Ubiquitous Substitutional Reality: Re-Experiencing the Past in Immersion

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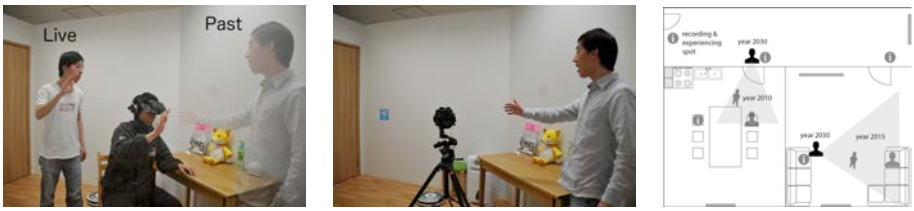

Figure 1: *Left: Re-experiencing past reality. Center: Recording past reality. Right: Experiencing at different locations of household.*

1. Introduction

We propose an immersive Substitutional Reality (SR) system that enables users to experience alternate realities as they walk around in the live reality's environment by substituting or blending in pre-recorded realities. SR is fundamentally a concept of presenting realities that are of a different time than the live reality to the users through seamless transitions so the users feel as one coherent experience. Suzuki et al. construct the alternate realities from pre-recorded panoramic video images of the past and aim to study humans' brain behavior when they perceive the past reality as happening before their eyes and interact in their SR system [1]. We install our system in the home environment as to provide an immersive way for people to record and re-experience their treasured memories. To achieve seamless transition, we integrate sensors in the furniture that can sense the users' interactions so the transition can be implicitly triggered as users subjectively interact with the furniture. As the sensor interfaces are integrated invisibly with the furniture and the experience occurs naturally when interacted, we consider this to be a kind of ubiquitous experience.

2. System Overview

The key to an immersive SR experience is the seamless transition between the live reality and past reality. We suggest the method of implicit transition when users subjectively interact with the furniture. Implicit transition improves immersion in that the users do not have a preconceived idea that reality is about to change. Also, the cross-modality of visual and audio sensation improves realism. We add the element of binaural audio to the original visual focused SR system so the audio environment is just as realistic as listening from our own ears. The system has three core components: recording, experiencing, and transition.

Recording The recording of the past reality is through a panoramic video camera with two mono microphones placed at a distance close to a human's ear distance to record in binaural. The recording of the visual and audio sensation has to be placed at the same location as the interaction is in the live reality (Figure 1).

Experiencing The users experience through a video see-through head mount display that lets them see the live and past reality. A 9 DOF sensor is attached to the HMD so the users' head orientation

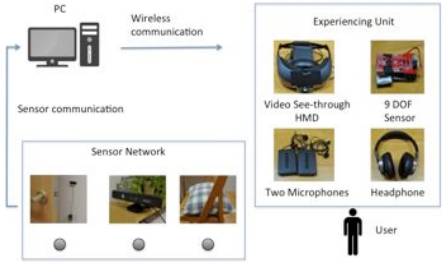

Figure 2: *Sensor network implicitly triggers the transition to be experienced by the users when they interact.*

is tracked and the correct view of the recorded panoramic video can be presented to the users. Two microphones are fixed beside the user's ears to capture live binaural audio. The recorded binaural audio will also change according to orientation. The users are able to walk around in the live reality for SR experience at different locations in the household (Figure 1).

Transition The implicit transition is subjectively initiated by the users as they interact with the sensor-integrated furniture (Figure 2). We implemented three examples: A infrared distance sensor that senses how much a door opens, a tracking sensor such as Kinect that tracks the user's position at a certain location and triggers a binaural audio to elicit the user's head turning which in turn triggers transition, and a sensor-integrated cushion that senses the sitting pressure to trigger the transition. Theoretically, we can expand to any kind and number of sensors in a household.

3. User Experience

The users put on the video see-through HMD and binaural microphone and can observe their surroundings while interacting with the people in the live reality. The users can explore the environment any way they prefer, and when they interact with the sensor furniture, the past reality will be implicitly transitioned. They can turn to view different angles of the past reality in cross-modality with binaural sound. The implicit seamless transition and the ability to immerse in both realities will confuse the users into doubting what they are experiencing is the actual live reality or a recorded one.

4. Acknowledgement

This work is supported by Microsoft Research CORE9 Project.

References

1. Suzuki, K., Wakisaka, S. and Fujii, N. 2012. Substitutional Reality System: A Novel Experimental Platform for Experiencing Alternative Reality. In *Sci. Rep.* 2, 459.

SIGGRAPH 2014, August 10 – 14, 2014, Vancouver, British Columbia, Canada.

ACM 978-1-4503-2958-3/14/08