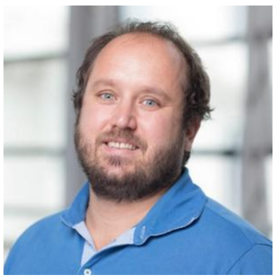
SPATIAL HEARING - INTERACTIVE OPEN LAB MEETING

10 JUNE 2026 11:30 A.M.
AULA 14
PALAZZO PIOMARTA
Corso Bettini 84, Rovereto



11:30 Talk + Q&A

Lorenzo Picinali, PhD
Professor in Spatial Acoustics and Immersive Audio
Dyson School of Design Engineering at Imperial College London

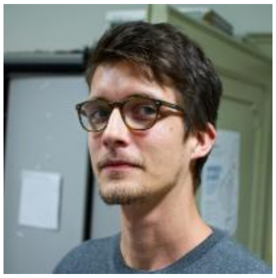
Vision in Spatial Hearing Assessment and Training

Spatial hearing is most commonly assessed using sound localisation tasks that are widely regarded as a gold standard for evaluating auditory spatial function. These paradigms typically rely on highly controlled experimental conditions, in which listeners are visually deprived, required to keep their head stationary, and exposed to brief noise bursts presented in different locations within anechoic environments. While such methods provide precise and reproducible measurements, they represent listening situations that are largely detached from everyday auditory experience. In natural environments, sound sources are multiple and rather complex from a spectral envelope point of view, listeners actively move their head and body, and spatial judgments are frequently resolved through dynamic interactions between proprioception, audition and vision.

This mismatch raises fundamental questions about the ecological validity of traditional spatial hearing assessments and about the role of vision in both assessing and training spatial auditory functions. Even alternative approaches, such as speech-based measures of spatial release from masking, implicitly depend on visual information, which supports spatial expectation, source identification, and audiovisual speech integration. Consequently, vision is not merely an auxiliary modality but an integral component of spatial hearing in real-world contexts.

I will present recent work exploring assessment paradigms that explicitly incorporate vision while preserving the functional contribution of auditory spatial cues. A first study focuses on a visual search task in which spatialised sound guides attention toward a visually defined target will be introduced. Although the task can ultimately be completed using vision alone, auditory information significantly affects reaction times, movement trajectories, and search strategies, providing sensitive performance metrics beyond localisation accuracy. For example, this paradigm has revealed subtle but systematic differences between individualised and non-individualised head-related transfer functions. In a second one, a game-based localisation tasks employing audio-visual anchors and auditory distractors shows that visible and head-tracked sound sources can facilitate faster learning than non-tracked and visually absent ones.

Finally implications of these findings for spatial hearing training. Across laboratory and clinical applications, including training for bilateral cochlear implant users, our results highlight the importance of multimodal feedback for perceptual remapping. Coupling auditory and visual information supports adaptation to altered spatial cues, while progressively reducing visual guidance enables the transfer of learning to audition alone. Together, these findings argue for a systematic integration of vision into spatial hearing assessment and rehabilitation, moving beyond purely auditory paradigms toward more ecologically valid and functionally informative approaches.



12:10 Talk + Q&A

Roberto Barumerli, PhD
MSCA Postdoctoral Fellow
Dyson School of Design Engineering at Imperial College London

Bayesian Models for Spatial Hearing: From Mechanisms to Statistical Inference

Computational auditory models simulate how listeners perceive and localise sounds, providing tractable tools for studying the functional mechanisms underlying spatial hearing. Over the past decades, these models have been validated against behavioural data in controlled laboratory experiments, yielding mechanistic accounts of how humans extract directional information from acoustic cues. However, existing models often rely on ad-hoc statistical methods that limit their ability to compare competing perceptual hypotheses across experimental conditions, ultimately hindering reproducibility and incremental progress. Here, I will present a probabilistic framework based on Bayesian inference that addresses both limitations: it explicitly encodes perceptual mechanisms as generative models and enables formal model comparison through statistical hypothesis testing. I will illustrate the approach with examples spanning Bayesian models of sound localisation across different scenarios, modelling of accuracy–speed trade-off in looming bias, and motor planning with looming sounds in children. These examples will demonstrate how the same statistical framework can account for idiosyncrasies, assess perceptual mechanisms, and even accommodate heterogeneous data, including neurophysiological and personality trait data, within a single model. The result is a reusable, interpretable pipeline for auditory spatial perception research that supports both fundamental science and the applied evaluation of spatial audio rendering in virtual reality.

Hosted and organised by Francesco Pavani, PhD and Chiara Valzolgher, PhD

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CHERISH Cochlear implants & spatial hearing

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