Speech-evoked brain activity is more robust to competing speech when it is spoken by someone familiar

Background

We already know through research that when speech is masked by competing sound, people are better at understanding what is said if the talker is someone familiar to them - when you're listening to a friend or partner for example. Despite this familiar-voice benefit, we don't yet understand the mechanisms in the brain that make familiar voices more intelligible.

How is speech spoken by familiar and unfamiliar people represented in the brain?

The Research

Given that familiarity with a speaker improves intelligibility when there is competing sound, we wondered if we could identify areas of the brain that are sensitive to intelligibility by comparing activation patterns for familiar and unfamiliar voices. We presented our participants with sentences spoken by their friend or spouse and also with sentences spoken by the friends and spouses of other participants, who they'd never met before. We did this both with no other sounds and with competing speech. We used high-resolution fMRI to explore the difference in brain activity between clear and competing speech.

The Findings

When the target voice was familiar, the spatial pattern of brain activity (identified in the left posterior temporal regions) for the sentence with competing sound more closely resembled the same sentence presented alone, than when the target voice was unfamiliar. The brain representation is less affected by the presence of background noise such as a competing talker - the 'cortical signal-to-noise ratio' is better for familiar compared to unfamiliar voices. We found that people who have a more robust neural representation of a familiar voice are better at reporting what that person said, regardless of how long they'd known their friend/spouse or how often they spoke to them.

Our results showed that this representation of spoken-sentence information in left posterior temporal regions is more resistant to interference by competing speech if the target talker is familiar.

Key Points

The representation of spoken-sentence information in specific regions of the brain is more resistant to interference by competing speech if the target talker is familiar. The posterior temporal cortex represents information about target speech more robustly in the presence of competing speech when the target talker is a friend or partner. We have also shown that the relative robustness of the representations for a familiar, compared to an unfamiliar, voice aligns with the intelligibility benefit that the listener gains from that familiar voice.

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Next Steps

Overall, our study demonstrated that the posterior temporal cortex represents information about target speech more robustly in the presence of competing speech when the target talker is a friend or partner, compared to someone unfamiliar. We have also shown that the relative robustness of the representations for a familiar, compared to an unfamiliar, voice aligns with the intelligibility benefit that participants gain from that familiar voice.

What we haven't established is if these posterior temporal regions are representing voice-specific speech information, or a more general, reconstructed 'best guess' at the identity of a masked speech signal. This is a first step in establishing the neurobiological organization supporting the intelligibility benefit obtained when speech is in a familiar compared to unfamiliar voice. This benefit is large, and may be of substantial importance in everyday life, particularly for those with hearing impairment.

Western Researchers

Ingrid Johnsrude

University College London Researchers

Emma Holmes

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