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Towards an Optimal Viewpoint in Third-Person out-of-body Experiences

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Abstract

Human vision underlies natural constraints. Field of view, perceived wavelength, angular resolution, or perspective are just a few. Combining a head-mounted display with a camera can overcome some of these limitations and constraints. We investigate the field of view, which is created by presenting a third person view to the wearer of the head-mounted display. We propose an automatic camera positioning that may provide a better overview to the user compared to a manual positioning.

1 Introduction

Traditionally, a first person view (1PV) is defined as how humans perceive the world through their eyes. Thereby some parts of the own body cannot be seen in 1PV (e.g., the head). In virtual environments (e.g., video games) the way we are able to see, can be changed to a third person view (3PV). Furthermore, in games a 3PV is used to provide the player with better vision and more control over their avatar and a better perception of their surroundings (Schuurink & Toet 2010).

The use of a 3PV is not limited to gaming. Persons suffering from a vertebral fracture are not allowed to move their head for some time. During that time, the injured person could be supported by a 3PV. Furthermore, a 3PV could also be of interest when operating machines (e.g., parking a car or using a wheelchair) or learning a movement (e.g., dancing or poi).

Rapp and Gena compared 3PV to 1PV (Rapp & Gena 2014). Their findings showed that searching and finding objects is easier in 1PV. In contrast, 3PV is suited better for orientation. Satyavolu et al. found that people are able to point towards an object in 3PV (Satyavolu et al. 2014). Previous work did not investigate changing the 3PV position during runtime. Therefore, we considered to focus on the camera positioning in 3PV.

2 Concept

We use a camera and a head-mounted display (HMD) to provide a 3PV. We investigate different approaches to manipulate the camera position. In detail, we want to compare a manual camera positioning to an automated camera positioning. In the manual approach, the user has to reposition the camera depending on the situation. In contrast, automatic positioning provides the user with the optimal field of view depending on the movement of the user.

The idea is that automatic positioning reduces the workload and therefore improves performance. With the increasing number of unmanned aerial vehicles (UAV) and virtual reality glasses, we believe that in the future a 3PV becomes feasible.

3 System

We built an experimental prototype to evaluate how people behave when provided with a 3PV. The prototype consists of two core components: (1) a camera stick and an (2) HMD (see Figure 1). The stick has a total length of 131cm and has a Creative Socialize HD webcam, with resolution of 640x480, mounted at the top. The angle of the camera can be adjusted vertically using a cord while walking. Since the human field of view is close to 180° (Goldstein 2010, 290), we considered using a 180° camera. Instead, we used a wide-angle lens to extend the field of view of the webcam to 180°. The HMD consists of a Samsung Galaxy S4[1] and a Google Cardboard VR-headset.

We use a Lenovo T440s[2] to connect the webcam and the Samsung Galaxy S4. The T440s records the video stream of the webcam and streams the video to the Samsung Galaxy S4. The notebook is either carried by the user in a backpack or used by the experimenter to monitor the camera image (see Figure 1). The video stream is sent to the HMD using VR Streamer[3].

[1] GT-I9505, running Android 4.4.2

[2] Intel(R) Core(TM) i5-4300U CPU @ 1.90 GHZ, 8GB RAM, Windows 8.1, Windows Media Capture 9

[3] http://www.swatterco.com/vr_streamer.php, (Version 1.2)

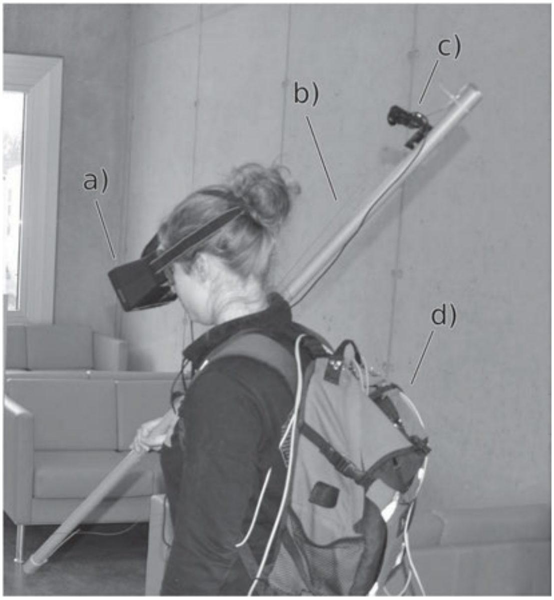

Figure 1: A user wearing our prototype. a) head-mounted display, b) camera stick, c) camera, d) backpack

4 Proposed Study

In future, we want to conduct a study that compares different camera positioning approaches. In the first approach, the camera is carried by the user holding the camera stick. In the second approach, the camera is carried by the experimenter, acting as a Wizard of Oz (WOz). If the WOz approaches shows promising results we also plan to mount the camera to an UAV that automatically provides the best perceived field of view depending on the user's movement. In addition, a long-term study would be of interest.

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