

From: MARK TRAMO <[REDACTED]>

To: Jeffrey Epstein <jeevacation@gmail.com>

Subject: Fwd: Detection vs. Discrimination vs. Recognition

Date: Sat, 28 Jul 2018 01:17:45 +0000

JE - FYI - Thought you might enjoy this - especially if within earshot of an accordion player. Where does one draw the lines between these reductionist classifications of tonal information processing - detection v discrimination v recognition?

Effects of stimulus spectrum and bilateral auditory cortex lesions on pitch direction discrimination for pure-tones and complex-tones with and without energy at F0

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Abstract

We carried out a series of experiments to test the following hypotheses: 1) fundamental-frequency difference ($\Delta F0$) thresholds for harmonic-tone pitch direction discrimination with and without energy at F0 are greater than and proportionate to pure-tone frequency difference thresholds in normal adult listeners; 2) auditory cortex is necessary for high-acuity pitch direction discrimination in humans; 3) auditory cortex is not necessary for low-acuity pitch perception; and 4) elevations in $\Delta F0$ thresholds for harmonic-tone pitch perception following bilateral auditory cortex lesions are proportionate to elevations in pure-tone frequency difference thresholds. The first hypothesis was supported by experiments with nine, middle-age, non-musicians and five types of tone stimuli: 1) pure-tones; 2) harmonic-tones with energy at low harmonics, including F0; 3) low-frequency harmonic-tones without energy at F0; 4) harmonic-tones with energy at high harmonics and F0; and 5) high-frequency harmonic-tones without energy at F0. The last three hypotheses were supported by an existence proof provided by experiments with a middle-age man (*Case A1+*) who lost all of primary auditory cortex and much of auditory association cortex due to bilateral middle cerebral artery strokes. There was no evidence of a functional dissociation that would suggest selective loss of putative temporal or place-rate coding mechanisms following bilateral auditory cortex lesions. A functional dissociation was found between impaired tone discrimination and spared tone detection, consistent with the results of numerous lesion-effect experiments with humans, non-human primates, and other mammals. The present and previous findings suggest there is no unitary "pitch center" residing in human auditory cortex that is necessary for pitch perception per se, even for perception of the "missing fundamental." Rather, regions of superior temporal cortex that show evidence of

physiological activation in normal listeners during pitch and loudness perception may constitute an "auditory acuity center" for high-resolution processing of tone frequency and intensity, akin to the role played by somatosensory cortex in two-point tactile discrimination and visual cortex in two-line orientation discrimination. The distinction between "low-level" and "high-level" auditory functions with reference to the anatomical level of underlying neural substrates in the central auditory pathway, epitomized by Campbell's influential dichotomization of auditory cortex subregions as "sensory" or "psychic" on anatomical grounds, may be illusory, unless the line is drawn between stimulus detection and, broadly, stimulus perception, including discriminative processing of simple stimuli.

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From: **MARK TRAMO** <[REDACTED]>
Date: Fri, Jul 27, 2018 at 6:07 PM
Subject: Detection vs. Discrimination vs. Recognition
To: Peter Cariani <[REDACTED]>

Hi Peter -what do you think of the following expanded Abstract? Auditory psychologists like Peretz and Zatorre like to categorize percepts like roughness and pure-tone pitch as "low-level" and "virtual pitch" perception as "high-level." Well where does one draw the line? The thinking is "brainstem" vs. "cortex." or primary vs association cortex. This case has always been interesting in that way - Andy Dykstra and I addressed this in the pure-tone intensity paper with Case A1+ published in PLoSOne. The implications go beyond the auditory system - basic sensory processing. Maybe its how fine-grained the acoustic information processing is that distinguishes the contributions of different levels within the system?

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