UNIVERSITÀ DEGLI STUDI DI PADOVA

SEMINAR

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Dip. di Scienze Biomediche (edificio ex. Istituto di Fisiologia)
Via F. Marzolo, 3 - Aula B

Encoding speech through cortical oscillations

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Abstract

The fact that feed-forward and top-down propagation of sensory information use distinct frequency bands is an appealing assumption for which evidence remains scarce. From human depth recordings in two auditory cortical regions, while subjects listen to sentences, we show that information travels in each direction using separate frequency channels. Bottom-up and top-down propagation dominates in gamma and beta bands, respectively. The predominance of low frequencies for top-down information transfer is confirmed by cross-regional frequency coupling, which indicates that the power of gamma activity in A1 is modulated by the phase of beta activity sampled from association auditory cortex (AAC). Finally, we show that information transfer does not proceed continuously but by time windows where bottom-up or top-down processing alternatively dominates.
Furthermore, in order to better understand the role of brain rhythms in speech perception we built a neural model that addresses whether coupled intrinsic theta and gamma oscillations, as observed in human auditory cortex, could underpin the multiscale sensory analysis of speech. Speech presents, as a matter of fact, a quasi-rhythmic structure at different timescales that the brain needs to decompose and integrate. Cortical oscillations have been proposed as instruments of sensory *de-multiplexing*, i.e., the parallel processing of different frequency streams in sensory signals. We show that theta-spiking oscillations can flexibly track the syllabic rhythm in continuous speech, and temporally organize the phoneme-level response of gamma neurons into a code that allows for syllable identification in continuous speech. These results suggest a potential mechanistic role for cortical oscillations in speech de-multiplexing, parsing, and encoding.

Host:

Dr. Samir Suweis , Prof. Stefano Vassanelli