

Exploring Nonverbal Behavior Interactions of Virtual Problem Student Avatar Using Eye-Tracking in Virtual Teaching Simulation

Kukhyeon Kim
Chonnam National University
rnrgus6226@naver.com

Sun Kim
Chonnam National University
sunkimkimsun@gmail.com

Abstract: The aim of this study was to explore nonverbal behavior interactions of virtual problem student avatar in virtual teaching simulation using eye-tracking. Recently, eye-tracking measures are being used as a research method to measure an interaction, because it helps to analyze data objectively. The virtual teaching simulation of this study was developed similar to the real classroom environment in order to increase the immersive perception. The problem situations were divided into two serious levels depending on the students' problem behavior: 1) a mild level, 2) a serious level. The total sample size of this study was 46 participants. Through this study, two findings were revealed. First, the fixation duration on the face was significantly higher, both at mild and serious degrees. Second, the fixation duration on the face in a serious degree was significantly more visible than a mild degree at the critical level.

Keywords: Virtual problem Student Avatar, Eye-tracking, Virtual Teaching Simulation

INTRODUCTION

Simulation is widely used as a training program in areas such as health care, military and management (Stavroulia, Makri-Botsari, & Kekki, 2014). Simulation can be described as a technology to recreate features and experiences of the real world (Gusie, Chambers, & Valimaki, 2012). These simulations allow learners to learn again in a safe environment and to learn anytime and anywhere. This simulation of a virtual reality class gives teachers a sense of immersion, allowing them to feel similar to the real class environment (Stavroulia et al., 2014).

Recently, eye-tracking is seen as a tool used to measure interactions, which can provide information about the process of internal cognitive thinking by giving directions of vision. Visual movement is a way to objectively explore the reactions of a person and is an indicator of a learner's attention concentration quantitatively. (Israel & Duffy, 2009). Eye fixation duration, eye-fixing time, is an important observation in the visual tracking study, which refers to the time at which the learner's gaze is observing a specific position in the learning material. (Olsen, Smolentzov, & Strandvall, 2011).

METHOD

participants

The total sample size of this study was 50 participants, but 46 samples can be used because four participants who fail to access to calibration, eye-tracking technology, were excepted on this study

analysis. The gender ratio of participants was 25 males (54.3%) and 21 females (45.7%). The average age of participants was 22.89 years. 25 participants have experienced HMD (Head Mounted Display) in 3D VR (Virtual Reality) environment. They are recruited through google drive and participants were paid for their involvement in this study.

Experiment Materials and Design

For the experiment, virtual problem student avatar called "Bae Doa" is used, which is abbreviation of the word 'Behaviorally Aggressive and Emotional Disorder Operational Avatar'. For the purpose of eye tracking, AOI were divided into five sets on the avatar: 1) face, 2) right arm, 3) torso, 4) left arm, and 5) others. The figure 1 shows the AOI on the problem student avatar, Bae Doa.

The virtual classroom situation was developed similarly to actual classroom. The problem situations were divided into two degrees: 1) a mild degree, 2) a serious degree. The mild degree was based on rude behaviors distracting instruction by asking irrelevant questions. The serious level was based on acts challenging the authority of teachers, and representing a verbal provocation.

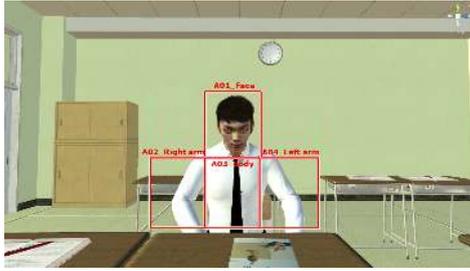


Figure 1. AOI on 'Bae Doa'

Experiment setting and Procedure

This study was conducted in an experiment lab. Before starting the experiment, the participants signed a consent form and filled out a background survey. A moderator explained the experiment and trained the participants to practice conversation with the problem student avatar, as a Korean history teacher. They were required to persuade the problem avatar to concentrate on the lesson.

After experiment preparation, the moderator sat beside the participant and, according to the participant's responds, controlled the problem student's rude behavior or dialogue depending upon the degree of problem by pressing the keys that were recorded. Figure 2 presents the scene of experiment.



Figure 2. Scene of the experiment with a participant

While the conversation continued, FOVE recorded fixation duration on AOI. Figure 3 shows calibration process. The order of two degree conversations were implemented alternately. Twenty-three participants initially went from a mild degree to a serious degree and the other twenty-three ones were in the opposite order. The experiment took about 20 minutes.



Figure 3. Calibration process

Data collection and analysis

For the data analysis, repeated measure ANOVA is used and compare fixation duration with two levels.

SPSS 23 was used for analysis of experimental data and the significance level was set to .05.

RESULTS AND DISCUSSION

Through this study, two findings were revealed. First, the fixation duration on the face was significantly higher, both at mild and serious degrees. Second, the fixation duration on the face in a serious degree was more significant than a mild degree at the critical level. The figure 4, 5 shows the graphic comparing fixation duration on two degrees. This result indicated facial expression might be the most important factor developing avatars in virtual reality.

This study has several limitations. First, the avatar's narration is limited 23 ones, which might not help the participants interact actively with the avatar. Second, only one avatar, Bae Doa, is in the classroom.

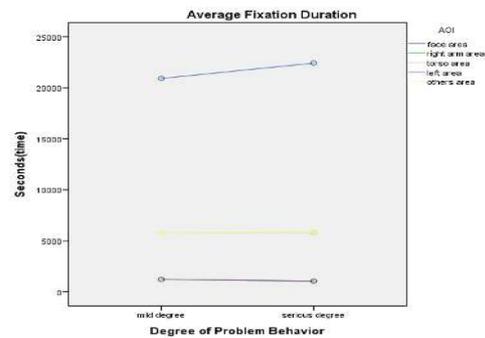


Figure 4. Average Fixation Duration on AOI

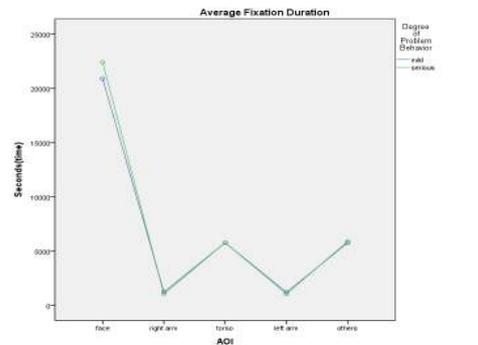


Figure 5. Average Fixation Duration on Degree of Problem Behavior

REFERENCES

Guise, V., Chambers, M., Valimaki, M. (2012). What can virtual patient simulation offer mental health nursing education?. *Journal of psychiatric and mental health nursing*, 19(5), 410-418.

Israel, S. E., & Duffy, G.G. (2009). *Handbook of research on reading comprehension*. New York: Routledge.

Lee, Yongjin, L., & Jeeheon, R. (2017). Exploratory Study of Eye-Tracking Data on Students'

Attention in Instructional Video. *Korea Educational Review*, 23(3), pp.5-33.

- Olsen, A., Smolentzov, L., & Strandvall, Y. (2010). Comparing different eye tracking cues when using the retrospective think aloud method in usability testing. *In proceedings of the 24th BCS Interaction Specialist Group Conference* (pp. 45-53). British Computer Society.
- Stavroulia, K., Makri-Botsari, E., Psychairs, S., & Kekkeris, G. (2014). Using simulations as a tool to enhance classroom management practice. In *Proceedings of the International Conference on Information Communication Technologies in Education*.