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A cortical view on auditory scene analysis: a physiological & computational approach

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Abstract

The perceptual organization of sounds in the environment into coherent objects is a feat constantly facing the auditory system. It manifests itself in the everyday challenge to humans and animals alike to parse complex acoustic information arising from multiple sound sources into separate auditory streams. For instance, following a conversation at a noise cocktail party or locating your newborn in the middle of a colony of screaming birds relies on successfully segregating sounds into meaningful streams. While seemingly effortless, uncovering the neural mechanisms and computational principles underlying this remarkable ability remain a challenge facing both the biological and mathematical communities.

In this talk, I shall discuss how this perceptual ability of the auditory system may emerge as a consequence of a multi-scale spectro-temporal analysis of sound in the auditory cortex, which is thought to play a role in the perceptual ordering of acoustic events. This view highlights the principle that sound elements belonging to the same stream tend to evolve together in time. It postulates that grouping features according to their levels of temporal coherence is a viable organizing principle underlying cortical involvement in sound segregation. By closely collaborating with ongoing physiological and perceptual experiments investigating various aspects of stream segregation, this mathematical scheme offers a rigorous framework for facilitating the integration of the experimental findings and testing potential biophysical mechanisms implicated with a role in auditory streaming.