Gaze and Gesture Based Object Manipulation in Virtual Worlds

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ABSTRACT

In this work we present a framework for enabling the use of both eye gaze and hand gestures for interaction within a 3D virtual world. We define a set of natural interaction mechanisms for manipulation of objects within the 3D space and describe a prototype implementation based on Second Life that allows these mechanisms to be used in that world. We also explore how these mechanisms can be extended to other spatial tasks such as camera positioning and motion.

Categories and Subject Descriptors

I.3.7 [Computer Graphics]: Three-Dimensional Graphics and Realism - Virtual reality

Keywords

virtual reality; gesture recognition; eye tracking; Kinect

1. INTRODUCTION

Motivated by interfaces depicted in films such as *Minority Report*, much attention has been placed on the use of spatial gestures for interactions in 3D virtual spaces [1, 2]. Research on natural gaze behavior and hand-eye coordination during object manipulation suggests that the use of gaze data, in addition to gesture based methods, may increase the effectiveness of performing these tasks in a virtual space.

2. ARCHITECTURE & INTERACTION

The system (Figure 1) provides two paths for user interaction: detection and recognition of 3D gestures and the tracking the eye gaze of the user. Together, these signals are used to trigger actions from a set of predefined mappings: from gesture / gaze to controllable events within the virtual space. These events are then realized within a particular virtual world environment using the mechanisms available in that environment.

We combine a "look at" mechanism for choosing objects with a handle bar metaphor[2] for object manipulation. Hand state is used as a trigger for selection and deselection of objects while eye gaze data is used to determine the object on which to apply the selection. Once selected, objects can be translated, rotated, and scaled by use of intuitive 3D gestures as shown in Figure 2. For translation, eye gaze is also used to locate a target position for the translated object.

Figure 1: System Architecture

Figure 2: Interaction Mechanisms

We have implemented a prototype of the system using a Microsoft Kinect sensor for gesture capture, a Mirametrix eye tracker to detect eye gaze and Second Life as the target virtual world platform. The prototype serves as a proof of concept and a framework for testing other kinds of interaction based on gesture and gaze (e.g. camera motion).

3. REFERENCES

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