Neural mechanisms supporting brain asymmetry for speech and music

(Parole et musique : origine et nature de la latéralisation hémisphérique des processus auditifs)

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A major debate in cognitive neuroscience concerns whether brain asymmetry for speech and music emerges from differential sensitivity to acoustical cues (temporal/spectral dimensions) or from domain-specific (language/music categories) neural networks. This debate is closely related to the question of the origins of hemispheric specialization. Despite years of debate and empirical work, these issues have remained unresolved, and indeed have generated intense disagreement in the literature (e.g., Zatorre et al., 1992, McGettigan et al., 2012). We believe this situation is due to the insufficiently specific computational specification of prior models, and to a lack of clear grounding in neurophysiology.

This project will tackle these questions in a neuroimaging experiment involving human participants, in which the candidate will investigate the respective sensitivity of the left and right hemispheres to low-level acoustical cues (temporal/spectral information) and high-level categories (speech/music).

This will be done by: 1- capitalizing on a recently created corpus of sung speech stimuli in which melodic and verbal content is crossed and balanced (allowing to dissociate their respective neural correlates); 2- selectively degrading stimuli in either the temporal or spectral dimension, by use of a recent framework of acoustic processing (the spectrotemporal modulation framework; see Flinker et al., 2019); and 3- recording neural responses to theses stimuli with intracranial recordings of human brain activity (intracranial electroencephalography, iEEG) acquired on patients implanted for clinical purposes at La Timone hospital.

The ultimate goal of this project is to understand the neural dynamics underlying the processing of auditory (temporal/spectral) information in left and right hemispheres and to highlight their selective role in the processing of speech and music.