

Music from Motion: Sound Level Envelopes of Tones Expressing Human Locomotion
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In this paper, Friberg, Sundberg, and Frydén present the results of three listening experiments designed to determine whether the motion quality of different gaits could be transferred to music and perceived by the listener. Motivation for these experiments came from the authors' hypothesis that music induces associations to our subjective experience of different gaits, and that our experience of motion can be well represented by the pressure perceived in the foot during different types of gaits.

In order to obtain a representation for gait, the authors utilized a force platform to record the reaction forces exerted by the foot in three directions: up-down, left-right, and front-back. They recorded force data for a professional dancer who improvised dances in response to different musical excerpts, and for an untrained individual who was instructed to demonstrate three types of walking: forceful, forceless, and solemn. Since the vertical force component showed the greatest variation among gaits, it was the only component used for the experiment.

To translate gait into sound, the authors mapped the force curve to sound level. Each force curve was translated to a sound level envelope for a single tone of 196 Hz obtained from a synthesizer set to produce an organ timbre. The resulting tones for each gait were repeated in isochronous sequences at four different inter-onset-intervals (IOIs): (1) original tempo; (2) slow tempo with IOIs 25% longer than the originals; (3) fast tempo with IOIs 25% shorter than the originals; (4) standard tempo with an IOI of 820 ms. Two copies of the resulting 24 tone sequences (6 gait types x 4 tempi) were recorded onto a DAT in randomized order for testing.

The purpose of Experiment 1 was to determine if the resulting tone sequences possessed any motion quality at all. The tapes were played to 10 listeners. They were asked to simply write down descriptions of the tones in any terms they found appropriate. It was found that 25% of the answers explicitly referred to motion. However, the number of motion references varied greatly for different listeners, from 2 to 20 out of 48 presentations. The motion answers were categorized into five motion categories: dancing, jumping, running, walking, and stumbling. It was found that, on average, motion was associated more with the fast tempo than the original tempo.

Experiment 2 focused on the details of motion. Listeners were asked to describe the motion character of the sequences, and the resulting responses were again categorized according to the five categories of motion from Experiment 1. 71% of responses referred directly to motion, and 49% of those could be classified according to the five categories of motion.

Experiment 3 further examined the listeners' impressions of motion by asking them to rate each sequence along 24 adjective scales. A factor analysis was carried out, and it was found that the responses could be divided into 4 factors. Two adjectives, one with high positive loading, and one with high negative loading, were associated with 3 of the factors. The resulting combinations were: Factor 1: Swift-Solemn; Factor 2: Graceful-Stamping; Factor 3: Limping-Forceful; and Factor 4: Springy. These factors were found to correspond with ones found by Gabrielsson in describing different rhythms.

The authors concluded that the three experiments show that the motion character of a gait can be conveyed to a listener by the sound level envelopes of tones, modeled from the vertical force pattern exerted by the foot. I am a little skeptical about their findings given the limited number of subjects involved in the experiments and the often unscientific assumptions and conclusions they made. The methodology simply left too many factors in play to draw any hard

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conclusions. Writing down adjectives is a very inexact way to characterize the subjects' perception of the music, and the resulting analysis and categorization of the answers seemed to ignore the fact that there is much subjectivity in the choice of words, and that factors such as vocabulary, education, and past experience can act as unpredictable filters in the subject's communication of what he or she perceived musically.