Exploring the use of avatars in virtual urban environments

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Structure:
- City: Nantes (France)
- Category of hosting institution: Research Laboratory
- Host institution: Ecole Centrale de Nantes

Keywords:
- Virtual Reality, Avatar Embodiment, Virtual Urban Environments

Duration and start date:
- 6 months, starting in february 2023 (flexible date), with a potential opening towards a PhD depending on funding opportunities.

Internship context:

Offering the capacity to immerse users and provide strong illusions, Virtual Reality (VR) has already established a convincing usability for urban studies and design. This is especially true in the context of evaluating urban projects where the study of urban space perception by participants is a key aspect of the design phase [1]. In this context, questions related to the avatar, i.e. digital representation of a user in a Virtual Environment (VE), are becoming more and more important because of their potential influence on space and distance perception, especially as avatars have been demonstrated to improve immersion and the sense of "presence" in VEs [2]. Therefore, in the context of urban studies, the integration of virtual avatars during user experiences seems essential to improve immersion and perception of urban VEs. Yet, there is up to this day a gap of knowledge on the impact of being embodied in a virtual body on the perception of urban ambiances.

First, in order to have efficient experiences with avatars, users must feel strongly embodied in their virtual body, which is commonly characterized and assessed by studying the Sense of Embodiment (SoE) [3]. Moreover, it was shown that the perception of the avatar is altered by the type of task users have to perform in the VE [4]. It is therefore important to explore how tasks specific to urban spaces (e.g., large-scale navigation, negotiation of urban projects) may influence users' SoE. Furthermore avatars have rarely been studied in large outdoor VEs but rather in small controlled virtual rooms, reinvigorating the need to explore how such characteristics could influence one's own avatar perception. Second, while some works studied how visual cues in VR could impact the perception of urban ambiance, such as climate effects [5], it remains unclear how avatars could contribute in conveying a specific urban ambiance. Avatars' representations were also found to influence space perception in terms of distance or heights [6], but these works remain mainly limited to the perception of indoor virtual spaces, or only tackle the influence of size modulation of the avatar. On the one hand, we may wonder if such results extend to the perception of larger urban spaces? On the other hand, we can question if other avatar alterations rather than size change (e.g. change in the rendering from cartoon to realistic, etc.) might also influence the perception of urban spaces? Furthermore, it was demonstrated that seeing other users embodied

in avatars in a VE could be taken as an evidence of one's proper existence in the VE, and could increase the sense of presence, engagement [7] and impact users behavior and perception of the VE by for instance amplifying their reaction in the virtual experience. Yet, social interactions in VEs are often limited in these previous works, notably due to the technical challenges of tracking and giving feedback of users movements and facial expressions, and the context of urban space perception was rarely considered, leaving this question open: will social interaction in the VE enhance users' perception of urban ambiances?

In that context, the aim of this internship is to explore how avatars can contribute to convey specific urban ambiances. For instance, an objective of this project is to sensibilize towards climate change and future rise of temperatures. We can imagine an experiment to explore how applying fake visual feedback on the avatar to evoke physiological changes of temperature (red color on skin, drops of sweat, goosebumps) induced by the urban space could help sensibilize towards global warming. Overall, several leads are considered for exploration in this internship and they will be discussed with the intern to decide on a specific research question. Then, the intern will have to develop an immersive environment in Unity 3D (or Unreal Engine if preferred) to allow the immersion of users in a virtual urban environment while being embodied in an avatar (see example figure 1). The internship can include a user study on participants and if the results are conclusive, the intern will also have the possibility to write a research paper with the help of the supervisors. Adapted equipment will be provided (VR-compatible computer, VR HMD, trackers, etc.).
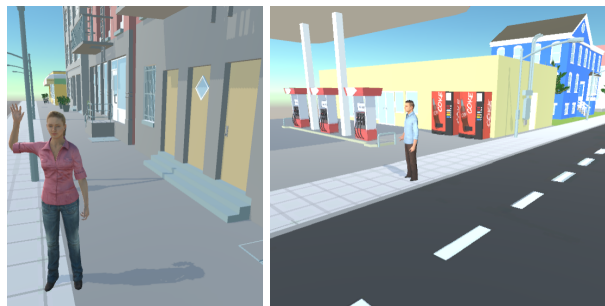

Figure 1. Avatars in a virtual urban environment

Expected skills:
- Object-oriented programming (C#, or C++)
- Unity 3D
- Autonomy
- Interest in user studies and data analysis (not primordial)

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