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## Temporal fine structure discriminations in harmonic complexes by birds

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Studies of auditory temporal resolution in birds have generally found abilities similar to other animals. Most of these studies involved perception of temporal envelopes in complex sounds. Recent studies, however, have shown that budgerigars can discriminate temporal fine structure within very short intervals of complex sounds, as much as three times shorter than the limits of human perception of fine structure. Here, we test the generality of this enhanced temporal resolution in other species of birds including zebra finches and canaries. Birds and humans discriminated between harmonic complexes with temporal waveforms that differed only in temporal fine structure. The birds were tested using operant conditioning procedures and the Method of Constant Stimuli. They were trained to discriminate between harmonic complexes with component phases selected according to an algorithm developed by Schroeder (1971). Phases either increase or decrease monotonically with increasing component frequency, producing stimuli that have equal temporal envelopes, but time-reversed fine structure relative to one another. Fundamental frequencies of the harmonic complexes ranged from 150 to 1000 Hz. All three species of birds could discriminate the time-reversed waveforms at much higher fundamental frequencies than the limits observed in humans. The canaries and zebra finches easily discriminated among harmonic complexes with fundamental frequencies up to 1000 Hz. Humans are unable to perform similar tasks for fundamental frequencies higher than about 300 Hz. These findings suggest that enhanced time processing of complex sounds, relative to time resolution in humans, may be a general characteristic of the avian auditory system.

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