

Envelope vs. Fine Structure in Bilateral Hearing

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In normal hearing, interaural time differences (ITD) in the fine structure are important for the lateralization of sound sources and for speech recognition in noise. We studied the effects of ITD in the fine structure, the gating portions, and the ongoing envelope in four bilateral cochlear implant (CI) listeners. The pulse rate was varied as an independent parameter. In the first study, four-pulse-sequences were used and ITD was presented either in the ongoing pulses, or in the onset and offset pulses. All listeners were sensitive to ongoing ITD, one up to 800 pulses per second (pps), two up to 400 pps, and one at 100 pps only. This result reveals the importance of ITD in the fine structure. For three CI listeners, the sensitivity to onset ITD increased with the pulse rate. In the second study, amplitude modulated pulse trains were used and ITD was independently presented in the fine structure and the envelope. Fine structure ITD had the strongest impact on lateralization at lower pulse rates, with significant effects up to 800 pps. At the higher pulse rates tested (up to 1600 pps), lateralization discrimination depended solely on envelope ITD. The data from both studies suggest that bilateral CI listeners benefit from transmitting fine structure ITD at lower pulse rates. However, there were strong inter-individual differences.