Science

Scientists find part of brain responds selectively to sound of singing

US results also confirm previous findings that some neurons respond to speech or music

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It may not yet feature in a West End musical but scientists say they have found an unexpected response to singin' in the brain.

Researchers say they have found particular groups of neurons that appear to respond selectively to the sound of singing.

Writing in the journal Current Biology, a team of scientists in the US report how they made their discovery by recording electrical activity in the brains of 15 participants, each of whom had electrodes inserted inside their skulls to monitor epileptic seizures before undergoing surgery.

The team recorded electrical activity in response to 165 different sounds, from pieces of instrumental music to speech and sounds such as dogs barking, and then processed them using an algorithm. They combined the results with data from fMRI brain scans previously collected from 30 different individuals to map the location of the patterns in the brain.

Dr Samuel Norman-Haignere, a co-author of the study based at the University of Rochester, said the team decided to combine the data from the different approaches to overcome their respective weaknesses and combine their strengths.

“fMRI is one of the workhorses of human cognitive neuroscience, but it is very coarse. Intracranial data is much more precise but has very poor spatial coverage,” he said.

The results confirmed previous findings from fMRI scans that some neurons respond only to speech or respond more strongly to music. However, they also revealed populations of neurons that appear to respond selectively to the sound of singing, showing only very weak responses to other types of music or speech alone.

“These results suggest that representations of music are fractionated into subpopulations selective for different types of music, one of which is specialised for the analysis of song,” the team write.

The work reveals these song-specific neurons appear to sit in the superior temporal gyrus, close to areas previously identified as responding particularly to music or to speech.

The authors write that it is likely the song-selective neurons were not spotted in previous work using fMRI scans alone, since the use of electrodes allows for a finer-grained measures of the activity of neurons.

The researchers add work is now under way to understand what it is about singing that these areas of the brain are responding to - for example whether it is pitch and timbre, or melodies and rhythms - while they also hope to explore how such selectivity arose during development or evolution.

“Our study presents a first step toward answering these longstanding questions,” the authors write.

They also raise the possibility of studying the impact of activating areas of the brain related to songs and exploring interactions with other parts of the brain, noting that songs can elicit particular emotions or memories.

Sophie Scott, a professor of cognitive neuroscience at University College London who was not involved in the research, welcomed the study.

“The singing voice is the only musical instrument that almost everyone is born with, so one might expect us to have a rather different relationship with human song, relative to other kinds of music,” she said.

“We know that there are some significant differences between the brain systems that control how we speak and those that control how we sing, so it’s very interesting that some of these distinctions are also seen when we listen to human song.”

Dr Ediz Sohoglu, a cognitive neuroscientist at University of Sussex, said the findings were striking.

“One of the interesting questions that arises is why the brain has evolved or been shaped by experience to develop such specialised neurons. Why not just use the same neurons in a multi-purpose fashion to process more than one type of sound?” he said.

“One possibility is that having specialised neurons helps a listener to focus on certain sounds in noisy environments. For example, if I am listening to my favourite singer in a concert, I might find it easier to ignore the loud conversation behind me - which would be represented in a different part of my brain.”