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Modelling the temporal response of the auditory nerve to the pitch of complex tones in reverberation

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A computational model of the auditory nerve has been used to investigate the effect of reverberation on the response to the fundamental frequency (F0) of frequency-swept harmonic complexes. The model used a computationally efficient dual resonance non-linear (DRNL) model of basilar membrane frequency selectivity. The DRNL architecture comprises two parallel filter paths providing linear and non-linear responses. The model successfully reproduced the results of a physiological investigation using the same stimuli in a population of single units from the ventral cochlear nucleus (VCN). In particular the effect of reverberation was dependent upon unit best frequency, F0 and source-to-receiver distance. The model results suggest that the effects of reverberation observed at the level of the VCN are already present in the auditory periphery. The use of the model has also enabled us to examine the effect of hearing impairment by the removal of the non-linear path response. This simulation of a sensorineural hearing loss accentuated the loss of the temporal representation of F0 in the presence of reverberation.