Medical Xpress

Sensitivity of brain center for 'sound space' defined

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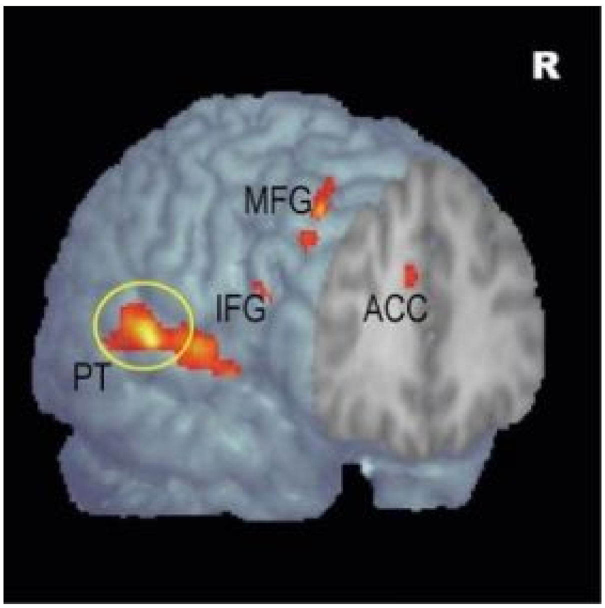

Illuminated areas in this brain image indicate activation related to perceptions of spatial change. The planum temporale region is marked with a yellow circle. Credit: The Hebrew University of Jerusalem

While the visual regions of the brain have been intensively mapped, many important regions for auditory processing remain "uncharted territory." Now, researchers at the Hebrew University of Jerusalem and elsewhere have identified a region responsible for a key auditory process — perceiving "sound space," the location of sounds, even when the listener is not concentrating on those sounds.

The findings settle a controversy in earlier studies that failed to establish the auditory region, called the planum temporale, as responsible for perception of auditory space by default.

The researchers, led by Dr. Leon Y. Deouell, of the Psychology Department and the Interdisciplinary Center for Neural Computation of the Hebrew University, and colleagues from the University of California, Berkeley, and the Weizmann Institue of Science published their findings in the Sept. 20 issue of the journal *Neuron*, published by Cell Press. Working with Deouell on the project were Aaron S. Heller of University of California, Berkeley; Prof. Rafael Malach of the Weizmann Institute of Science; and Prof. Mark D'Esposito and Prof. Robert T. Knight of the University of California, Berkeley

Studies by other researchers had shown that the planum temporale was activated when people were asked to perform tasks in which they located sounds in space. However, many researchers believed that the region was responsible only for intentional processing of such information. And, in fact, previous studies had failed to establish that the planum temporale was responsible for automatic, nonintentional representation of spatial location.

Previous research done by Dr. Deouell and others has shown that some patients with brain damage may be specifically impaired in this function. Understanding how the normal brain machinery for this function is organized may help to understand why it breaks down and eventually how to mend it.

In their work, Deouell and colleagues used an improved experimental design that enabled them to more sensitively determine the brain's auditory spatial location center. For example, they presented their human subjects with sounds against a background of silence, used headphones that more accurately reproduced sound location, and used noise with a rich spectrum, which has been shown to be more readily locatable in space. They also used sounds recorded from microphones placed in each subject's own ears, and then played the same sounds back, thus tailoring the sounds specifically to the subjects' own head and ears.

In their experiments, they presented bursts of the noise to the volunteers wearing the headphones while the subjects' brains were scanned by 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 locations.

The subjects were instructed to ignore the sounds. And, to divert their attention, they either watched a movie with the sound turned off or were given a simple button-pushing task.

When the position of the noise bursts was varied in space, the researchers found that the planum temporale in the subjects' brain was, indeed, activated. What's more, the greater the number of distinct sound locations subjects heard during test runs, the greater the activity in the planum temporale.

The researchers thus concluded that their experiments "suggest that neurons in this region represent, in a nonintentional or preattentive fashion, the location of sound sources in the environment."

Source: The Hebrew University of Jerusalem