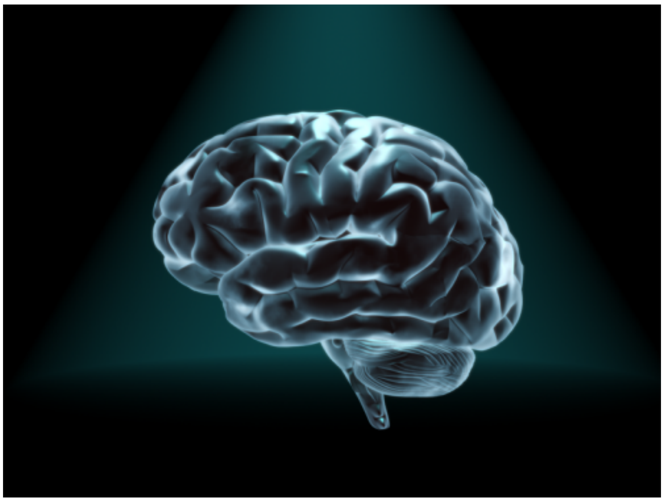
Brain scans illuminate emotional response to sound

16 November 2015



Credit: Human Brain Project

Noisy gymnasiums, restaurants where conversations are nearly impossible and concert halls less than perfect for the music are all acoustical problems. Now Penn State acoustical engineers are using functional MRI to better understand room acoustics and the emotions they can cause.

"Traditional methods of evaluating room acoustics use subjective rating methods and part of our study uses this method," said Michelle Vigeant, assistant professor of acoustics and architectural engineering. "The other part uses fMRI to see how changes in acoustics appear in the brain."

fMRI measures brain activity by sensing changes in blood flow in the brain, which is linked to brain activity.

Vigeant and Martin S. Lawless, Ph.D. student in acoustics, are looking at the emotional response to reverberation in room acoustics. Reverberation is a measure of how long a sound persists in a space after it is made. In concert halls, reverberation is used to support the music, but in many spaces it is excessive. Noisy rooms where background sounds just seem to hang in the air making it difficult to hear speech or music have a lot of reverberance.

"For room acoustics there are a lot of attributes that aren't well defined," said Vigeant. "We don't know what changing variables x, y or z will do. However, for reverberation, everyone usually agrees on what is in a good range and what is not."

To test the emotional response to reverberation, the researchers use short pieces of music recorded in anechoic chambers—rooms that absorb all reflection and echoes of sound. These symphonic snippets are then altered to contain differing amounts of reverberation. Theresearchers report their results in a recent issue of *Journal of the Acoustical Society of America Express Letters*.

Vigeant and Lawless tested five subjects each in both an fMRI simulator and a real machine for about 70 images in each machine. At the same time, they asked the subjects to rate the music on a scale from -2 to +2 as unpleasant to pleasant. The researchers note that the number of subjects is small, but also that each individual had seven scans for each of the musical snippets with reverberation. They also note that fMRI statistical analysis is relatively complex and can vary depending on a study's design.

"We used musicians as subjects because they are used to doing critical listening," said Lawless. "They learn more quickly than non-musicians, which means their answers are more reliable."

The simulation fMRI testing prepares the subjects for the closeness of the real machine, although the simulator lacks some of the properties of the real thing. In both machines, the subjects wear headphones and view a small mirror screen that tells them when the sounds will occur. Because complete stillness is necessary for the scans, the subjects use a trigger to choose their preference ratings and a thumb button to submit their choices. The subjects hear a setup tone and then 16 seconds of music, which is then followed by a rating period of 10 seconds.

Every person experiences music selectively, the researchers note. When something is pleasurable, certain areas of the brain increase activity, which shows on the fMRI.

"The brain is always active, so what we see is a change in activity," said Vigeant.

Vigeant and Lawless found two subjects whose brains lit up in an area that signifies anticipation of pleasure when listening to those music segments they rated as most pleasurable.

Provided by Pennsylvania State University
APA citation: Brain scans illuminate emotional response to sound (2015, November 16) retrieved 20 September 2021 from https://medicalxpress.com/news/2015-11-brain-scans-illuminate-emotional-response.html