Processing of music and language in our brain more complex than previously thought

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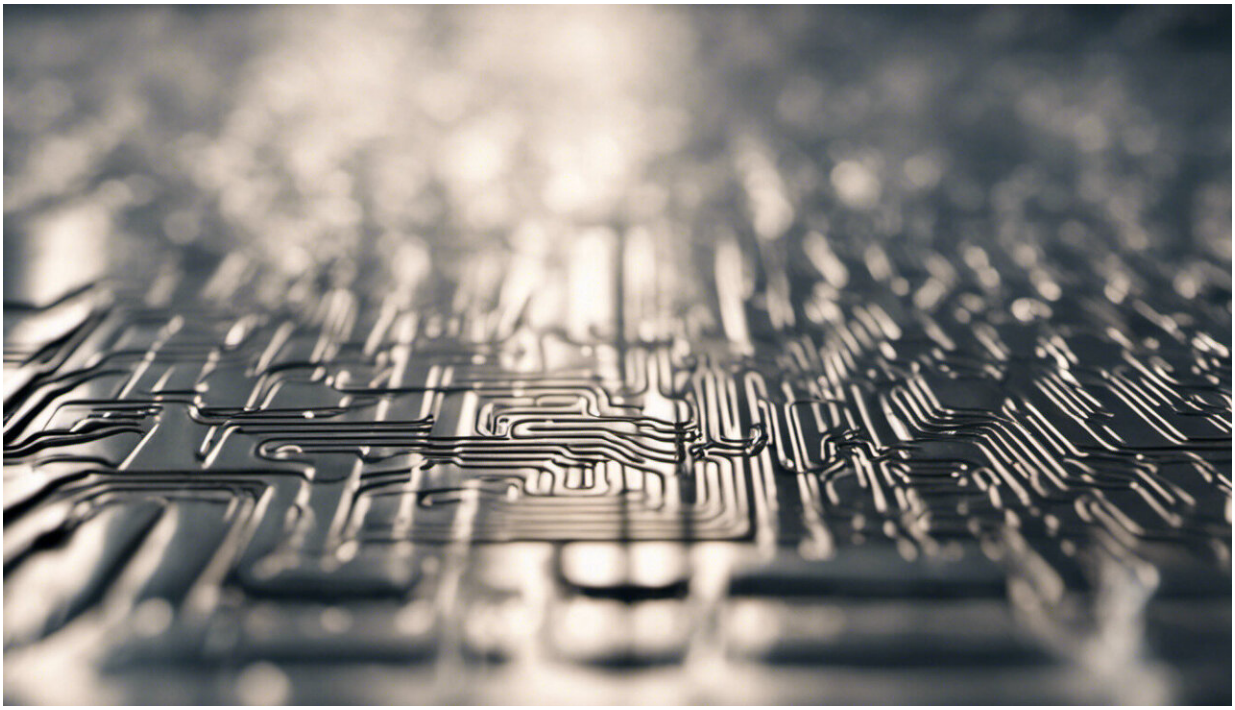

Credit: AI-generated image (disclaimer)

Some parts of our brain that process sound have a subsequent spot for each pitch, just like the keyboard on a piano. One part – the auditory part of the thalamus – even processes each sound on two 'keyboards' next to each other. That is one of the discoveries brain researcher Michelle Moerel of Maastricht University made while carrying out

measurements into human sound processing at the Center for Magnetic Resonance Research (CMRR) in Minneapolis (USA) with Rubicon funding from NWO Social Sciences.

Results have recently been published in *Scientific Reports*.

Ultra-strong magnetic field

Michelle Moerel investigated how people process sound in two small subcortical – situated under the cerebral cortex – areas of the human brain. These inferior colliculi, of which everybody has two, and the auditory of part of the thalamus are part of the hearing system in the brain. As the areas are just a few cubic millimetres in size, Moerel used MRI scanners with an ultra-strong magnetic field with a strength of 7 Tesla. Thanks to this, the researchers were able to view both the brain and brain processes at a far higher resolution than is possible with conventional MRI scanners.

Moerel: 'The Netherlands also has such powerful scanners, but at CMRR, I could learn from experts in this area. We still know so little about the areas of the human brain that deal with sound. Much more is known about this in animals. However, what takes place in the human brain is far more complex. After all, we process intricate sounds such a spoken language and music. How exactly we are able to do that is still largely unknown.'

During the experiment, study subjects in the MRI scanner heard a wide range of sounds such as music, animal noises and speech. These sounds came from different locations with respect to the participant. The research revealed that sounds that came from the left were processed in the right inferior colliculus and thalamus and vice versa. This result was not surprising, as previous research in animals had also shown this to be the case.

However, the researchers discovered something else. In both the inferior colliculi and the thalamus, sound processing is 'tonotopically' organised, in other words organised by pitch. Each part of the areas investigated responded strongest to a specific sound frequency. Researchers could see that because at that moment, the part concerned consumed the most oxygen. Successive pitches were found to be processed next to each other, in a comparable manner to the keys on a piano. Even more striking: in the inferior colliculi, there is a single representation ('complete keyboard') for all pitches, and in the auditory part of the thalamus, there are two of those 'keyboards'. Why the thalamus has a double processing of each pitch is unclear.

This is the first time that sound processing in the auditory thalamus has been investigated. In the past, brain researchers have always focused more on visual processing in the brain and far less on sound.

More information: Michelle Moerel et al. Processing of frequency and location in human subcortical auditory structures, *Scientific Reports* (2015). DOI: 10.1038/srep17048

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