# Study and analysis of multimodal attention in immersive virtual reality

## Supervisors

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## Hosting laboratory

Centre Inria d'Université Côte d'Azur

## Duration

4-6 months, starting between January - March 2023

## Salary

550€ / month

## To apply

Please contact hui-yin.wu@inria.fr with your CV and latest transcripts. A short (1 paragraph) statement of motivation is appreciated.

## Description

This internship is situated in the context of ANR CREATTIVE3D (https://project.inria.fr/creattive3d/), a French state-funded project that deploys virtual reality headsets (VR) to study navigation behaviors in complex environments under both normal and simulated low-vision conditions. We aim to model multi-modal user attention and behavior, and use this understanding for the design of assisted creativity tools and protocols for the creation of personalized 3D-VR content for low vision training and rehabilitation.

When using virtual reality for real-life applications such as rehabilitation and training, cognitive and behavioral measures are put in place to better understand the user experience and evaluate the effectiveness of these applications. Questionnaires are a popular tool to measure the sense of presence [Sla99], emotion [BBC04], and broader user experiece components including immersion and engagement [TLC16], which have been notably been adopted by Jicol et al. [JWD21] to investigate the interplay between agency, presence, and emotion with the use of structural equation models. Our recent work combining the use of physiological sensors and gaze tracking [GRB22] investigated correlations between attention, emotion, and content when viewing 360 videos in VR.

The internship project aims to study the impact of simulated low vision when carrying out 6 degrees of freedom navigation tasks in virtual reality. We propose a set of hypotheses that investigate the interplay between gaze, motion, emotion, in order to (1) understand how they can be used to measure the level of presence in VR, and (2) measure the impact of simulated low-vision conditions as compared to the literature in real-life studies. The recruited intern will integrate into the multidisciplinary team to carry out three principal tasks:

1. Conduct a state of the art of cognitive and behavioral measures for the impact of low-vision on motion, emotion, and gaze, and familiarize with the existing work on measuring presence in virtual reality.
2. Carry out a formal user study requiring participants to navigate street crossing scenes under various conditions with capture of multi-modal attentional data.
3. Conduct preliminary analysis on the study data to investigate a set of hypotheses on presence and impact of low-vision on VR navigation tasks.

## Competences

We seek candidates with a strong profile (backed by coursework and/or projects) in at least one of the following areas :

- mathematical/computational modeling, with strong competences in data processing and statistical analysis
- human-computer interactions, with competences in designing and carrying out user studies, and conducting post-study analysis
- cognitive science or neuroscience, specializing in visual perception, action, and/or emotion

We equally appreciate:

- a good level of French and English, in speaking and writing
- experience in using physiology, gaze, or motion capture sensors and data
- passion in virtual reality technology

## References

[BBC04] Baños, R. M., Botella, C., Alcañiz, M., Liaño, V., Guerrero, B., & Rey, B. (2004). Immersion and emotion: their impact on the sense of presence. Cyberpsychology & behavior, 7(6), 734-741.

[GRB22] Guimard, Q., Robert, F., Bauce, C., Ducreux, A., Sassatelli, L., Wu, H. Y., . . . & Gros, A. (2022, June). PEM360: A dataset of 360° videos with continuous Physiological measurements, subjective Emotional ratings and Motion traces. In Proceedings of the 13th ACM Multimedia Systems Conference (pp. 252-258).

[JWD21] Jicol, C., Wan, C. H., Doling, B., Illingworth, C. H., Yoon, J., Headey, C., . . . & O'Neill, E. (2021, May). Effects of emotion and agency on presence

in virtual reality. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (pp. 1-13).

[Sla99] Slater, M. (1999). Measuring presence: A response to the Witmer and Singer presence questionnaire. Presence: teleoperators and virtual environments, 8(5), 560-565.

[TLC16] Tcha-Tokey, K., Loup-Escande, E., Christmann, O., & Richir, S. (2016, March). A questionnaire to measure the user experience in immersive virtual environments. In Proceedings of the 2016 virtual reality international conference (pp. 1-5).