

INVESTIGATING THE RELATIONSHIP BETWEEN GROOVE FEELING AND ACOUSTICAL CHARACTERISTICS REGARDING ISOCHRONALLY-PLAYED PERCUSSIVE SOUNDS

Takahide Etani¹, Atsushi Marui², and Toru Kamekawa²

¹Research Field of Creativity in Music and Sound, Graduate School of Music, Tokyo University of the Arts

²Department of Musical Creativity and the Environment, Faculty of Music, Tokyo University of the Arts

Background

While eliciting groove feeling is regarded as a crucial skill in popular music especially for drummers, the relationship between groove feeling and acoustical characteristics is still unknown.

Aims

The aim of this study was to investigate the acoustical characteristics affecting the rating of groove feeling by conducting a subjective evaluation experiment.

Method

Six percussionists and drummers participated in the recording of stimuli. A ride cymbal was used for the recording, and the performers played 64 quarter notes at five various tempos including 60, 120, 180, 240, and 300 bpm. The tempo was presented for 20 seconds by a metronome before playing, whereas no metronomic guidance was provided during the recording. After the recording session, the middle 32 attacks were extracted, and the mean of inter-onset interval or IOI (s), the standard deviation of IOI (s), the mean of IOI ratios between consecutive notes (%), the standard deviation of IOI ratios between consecutive notes (%), the mean of sound power ratios between consecutive notes (%), the standard deviation of sound power ratios between consecutive notes (%), and the spectral centroid (Hz) of each stimulus were extracted as acoustical characteristics.

Then, a subjective evaluation experiment was conducted, in which 15 participants rated the groove feeling of each stimulus. In the experiment, participants listened to the stimuli with headphones in random order and rated each stimulus on the computer using seven point rating scale. The term “groove feeling” was defined as “a feeling that elicit body movement while listening.”

Results

A stepwise multiple regression analysis was conducted to investigate the acoustical characteristics affecting the groove rating. In the analysis, the mean rating of each stimulus was set as dependent variable, and the extracted seven acoustical characteristics were set as independent variables. As a result, the standard deviation of IOI, and the standard deviation of sound power ratios between consecutive notes were significantly affecting the groove rating ($p < .05$). Furthermore, the following model was proposed in which y represents the groove rating (one to seven points), x_1 represents the standard deviation of IOI (s), and x_2 represents the standard deviation of sound power ratios between consecutive notes (%).

$$y = 0.23 - 43.14x_1 + 0.035x_2$$

Discussion

The result showed that the standard deviation of IOI was significantly affecting the groove rating. In addition, the standardized partial regression coefficient suggested that less variation in tempo elicits higher groove feeling. The standard deviation of sound power ratios between consecutive notes was also significantly affecting the rating. Furthermore, the standardized partial regression coefficient suggested that high groove feeling could be obtained by having greater variation in accents.

Conclusion

In this study, the relationship between acoustical characteristics and groove feeling was investigated. The result showed that the variation of tempo and the variation of accents were significantly affecting the groove rating ($p < .05$). This suggests that (1) less variation in tempo elicits higher groove feeling, and (2) greater variation in accents produces higher groove feeling.