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Computer generation of sequential musical patterns

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2:30

E2. Discrimination of acoustic patterns under various levels of stimulus uncertainty. Charles S. Watson (Central Institute for the Deaf and Washington University, St. Louis, Missouri 63110)

The discriminability of sequential acoustic events is partially predictable from listeners' well-established abilities to discriminate among the events' component sounds (e.g., single tones, noise bursts, or clicks). Research in our laboratory and in others suggests that failures of such predictions result, in large part, from the greater demands complex sounds place upon the mechanisms of attention and memory. Some acoustic sequences can be resolved as accurately as can their individual components, but only when they are heard in a minimal-uncertainty context. Even a moderate degree of stimulus uncertainty can degrade performance for these sounds by more than an order of magnitude. Although listeners can resolve such sounds with greater accuracy under special conditions, those conditions are not all representative of music or connected discourse. Maximum capabilities to discriminate acoustic sequences under high-uncertainty listening conditions should therefore be considered as important a limitation on auditory processing as other, more primitive, psychophysical measures. [This research was supported in part by a grant from the National Institute of Neurological Diseases and Stroke to the Central Institute for the Deaf.]

3:00

E3. Auditory sequence and phonetic classification. Michael Studdert-Kennedy (Queens College and Graduate Center of City University of New York, and Haskins Laboratories, New Haven, Connecticut 06510)

The distinctive characteristic of speech perception, as compared with purely auditory perception, is phonetic classification. The process is one of transforming an auditory pattern into a sequence of nonauditory, abstract segments. The listener therefore brings to bear both auditory and nonauditory, or linguistic, capacities. The former set limits on what he can detect, the latter assign perceptual weights to portions of the auditory patterns and so determine the phonetic percept. The transformation of the auditory pattern into a phonetic percept may enable the listener to evade some of the constraints of auditory masking, to extend the limits of auditory memory and to increase his capacity for temporal resolution. These ideas are discussed and illustrated with examples from recent work on voice onset time, the perception of temporal sequence, and prosody.

3:30

E4. Computer generation of sequential musical patterns. Lejaren A. Hiller (SUNY at Buffalo, Buffalo, New York 14214)

It has been thought that music is a multilayered hierarchical communication system in which relationships exist among several levels of structural significance. This view of music structure can be tested by computer synthesis of statistically converted melodic and/or harmonic sequences, starting with random music through simple stochastic music in which each musical event is affected by previous events to successively more and more complex structures that have imbedded in them whole groupings of events such as phrases, themes, and so forth. The background for this work is briefly reviewed and programming methods for a number of examples of computer-generated sequences of increasing complexity are discussed. Included in the presentation are some recorded examples of this output.

Contributed Papers

4:00

E5. Identification of the temporal order in three-tone patterns embedded in eight-tone sequences. Pierre L. Divenyi and Ira J. Hirsh (Central Institute for the Deaf, St. Louis, Missouri 63110)

Highly trained listeners identified three-tone patterns that were part of an eight-tone sequence. The patterns constituted the six random permutations of three temporally contiguous tones composing a 1/3-octave span (890, 1000, 1118 Hz). The five nonpattern "background" tones were randomly chosen, in each trial, from a 2/3-octave range. Three parameters were investigated: duration of each component tone, temporal position of the pattern within the sequence, and the band from which the background tones were chosen. Subjects had no difficulty identifying the patterns even at very short durations (18 msec/tone), whenever the patterns occupied initial or final position in the sequence, or whenever the frequency range of the background was remote from that of the pattern. However, in those conditions where the pattern was in the middle of the sequence, the average duration for threshold performance (d' = 1.0) was longer: about 90 msec when the background-frequency range enclosed that of the pattern, about 65 msec when the background range was located slightly above the pattern range, and about 35 msec when it was located slightly below the pattern range. The experiments constitute an auditory analogy to visual figure—ground effects and demonstrate that an auditory figure can be perceptually separated from the ground on the basis of either temporal or spectral differences. [Supported by NINDS Grant No. 03856.]