

The influence of perceptual stability of auditory percepts on motor behaviour

René van Egmond¹, Ruud G.J. Meulenbroek², & Pim Franssen²

¹Faculty of Industrial Design Engineering
Delft University of Technology

²Nijmegen Institute for Cognition and Information
Radboud University Nijmegen
The Netherlands

Abstract

In user-product interaction the way perception influences accuracy of movement or human error is important. Studies on visual illusions have shown that multi-interpretable images often lead to confusion or error. In the present study we investigated whether multiple-interpretable auditory sequences have a similar effect on motor behaviour. An auditory model accounting for the perceptual stability of tone sequences is proposed. On the basis of this model tone sequences were generated that contained multiple levels of perceptual stability. Analogous to a multi-interpretable Necker cube, only one representation of the tone sequences was presumed to be dominant at a specific moment in time. In a perceptual study, the predicted saliency of the perceptual representations was corroborated. The proposed model predicted the results adequately. While listening to the sequences in a second experiment, participants tapped on a table such that their tapping height reflected the low, middle, and high pitches that they perceived. We found that the variability of the tapping movements was higher for the unstable than for the stable percepts. Collectively, the results of the present study show that predicting the perceptual stability of auditory sequences is important to gain insights into the relationship between acoustic dimensions and performance accuracy.

Introduction

Everybody has experienced that sound influences various aspects of our motor behaviour. Music sometimes forces us to move. People tap with their feet while listening to music (often not being aware of it), they dance on music, and they run on music. In all these examples the frequency with which one moves corresponds to a perceived beat evoked by the music. But also in working environments, sound –or more specific music– has been used or is used to influence our behaviour. For example, typists are often trained by means of a metronome to achieve a certain typing speed. Alarm signals disrupt concentration and afford certain actions. In intensive cares both sound and alarm signals should not in any way disturb fine motor behaviour.

In D. de Waard, K.A. Brookhuis, R. van Egmond, and Th. Boersema (Eds.) (2005), *Human Factors in Design, Safety, and Management* (pp. 235 - 246). Maastricht, the Netherlands: Shaker Publishing.