The Reality Helmet: A Wearable Interactive Experience

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Abstract

The Reality Helmet is an *interactive experience*, in which the user's vision and hearing is shielded off from the world. Video and sound is nevertheless recorded by the Reality Helmet, but through computer processing it presents sound to the user as vision, and likewise, vision is turned into a soundscape. The result is a form of *artificial synesthesia*. Other than as an appreciated art installation, which seems to make people calm and reflective, the Reality Helmet is used to explore relationships between the wearer's sense of *presence* and the kind of *realism* provided by the interactive environment.

1 Introduction

The Reality Helmet is a wearable computer developed with the purpose of providing its users with *altered interactive experiences of reality*, (or *artificial synesthesia*) a form of art in which users are actively involved in creating their own, individual experiences through the use of digital technology. It physically consists of a custom-made helmet that the user wears, and computational equipment placed in a custom built backpack, which allows a high degree of mobility for its user.

Figure 1. Physical Setup of the Reality Helmet.

On the helmet, there are mounted a digital video camera and stereo microphones. On its inside, perceived by the user only, are a pair of small visual displays and headphones. As shown in Figure 1, the eyes and ears are completely covered when wearing the Reality Helmet, and users become audiovisually shielded, while their other senses are not interfered with. Thus, while immersed in a personal virtual environment, users still have the benefit of spatial freedom, which separates the Reality Helmet from many other virtual environments (cf. VR Caves).

Through computer processing, the Reality Helmet alters the user's perceptual experience by providing a real-time visualization of the auditory environment in which the user moves, and likewise, a landscape of sound generated from the digital video input. Hence, the user sees what she would normally hear, and hears what she would normally see.

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Other than as an appreciated installation of art, seemingly making users calm and reflective, the Reality Helmet is being used to examine some pertinent research questions. One such area is the concept of presence, in which our prototype is used to challenge the argument that presence requires a high degree of 'realism', something which is often sought in VR. This work resonates with those who primarily seek to provide users with extraordinary experiences, rather than realism [Davies and Harrison, 1996].

2 Implementation

The software consists of two applications running simultaneously on a laptop, under the Linux operating system, placed in the backpack. Sound analysis is based on the open source project Specgram. A Fast Fourier Transform allows a real-time frequency analysis of the sound in stereo, which feeds data to a visualization presented to the user. The user has the experience of slowly traveling through a tunnel, whose walls reflect the sound environment in which the user is but cannot hear.

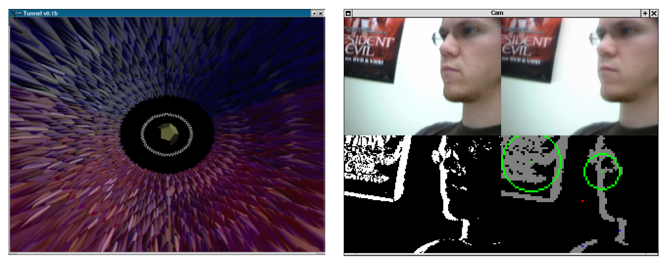

Figure 2. Sound visualization (left); Image analysis (right).

Auditorily, the user is presented with a soundscape based on recognition of change in the video input. A calm and ambient background sound is played when changes occur in the image as a whole. In addition, sound effects of different kinds are added in real-time for every object recognized by image analysis. Top left is the current frame, F_i, from the camera. Top right image is a merge, M_i, of previous frames. $M_i = F_{i-1}\,\alpha + M_{i-1}\,(1-\alpha)$, where $\alpha \in [0,1]$. Applying this gives the image a certain motion. Bottom left is the image when a threshold operation is applied to the absolute difference of F_i and M_i. Every pixel with a value above threshold is turned into white, and every pixel with a value below the threshold is turned black. Bottom right is an image where a sound source has been connected to a 'blob'. A blob is a set of interconnected pixels, i.e. pixels touching other pixels in four directions. The largest blobs are singled out and their center points calculated. The size of any given blob is used to determine the volume of the sound source which gets associated to it. The position of the center point in the horizontal direction determines the position of that particular sound, which may change in real-time and appear to the user as moving around in the soundscape.

References

DAVIES, C. AND HARRISON, J. 1996. Osmose: Towards Broadening the Aesthetics of Virtual Reality, *ACM SIGGRAPH Computer Graphics,* Vol. 30, No. 4, p. 25—28.