Letter to the Editor: Possible Sex Effects on the Processing of Temporal Cues in Word Segments in Adult Cochlear-Implant Users

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We recently published an article in *Trends in Hearing* on "Age-Related Temporal Processing Deficits in Word Segments in Adult Cochlear-Implant Users" (Xie et al., 2019). In Experiments 1 and 2 of this article, younger, middle-aged, and older adult cochlear-implant (CI) users performed a word categorization task for a dish–ditch continuum (i.e., identifying each token along the continuum as being either "dish" or "ditch") across presentation levels of 25 to 85 dB SPL. This continuum consisted of seven steps in which the silence duration cue preceding the final fricative (signaling the word contrast) varied from 0 ms (dish) to 60 ms (ditch). Results revealed that older CI users, compared with younger CI users, exhibited later crossover points and shallower slopes in the categorization function but only at higher presentation levels. We interpreted these findings as suggesting age-related declines in the ability to use brief temporal cues in word identification in CI users. The level dependency of the age effects may reflect the limits of CIs to transmit speech cues, auditory temporal processing deficits associated with aging, or their interaction.

In light of the potential sex influence on hearing thresholds (Pearson et al., 1995) and speech recognition (Dubno et al., 1997), and the recent priority of federal funding agencies to consider sex as a potential biological variable that could affect performance, we reanalyzed the data in this article to examine possible sex effects on the ability to use temporal cues in word identification with a relatively large sample of adult CI users (Experiment 2). We identified 29 ears (from 22 listeners) for the female group and 25 ears (from 19 listeners) for the male group. The two sex groups did not significantly differ in age, $t(42.41) = 0.35$, $p = .728$, duration of deafness, $t(51) = 1.144$, $p = .258$, CI use duration, $t(47.51) = -1.376$, $p = .175$, or distribution of test ear, $\chi^2(1) = 0.003$, $p = .951$.

Results regarding crossover points showed that there was no significant main effect of sex, $F(1, 52.05) = 0.58$, $p = .45$, or a significant interaction between sex and presentation level, $F(4, 207.43) = 0.44$, $p = .777$. Regarding slopes, there was a significant main effect of sex, $F(1, 51.87) = 5.96$, $p = .018$, wherein female CI users exhibited steeper slopes (mean ± standard deviation: 2.48%/ms ± 1.97) compared with male CI users (1.74%/ms ± 1.62). Steeper slopes are interpreted as indicating a sharper distinction between the contrasts dish and ditch. The interaction between sex and presentation level was not significant, $F(4, 207.02) = 1.83$, $p = .123$. These findings may suggest that female CI users, relative to male CI users, find it easier to discriminate contrasting words that vary in a discrete temporal cue.

We speculate that the sex differences in the ability to use brief temporal cues in word identification in CI users may be hormone-driven. For example, prior work suggests that some hormones (e.g., estrogen) may provide protective effects on hearing and speech abilities in women, whereas other hormones (e.g., progesterone) may have a negative influence on these abilities (Guimaraes et al., 2006; Shuster et al., 2019). Understanding the modulating effects of hormones on hearing and speech perception may provide insights into novel hormone-related therapeutics for declines in hearing thresholds and speech understanding associated with aging and hearing impairment (Shuster et al., 2019).

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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