Avatar Anthropomorphism and Acrophobia

Jean-Luc Lugrin* Ivan Polyschev† Daniel Roth‡ Marc Erich Latoschik§
HCI Group, University of Würzburg

Figure 1: ***Experiment Condition and Task****: Participant saw their avatars body from a first person perspective and synchronized with their real body in space and time. Each participant experienced both an avatar with a Human body (either an adult female* A*) or male (*B*) and one with Non-Human body (a robot (*C*). Participants had to find and touch white spheres which were appearing at different position around a virtual plank positioned at approximately twenty meters height on the facade of an old industrial building.*

Abstract

In this paper, we investigate the impact of avatar anthropomorphism on the fear of heights, when using full body avatar embodiment under an immersive virtual reality (VR) setting. Clear differences could be found in perceived anthropomorphism, but preliminary results do not show differences in stress level between *Human* and *Non-Human* avatars, although a high level of perceived secureness was reported with *Non-Human* avatars.

Keywords: Avatar Embodiment, Acrophobia, Virtual Therapy

Concepts: •**Human-centered computing** → **Virtual reality;**

1 Introduction

Recent work demonstrated that Non-Human-looking avatars produce a similar illusion of virtual body ownership (IVBO) than Human-looking ones [Lugrin et al. 2015a]. This illusion can temporarily shift ones bodily self-perception towards the virtual body of an avatar with a different gender, age, ethnicity, body shape, limb measures, or even having different postures [Spanlang et al. 2014].

However, the impact of body ownership on the perceived level of danger, using different anthropomorphic avatar levels, has not been fully investigated. In particular, the degree to which a possible *Proteus* effect could influence acrophobia is still unknown. This effect describes a change of behaviour caused by the avatar's visual and behavioural characteristics [Yee and Bailenson 2007]. Based on this effect, *stronger-looking* or *Non-Human* avatars could be used in graded stress exposure therapy. They could unconsciously relax, increase confidence or motivate patients to face and overcome their fears, such as acrophobia (i.e, intense fear of heights). Recently an experiment reported no significant differences between concrete and abstract Human avatar representation when facing fire [Lugrin et al. 2015b]. However, this experiment was only using partial avatar embodiment. Therefore, the goal of this research is to provide a first investigation of the *Proteus* effect on fear of heights using full-body avatar representation and Non-Human ones. The overall objective is to explore the possibility of using the avatar's appearance as novel factor for VR exposure therapy.

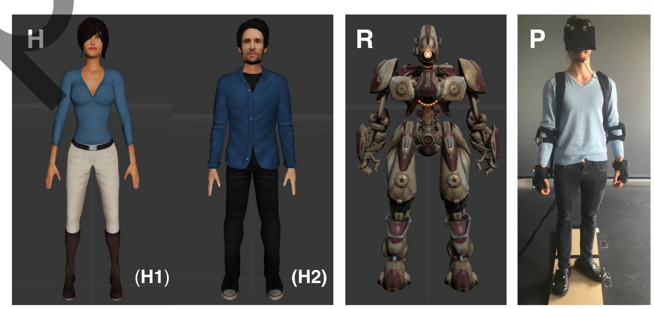

Figure 2: *Human avatars: a generic Human female (H1) and male (H2); Non-Human avatar: a robot (R); A participant on the virtual plank replica and wearing an HMD and rigid-body markers (P).*

2 Experiment

We designed an immersive fear-of-heights inducing virtual environment and evaluated participant's experience with different types of avatars. Consequently, we adopted a *mixed* experimental design with the avatar type (i.e. *Human* or *Non-Human*) as within-subject factor and the experimental sequencing as between-subject factor. As illustrated in Figure 2, each participant experienced both a *Non-Human* one (a *robot*) and a *Human* looking character (a male or female Human adult depending on the participant's gender). Participants were immersed in a virtual reality in a first-person perspective via a head-mounted display (HMD) and represented to themselves as one of the avatars. Similar to [Roth et al. 2016], we relied on a limited set of rigid-body markers to replicate the users' body motion in real-time to their virtual body.

*e-mail:jean-luc.lugrin@uni-wuerzburg.de
†e-mail:ivan.polyschev@stud-mail.uni-wuerzburg.de
‡e-mail:daniel.roth@uni-wuerzburg.de
§e-mail:marc.latoschik@uni-wuerzburg.de

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The task consisted of a simple game of finding and touching targets (i.e., large white spheres). The participants had to touch twelve spheres using their virtual body's hands or feet. One game session lasted approximately three minutes in average. The spheres were randomly appearing at different places around a plank that overlooks an empty car park surrounded by a forest (Figure 1). The plank was positioned at a height equivalent to 20 meters. It was attached to the facade of an old industrial building and accessible through a door, itself connected to a room. Participants started the experiment in this room, where they were first *acclimatized* to the VR environment and their avatar. This room represented a space of 3 x 3 meters, where they could freely move around for few minutes.

