Zeroing in on the brain's speech 'receiver'

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A particular resonance pattern in the brain's auditory processing region appears to be key to its ability to discriminate speech, researchers have found. They found that the inherent rhythm of neural activity called "theta band" specifically reacts to spoken sentences by changing its phase. The researchers also noted that the natural oscillation of this frequency provides further evidence that the brain samples speech segments about the length of a syllable.

The findings represent the first time that such a broad neural response has been identified as central to perceiving the highly complex dynamics of human speech, said the researchers. Previous studies have explored the responses of individual neurons to speech sounds, but not the response of the auditory cortex as a whole.

David Poeppel and Huan Luo published their findings in the June 21, 2007 issue of the journal *Neuron*, published by Cell Press.

In their experiments, the researchers asked volunteers to listen to spoken sentences such as "He held his arms close to his sides and made himself as small as possible." At the same time, the subjects' brains were scanned using magnetoencephalography. In this imaging technique, sensitive detectors are used to measure the magnetic fields produced by electrical activity in brain regions.

Poeppel and Luo pinpointed the theta band—which oscillates between four and eight cycles per second—as one that changed its phase pattern with unique sensitivity and specificity in response to the spoken

sentences. What's more, as the researchers degraded the intelligibility of the sentences, the theta band pattern lost its tracking resonance with the speech.

The researchers said their findings suggest that the brain discriminates speech by modulating the phase of the continuously generated theta wave in response to the incoming speech signal. What's more, they said, the time-dependent characteristics of this theta wave suggest that the brain samples the incoming speech in "chunks" that are about the length of a syllable from any given language.

Source: Cell Press