Summer 2015

The Development of an Eye-Tracking Program to Examine Working Memory During Gameplay

Jett Bagley
Po-Lei Lee
Yolanda Rankin

Follow this and additional works at: http://digitalcommons.auctr.edu/scgstempst

Part of the Science and Technology Studies Commons

Recommended Citation
Bagley, Jett; Lee, Po-Lei; and Rankin, Yolanda, "The Development of an Eye-Tracking Program to Examine Working Memory During Gameplay" (2015). G-STEM Posters. 11.
http://digitalcommons.auctr.edu/scgstempst/11
The Development of an Eye-Tracking Program to Examine Working Memory During Gameplay

Jett Bagley
Dr. Po-Lei Lee, Dr. Yolanda Rankin
Computer Science

Introduction

In this experiment we work to examine brain activity and cognitive resources, by using a visual resource (virtual game of Mahjong) to study human working memory. Working memory is the process used to manipulate and maintain information so that the information can be used to carry out tasks (Baddley, 1974) Many studies have shown that performance on working memory tasks are able to be correlated with performance on reading comprehension, intellectual aptitude tests, general intelligence, reasoning skills factors, and even moral judgments (Daneman & Carpenter, 1980; Oberauer, Wilhelm, Schulze & Sub, 2005; Kane & Engle, 2000; Kyllonen & Christal, 1990; DeCaro, Thomas, & Bellock, 2006; Moore, Clark & Kane, 2008). Furthermore, poor visual working memory, the small amount of visual information held in the mind to carry out cognitive tasks, has been connected to disorders like Attention-deficit/hyperactivity disorder (Castellanos & Tannock, 2002; Rapport, Alderson, Kofler, Sarver, Bolden & Smi, 2008).

It is possible that cognitive differences influence individual eye movement differences. For example, differences in intelligence, speed of processing, or working memory can influence the speed and direction of the eye during tasks.

Materials and Methods

Materials

We used a Shielded room, 12-Channel EEG System, Eye Tribe Eye Tracker, Dell P Series 22 inch 1680 x 1050 Monitor, 2 Toshiba Satellite 15.6 inch Netbooks, and Standard Computer Mouse to complete the experiment.

Methods

In creation of the eye-tracking program, the coordinates are passed from the Eye Tribe Gaze API. They are then filtered to account for off-screen glances, blinks and any other user disengagement with the screen on which the game is being played. Each coordinate is time stamped for later use when it is being matched with the screen capturing of the game and EEG signal being recorded.

Results

At start time, the program writes its connection to the Eye Tribe Tracker system. The program then sets constraints of the eye coordinates it will receive based upon the size of the display. The real-time coordinates of the participant’s individual eyes are captured, as well as the overlap between the two eyes that represents the participant’s point of gaze. The gaze coordinate along with a timestamp are stored every 1/45 seconds. Below is a sample of the capturing code to these functions.

Summary & Conclusion

The study sought to determine if a relationship exists between individual differences in working memory, eye movement measures, and EEG signals. To determine if a correlation could be found, a working memory game was administered to participants while their eye movement and brain activity was monitored. My specific role was to create the code used in the eye-tracking program.

Overall, the program efficiently and accurately stored the gaze data of the participant. The program written to track eye movement was accurate up to the 45 frames per second capturing rate limit defined by the Eye Tribe monitoring device used. These technical limitations, limited the accuracy during rapid eye movement. In addition, the program was able to capture only eye movements across a standard desktop monitor screen. Inability of recording coordinates beyond the screen. In result, further iterations of this experiment require faster capturing and larger monitoring capabilities to produce relevant results. The program produced could also be used for other studies in which eye movements need to be captured from participants. For example, in research for the development of tools to be used by patients with limited head eye movement, able-bodied people are often used for testing. This program could be used to ensure testing participants stay with the limited eye movements that replicate patients with disabilities.

Acknowledgments

The code used to track eye movement was written using the Visual Studio Development environment. It was continuously tested and peer reviewed to ensure eye coordinates captured reflected the X and Y coordinates of display device. Once the screen capturing program was selecting, the code was updated again to have the capturing boundary as the screen capturing software.