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Sonification Design for Complex Work Domains: Dimensions and Distractors

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Abstract

Sonification—representing data in sound—is a potential method for supporting human operators who have to monitor dynamic processes. Previous research has investigated a limited number of sound dimensions and has not systematically investigated the impact of dimensional interactions on sonification effectiveness. In three experiments we investigated accuracy for identifying changes in six target auditory dimensions of a continuous pulse stream under three conditions: no distractor, one distractor and five distractors. In Experiment 1 amplitude, frequency, harmonics, speed, tremolo (cycles per pulse) and width were tested. Accuracy and patterns of interaction between the dimensions were mapped. In Experiment 2 the same dimensions were tested but tremolo was operationalised as cycles per second. The patterns of interaction between the temporal dimensions differed from Experiment 1. In Experiment 3 the amplitude contour of the pulse stream was changed. The dimensions tested were amplitude, frequency, formants, speed, tremolo (cycles per pulse) and width. Results showed low accuracy for formants and many interactions, both positive and negative between the dimensions. We interpret our results in terms of theories of perceptual interference in auditory dimensions.

Keywords: sonification, perceptual interaction, auditory perception, auditory attention, auditory display