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Senseparation

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Abstract

This paper describes the interdisciplinary joint project Senseparation [1] that focuses on the cross-border networking of people between virtual and real space. We set up an encounter between two persons located at different places to encourage people to think critically about today's online communication. In our experiment, one person in a virtual reality (VR) installation (CAVE) [11] or wearing Oculus Rift glasses is able to interact with another person located in a dark room wearing a vest with vibration motors, compass and controller. The person in real space is represented as an avatar in the VR environment. The one in the real space is able to perceive the person in the VR environment with tactile and auditory senses. Spatial audio in the dark room supports the representation of the proximity of the two people. The person connected to the VR environment can interact with the avatar and touch it by means of a 6 degree of freedom input device. Touching the avatar gives also visual feedback on the avatar. We separated tactile, visual and auditory feedback for this encounter in order to increase the intensity of the distant encounter.

Keywords

Telehaptic, Wearables, VR Environment, Performativity, Tactile Feedback, Interaction, Virtual Reality

Introduction

Research in the field of Human Computer Interaction (HCI) aims to make the communication with the digital data more human and intuitive. Encounters in the virtual world and over distances are quite common today.

Ways of getting in touch with people have changed completely since the Internet has become part of daily life. For hundreds of years people usually met personally in real life and then perhaps became friends. Nowadays it is often the reverse. People often meet first on the Internet before meeting in real life. One real world impact of digital communication is that we dispense with the bodily nearness to our communication partners.

Despite all the advantages of digital communication this means a disruption in our habits. In digital communication we are limited to reading, listening, seeing and interacting verbally and visually. What about the body language, the body expressions and gestures, the expression of emotions, the warmth, the breath, the personal charisma and the smell of a person? Based on these thoughts, we have developed a concept of a telehaptic encounter between two people in distant places.

Related Work

Solve et Coagula (SeC)–mating man and machine by Stahl Stenslie combines interaction between a person, equipped with a bodysuit with built-in pressure sensors and vibrators, and a virtual cyberorganism. The artificially intelligent virtual creature speaks to the user through spatial sound and is able to touch him or her. SeC 'attempts to sensorially pair man and computer together'. While the user experiences SeC in an immersive VR world with visual, tactile and auditory stimuli, these are separated in our project: the VR user has a visual experience while the other user perceives auditory and tactile feedback. [2]

Can you see me now? by Blast Theory in collaboration with the Mixed Reality Lab is a chasing game which overlaps a part of a physical with a virtual city by the use of handheld computers connected over the internet. This game is closely related to our project in terms of interest about proximity between participants in the real and virtual world superimposed. [3]

Sommerer and Mignonneau communicate body sensations and smell with touch-devices shaped as gourds. They share private body sensations like heart beat, blood volume pressure, pulse, skin conductivity, sweat and smell, with strangers over the mobile phone network. These sensations are perceived via vibrator motors, ventilators, micro-electro-mechanical and micro-bio-electrochemical actuators. They investigate how technology has changed our lives by exchanging privacy for mobility and connectivity. [4]

Concept

The goal was to stage a telehaptic performance with tactile, auditory and visual feedback and to get information on triggered emotions. In this type of encounter sensual components are missing compared to encounters in the real space. Which sensory perceptions are necessary to raise positive emotions in a virtual encounter?

To find out these conditions, we have developed an experimental setting. The sensory experience takes place in two different locations. By means of an avatar, the user in the virtual reality is able to interact using an input device with the person in the real space, in a dark room wearing a vibro-tactile vest. The position and orientation of the avatar corresponds to the position of the person in the dark room. Each contact between the user in the VR environment and the avatar gives an additional visual feedback on the avatar in the VR environment. In return, the person in the real space is able to perceive the other person with tactile and auditory senses. Vibration motors in the vest give tactile feedback at the contact points. We selected three different

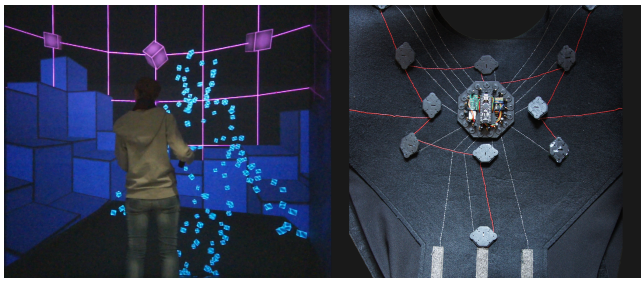

Figure 1 VR environment, vibro-tactile vest

touch patterns for the interaction with the avatar: hit, touch and bump.

