Reaction Time in Virtual Reality

Kennesaw State University

110 South Marietta Pkwy SE, Marietta, GA 30060

Nawal Ahmed
Computer Science Department
nahmed10@students.kennesaw.edu

Charles Nixon
Computer Science Department
cnixon18@students.kennesaw.edu

Zave Timsina
Computer Science Department
jtimsina@students.kennesaw.edu

Matthew Fissel
Computer Science Department
mfissel@students.kennesaw.edu

Carlos Lopez
Computer Science Department
clopez10@students.kennesaw.edu

Rafael Rosales
Electrical Engineering Department
rrosale1@students.kennesaw.edu

Abstract

The success of physical training and rehabilitation with the use of Virtual Reality has been studied extensively and the difference on a subject's cognitive factors has been measured after entering a Virtual Environment, but the transfer of skills gained in a virtual environment to a real-world activity is not well documented. This study investigates the effect of reaction time training in a virtual environment and the impact that the training has on a subject's reflexes in the real world. Test subjects were exposed to reaction-time training exercises and their improvement was measured. A baseline for each subject's reaction time was first measured through the subject's ability to evade dodgeballs thrown from various distances. Each subject's reaction time was measured by the percentage of avoided dodgeballs. The subject was then placed in a virtual environment where the subject was asked to perform the task of evading dodgeballs as a reaction-time training exercise for 30-minute sessions over the course of several days. The virtual environment was created using the Unity game development platform. The HTC Vive Virtual Reality System was used to provide user interaction with the virtual environment. Finally, each subject performed the baseline exercise and their reaction time was measured once again. The change on each a subject's performance was calculated and an average measure for the group was obtained. In average, subject's reaction time.....results and conclusion to be determined.....


Figure 1. HTC Vive Virtual Reality System

Introduction.

Virtual Reality has become a key tool for a variety of private professions. Virtual Reality based Training Systems (VRTS) may provide a valuable alternative to training when either the cost or possible negative consequences of exposing trainees to the real task environment are considerable (Nathanial, & Mosialos, 2010). Virtual reality Human Computer Interaction (HCI) is still a new field, however, and still needs some guidelines for designing in virtual reality. For example, when designing a computer program on a windows-based PC, the designer makes a few assumptions like that the user is aware that he is using a machine and that there are common peripherals used such as, a monitor, keyboard, and mouse. When a user is immersed into a virtual environment, the designer has to think about the different kinds of inputs. In the case of the HTC Vive, there are two SteamVR Tracking controllers and the dual AMOLED 3.6" diagonal screen headset. The headset uses "room scale" tracking technology, allowing the user to move in 3D space and use motion-tracked handheld controllers to interact with the environment. Few studies have evaluated how the human mind reacts to events while using the device. One assumption we can make is that the setup for the HTC Vive provides the user to have low reaction time and may be backed up by Fitt's Law since the screen is substantially closer to the user's eyes than a normal personal computer would be.

Literature Reviews

Since the virtual Reality has been introduced back in the 60's it has been improved so much to make it look same as present reality. According to Anshel, a Moor Insights & Strategy technologist and technical writer focusing on consumer platforms, HTC Vive is the best virtual reality device that is cheap and "premium". It is "premium" because of its amazing features such as best tracking system and designed controllers. Space perception in the Vive was comparable to real-world space perception when measured by blind-walking but slightly underperformed real-world perception when measured by verbal report. Furthermore, space perception in the Vive was more accurate when compared to older head-mounted-displays (HMDs) (Kelly, Cherep, & Siegel 2017). This leads us to hypothesize that one's ability to react will be different in a virtual environment as opposed to a real environment and that the ability to have low reaction times in virtual reality will result in even better reaction times in a real life environment doing the same task.

Methodology

We are interested in reaction times and their variance within both the physical space and the virtual one. In order to assess this, we are submitting our test subjects to a series of tests utilizing dodge balls and their ability to avoid being hit by them. These tests will take place over multiple distances and speeds, in order to determine the difference in reaction timing based on a variety of factors.

Participants

The initial sample size is fifteen participants. They will have no prior knowledge or experience with the HTC Vive System, in order to avoid any discrepancies caused by having a familiarity with the system, and how it works. The population sample will consist of students at Kennesaw State University, as that is the most readily available group available to us.

The subjects will be given a few minutes to familiarize themselves with the VR environment prior to the first time that they will use it, in order to gain a basic understanding of how to interact with and properly perceive the space that they are in.

Physical Tests

The tests outside of the VR System will be used as a reference point for performance within the VR Space. We will be conducting multiple tests from 5, 10, and 15 meters to allow for results with differing amounts of preparation for the subjects.

In recording the data for these tests, we will have a multiple camera set-up, to determine the reaction time with greater precision, and as a way to have a greater record of the tests.

VR Tests

When performing these tests in the VR Space, we must establish an adequate manner of tracking whether the subject is able to react and dodge the object. To track this, we have created a "hit box" that is created through tracking the head mount and the two controllers and creating a triangle within the three. If the ball thrown hits this triangle, it is registered as a hit, and therefore deemed that the subject is unable to dodge the object.

We will be recording these sessions as well, to further analyze them side-by-side with the tests done in the physical space.

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