

PhD Position F/M -

Designing and evaluating avatar embodiment and Proteus effect in augmented reality



Figure 1: Examples of AR avatars in the literature. Left: [1], Center: [2], Right: [3]

Contract type: Fixed-term contract (3 years)

Level of qualifications required: Graduate degree or equivalent

Fonction: PhD Position

Level of experience: Recently graduated

Location: PACCE team, Ecole Centrale de Nantes (with stays at Inria, Rennes - Hybrid team)

Starting date: September/October 2024

Context

This PhD position is framed in the context of the ANR project ASTRAL (Augmented Self: TowARds effective Avatars in augmented reaLity). The general context of this project is the design and study of avatars in augmented reality. Avatars, i.e. digital representations of users in a Virtual Environment (VE) [7], are more and more present in our lives due to the recent democratization of Virtual Reality (VR) headsets and supported by the colossal investments of major economic actors such as Meta or Microsoft. Avatars today are the most broadly used means for representing users in an immersive VE and can be found in a wide range of applications in areas such as entertainment, tele-communication, medicine, education, etc. Such avatars have been shown to improve users' presence [5] and performance [6] in immersive VEs, and even alter their perceptions [7]. Our general objective is therefore to enable and evaluate AR avatarization (i.e. providing users with their own AR avatar). Reaching this objective will help us pave the way to new innovative AR avatars by proposing new rendering and interaction methods along with perceptual understanding of their use. This PhD will focus on the design and perception of AR Avatars, and in understanding if it is possible to feel embodied in an AR avatar and how. We aim to identify and characterize factors influencing AR avatars acceptance and to explore in general the possibility of AR avatars to have economic and societal impacts.

Supervision

The supervision will be shared between ECN and Inria Rennes, but the PhD candidate will be physically located at ECN, in PACCE team of LS2N and will integrate the Hybrid Research team. The PACCE team has strong interests in Virtual Reality, human-computer interaction and Human Factors (<https://www.ls2n.fr/equipe/pacce/>). The team is composed of ~30 members including (12 permanent staff, 10 PhD students, 1 Postdoc, 1 VR/AR engineers). The Hybrid research team strongly focuses on Virtual and Augmented Reality research, and it is located at Inria Rennes/IRISA (<https://team.inria.fr/hybrid>). The team is composed of ~35 members including (14 permanent staff, 11 PhD students, 3 Postdocs, 4 VR/AR engineers).

The official supervisors of the PhD will be:

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Assignment

In the context of the project ASTRAL, this PhD will focus on the perception dimension, and in understanding if it is possible to feel embodied in an AR avatar and how. We aim to identify and characterize factors influencing AR avatars acceptance and to explore the possibility to induce an Augmented Proteus effect, defined as the extension of the “classical” Proteus effect in AR, and in general in the possibility of AR avatars to improve user’s skills (e.g., cognitive, motor skills, etc.)

While designing novel AR avatars, it is of the utmost importance to understand how users perceive them, and more specifically, if it is possible to feel embodied in an AR avatar. The degree to which users accept or reject their virtual body in VR is commonly referred to as the Sense of Embodiment (SoE) [7], which is divided in three subcomponents: the sense of self-location (feeling spatially inside a body), the sense of agency (feeling in control towards a body), and the sense of body ownership (self-attribution of a body). While the SoE in VR has been widely studied in the literature, it is still unclear if an AR avatar in a real environment would provide a similar experience.

Main activities

Therefore the main goal of the PhD will be to better understand the design and perception of avatars in AR iteratively, seeking to expand the definition of embodiment as defined in VR in an AR situation. This implies, based on the embodiment research corpus [1], to study, design and quantify the specific relationship to bodies (virtual, real, mixed) in AR. More precisely, this will be done by designing advanced technological setups, and then conducting user studies in order to evaluate different criteria, such as the sense of embodiment towards AR avatars, performance ratings when using them in specific tasks, and other elements to characterize the overall user experience of these avatars. Furthermore, this PhD will aim to contribute in better understanding the psychological and societal

implications of such avatars and their potential benefits in such contexts. As such, representative use-cases can be implemented here in order to leverage AR avatars and conduct user studies to assess their value.

The main outcome of this PhD will be to provide insights regarding how AR avatars are perceived and used in order to improve their design, and also to formulate guidelines for the AR/VR community members who would be interested in developing such avatars.

Bibliography

- [1] A. C. S. Genay, A. Lecuyer, et M. Hachet, « Being an Avatar “for Real”: a Survey on Virtual Embodiment in Augmented Reality », IEEE Trans Vis Comput Graph, vol. PP, juill. 2021, doi: 10.1109/TVCG.2021.3099290.
- [2] C. Nimcharoen, S. Zollmann, J. Collins, et H. Regenbrecht, « Is That Me?—Embodiment and Body Perception with an Augmented Reality Mirror », in 2018 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct), oct. 2018, p. 158-163. doi: 10.1109/ISMAR-Adjunct.2018.00057.
- [3] S.-T. Noh, H.-S. Yeo, et W. Woo, « An HMD-based mixed reality system for avatar-mediated remote collaboration with bare-hand interaction », in Proceedings of the 25th International Conference on Artificial Reality and Telexistence and 20th Eurographics Symposium on Virtual Environments, Goslar, DEU, oct. 2015, p. 61-68.
- [4] D. Dewez, L. Hoyet, A. Lécuyer, et F. Argelaguet, « Towards Avatar-Friendly 3D Manipulation Techniques: Bridging the Gap Between Sense of Embodiment and Interaction in Virtual Reality », in Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems, New York, NY, USA: Association for Computing Machinery, 2021, p. 1-14.
- [5] T. Feuchtner et J. Müller, « Extending the Body for Interaction with Reality », in Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems, New York, NY, USA: Association for Computing Machinery, 2017, p. 5145-5157.
- [6] E. Peillard, F. Argelaguet, J.-M. Normand, A. Lécuyer, et G. Moreau, « Studying Exocentric Distance Perception in Optical See-Through Augmented Reality », in 2019 IEEE International Symposium on Mixed and Augmented Reality (ISMAR), 2019, p. 115-122.
- [7] K. Kiltner, R. Groten, et M. Slater, « The Sense of Embodiment in Virtual Reality », Presence Teleoperators & Virtual Environments, vol. 21, 2012.

Skills

The candidate must have a master degree (or equivalent), with a preference in mixed reality or human computer interaction. In addition, the candidate should be comfortable with as much following items as possible:

Experience in 3D/VR/AR applications (e.g. Unity3D).

Experience in evaluation methods and controlled users studies.

Good knowledge in programming languages (e.g. C#, C++).

Good spoken and written English.

Good communication skills.

Benefits package

Subsidized meals

Partial reimbursement of public transport costs

Possibility of teleworking (90 days per year) and flexible organization of working hours

Partial payment of insurance costs

Remuneration

Monthly gross salary amounting to 2100 euros.