

Effects of interaural time differences in fine structure and envelope on lateral discrimination

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Objectives: Bilateral cochlear implant (CI) listeners currently use stimulation strategies which encode interaural time differences (ITD) in the temporal envelope but which do not transmit ITD in the fine structure, due to the constant phase in the electrical pulse train. To determine the utility of encoding ITD in the fine structure, ITD-based lateralization was investigated with four CI listeners and four normal hearing (NH) subjects. **Methods:** Lateralization discrimination was tested at different pulse rates for various combinations of independently controlled fine structure ITD and envelope ITD. **Results:** Results for electrical hearing show that the fine structure ITD had the strongest impact on lateralization at lower pulse rates, with significant effects for pulse rates up to 800 pulses per second. At higher pulse rates, lateralization discrimination depended solely on the envelope ITD. Furthermore, results for CI listeners show an ambiguity in lateralization discrimination due to the periodicity of the fine structure ITD cue combined with a small sensitivity to the envelope ITD cue for large ITD values (600 μ s) and higher pulse rates (>400pps). However, there were strong individual differences: the better performing CI listeners performed comparably to the NH listeners. **Conclusions:** The data suggest that bilateral CI listeners benefit from transmitting fine structure ITD at lower pulse rates. A new ITD coding rule is proposed which resolves the ambiguity, giving an improved lateralization discrimination in electrical hearing.