
Effect of Temporal Dispersion on Vibrotactile Frequency Encoding

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Abstract

Background: For coherent perception of touch inputs, the nervous system must solve the problem of temporal dispersion caused by different conduction velocities in different peripheral afferents. One potential solution is that action potentials that occur close in time, *i.e.* within a "burst", are perceptually grouped together as one peripheral event. We have previously shown that perceived vibrotactile frequency on the fingers depends on the "burst gap": the interval between two successive bursts of mechanically-evoked action potentials.

Aim: To test the burst gap integration window for vibrotactile stimuli applied to feet compared with existing data from the hand. It is predicted that the longer conduction distance to CNS from the foot will cause greater dispersion that will result in a burst extending over a longer time envelope.

Methods: Healthy subjects discriminated the frequency of mechanical two-pulse stimuli applied to the toe compared with regular trains of acoustic stimuli. The intraburst spike interval was varied from 4 to 56 ms.

Results: The burst gap code was found to determine frequency perception in toes as in the fingers. The integration window for bursts was 5 ms longer for the toes compared to fingers.

Discussion: Although an increased integration time window was observed with toe stimulation, it is not sufficient to account for the expected doubling of dispersion related to the increased conduction path. This confirms the essential similarity of upper and lower limb vibrotactile perception, and suggests that other mechanisms play the key role in determining the burst integration envelope.

Keywords: temporal coding, frequency perception, dispersion, foot, psychophysics, peripheral nerve

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