Abstract

Mental Representations of Statistical Regularities in Melodic Phrases

by

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Universals appear in a number different forms, from naturally occurring mathematical universals like the Fibonacci series, phi, and fractal scaling, to aesthetic universals like the golden ratio in architecture and other facets of human behavior like dance and religious belief. Music is a powerful human universal. Further, within music there are a number of statistical regularities that have been empirically observed nearly universally. One such example would be the division of the octave into 12 equidistant tones. There are also a number of universal regularities that pertain to melodic phrasing. This paper will examine four such statistical regularities of melodic phrases: that there is an increased prevalence of smaller intervals over larger intervals (defined as Rule 1 throughout this dissertation), that larger intervals tend to ascend and smaller intervals tend to descend (defined as Rule 2 throughout this dissertation), that the overall contour of melodic phrases tend to ascend then descend (defined as Rule 3 throughout this dissertation), and that melodic phrases tend to end on the tonic (defined as Rule 4 throughout this dissertation). Here I look at the aggregate influence of these four regularities in melodic phrases, as they have hereto only been studied individually. In an initial series of experiments, labeled throughout this paper as Experiments1A, 1B, 1C, and 1D, I try to determine the degree that these regularities interact to influence people's melodic preferences, their perception of well formed-ness and their ratings of interestingness. In a further set of experiments, labeled throughout this paper as Experiments 2A and 2B, I will test which, if any, of these regularities can be explicitly identified by experimental subjects. Lastly, in Experiment 3, I tested how malleable melodic preferences are, and whether people's preferences can be influenced or changed by exposure to certain types of melodic phrases.

In order to test these questions, I have generated a large bank (64 in total) of 16-note melodic phrases representing each of the four aforementioned regularities and their combinations. In these artificially generated melodies, all notes were rhythmically consistent, with all notes being quarter notes. All melodies were also in the key of C Major and played at 120 beats per minute.

First, I wanted to determine the possible predictive power of each of these rules both individually and in combinations. In order to do that, I piggybacked on a method used by Reber (1969) in his research into implicit learning. Reber's technique involved exposing people to a pool of stimuli demonstrating a certain statistical regularity or regularities (i.e., pseudo-words generated with a Markov chain) during a learning phase, then exposing them to stimuli that either adhere to or violate the regularity or regularities to which they were exposed, and to elicit their ratings along a few possible dimensions. In this present case, since people generally accumulate a large amount of musical experience simply by exposure and listening over the course of their lives, unlike the Reber studies that involve a learning phase to expose

people to the rules governing the artificial system, an experiment that tests musical regularities would not need such a learning phase, as that has already occurred over the course of the lives of the participants. Therefore, here participants were simply exposed to a few examples of each of the melodic combinations, and after each melody they were asked to rate the phrase's well-formedness, preference, and interestingness. In other words, after hearing each melody people specified how well-formed the phrase seemed, how interesting the phrase was, and their preference, along a seven-point Likert scale. The results of this study were used to show the possible correlations between these various three dependent measures of well-formedness, preference, and interestingness dependent upon the combination of the phrase regarding the four regularities being used here. These initial few studies were analyzed using hierarchical linear modeling, which allows observations of individual differences in data that are heavily nested, as these data are. The results of these analyses showed that the most reliable predictor of people's aesthetic ratings was whether the phrase ended on the tonic or not (Rule 4), phrases that had tonic endings elicited significantly higher ratings than those that did not.

Next, I attempted to determine which of the regularities could be explicitly identified by participants. To do this, participants were exposed to a number of melodies that adhered to all four of the proposed regularities, and after hearing the bank of melodic phrases, they were asked to identify any characteristics that were shared by all the phrases they have just heard. The results showed that 67% of participants were able to identify that each phrase seemed to ascend then descend (Rule 3), and 58% of participants were able to articulate that each phrase ended on the tonic note (Rule 4). The idea here is that if the regularity or combination of regularities influences people's ratings of well formedness, preference or interestingness, and they are unable to explicate the regularities, then these regularities must be operating on an unconscious or implicit level, in this case, melodic contour did not seem to have a predictable influence in the first set of experiments done here ,but tonic did, so the tonic ending appears to influence people's aesthetic ratings and they can generally explicitly specify the occurrence of this regularity.

In the next experiment, subjects were trained on the four regularities, and then asked to decide if a phrase adhered to a particular rule or not. Here, participants were able to accurately decide if a phrase ended on the tonic (Rule 4) 70% of the time, and surprisingly whether there were more smaller intervals than larger intervals (Rule 1) 60% of the time.

In a final experiment I tried to replicate a finding that previously showed that exposure to unpreferred aesthetic stimuli causes people to like them even less (Meskin, Phelan, Moore, & Kieran, 2013). Here I exposed participants to only phrases that did not end on the tonic, since they were shown in Experiment 1A to have the lowest aesthetic ratings. The results showed that although the mean difference in the ratings did not seem to significantly change, the direction of their actual ratings did. In other words, people did rate the melodies lower after being exposed to similar non tonic ending phrases, but the degree to which they rated them less was not statistically significant.

These studies collectively show that regarding the nature of people's mental representations of melodic phrases and the statistical regularities of interest here, people are able to articulate that a phrase ends on the tonic with and without explicit instruction, and also phrases that end on the tonic elicit higher aesthetic ratings.

These experiments help shed some light on the nature of the mental representations listeners use while engaged in music listening, and also help to understand the nature of melodic statistical regularities and how they influence people's perception of melodic material. As

mentioned, these universal regularities have not been previously studied as an aggregate, so understanding whether or not they are interdependent and whether they can be ordered or ranked according to their influential power over people's preferences and reports of well formedness and interestingness would benefit researchers trying to understand how people develop their preferences and how much power individual composers have over the artistic rules governing their own compositions. In the future, one could imagine analyzing rhythmic components to music the same way melodic components were analyzed here, and even observe the possible differences in mood states and emotions that different combinations of these regularities, and other types of musical regularities, might elicit. This line of research could have implications not only wiyhin cognitive psychology and the psychology of music, but also in music therapy and applied aspects of artificially generated music using AI and other computer software.