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*Internship in Computer Sciences (Master/Engineer)*

## **Eye-tracking in VR: Application à l'évaluation et la réhabilitation thérapeutiques de la négligence spatiale par audio 3D**

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**Laboratories :** CEDRIC, équipe Interactivité pour Lire et Jouer, Conservatoire National des Arts et Métiers, Paris - 2 rue Conté, 75003 Paris

**When :** 4 to 6 months between January and July 2020 (to be precised with the candidate)

**Remuneration :** ~580 € / month (internship gratification)

The **AudioRV-NSU** project is supported by the Paris Ile-de-France Region.

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### **CONTEXT AND GOALS**

The AudioRV-NSU project aims to design, in a long-term process, a therapeutic rehabilitation program, based on sound localization in virtual reality (VR), for patients suffering from a spatial neglect syndrome. Preliminary work [1] has allowed us to develop a sound localization training program in VR, and to validate it can improve sound localization for healthy people. We want to make this training accessible to spatial neglect patients for whom space perception is complicated and manual movements restricted. The main goal of the internship is therefore to test if eye tracking tools integrated into VR headsets can be considered as a pointing tool in sound location tests. This internship will also give us the opportunity to test whether eye tracking can be used to assess the syndrome level for the patients through various 3D tasks.

### **PLANNING AND TASKS**

Several tasks would be explored in function of the student interest

- (1) State-of-the-art on VR eye-tracking applications and methodologies, and on sound influence on gaze direction.

#### **Eye-tracking as measurement tool**

- (2) Integration of an eye-tracking system into preexisting 3D audio localization training programs [1] + evaluation of visual spatial exploration in VR through gaze control. Implementation of an interactive visualization tool to extract eye-movement data from different 3D scenes.
- (3) Experimental validation of eye-tracking as an assessment tool (spatial exploration capacity) on healthy/control participants.

#### **Eye-tracking as pointing tool**

- (4) Comparison of 3D audio localization tests in VR through traditional hand-pointing techniques and eye-tracking techniques.
- (5) Implementation of different 3D scenes and tasks, developed as mini-games, to explore peri-/extra-personal space through eye-tracking.

### STUDENT PROFILE:

Master 2/3rd year engineering school level, or equivalent, in computer science with strong interest in human-computer interaction, virtual reality, 3D audio, and multisensory perception. Required skills: Fluency in English or French. Capacity to work in a multidisciplinary research team (two other students, in neuropsychology and cognitive psychology will work on the project).

Preferred skills: 3D/game engine programming (Unity 3D, C#). Experimental protocol design. The development will be done on Unity for an HTC VivePro headset equipped with a Tobii eye-tracker. It is not required for the student to already know the technology and the development tools, but motivation to learn is mandatory.

### REFERENCES

- [1] Bouchara, T., Bara, T.G., Weiss, P.L & Guilbert, A. (2019). Influence of vision on short-term sound localization training with non-individualized HRTF. *In Proceedings of the 1st EAA Spatial Audio Signal Processing Symposium*. <https://hal.archives-ouvertes.fr/hal-02275168/document>
- [2] Clay, V., König, P., & König, S. (2019). *Eye tracking in virtual reality*. *Journal of Eye Movement Research*, 12(1) <https://bop.unibe.ch/JEMR/article/view/4332-Clay-final-sub/7749>
- [3] Antoine Coutrot, Nathalie Guyader. How saliency, faces, and sound influence gaze in dynamic social scenes. *Journal of Vision, Association for Research in Vision and Ophthalmology*, 2014, 14 (8) <https://hal.archives-ouvertes.fr/hal-01018237/document>
- [4] Alexander C. Volck, Roman D. Laske, Ralph Litschel, Rudolf Probst & Abel-Jan Tasman (2015) Sound localization measured by eye-tracking, *International Journal of Audiology*, 54:12, 976-983