Design and Development of a Virtual Reality Application to Introduce Gesture-Based Interaction

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Gesture-based interaction and Virtual Reality(VR) are two rapidly evolving technologies with a great potential to complement each other. VR benefits from gesture-based interaction since the hand tracking allows the user to see and use virtual representations of their hands. Gesture-based interaction benefits from VR by the possibility it provides to visualize the interface where the gestures are performed instead of on a screen in front of the user.

With a gesture-based interaction platform to start from, during this project VR applications were developed to make use of these potential benefits and introduce new users to a set of gestures. The gestures used are based on a cognitive model of holding a sphere in your hands and tapping on its surface. By using the hand tracker Leap Motion and the Head Mounted Display Oculus Rift the sphere shaped controller is placed in the user's virtual hands as seen in Figure 1. The thesis is a collaboration with Erghis Technologies AB who developed the concept of the sphere and software to track the gestures.

Gesture based interfaces are called natural user interfaces. A natural experience should be easy to understand and meet the users expectation to interactions. For the user to understand what interactions are possible the system shows the gestures on a video played in the virtual environment. After the short introduction the gestures can be better understood by using them and interacting with the system. The applications were designed to achieve this by making sure that the effect of each gesture is conveyed to the user and reinforced with feedback.

For the interaction loop to flow the gestures need to be reliably tracked. The gestures are easier to track when the hands are easy for the camera to see. By using visual cues for the users to position their hands in a way that can easily bee seen by the tracking camera and making sure that the gestures used are easy to detect, the users experience will improve.

Another important aspect for the users experience is that the hands position in the real and virtual world always match. To achieve this a mount and software released during the development of this thesis can be used to position the Leap Motion on the Oculus Rift. The move of the Leap Motion from the table to the HMD was an unforeseen requirement found at the end of development. The change in orientation had a negative impact on tracking reliability since the gestures of the sphere were poorly adapted to this new position of the camera.

The developed application "Control Sphere" got a very positive response from user evaluation and has seen more than 200 downloads. The gestures combined with the visual feedback was seen as an engaging method of interaction. A version of the application was created for a regular monitor and user tests confirmed that performing the gestures in VR was a more natural experience.
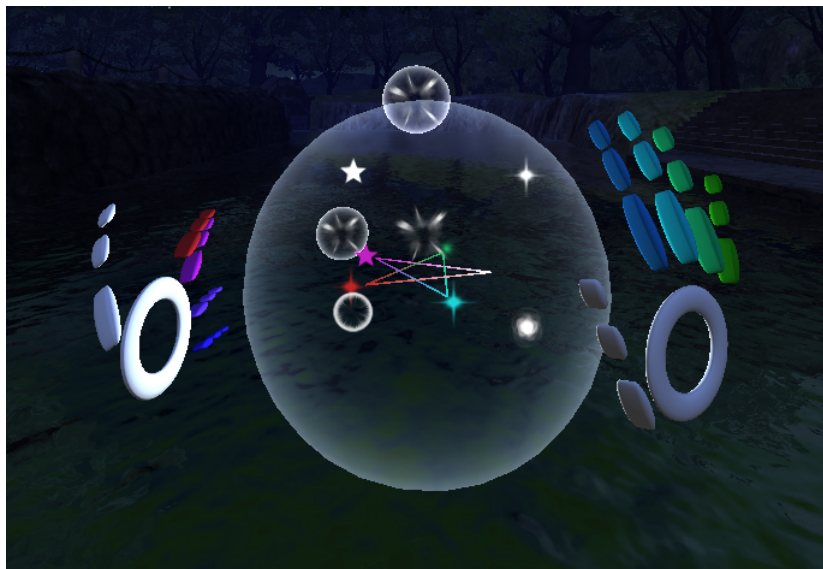

Figure 1: The Control Sphere placed in virtual hands