Pitch

Pitch is one of the primary auditory sensations, along with loudness and timbre. In music, sequences of pitch define melody, and simultaneous combinations of pitch define harmony. In speech, rising and falling pitch contours help define prosody and in tone languages, such as Mandarin and Cantonese, pitch contours help define the meaning of words. In complex acoustic environments, differences in pitch can help listeners to segregate and make sense of competing sound sources.

A work sought correlates of pitch perception, defined by neural activity above the lower limit of pitch (LLP), in auditory cortical neural ensembles, and examined their topographical distribution. Local field potentials (LFPs) were recorded in eight patients undergoing invasive recordings for pharmaco-resistant epilepsy. Stimuli consisted of bursts of broadband noise followed by regular interval noise (RIN). RIN was presented at rates below and above the LLP to distinguish responses related to the regularity of the stimulus and the presence of pitch itself. LFPs were recorded from human cortical homologues of auditory core, belt, and parabelt regions using multicontact depth electrodes implanted in Heschl's gyrus (HG) and Planum Temporale (PT), and subdural grid electrodes implanted over lateral superior temporal gyrus (STG). Evoked responses corresponding to the temporal regularity of the stimulus were assessed using autocorrelation of the evoked responses, and occurred for stimuli below and above the LLP. Induced responses throughout the high gamma range (60-200 Hz) were present for pitch values above the LLP, with onset latencies of approximately 70 ms. Mapping of the induced responses onto a common brain space demonstrated variability in the topographical distribution of high gamma responses across subjects. Induced responses were present throughout the length of HG and on PT, which is consistent with previous functional neuroimaging studies. Moreover, in each subject, a region within lateral STG showed robust induced responses at pitch-evoking stimulus rates. This work suggests a distributed representation of pitch processing in neural ensembles in human homologues of core and non-core auditory cortex [1].

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Gander PE, Kumar S, Sedley W, Nourski KV, Oya H, Kovach CK, Kawasaki H, Kikuchi Y, Patterson RD, Howard MA 3rd, Griffiths TD. Direct electrophysiological mapping of human pitch-related processing in auditory cortex. Neuroimage. 2019 Aug 8:116076. doi: 10.1016/j.neuroimage.2019.116076. [Epub ahead of print] PubMed PMID: 31401239.