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# 'Brain waves' challenge area-specific view of brain activity

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Our understanding of brain activity has traditionally been linked to brain areas – when we speak, the speech area of the brain is active. New research by an international team of psychologists led by David Alexander and Cees van Leeuwen (KU Leuven – University of Leuven) shows that this view may be overly rigid. The entire cortex, not just the area responsible for a certain function, is activated when a given task is initiated. Furthermore, activity occurs in a pattern: waves of activity roll from one side of the brain to the other.

The brain can be studied on various scales, researcher David Alexander explains: "You have the neurons, the circuits between the neurons, the Brodmann areas – brain areas that correspond to a certain function – and the entire cortex. Traditionally, scientists looked at local activity when studying brain activity, for example, activity in the Brodmann areas. To do this, you take EEG's (electroencephalograms) to measure the brain's electrical activity while a subject performs a task and then you try to trace that activity back to one or more brain areas."

In this study, the psychologists explore uncharted territory: "We are examining the activity in the cerebral cortex as a whole. The brain is a non-stop, always-active system. When we perceive something, the information does not end up in a specific part of our brain. Rather, it is added to the brain's existing activity. If we measure the electrochemical activity of the whole cortex, we find wave-like patterns. This shows that brain activity is not local but rather that activity constantly moves from one part of the brain to another. The local activity in the Brodmann areas

only appears when you average over many such waves."

Each activity wave in the cerebral cortex is unique. "When someone repeats the same action, such as drumming their fingers, the motor centre in the brain is stimulated. But with each individual action, you still get a different wave across the cortex as a whole. Perhaps the person was more engaged in the action the first time than he was the second time, or perhaps he had something else on his mind or had a different intention for the action. The direction of the waves is also meaningful. It is already clear, for example, that activity waves related to orienting move differently in children – more prominently from back to front – than in adults. With further research, we hope to unravel what these different wave trajectories mean."

**More information:** The full text of the study "Traveling waves and trial averaging: the nature of single-trial and averaged brain responses in large-scale cortical signals" is available on the website of *NeuroImage*: www.sciencedirect.com/science/ … ii/S1053811913000633

Provided by KU Leuven