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Augmenting Shared Spaces in Psychotherapy Contexts

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***Abstract*—The ongoing growing of computational power of small portable devices allow the emergence of new forms of Augmented Realities, such as, virtual shared spaces. In this work, we will explore the use of this technology to improve the collaborative work between people in the same physical space or in remote locations sharing virtual contents. The idea is to have a scene shared between several people where everyone can see and interact with it. Those live interactions can improve the quality of collaborative work by presenting in real time ideas and thoughts of any participant directly on top of the 3D model. Our main goal is to apply this concept to psychological therapies, specially to exposure therapies, where it is very important for the therapist to control and manipulate the scene that the patient is exposed to in order to obtain the desired results.**

***Index Terms*—Mixed Reality, Virtual Shared Spaces, Collaborative Experiences, Psycho-therapeutic Tools**

I. Introduction

In this work, we design and explore future technologies and environments that will improve the interaction between humans and computers as well as interaction between humans mediated by computers. Specifically, we investigate how Augmented Reality enhanced by physical and spatial 3D user interfaces can be used to develop effective face-to-face collaborative computing environments. With this technology, computers can provide the same type of collaborative environment that people have in face-to-face interactions, such as communication by object manipulation and gestures.

The evolution of human-computer interaction research seems to be about integrating typically human characteristics (e.g., cognitive, behavioural, and emotional) into a more intuitive, enjoyable, and useful human-machine approach to everyday contexts. In this sense, Augmented Reality is an useful technology to build scenarios or situations, in which one can interact to develop useful skills to apply in real environments. Recently, the full spectrum of Mixed Realities have covered many areas and gone beyond the research or prototypes, entering the field of commercial and practical solutions. The availability of low cost immersive devices, the growing computing power of portable devices and cloud services create excellent opportunities for the application of Augmented Reality systems in therapeutic uses. Psychology is exactly one of the areas that can have a real benefit with these systems, in particular in exposure-based therapies.

In psychology field, the notion of exposure and response prevention is used in the treatment of obsessive-compulsive disorder to deal with compulsive behaviours as a maintenance problem. The most common fears or obsessions include worries about dirt and contamination, which consequently are associated with washing, checking, repeating, ordering/arranging. These compulsive behaviours serve an emotion regulation function and are aimed to reduce anxiety and other difficult emotions (e.g., disgust). Exposure tasks are planned and set up in a collaborative way between therapist and patient. At the beginning, the therapist acts as a role model in exposure exercises, and then the patient perform the exposure by himself [1]. Some of these fear scenarios for exposure tasks are difficult to design and have in real life, so the aid of complementary technologies may be both helpful and highly attractive for patients.

This work has been motivated by previous research in fully immersive spaces through virtual reality, where we could find that the interaction with environment was intuitive with a good sense of presence [2] [3]. However, most virtual reality systems are fully immersive, it separates the user from the real world. This means that is very difficult to access to everyday real objects and tools from immersive virtual reality environments. In opposition to virtual reality and other computer supported collaborative work, Augmented Reality interfaces are able to overlay computer generated objects and audio onto the real world, allowing them to coexist with real objects. Furthermore, these 3D objects can have a very realist appearance and be manipulated by the user.

More than a simple Augmented Reality application this technology allow everyone to see and share any changes made to both virtual and physical space at the same time.

II. Shared Spaces in Emotion Communication

Augmented Reality is very useful to present objects coexisting with the real spaces in a realist and coherent way. Although, most of the experience are designed for only one person, i.e. the observer, the one with the device that enables

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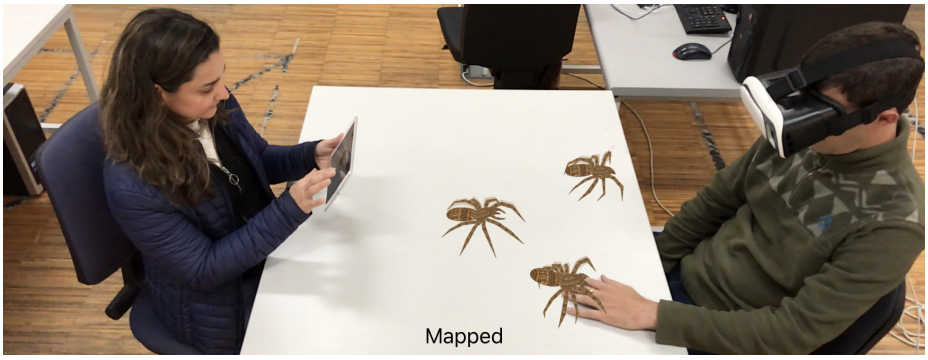

Fig. 1. Experiment Apparatus: Shared Space between Therapist (on left), Participant (on right) and Observer (taking the photo).

the experience. To solve this limitation and continue to take full advantage of Augmented Reality we bring the concept of shared spaces to the equation.

Shared spaces are very relevant to enhance the communication between two or more persons. Furthermore, this alliance between Augmented Reality and shared spaces allow all the participants to continue interact in a face-to-face way, either when they are physically in the same space or remotely with a graphical representations of selves (i.e., avatars). In communication, in particular when sharing experiences, it is fundamental to have everyone in the same context to guarantee that there are no misleading or bad interpretation about the situation. This is special important in psycho-therapeutic environment where the therapist must infer most of the cues from observation. For that reason, this system can be a useful tool to aid the therapist in the exposure therapy procedure.

III. Shared Space Experiment

In psychotherapy exposure context, this can be very useful for the treatment of several phobias, such as, arachnophobia (Fig. 1) or even obsessive compulsive disorder. These psychological disorders involve the experience of high levels of anxiety and distress in face of phobic stimulus (e.g., spider in the case of arachnophobia; dirty objects and fear of contamination in some obsessive compulsive disorders). The phobic stimulus or contexts are avoided which in turn leads a reduction of anxiety and a temporary emotional relief. This cycle reinforces anxiety and avoidance behaviours. In general, the psychological treatment involves breaking this vicious cycle, through the exposure the person to the phobic stimulus in a gradually way [4]. Some of this exposure procedures requires hazardous environments which therapist can not design and manipulate in real world.

The purpose of this experiment is to create an environment where the therapist can manipulate the 3D scene presented in Augmented Reality and the changes seen by others. The manipulations and changes made by the therapist in this experiment intend to result in emotional activation and/or behavioural responses in the participant. These responses are the target in the psychological treatment and reducing it without avoidance is the main goal.

A. System Setup

This shared space demonstration can be experienced using optical or video see-through devices, such as head-mounted displays, smart glasses or handheld based. In addition to those devices the only requirement is a surface where the interaction and sharing will occur.

B. Physiological Signals

Physiological data can also be used as complementary to data collected from the participants assessments and therapist observations. Physiological patterns may help in assessing and quantifying stress, anxiety, anger and other emotions that influence physical and mental health. The physiological signal are acquired from various modalities such as electroencephalogram (EEG), electrocardiogram (ECG), electromyogram (EMG), galvanic skin response (GSR), blood volume pressure, respiration pattern, skin temperature, etc. These data are processed and can not only provide useful cues to the therapist but also intends to control the system, i.e. if participant's anxiety levels are low during the exposure, the phobic stimuli are reduced, and vice-versa.

IV. Conclusion

In this work, we combine real and virtual environments to create coherent and realist 3D collaborative experiences in psychotherapy context. The systems is intended to aid the therapist with patient's emotional understanding by creating situations and scenarios that were not possible to conduct in purely real live environments. In the future we plan on investigating how our Augmented Reality shared spaces approach can work with remote participants and their virtual representation and how it will affect the sense of presence.

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