Research Week 2020

Cortical Evoked Potentials in Reverberant Speech Perception

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Keywords

Auditory Rehabilitation, Speech Perception, Evoked Potentials, Brain Behavior Relationships

Abstract

Individuals with similar hearing abilities often vary greatly in their ability to successfully understand reverberant speech. Our poor understanding of reverberant speech perception hinders the development of effective treatments. Reverberation temporally smears speech, diminishing onsets which aid successful speech perception. Cortical auditory evoked potentials (CAEPs) can be elicited in response to these onsets in continuous speech. This study analyzed the effects of reverberation on CAEPs and related them to perceptual difficulties in reverberant speech perception. We hypothesized that greater reverberation would degrade the cortical responses and increase perceptual difficulties.

A naturally produced /ba/ syllable was modified by increasing the voice onset time (VOT) to produce 11 tokens that sounded increasingly /pa/-like. These 11 tokens were concatenated with a naturally produced /da/ to create two-syllable tokens. Two additional reverberant versions of each stimulus (a mild and high level) were also generated. CAEPs (the P1-N1-P2 complex) were elicited to a subset of these stimuli. Listeners also separately labeled the second syllable of the clean and reverberant /daba/ - /dapa/ stimuli and provided a rating of confidence in their label. Electrophysiological recordings and behavioral responses were obtained from 20 young normally hearing adults (9 female; mean age: 28.3; 23 – 37 yrs.).

A comparison of CAEPs obtained in response to clean and reverberant stimuli revealed the effect of reverberation on the neural coding of speech: while the responses to the first syllable were minimally affected by the reverberation, the responses to the second syllable were increasingly degraded with increasing reverberation. Preliminary analyses of the behavioral responses showed that increased reverberation not only caused listeners to label a greater number of tokens as a /ba/ but also increased the variability in labels assigned to a stimulus across listeners. Listeners were also less confident when labeling reverberant stimuli. These data serve as baseline data in the further study of reverberation-related changes in speech processing in populations with impairments. In the long term, these results will aid the design of diagnostic tests for use in hard-to-test

populations and lead to individualized rehabilitation strategies to improve speech perception in difficult listening situations.

Work supported by R01 DC015240]