Is there a central brain area for hearing melodies and speech cues? Still an open question

November 29 2011

Previous studies have suggested a particular hotspot in the brain might be responsible for perceiving pitch, but auditory neuroscientists are still debating whether this "pitch center" actually exists. A review article discusses a recent study claiming that this pitch center may not exist after all, or may not be located where previous research has suggested.

The perceptual feature of sound known as pitch is fundamental to human hearing, allowing us to enjoy the melodies and harmonies of music and recognize the inflection of speech. Previous studies have suggested that a particular hotspot in the brain might be responsible for perceiving pitch. However, auditory neuroscientists are still hotly debating whether this "pitch center" actually exists. In a new review article, Daniel Bendor, Ph.D., of the Massachusetts Institute of Technology, discusses a recent study claiming that this pitch center may not exist after all, or alternatively, may not be located where previous research has suggested. The article is entitled "Does a Pitch Center Exist in Auditory Cortex?"and appears in the Articles in PresS section of the Journal of Neurophysiology, published by the American Physiological Society.

Methodology

Dr. Bendor writes a brief review outlining previous research that found a pitch processing center in a region of human auditory cortex located in lateral Heschl's gyrus, as well as other more recent studies that report

data that contradict these earlier findings.

Results

The review points out decades-old research suggesting that the auditory cortex plays a pivotal role in pitch perception. Researchers originally obtained this finding by training cats to distinguish pitch, then removing the auditory cortex on both sides of the brain-rendering the animals unable to distinguish pitch, but still able to discriminate other aspects of sound, such as frequency. Studies using functional Magnetic Resonance Imaging (fMRI), a technique that examines brain activity while subjects are actively performing tasks in an MRI scanner, suggested that the lateral Heschl's gyrus is the main player in pitch perception. Several fMRI studies have scanned subjects' brains while listening to noise, then compared the brain activity to when subjects listen to a sound called iterated ripple noise (IRN), similar to noise but with a pitch component. However, recent studies that compare IRN and an IRN stimulus modified to have no pitch found that both sounds seem to activate the same region of the brain, suggesting that this area may not be involved in pitch perception after all. Bendor points out that it is too soon to dismiss the existence of a pitch center, however additional studies are needed to confirm its existence given these new results. He adds, although auditory cortex overlaps Heschl's gyrus, the exact placement can vary between subjects. Intersubject variability presents a significant problem when averaging data across multiple subjects, and could be one reason why an fMRI study fails to replicate a result.

Bendor notes that other research suggests that a different area of the brain behind the lateral Heschl's gyrus, called the anterior planum temporale, may play a role in perceiving pitch-a topic that needs further investigation.

Importance of the Findings

The reviewed studies suggest that the existence of a pitch center, especially one located in the lateral Heschl's gyrus, is still an open question.

"Although there is general agreement that the auditory cortex is essential for pitch perception, whether pitch processing is localized within a single functionally-specific region within the auditory cortex remains a controversial issue among auditory neuroscientists," Bendor says. Dr. Bendor is affiliated with the Picower Institute for Learning and Memory, Department of Brain and Cognitive Science at the Massachusetts Institute of Technology.

More information: The article, "Does a Pitch Center Exist in Auditory Cortex?" is available online.

Provided by American Physiological Society