Effects of Two Perceptual Learning Tasks on Perception of Shape from Friction-Generated Sound

Patrick A. Cabe, University of North Carolina at Pembroke, NC
John G. Neuhofer, College of Wooster, Wooster, OH
Katharina S. Bochtler, College of Wooster, OH

Introduction

Friction sounds are produced when a person rolls a rigid object such as a rock or a block across a rough surface. These sounds are generated by the deformation of the surface as it is rubbed against the object. Friction sounds are important in various fields, such as in the design of machines and in the production of musical instruments. Understanding how the brain perceives these sounds can help us better design machines and musical instruments.

Perceptual learning is a process by which a person’s ability to perceive something improves over time with practice. In this study, we explore how two different types of perceptual learning tasks affect the perception of friction sounds.

We compared effects of judgment accuracy feedback in scalar judgment and multiple-choice judgment tasks, using parallel presentation procedures.

Acoustically friction

When a continuous object is rolled on a flat surface, a contact area, surface roughness, and the orientation of the surface can change the friction generated sound depend on the surface roughness of the contact point. The friction sound varies with the frictional resistance to the contact point. The friction sound is also affected by the orientation of the contact point. In particular, different motions (such as rolling or sliding) can affect the friction sound, and the type of changes between these motions is also affected by the orientation of the contact point.

Research questions:

(a) Will perceptual learning judgments with feedback on acoustically improve perception of sound from shape?

(b) Will perceptual learning judgments differ between scalar judgments and multiple-choice judgments of shape from sound?

General method

Participants:

Perceptual learning method:

Tasks:

Procedure:

Results:

Training phase:

Transfer phase:

Comparison of Experiments 1 and 2:

Perceptual Categorization Index (PCI)

Conclusions:

- Friction-generated acoustical information informs ellipse shape discrimination, with both scalar and multiple-choice methods.
- Judged shape tracked actual shape with both procedures.
- Shape differentiation improved with both methods, with more the simpler multiple-choice procedure than with the scalar judgments.
- Transfer was equivalent across rotation speeds, suggesting relative information was a key factor in perceptual performance.
- Individual differences remain to be explained.
- Results demonstrated the utility of the Cabe-Wagman Perceptual Categorization Index for perceptual learning experiments.

References:


Acknow legmen ts: We thank the College of Wooster for financial support.