Sensory Impact of Removing Pure Tones from Complex Vibrations

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Abstract

Compared to sinusoidal vibrations (one tone), little is known on the mechanisms underlying the ability to discriminate between complex signals (> one tone), that are more representative of those occurring in natural tactile scene. Firstly, studies have found that comparing two simple signals appears easier than comparing two complex signals, suggesting that complexity affect discrimination. Secondly, harmonic relationship between frequency seems to be also a potential cue. However, most of the studies predominantly focused on signals composed of two frequencies which were usually chosen in the range of the Pacinian channel. The present study aims to evaluate the effect of removal frequency on the perception of vibrotactile signals encompassing up to four pure tones with varying complexity and harmonicity targeting both Meissner and Pacinian channel.
Thirty vibrotactile signals were created from two sets of four pure tones: 60, 120, 180, 240 Hz (Harmonic condition) and 75, 135, 195, 255 Hz (Non-harmonic condition) to create complex signals with the sum of two, three or four tones. The participants performed a task to differentiate two signals, one of which had a pure tone removed. The signals were presented through a voice-coil actuator attached to the participants' index finger. A total of 448 signals per participant were analyzed using a Generalized Linear Mixed Model including. The results showed that the lowest pure tone from the reference signal led to strong discrimination. Finally, there is no effect of complexity and harmonicity since the effect of removed pure tone is similar across complexity and harmonicity levels.

Keywords: complex vibrotactile signals, pure tones, harmonicity, tactile channels, inter, frequency interval

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