ARTIST: ADAPTIVE RESONANCE THEORY TO INTERNALIZE THE STRUCTURE OF TONALITY

(a neural net listening to music)

by

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After sufficient exposure to music, we naturally develop a sense of which note sequences are musical and pleasant, even without being taught anything about music. This is the result of a process of acculturation that consists of extracting the temporal and tonal regularities found in the styles of music we hear.

ARTIST, an artificial neural network based on Grossberg's (1982) Adaptive Resonance Theory, is proposed to model the acculturation process. The model self-organizes its 2-layer architecture of neuron-like units through unsupervised learning. Its performance is assessed by how well it accounts for human data on several tasks, mostly involving pleasantness ratings of musical sequences.

ARTIST's responses on Krumhansl and Shepard's (1979) probe-tone technique are virtually identical to humans', showing that ARTIST successfully extracted the rules of tonality from its environment. Thus, it distinguishes between tonal vs atonal musical

sequences and can predict their exact degree of tonality or pleasantness. Moreover, as exposure to music increases, the model's responses to a variation of the probe-tone task follow the same changes as those of children as they grow up.

ARTIST can further discriminate between several kinds of musical stimuli within tonal music: its preferences for some musical modes over others resembles humans'. This resemblance seems limited by the differences between humans' and ARTIST's musical environment.

The recognition of familiar melodies is also one of ARTIST's abilities. It is impossible to identify even a very familiar melody when its notes are interleaved with distractor notes. However, a priori knowledge regarding the possible identity of the melody enables its identification, by humans as well as by ARTIST.

ARTIST shares one more feature with humans, namely the robustness regarding perturbations of the input: even large random temporal fluctuations in the cycles of presentation of the inputs do not provoke important degradation of ARTIST's performance.

All of these characteristics contribute to the plausibility of ARTIST as a model of musical learning by humans. Expanding the model by adding more layers of neurons may enable it to develop even more human-like capabilities, such as the recognition of melodies after transposition.