[DC] The Impact of Social Interactions on an Embodied Individual's Self-perception in Virtual Environments

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ABSTRACT

In shared immersive virtual reality, users can interact with other participants and experience them as being present in the environment. Thereby different aspects of the respective interaction partners can have an impact on the perceived quality of the communication and possibly also the self-perception of an embodied user. This paper describes various factors the author aims to investigate during his doctoral studies. As the research area of embodied social interactions is broad, relevant factors and concrete research questions have been identified to investigate how social contact with one or multiple other persons may affect one's self-perception, behavior and her or his relationship with the others while being embodied in a virtual environment.

Index Terms: Human-centered computing—Human computer interaction (HCI)—Interaction paradigms—Virtual reality; Human-centered computing—Human computer interaction (HCI)—Interaction paradigms—Mixed /augmented reality; Human-centered computing—Human computer interaction (HCI)—Interaction paradigms—Collaborative interaction;

1 INTRODUCTION

In "Immersive Virtual Environments" (IVEs) avatars can serve as digital representations of users and the mapping of one's body movement to a virtual body facilitates its direct control. The state of being "embodied" is thereby associated with various psychological effects like the illusion of virtual body ownership (IVBO) [4,9], or the Proteus effect [10], giving the potential to change one's body schema and self-image. In shared virtual environments users can also interact with other participants and experience them as being present in the environment [8]. This also raises the question of how social interactions impact the perception of a person's embodied self, one's behavior or her/his relationship with other participants.

2 RELATED WORK

Social responses to virtual humans have been studied in different contexts. Garau et al. investigated the impact of visual and behavioral realism of avatars on the perceived quality of communication in IVEs [2]. Roth et al. compared interactions in virtual reality (VR) and the real world to explore the effects of reduced social information on the effectiveness of communication [7] and the work of Latoschik et al. suggested that the appearance of others' avatars might have an impact on the user's self-perception [3]. In the context of the proposed Ph.D. project, the impact of appearance and participation of others in shared virtual worlds on an embodied participant's self will be further investigated, yielding to an expanded in-depth exploration of the aforementioned work and its results.

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Figure 1: A prototype of a virtual mirror system for immersive obesity therapy in virtual reality. Left: An embodied person with a regular-weight avatar. Right: An embodied person with an "adjusted" over-weight avatar. The bottom images show the corresponding first-person views of the users.

3 THE "ViTRAS" PROJECT

As the number of obesity cases is rapidly increasing worldwide, leading to a massive problem for the well-being of the individual and enormous macroeconomic consequences, the "ViTraS[1]" project is developing therapy methods based on a controlled modulation of body perception and body behavior using current virtual and augmented reality (AR) technologies (see the project outline [1]). As Fig. 1 shows, the goal is to develop and evaluate a full or partly immersive virtual mirror application that can adjust the "displayed weight" of photo-realistic avatars in real-time. Furthermore, a shared VR-application for social support in group therapy will be implemented and its impacts investigated. Since August 2019 the author has been involved in the "ViTraS" project.

[1]ViTraS: Virtual Reality Therapy by Stimulation of Modulated Body Perception

4 RELEVANT FACTORS

Going beyond the scope of "ViTraS", this Ph.D. project will investigate the impact of others and their attributes on one's self-perception, relationships and behavior while being embodied in virtual reality. The attributes of others with whom one has social contact in virtual reality may vary to explore their impact. Independent variables will include but are not limited to the following factors:

- **The Appearance of Others:** State-of-the-art technology provides the possibility to vary different aspects of the other's appearance [5]. Both simple and photo-realistically scanned avatars can be presented as well as various non-verbal channels such as gaze or facial expressions. "ViTraS" also promotes the development of a controlled modulation of the avatar's weight or BMI (see Fig. 1) [1].

- **Participation of Others:** By what means do others share the virtual world with the immersed person? Are they embodied, abstract, only perceived via spatial audio, or do they speak to her or him from the real world? This case can be particularly interesting in individual therapeutic situations in which the therapist interacts with an immersed patient.

To discover the impact a social interaction might have on the embodied person's conscious or unconscious perception of her/his self or environment, the following dependent factors will be investigated:

- **Self-Perception:** How does one's virtual body perception change depending on social contact with others? Can factors such as body perception and image, presence or IVBO be influenced by the attributes of others?

- **Relationships:** How do the attributes of others shape the embodied person's relationship with them?

- **Behavior:** How does the behavior of an embodied person towards others change, depending on the others' attributes?

In a top-down approach, fundamental effects are first investigated in studies with randomized participants interacting with agents and other embodied humans. Subsequently, concrete studies in the field of obesity therapy will be conducted with real patients and therapists.

5 UPCOMING WORK

A first empirical study is planned based on the work of Latoschik et al. [3], who found "a marginally significant effect" for the realism of the other's avatar on the "change factor" of the IVBO measure [6]. Therefore, the upcoming work aims to replicate the fundamental principles of the study while explicitly aligning the study design to investigate the variation of the matching or deviating degrees of realism of one's own and the virtual other's avatar.

6 RESEARCH QUESTIONS

The main goal of the presented Ph.D. project is to investigate the impact of social interactions with one or multiple others on a participant being embodied in an immersive virtual environment. Based on the already mentioned factors this leads to the following research questions and their outcomes for the "ViTraS" project.

RQ1: How does social contact with another person affect one's self-perception and her/his behavior and relationship towards the other while being embodied in a virtual environment? As the attribute "Participation of Others" implies, the "others" can be part of a shared virtual environment or act in the real world. In the context of the "ViTraS" project, the relationship and its effects between patient and therapist will be further evaluated.

RQ2: How does an embodied group interaction in a shared virtual environment impact one's self-perception as well as behavior and relationship towards the others depending on the attributes of the group members. Regarding the "ViTraS" shared VR application, the appropriate attributes of participants for a safe and controllable environment shall be determined.

RQ3: What is the impact of the degree of immersion on RQ1 and RQ2. How do the specified research questions interact with the degree of immersion, between augmented and virtual reality?

7 CONCLUSION

This paper addressed current research on social interactions between two or more participants, with at least one of them being embodied in a virtual environment. Possibly relevant factors and concrete research questions for the author's doctoral project have been investigated. During the IEEE VR 2020 doctoral consortium, the research questions and different experimental tasks can be discussed, as well as the metric to be used to investigate the effect of the independent variables. Also, additional factors or attributes that can influence self-perception, relationships, and behavior in shared virtual environments may be examined.

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