

Binaural jitter with cochlear implants, improved interaural time-delay sensitivity, and normal hearing

Laback and Majdak (1) recently showed that interaural time-delay (ITD) sensitivity in bilateral cochlear implant (BiCI) users can be improved at high rates by diotic randomization of the electrical pulse timing. They ascribed their result to “restarting” of the binaurally adapted auditory system. However, an alternative explanation is that randomizing electrical pulse rate introduced low-rate cues, which offer better ITD sensitivity than do high rates (2). Such cues can arise because (i) rate jitter may lead to level fluctuations at the output of physiological low-pass-filtered envelope detectors and/or (ii) instantaneous pulse rates can be much reduced for large jitter, and times between neural responses may further be lowered by refractory effects in preceding high-rate intervals. Restarting also does not explain why benefits were seen at 800 but not 400 Hz. Although the authors suggested that cues were already well perceived at 400 Hz, much stronger cues at even lower rates (2) would leave ample opportunity for im-

provement through restarting. Also, in normal-hearing listeners restarting occurs even at 300 Hz with high-frequency click trains (3). Finally, it is important to note that, although the introduction of jitter in high-rate pulse trains improved BiCI users’ ITD sensitivity, at best it approached their fairly poor low-rate performance. Similar relatively poor performance is seen in normal-hearing listeners attending pure tones at 100 Hz, but in that case sensitivity improves by an order of magnitude as frequency increases to 1,000 Hz (4), which is clearly very different from what is observed in BiCI users, whether jitter is applied or not.

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1. Laback B, Majdak P (2008) Binaural jitter improves interaural time-difference sensitivity of cochlear implantees at high pulse rates. *Proc Natl Acad Sci USA* 105:814–817.
2. van Hoesel RJM (2007) Sensitivity to binaural timing in bilateral cochlear implant users. *J Acoust Soc Am* 121:2192–2206.
3. Hafter ER, Buell TN (1990) Restarting the adapted binaural system. *J Acoust Soc Am* 88:806–812.
4. Klumpp RG, Eady HR (1956) Some measurements of interaural time difference thresholds. *J Acoust Soc Am* 28:859–860.

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