Where the brain makes sense of speech

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Researchers have identified regions of the brain where speech sounds are perceived as having abstract meaning, rather than as just a stream of sensory input. They said their identification of the regions demonstrates that the understanding of speech does not just emerge from lower-level processing of speech sounds, but involves a specialized perceptual region.

Steven Small and his colleagues published their findings in the December 20, 2007, issue of the journal *Neuron*, published by Cell Press.

To distinguish speech perception regions, the researchers asked volunteer subjects to listen to a series of simple speech sounds while watching video of people pronouncing the sounds. During these trials, the subjects' brains were scanned using functional magnetic resonance imaging. In this widely used brain-scanning technique, harmless magnetic fields and radio waves are used to image blood flow in brain regions, which reflects brain activity in those regions.

In the experiments, the speech sounds might either match the video representations or not. By manipulating the sequences of the various combinations of speech sounds and video of the sounds, the researchers could distinguish brain regions that were active in abstract processing of the speech sounds versus only their sensory properties.

Analyzing the results of their experiments, the researchers identified two areas of known left-hemisphere speech-processing regions—called pars

opercularis and planum polare—that code speech at an abstract level.

The researchers concluded that “We have shown that there are neurophysiological substrates that code properties of an audiovisual utterance at a level of abstraction that corresponds to the speech category that is ‘heard,’ which can be independent of its sensory properties. We set out from the observation that there is no need to posit the existence of abstract coding to explain emergent features of audiovisual speech, because these features may just be the result of joint activity in lower-level unisensory regions. Yet, our results indicate that neural activity in left-hemisphere regions does indeed track the experienced speech percept, independent of its sensory properties.”

Source: Cell Press