Abstract

Optical hand tracking technologies in Virtual Reality (VR) offer an exciting new method of human-computer interaction. Among the applications being explored, its use for education holds great promise. Gesture recognition systems are in development, but none have yet proven to support existing gesture collections such as American Sign Language (ASL). Fingerspelling is central to ASL and is often a challenge to ASL learners, so digital tools could assist them in the acquisition of this skill. This paper explores the use of a virtual reality serious game which utilizes optical hand tracking to teach the ASL alphabet. The question is posed whether the use of such a game will improve a player's ability to fingerspell.

The new "ASL Fingerspeller" game was developed for the Oculus Quest using state of the art software and hardware, the latest of which came to market in February 2020. The game utilizes a simple sign recognition system which defines a sign as finger positions and wrist orientation and is customizable to each player. The game challenges the player to fingerspell names and places using the ASL alphabet.

Evaluation evidence confirmed that the game was able to successfully teach the ASL alphabet to participants in the research and improved their fingerspelling ability over a short period of time. Online users and in-person research participants enjoyed playing the game and thought it to be a useful learning tool. Results from extended testing saw an average improvement in sign production rate of 60 percent within five uses of the game. Testing showed areas for the game's improvement including improving the capability to detect signs with crossed or hidden fingers. These results are illustrative yet with the caveat that since testing of the game was limited by Covid-19 related restrictions, sample sizes were statistically insignificant.

The research demonstrates the potential use of hand tracking for educational purposes. The technology is not yet capable of supporting full ASL vocabulary but can support most signs of the alphabet. The game may not promote development of fingerspelling skills in the same manner native

signers learn the skill, but it can be used as a starting point for new learners. Further research could explore the inclusion of more advanced gesture recognition systems, especially those that recognize dynamic gestures.

This research is some of the first conducted using the Oculus Quest's hand tracking technology, and its application towards education. The methods in this study could be used as an example for further research in the fields of hand tracking games, games about ASL education, and simple gesture recognition systems. As the technology develops, including becoming even more user-friendly and affordable, this project illustrates that the opportunities for new applications are extensive and exciting.