Direct electrical recordings of neural activity related to auditory figure-ground segregation in the human auditory cortex

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The ability to detect a relevant sound by filtering out irrelevant sounds in the environment is crucial in day-to-day listening. This ability requires that the features of the relevant sound be grouped together as a single source (figure) and segregated from the features of other competing sounds in the environment (background). How the auditory system performs this task is not completely understood. In the current experiment we recorded local field potentials from human subjects undergoing invasive monitoring for pre surgical localization of epileptic foci. The subjects were implanted with depth electrodes in auditory cortex along the axis of Heschl's gyrus (HG) and subdural grids covering the superior temporal gyrus (STG).
The subjects listened to a stimulus in which the salience of the figure was varied systematically against a background. We used a stochastic figure-ground (SFG) stimulus developed in our lab that has been previously characterised using psychophysics and modelling. The SFG consisted of a sequence of simultaneously presented tones that were randomly distributed in log frequency space and varied from one 25 ms time frame to the next. During one time segment, a certain proportion of the tones remained the same over several consecutive time frames. This caused a figure to emerge from the background in which the salience was determined by the number of tones kept fixed (coherence) and the number of timeframes over which this occured (duration). In the current experiment, the first part (700 ms) of the stimulus consisted of only the background with no figure, and in the second part the coherence of the figure was varied systematically between 1, 2, 4 and 8. The overall duration of the figure was 24 25 ms time frames (700 ms). We measured event-related potentials (ERPs) and carried out single-trial time-frequency analysis using a wavelet transform. In HG no significant ERPs or power change were observed in response to the figure when compared to the acoustically matched background. We observed a sustained power change in the high gamma band (60-120 Hz) that

peaked at around 200 ms and varied with the coherence of the stimulus on STG for all tested subjects.
The data demonstrate a neural correlate of auditory figure-ground segregation in the form of high-frequency local oscillations in human non-primary auditory cortex.

Teki S, Chait M, Kumar S, Shamma S, Griffiths TD (2013) Segregation of complex acoustic scenes based on temporal coherence. eLife 2:e00699.