluates the sequences of sounds from this made up language."

The team first had the humans and monkeys listen to example sequences from the made up language, allowing them to hear what were correct orderings in the sequence of sounds. They then scanned the [brain activity](#) of both species as they listened to new sequences that either had a correct order or could not have been generated by the made up language.

Functional magnetic resonance imaging (fMRI) revealed that in both groups a corresponding region of the brain - the ventral frontal and opercular cortex - responded to the order that both species had learned to

expect.

These results suggest that the function of this frontal region, which is one of the areas involved in processing the order of words in a sentence in human language, is shared in both humans and primates, revealing its evolutionary origins. This brain region seems to monitor the orderliness, or organisation, of what is heard, which is an important cognitive function that provides a foundation for the more complex language abilities of humans.

These results provide first evidence that some of the functions of this brain area, which include understanding language in humans, are shared by other animals.

Professor Petkov adds: "This will help us answer questions on how we learn language and on what goes wrong when we lose language, for example after a brain injury, stroke or dementia."

Building on these developments, the Newcastle University team, with their neurology collaborators in Cambridge and Reading Universities have begun a project to study the function of this brain region and its role in language impairment in aphasic patients with stroke, which might lead to better diagnosis and prognosis of [language impairment](#).

Professor Petkov explains: "Identifying this similarity between the monkey and [human](#) brain is also key to understanding the brain regions that support [language](#) but are not unique to us and can be studied in animal models using state-of-the-art neuroscientific technologies."

More information: An artificial grammar paradigm reveals evolutionarily conserved regions of frontal cortex in macaques and humans. Benjamin Wilson, Yukiko Kikuchi, David Hunter, Fred Dick, Kenny Smith, Alexander Thiele, Tim Griffiths, William D. Marslen-

Wilson & Christopher I. Petkov. *Nature Communications*,
[dx.doi.org/10.1038/NCOMMS9901](https://doi.org/10.1038/NCOMMS9901)

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