We opted for the CAVE as the interface of the encounter to achieve a higher degree of immersion and presence and thus achieve an intensification of the encounter. Sound in the dark Room supports the representation of the proximity of the two persons.

Design

We designed a vest, the avatar and the virtual world environment in which the avatar is presented and the sound.

Garment Design

Wearables show [5] or hide [6] the integrated technology. We have combined both options. In our weareable design we played with the exciting contrast of cool technology and warm materials like fabric and felt. This idea represents our basic concept, where we combine human encounters, human proximity and thus warmness with functionality and the coolness of technology. We applied wires clearly visible on the vest, similar to a "network" pattern, alluding to the type of encounter [Fig. 1]. For tactile feedback we integrated 16 vibration motors along the spine, at the shoulders, the elbows, the breast and the hips.

Avatar Design

The degree of abstraction was a key element in the design of the avatar. First, the avatar provides enough mental room to imagine a real person behind it and is gender non-specific. Second, it is a pleasant and non scary counterpart. Based on the research on the Uncanny Valley effects [7], we decided against a photo-realistic rendering of the avatar. Inspired by existing projects [8] we have chosen a visualization in the form of a cube cloud. These cubes convert into a human silhouette when the two people come closer to each other as shown in Figure 1.

VR Environment Design

The VR environment where the avatar and the real person meet consists of a floor plate which is the same size as the dark room. It is surrounded by a larger virtual globe that is open at the top and is only restricted by a wire frame combined with blocks [Fig. 1]. This design element reflects the networked encounter. The lower part of the globe consists of a geometric architecture with blocks.

Dark Room Design

The dark Room is equipped with position and orientation tracking for a single user and a spatial 4-channel audio system. The tracking system consists of a single Kinect camera, used in depth mode, to capture the dark room user's position. The orientation of the user is sensed by a compass module integrated in the vibro-tactile vest. A communication server connects these components for exchange of data between them and the VR installation.

Sound Design

We use five separate sounds for the sonification of the VR user in the dark room: position and velocity, as well as the three touch patterns hit, touch, and bump. Position and velocity sounds are constantly played back as spatial sound in order to experience the exact location of the person in the VR installation and therefore the proximity of both participants. The main concern of the sound design consists of not losing these semiotic links between action and sound. The spatial audio system is realized in Pure Data, using the Ambisonics technique. [10]

Hardware Components

The virtual world can be displayed with an arbitrary VR installation like a CAVE or other multi-display installations. An alternative, easily reproducible setup consists of an Oculus Rift, a low cost HMD as an immersive display as well as a Razor Hydra input device. To realize the cross-platform and cross device functionality the application makes uses of OpenSG [12] as a scene graph and VRPN [13] for the abstraction of input devices.

The model transfer was implemented in VRML [14].

Conclusion

Senseparation establishes a critical reflection about distant encounters between virtual and real space. With Senseparation as an ongoing research project, we continue our investigation in opening the limits of digital communication: as a first step, we implemented the characteristics of someone getting close as tactile and auditory feedback on the one side and abstract visual output on the other side. Additionally different physical contacts are perceptible. Participants can compare the experience with isolated visual versus tactile and auditory senses.

Initial observations showed, that the users' reactions are ambivalent in terms of the triggered emotions. Most users felt comfortable about the VR environment. Also, the appearance of the avatar was evaluated in a positive way. The avatar was described as non scary and gender unspecific. It gives enough space to imagine another person. The situation in the dark room was described as ambivalent. It was confirmed that the sound reflects the proximity of the other person very well. The vibration feedback however needs to be optimized. Therefore further research is necessary. Body contacts could be felt, but they are not detailed enough to reflect real touches. However, the positions of the vibrations motors were described as well located.

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