Brain turns down volume of background noise in a busy cafe

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Credit: AI-generated image (disclaimer)

In a busy cafe, on the street, on the telephone or even in a lecture theatre: speech sounds are often lost in a sea of background noise. However our brain still manages to fill in the 'gaps'. You seem to hear softer word sounds right through loud noises. How does our brain do that? Neuroscientist Lars Riecke from Maastricht University discovered that

this is due to the automatic suppression of neural responses to hearing disruptions. It is as if the slides on a sound mixer in our head open and close. Riecke carried out his research with a Veni grant from the NWO Talent Scheme programme.

Information lost in noise

How on earth is it possible, thought Lars Riecke, that you can hold a telephone conversation at a busy train station and understand each other even though there is a cacophony of sound around you? Some of the information in the conversation must be lost in the noise. Clearly our brain is capable of constructing such a global sound pattern that you are able to hold a conversation with few problems.

With two studies, Riecke laid the foundation for an answer to that question. He first of all localised precisely which part of the brain makes up the 'missing' sound. He did that by subjecting study subjects to functional magnetic resonance imaging (fMRI), a technique that makes brain activity visible in a three-dimensional image. With the help of EEG scans he timed precisely the threshold values of that electrical activity. By bombarding the study subjects with simple signal sounds (important and disrupting) he gained insight into the fundamental functioning of the supplementing process by the brain.

Two competing noise streams

After that Riecke focused on the transfer of advanced sounds, such as the human voice. The participants in the study heard uninterrupted and interrupted vowels with both quiet and loud background noise. At the same time their brain activity was mapped. This study and other experiments revealed that two competing noise streams in a single environment lead to our brain adapting itself. Our brain 'turns up the

volume' of one noise stream at the expense of the other.

The research results of Lars Riecke first of all contribute to a better understanding of people's ability to listen selectively to a sound source despite a noisy environment. With the help of further research this new knowledge can be used to develop methods that might make it possible to improve this ability. Ultimately this might give a boost to new hearing aids, which can support people with attention problems and hearing limitations in noisy environments.

More information: Lars Riecke et al. Sustained Selective Attention to Competing Amplitude-Modulations in Human Auditory Cortex, *PLoS ONE* (2014). DOI: 10.1371/journal.pone.0108045

Lars Riecke et al. 4-Hz Transcranial Alternating Current Stimulation Phase Modulates Hearing, *Brain Stimulation* (2015). DOI: 10.1016/j.brs.2015.04.004

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