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# Specialist musical training and the octave illusion: analytical listening and veridical perception by pipe organists

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## Abstract

The octave illusion is a useful tool for investigation of the contribution of specialist training to auditory perception. The stimulus that induces the illusion involves two tones with a frequency ratio of 2:1, presented dichotically, and with ear of presentation reversed every 250 ms. Most listeners report hearing a single tone that alternates from high in the right ear to low in the left ear [Scientific American 233 (1975) 92–104]. The first experiment investigated the hypothesis that musical training contributes to veridical perception of an ambiguous stimulus. As hypothesized, participants with the highest level of musical training were more likely to perceive the stimulus veridically. Exploring the effects of specialist training, Experiment 2 contrasted expert pipe organists with other instrumentalists. As hypothesized, participants expert in playing pipe organ – an instrument with harmonic and spatial features similar to those of the octave illusion – were more likely to perceive the stimulus veridically. The results have implications for plasticity of the auditory system and the analytical listening that accompanies specialist, intensive training and rehearsal. © 2002 Elsevier Science B.V. All rights reserved.

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## 1. Introduction

Deutsch's (1975) octave illusion confronts the student of perceptual processes with an extreme of perceptive "reality". The octave illusion occurs when two tones with a frequency ratio of 2:1 (usually 800 and 400 Hz and preferably sinusoidal) are presented dichotically, and ear-of-presentation is reversed every 250 ms. The majority of respondents (right-handed) report hearing a single tone that alternates from high in the right ear to low in the left ear (see Fig. 1). By whatever mechanism, a tone is identified by most people as emanating from the opposite headphone to its actual physical location (Deutsch, 1975, 1999; Deutsch & Roll, 1976; ten Hoopen, 1996). Although apparently quite rare, there are individuals who perceive the stimulus veridically (in its true physical form). This study seeks to elaborate on the findings of Craig (1979) who suggests that musical training enhances veridical perception of the stimulus. As the two-tone stimulus for the illusion contains little musical content it seems probable that the advantage might involve acoustic as well as perceptual components. It has already been shown that intensive musical training attunes perception to tonal, rhythmic and harmonic features and structures (e.g., Beal, 1985; Davidson, Power, & Michie, 1987; Handel, 1989; Wolpert, 1990). The present study tests the assumption that *specialist* experience of musicians in the analysis, decomposition and re-composition of sound may further attune perception to atomistic acoustic components. Specifically, we compare percepts reported by musicians experienced with an instrument (the pipe organ) that in some ways simulates the octave illusion stimulus with reports from musicians trained on other instruments.

Studies that compare musicians and non-musicians, their attributes and abilities, and whether such attributes are innate or learned, abound (e.g., Beal, 1985; Chew,

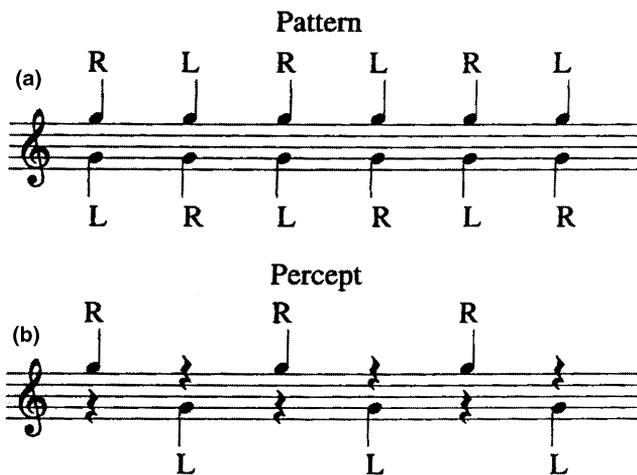


Fig. 1. Octave illusion stimulus (a) and common percept (b).

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