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## Neural signatures of early specialization for human speech in newborns: a NIRS-EEG study

### Abstract:

Human speech has a prosodic structure that fetuses can hear in the last trimester of gestation. We tested whether full-term newborns show neural sensitivity to speech compared to non-human vocalizations using concurrent functional near-infrared spectroscopy (fNIRS) and electroencephalography (EEG). Fifty-six full-term newborns listened to Italian sentences (Speech) and baboon vocalizations while brain activity was recorded with co-recorded NIRS-EEG. In each condition, most stimuli had a normal prosodic contour while some contained time-reversed prosody. Cluster-based permutation tests showed stronger right temporoparietal hemodynamic responses to speech than to vocalizations. EEG event-related potentials also revealed detection of prosodic violations in speech but not in vocalizations. These results suggest that, already at birth, the brain is selectively tuned to human speech, and that this specialization is grounded on the processing of its prosody.

### Bio:

Jessica Gemignani is a postdoctoral researcher at the University of Padova (Italy), Department of Developmental Psychology and Socialisation. She obtained her PhD from the Technical University of Berlin (2019) and was a Marie Skłodowska-Curie Fellow with the project BabyMindReader (2022-2024). Her research uses functional Near-Infrared Spectroscopy (fNIRS) to investigate the neural mechanisms underlying early language acquisition in newborns. She is particularly interested in how prenatal and early auditory experience shapes the developing brain. In addition to experimental work, she develops and validates methods for analyzing infant NIRS data, including data-driven and machine-learning approaches to improve multimodal integration with other neuroimaging techniques, such as EEG.

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