Our ability to focus on one voice in crowds is triggered by voice pitch

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Scientists have discovered that a group of neurons in the brain's auditory stem help us to tune into specific conversations in a crowded room.

In order to focus on a particular conversation, listeners need to be able to focus on the voice of the speaker they wish to listen to. This process is called "selective attention" and it has been long known by researchers that it happens in the part of the brain called the auditory cortex, which processes speech information.

Selective attention helps the brain to modulate sound information and to prioritise information over the background noise, such as focusing on one conversation above all others in a crowded room. However, what triggers selective attention in the auditory cortex has been debated by scientists.

In a study published today in the journal *eLife*, the researchers from Imperial College London write how they investigated the structures downstream of the auditory cortex. In particular, they looked at the contribution that the auditory brainstem, which sits below the auditory cortex, makes to the selective attention process.

The experiment

The researchers set up non-invasive experiments with 14 participants who listened to two competing conversations. Electrodes were fitted to the participants' heads and connected to a computer, which relayed the brain readings in the auditory brain stem. Algorithms devised by the team then decoded the information gathered by the electrodes.

When the participants chose to focus on one conversation above the other, neurons in the auditory brainstem responded more to the pitch of the voice that they listened to rather than to the pitch of the voice that they ignored. This suggests that an important aspect of selective attention occurs in the auditory brainstem and the neural signal is then relayed to the auditory cortex, where higher level processing of auditory information occurs.

Pitch is the key

Dr Tobias Reichenbach, the lead author from the Department of Bioengineering, said: "Humans excel at selectively listening to a target speaker when there are a lot of background noises, such as many competing voices. In this din of chatter the auditory cortex switches into action and with laser focus, processes information that enables us to zone in on one conversation. But how these selective process works have been debated.

"Now, our study is showing us that the pitch of the speaker's voice we want to focus on is an important cue that is used in the auditory brainstem to focus on a target speaker. This helps us to concentrate on a voice while filtering out all the background noise."

Implications for hearing

The team suggests that their discovery may hold the key to explaining why some people, who do not have hearing problems in the inner ear, still find it difficult to keep track of conversations in large crowds. It could be that the neurons in their auditory brainstem, associated with receiving pitch signals, are not properly activated.

Improving speech recognition technologies

The researchers say their discovery may also help engineers to refine speech recognition technologies such as automated answering machine systems and speech recognition technologies. Currently, these technologies do not function at their optimum level when there is a lot of background noise. The team suggests that if the technology could focus on the pitch of the user's voice, then it may help to make the speech recognition process more accurate in environments with a lot of noise.

Next steps

Now that the researchers have discovered that voice pitch causes a response in the auditory brain stem they want to refine their experiments further. The next stage will involve non-invasive experiments with participants who will listen to several conversations at once so that the team can determine how selective attention works in more complex environments.

Understanding this process in more detail could, for example, help engineers to build better hearing aids that are more adept at filtering out background noise for users, which is currently a challenge for those with hearing impairments in noisy places.

Provided by Imperial College London