Title: Processing temporal cues for word identification in adult cochlear-implant users: Effects of aging and context

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Abstract: Adults over 65 years old represent one of the fastest growing groups that use cochlear implants (CIs) to restore hearing and speech abilities. While CIs can remarkably improve speech understanding among older CI users, their performance is relatively poor compared to their younger counterparts. CIs convey temporal envelope information and have limited spectral information; thus, CI listeners must rely heavily on temporal cues for speech understanding. Here, we examined age-related temporal processing deficits as potential mechanisms underlying speech understanding deficits of older CI listeners. Word categorization tasks based on manipulation of a single temporal cue are often utilized to assess auditory temporal processing abilities, revealing age-related declines in temporal processing. Placing these temporal cues in a sentence context (e.g., preceded by a carrier sentence) often reduces their saliency and exaggerates age-related temporal processing deficits, though the underlying mechanisms are less unclear. The effects of aging and sentence context, however, have been observed only among acoustic-hearing listeners. We hypothesized age-related temporal processing deficits in CI listeners, which would be more apparent with sentence contexts.

Younger, middle-aged, and older CI listeners performed categorization tasks for two word contrasts (dish-ditch and buy-pie) based on different temporal cues. The words dish and ditch vary primarily in the duration of a silent interval preceding the final fricative. The words buy and pie vary in the duration of the time between the release of the articulators and the onset of voicing (i.e., voice-onset time). Seven-step continua varying these two duration cues were created. The 14 words were presented in isolation as well as preceded by uninformative contexts – either spoken carrier sentences or non-speech (specifically, speech-spectrum-shaped noise). Preliminary results from older CI listeners revealed a context effect for both word contrasts. Listeners required longer temporal cues to discriminate the word contrasts when preceded by uninformative contexts compared to when presented in isolation, with greater effects observed with the sentence context than the noise context. Data collection will continue to determine the effects of aging and sentence context on the ability to utilize temporal cues for word identification.

The findings of context effects highlight the necessity to examine auditory temporal processing and speech understanding in CI listeners with stimuli of higher ecological validity (e.g., sentences). The current study has implications for understanding how auditory temporal processing limits speech understanding of older CI listeners.

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