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Assessing listening with engaging, real-world auditory signals

BrainsCAN , Western University

Björn Herrmann
Western University

Ingrid Johnsrude 6612111
Western University, tadam@uwo.ca

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Assessing listening with engaging, real-world auditory signals

Background

More than 40% of people aged over 50 suffer from hearing loss. Typically, diagnosis happens long after older people first experience real-life problems such as difficulty understanding speech in the presence of other sounds.

Clinical tests of speech perception are typically limited: they require that listeners report words from brief sentences such as "They are buying some bread." Unlike speech in everyday life, these test sentences have no personal meaning and seem arbitrary, they have no context or narrative and they are usually not very interesting. Listeners may not engage with these sentences, which can increase performance variability. This variability then reduces the sensitivity to identifying hearing impairment.

In contrast to the simple phrases used currently in clinical tests, when healthy participants listen to short, interesting, actively engaging speech while undergoing fMRI or EEG testing, the patterns seen in their brain activity are very consistent - and the more engaging the material, the more similar their brain activity. This characteristic, that healthy brain activity patterns are consistent when listening to real-world, interesting speech, has the potential to be used to identify hearing impairment in a new, unique and participant-friendly way, without the variability that lack of engagement (rather than hearing impairment) can exhibit.

The Problem

The loss of information that results from hearing impairment necessarily increases the demand on the listener's cognition (such as demanding more attention, memory and knowledge-guided perception) and, in turn, requires more effort to listen. Standard speech testing doesn't capture the substantial variability in behavior related to listening effort. Two people may both fully understand speech in a given situation, but while it required great effort from one person who is tired afterwards, the other listener might have found it nearly effortless. That can lead to the listener with hearing impairment avoiding certain situations or choosing not to use a hearing aid because of the effort still required to understand speech - their behaviour is being influenced by the hearing impairment.

The potential power of differences in 'listening effort' to explain differences in behavior has sparked great interest among clinicians and industry.

The Project

Our project will develop and evaluate a novel way (using functional imaging, fMRI, and electrophysiology, EEG) to assess this cognitive impact of hearing loss with engaging, real-world auditory stimuli. We will try to assess listening effort in more realistic listening situations among healthy listeners, comparing detected effort in degraded and clear acoustic conditions.

Using EEG, we will then develop measures that are sensitive to the cognitive demands imposed by degraded speech, using these features to assess hearing function with engaging narratives in natural listening conditions.

Western Researchers

Björn Herrmann
Ingrid Johnsrude

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