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Improving ITD coding with bilateral cochlear implants through temporal enhancement

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ABSTRACT

Interaural time differences (ITDs) help normal hearing listeners perceive, locate and understand sounds in noisy and reverberant conditions, but their benefit is limited with bilateral cochlear implants (BiCI). Monaghan & Seeber (2016) presented a temporal enhancement algorithm that sharpens and deepens modulations at onsets of selected peaks in the signal envelope and showed improved ITD sensitivity with tone-vocoded speech. Based on the short-term direct-to-reverberant ratio (DRR) the algorithm selects peaks that are dominated by the direct sound rather than reflections and applies enhancements at times derived from the timings of envelope peaks. However, extensive analysis revealed that envelope peak timings do not robustly convey the ITD of a source in reverberant rooms. Presented here is an updated version of the algorithm that estimates the short-term ITD from the signal's temporal fine structure and adjusts the enhancement timings to encode that ITD. Furthermore, the new algorithm enhances envelope peaks based on the short-term interaural coherence. Evaluation with a vocoder revealed that the new algorithm improved ITD sensitivity relative to the old algorithm and unenhanced case, for all DRRs examined, without degrading speech understanding. This suggests that BiCI users in our current study will also demonstrate benefits.

Keywords: cochlear implant, stimulation strategy, reverberation, binaural hearing, auditory scene analysis

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