After feeling comfortable with navigating in VR, participants were asked to face a mirror inside this room (Figure 3). During one minute, they were then required perform a set of gestures following the experimenter's instructions (e.g., *"lift up your right hand in the air"*). A virtual mirror is a important requirement as it permits participant to be fully aware of their new appearance [Spanlang et al. 2014].

Figure 3: *Participant's avatar in front of mirror inside the virtual environment getting to "know" their new appearance.*

Additional haptic feedbacks were also provided to promote the illusion of a real place and therefore a more compelling fear of falling. The virtual plank (150 x 40 cm) had an exact real replica acting as passive haptic feedback. Silent air fans, synchronised with wind effects in the virtual environment (e.g., tree branches and leafs moving), were also installed to increase immersion.

The following measures were collected in this study:

1. **Proteus Effect**: *"Did you feel more secure with the robot avatar, and why?"*
2. **Stress Physiological Effects**: Electrodermal activity (EDA) measurements. Before the experimental task, each participant performed a 5-min relaxation exercise during which a baseline for the EDA, for a non-stressful activity, was collected.
3. **Stress Psychological Effects**: Arousal questionnaires for tense and energetic arousal [Thayer 1990].
4. **Bias Control**: questionnaires used by [Roth et al. 2016] for *Acrophobia*, *Immersive Tendency*, *Simulation Sickness*.

3 Results & Discussions

38 participants were involved in the experiment, 22 male and 16 female (μ_{age} = 21.13, σ_{age} = 2.0). For both, the physiological and psychological stress measurements, no significant differences were found between the avatars.High differences are found for both EDA measures before and after the exposure in comparison to the EDA baseline ($\mu_{baseline}$ = 5.13, $\sigma_{baseline}$ = 6.30). However, the differences between the avatars were marginal he (μ_{Human} = 12.22, σ_{Human} = 7.60 and $\mu_{non.Human}$ = 12.42, $\sigma_{non-Human}$ = 7.15). Consequently, the avatars seem to have elicited similar responses in terms of stress level, independently of their *Human* or *Non-Human* appearance.

Regarding the *Proteus* effect, 42% participants explicitly confirmed being more secured with the *Robot*. The participants' comments (e.g., *"The robot body give me more power and safety than the fragile female body", "I was feeling more adventurous and confident", "the robot looked more stable and less fragile"*) indicate that to some the *Proteus* effect had an impact. However, it appears that the effect was not important enough to be reflected in the stress measurements. The evaluation of the answers to the open questions also provides other interesting indications. Participants in the *Robot*-condition seemed to have perceived the avatar more susceptible to fall due to its heavy weight, bulkiness and larger dimension compare to the *Human* ones: (*"I felt like the robot was too heavy to stay stable, and I had to move more carefully"*).

4 Conclusion

We observed that all avatars elicited a similar level of stress despite the feeling of secureness reported with our *Non-Human* Robot avatar, which is possibly indicating an *Proteus* effect against fear of heights. At the same time, the effect observed and mentioned in qualitative data will require further investigations.

Therefore, our next steps is now to further confirm our observations by replicating this experiment with patients suffering of acrophobia and with long term studies, as well as using different types of *Non-Human* avatars with physical *attributes* more important for fear of falling, such as one reflecting more stability or invulnerability (such as a finer robot, with jetpack, suction cups or others).

References

LUGRIN, J.-L., LATT, J., AND LATOSCHIK, M. E. 2015. Anthropomorphism and illusion of virtual body ownership. In *International Conference on Artificial Reality and Telexistence Eurographics Symposium on Virtual Environments*.

LUGRIN, J.-L., WIEDEMANN, M., BIEBERSTEIN, D., AND LATOSCHIK, M. E. 2015. Influence of avatar realism on stressfull situation in vr. In *Proceedings of the IEEE VR 2015*.

ROTH, D., LUGRIN, J.-L., BÜSER, J., AND LATOSCHIK, M. E. 2016. A simplified inverse kinematic approach for embodied vr applications. In *in Proceedings of the 23rd IEEE Virtual Reality (IEEE VR) conference 2016*. (to be published).

SPANLANG, B., NORMAND, J.-M., BORLAND, D., KILTENI, K., GIANNOPOULOS, E., POMÉS, A., GONZÁLEZ-FRANCO, M., PEREZ-MARCOS, D., ARROYO-PALACIOS, J., MUNCUNILL, X. N., ET AL. 2014. How to build an embodiment lab: achieving body representation illusions in virtual reality. *Frontiers in Robotics and AI 1*, 9.

THAYER, R. E. 1990. *The biopsychology of mood and arousal*. Oxford University Press.

YEE, N., AND BAILENSON, J. 2007. The proteus effect: The effect of transformed self-representation on behavior. *Human communication research 33*, 3, 271–290.