



## **INTERNSHIP - Influence of sound reproduction system and low frequencies on emotional response to music (H/F)**

---

This internship is a collaborative project involving the Auditory cognition and communication team from the **Hearing Institute (Institut Pasteur)** and **L-Acoustics**, major player in the live sound industry, designing and manufacturing sound systems used in major music festivals, live events and opera houses around the world.

The L-Acoustics Field Application Research team is dedicated to the analysis and definition of good field practices in sound reinforcement, the qualification of sound system design parameters and of live sound experience (sound quality, emotional response, auditory health and annoyance of the neighbors), while identifying the conditions that may influence it.

Music listening can have strong emotional effects on listeners. Many factors contribute making the experience of live music unique, including social aspects (collective experience, emotion contagion), affective relation and connection with the artist, auditory stimulation (powerful low frequencies, high Sound Pressure Level), or visual stimulation (performers on stage, lights, etc.).

Focusing on the auditory stimulation, previous studies showed that room acoustic effects contribute to the overall emotional experience of a musical performance. Nevertheless, little is known about the role of sound reproduction system on the emotional impact of music. It is anticipated that the amount of energy in low frequencies that can be reproduced by different sound reproduction systems is one of the key factors driving the listener experience by providing both auditory and physical (body vibration) stimulation.

### **Missions**

The goal of this project is to evaluate the impact of sound reinforcement system on emotional response to music, and to qualify perception of low frequency contour modification. The work will address three main research questions:

1. Does the sound reproduction over a sound reinforcement system increase emotional response in comparison to a conventional listening experience over loudspeakers or headphones?
2. What is the influence of low frequencies contour modifications on the emotional response?
3. What are the key perceptual attributes related to low frequencies contour modifications?

After establishing a thorough literature review on the topic, the research effort will consist in designing and conducting perceptual experiments over a panel of participants exposed to various auditory stimulations. The evaluation of emotional response will be based on subjective measures (self-reports on scales) performed at L-Acoustics R&D facilities (Paris-Saclay), and physiological measures (pupillometry or EEG for instance) performed at the Hearing Institute (Paris). In addition, a verbal elicitation method will be used to describe the relevant perceptual attributes related to low frequency contour characteristics. Different sound reproductions systems will be considered, including typical sound reinforcement system, conventional loudspeaker system (Hi-Fi), and headphones.

Collected data will then be analyzed using state-of-the-art statistical methods (in R or Matlab). The findings of the internship will be documented and could lead to a scientific publication (conference or journal paper).

### **Education and required skills**

- The successful applicant should prepare a M.Sc. (last year) in Psychology, Cognitive sciences, Audiology, Acoustics or closely related fields.
- Good theoretical background in experimental psychology, with understanding of statistics
- Experience with behavioral or physiological measurements would be a plus
- Good communication skills (French and/or English)
- Internship 4-6 months minimum

**Location:** L-Acoustics R&D facilities (Paris-Saclay, France)

**Contact:** [samuel.moulin@l-acoustics.com](mailto:samuel.moulin@l-acoustics.com) - PhD, Field Application Research Engineer - L-Acoustics  
[luc.arnal@pasteur.fr](mailto:luc.arnal@pasteur.fr) - PhD, Head of Auditory cognition and communication - Hearing Institute (Institut Pasteur)