



EINLADUNG

zum Vortrag im Rahmen des Seminars des SFB/TRR 31

Freitag, 22. November 2013, 14 Uhr c.t.

im Raum W2 1-143 der Universität Oldenburg
und Raum H28 / R 2.31 des Med. Campus Magdeburg
(per Videoübertragung)

"On the controversy about the sharpness of human cochlear tuning"

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In signal processing terms, the operation of the mammalian cochlea in the inner ear may be likened to a bank of filters. Based on otoacoustic emission evidence, it has been recently claimed that cochlear tuning is sharper for human than for other mammals. The claim was corroborated with a behavioral method that involves the masking of pure tones with forward notched noises (NN). Using this method, it has been further claimed that human cochlear tuning is sharper than suggested by earlier behavioral studies. These claims are controversial. Here, we contribute to the controversy by theoretically assessing the accuracy of the NN method at inferring the bandwidth (BW) of nonlinear cochlear filters. Behavioral forward masking was mimicked using a computer model of the squared basilar membrane response followed by a temporal integrator. Isoresponse and isolevel versions of the forward masking NN method were applied to infer the already known BW of the cochlear filter used in the model. We show that isolevel methods were overall more accurate than isoresponse methods. We also show that BWs for NNs and sinusoids equate only for isolevel methods and when the levels of the two stimuli are appropriately scaled. Lastly, we show that the inferred BW depends on the method version (isolevel BW was twice as broad as isoresponse BW at 40 dB SPL) and on the stimulus level (isoresponse and isolevel BW decreased and increased, respectively, with increasing level over the level range where cochlear responses went from linear to compressive). We suggest that the latter may contribute to explaining the reported differences in cochlear tuning across behavioral studies and species. We further suggest that given the well-established nonlinear nature of cochlear responses, even greater care must be exercised when using a single BW value to describe and compare cochlear tuning.

Further reading:

- Eustaquio-Martín A, LopezPoveda EA (2011). "Isoresponse versus isoinput estimates of cochlear filter tuning," JARO-J. Assoc. Res. Otolaryngol. 12:281-299.
- Lopez-Poveda EA, Eustaquio-Martín A. (2013). On the controversy about the sharpness of human cochlear tuning. J. Assoc. Res. Otolaryngol. 14:673-686.
- Oxenham AJ, Shera CA (2003) Estimates of human cochlear tuning at low levels using forward and simultaneous masking. J Assoc Res Otolaryngol 4:541-554.
- Shera CA, Guinan JJ Jr, Oxenham AJ (2002) Revised estimates of human cochlear tuning from otoacoustic and behavioral measurements. Proc Nat Acad Sci 99:3318-3323.