

# Offre de stage

## Perception of Source Directivity in Reverberant Conditions

*Institut Jean le Rond d'Alembert*

*Équipe Lutheries – Acoustique – Musique. Thème Espaces Sonores*

<http://www.lam.jussieu.fr/index.php?page=Espacesonore>

### Context

Directivity refers to how a source radiates sound in all directions as a function of frequency. In reverberant spaces, this results in audible spectral and spatial cues for listeners, caused by the interaction between source directivity and room acoustics. In this internship project, we propose to investigate the effect of specific parameters on these cues. Understanding the details of this interaction could help optimise auralisation for virtual and augmented reality applications by using perceptually motivated principles. This would enable more acoustically realistic experiences in mixed realities.

### Objectives

The intern will conduct a literature survey on the subject of the internship. Then, they will examine potential acoustic cues in the signal domain which may vary coherently with varying source directivity. Following this, an experimental perceptual study will be designed and executed to investigate the perceived effect of controlling the identified parameters. As such, the project may involve conducting room acoustic measurements. The outcome of the investigation should offer a better understanding of the perception of source directivity in reverberant conditions.

### Competences

Background in acoustics with basic foundations of room acoustics, spatial perception and signal processing. Familiarity with scientific programming (e.g., MATLAB, Python) and audio prototyping software (Max MSP, PureData). Knowledge of statistical analysis methods would be useful.

### Contact

Pablo Abehsera-Morell ([pablo.abehsera@dalembert.upmc.fr](mailto:pablo.abehsera@dalembert.upmc.fr))

Brian FG Katz ([brian.katz@sorbonne-universite.fr](mailto:brian.katz@sorbonne-universite.fr))

David Poirier-Quinot ([davipoir@dalembert.upmc.fr](mailto:davipoir@dalembert.upmc.fr))

### Duration, Location and Remuneration

~5 months starting in March 2024 at the d'Alembert Institute, Sorbonne Université, Jussieu campus. Possibility to adapt start date to alternate school schedules. Remuneration following university policy (~500€/month).

### References

- [1] H. Steffens, S. van de Par, and S. D. Ewert, "The role of early and late reflections on perception of source orientation," *J. of the Acoust. Soc. of America*, vol. 149, no. 4, pp. 2255–2269, 2021, doi: [10.1121/10.0003823](https://doi.org/10.1121/10.0003823).
- [2] C. Pörschmann and J. M. Arend, "Analysis and Visualization of Dynamic Human Voice Directivity," presented at DAGA, Stuttgart, 2022. <https://doi.org/10.14279/depositonce-15551>
- [3] P. Abehsera-Morell, D. Poirier-Quinot, and B. F. G. Katz, "Projecting source directivity variations onto an existing binaural room impulse response," presented at the AES International Conference on Spatial and Immersive Audio, Huddersfield, 2023. <https://hal.science/hal-04188953v1/file/AES22181.pdf>
- [4] S. Werner, F. Klein, A. Neidhardt, U. Sloma, C. Schneiderwind, and K. Brandenburg, "Creation of auditory augmented reality using a position-dynamic binaural synthesis system—technical components, psychoacoustic needs, and perceptual evaluation," *Applied Sciences*, vol. 11, no. 3, p. 1150, 2021. <https://doi.org/10.3390/app11031150>