Temporal resolution in birds: Discriminating temporal fine structure in harmonic complexes (A)

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Recent behavioral experiments on auditory masking and waveform discriminations using harmonic complexes as stimuli have shown significant differences in performance between birds and humans. In humans, but not in birds, Schroeder-phase harmonic complexes constructed with monotonically increasing (positive Schroeder) or decreasing (negative Schroeder) component phases are differentially effective as maskers, even though they have identical temporal envelopes and long-term spectra. The similarity in masking effectiveness of these harmonic complexes notwithstanding, birds can easily discriminate the fine-structure differences between the positive and negative Schroeder waveforms even with harmonic periods as short as 2 ms. By contrast, humans are unable to make these discriminations unless the periods are greater than about 5–6 ms. These behavioral discrimination and masking results have now been replicated by measuring evoked-potential responses in budgerigars. Amplitude and waveform shapes of the compound action potentials reflect the behavioral discriminations between the two Schroeder stimuli, but cochlear microphonics do not. The similarity in results between the behavioral and the electrophysiological studies, using the same stimuli, suggest differences in both temporal and spectral processing in avian versus mammalian cochleas. [Work supported by NIH R01 DC00198, DC00626, and NRSA DC00046.]