Head vs. Eye-Based Selection in Virtual Reality

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ABSTRACT

This demo presents a VR system for comparing eye and head-based selection performance using the recently released FOVE. The system presents a virtual environment modelled after the ISO 9241-9 reciprocal selection task, with targets presented at varying depths. We have used the system to compare eye-based selection, and head-based selection (i.e., gaze direction) in isolation, and a third condition which used both eye-tracking and head-tracking at once.

1 INTRODUCTION

We present a demo of eye-based selection in VR using the FOVE, the first commercial eye-tracking VR HMD. It enables eye tracking for target selection; Users control a cursor to select objects simply using their eyes. However, eye-based selection performance has not previously been studied in VR. We developed an experimental platform to compare the performance of eye-based selection to the more common head-based selection. The demo allows SUI attendees to experience three different selection techniques across different target size/depth combinations: 1) eye-based selection 2) head-based selection and 3) eye- and head-based selection time.

The system is the first to be used to compare eye- and head-based selection in a 3D Fitts' law setting. Results of a first study indicate that head-based selection offers better selection speed, accuracy, and throughput than eye-based techniques [1]. We invite attendees of SUI to see for themselves by trying out our system.

2 THE SYSTEM

The system presents a simple virtual environment based on the multi-directional tapping test detailed in ISO 9241-9. See Figure 1.

The demo runs on a VR-capable desktop or laptop and uses a FOVE. The FOVE includes two integrated infrared eye-trackers offering tracking precision of less than 1° at a 120 Hz sampling rate. It also offers IMU-based sensing of head orientation, and optical tracking of head position. Figure 2 depicts the demo setup.
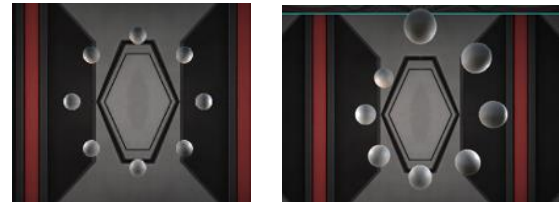
Figure 1. (Left) The software presenting the selection task. (Right) Same-sized spheres at varying depths.

Figure 2. The demo setup, using a desktop PC.

The software presents spheres in circular arrangement in the screen centre. After completing the FOVE calibration process, users select the orange highlighted sphere as quickly and accurately as possible. Selection involves moving the cursor (controlled by either the eye tracker or head orientation) to the target and pressing a key. A miss was determined by whether the cursor was over the target or not when selection took place.

Our recent study with the system used three fixed depths, plus mixed depths to add a depth component to the task. In the fixed depth conditions, all targets were presented at the same depth (5, 7, or 9 m from the viewer). In the mixed depth conditions, the sphere at the 12 o'clock position (the top sphere) was positioned at a depth of 5 m. Each subsequent sphere in the circle (going clockwise) was 10 cm deeper than the last. See Figure 1 (right).

This demo introduces attendees to a new experience of VR selection and provides an in-person comparison of head and eye-based selection. Full system details and the results of a first study are available in our forthcoming SUI 2017 paper [1].

REFERENCES

[1] Qian, Y and Teather, R. J., The eyes don't have it: an empirical comparison of head-based and eye-based selection in virtual reality, In *Proc. SUI '17*, to appear, October 2017.