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A filterbank model of human nonlinear auditory frequency selectivity

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Filterbank models of human nonlinear auditory frequency selectivity are useful in a variety of applications. Existing filterbanks are almost certainly flawed because they do not account for the recent observation that compression extends to a wider range of stimulus frequencies in apical than in basal cochlear sites [Lopez-Poveda et al. (2003), J. Acoust. Soc. Am. 113, 951-960]. Here, we present a filterbank based on the forward-masking data from which this observation was made. A forward-masking model was constructed by cascading a linear "outer/middle-ear" filter, followed by a dual-resonance nonlinear (DRNL) filter, followed by a linear temporal window. The temporal window was assumed to be identical across listeners and cochlear places. Only the parameters of the DRNL filter were adjusted to simulate the absolute threshold and the masking data of three listeners for probe frequencies of 0.5, 1, 2, 4 and 8 kHz. A bank of DRNL filters was then constructed by linear or quadratic regression of the optimum parameters. It is discussed that this filterbank is the best possible approximation of human level-dependent auditory frequency selectivity to date. Additionally, the results support the linearity of the temporal window. [Work supported by IMSERSO 131/06, PROFIT CIT-390000-2005-4, MEC BFU-2006-07536].