The Characteristics of Users' Perspectives in 360-degree VR Discussion Video by Observation Type

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Abstract

The purpose of this study is to explore how the observation type of discussion learning videos implemented as 360-degree VR videos affects the characteristics of users' perspectives. For this study, eight participants were recruited and randomly assigned to the participatory observation group (n=4) that provided verbal and non-verbal attention cues and participant intervention, or to the general observation group (n=4) that observe the video at 360 degrees without clues. According to this experiment, in the participatory observation group, the pupil size by time was smaller and more stable than in the general observation group, whereas the pupil size of the general observation group was larger. In addition, the participatory observation group showed a wide gaze in VR video at a certain height, and the general observation group had a narrower gaze than the participatory observation group. Based on this, 360-degree VR videos illustrated different characteristics of perspectives depending on the observation type. This implied that it is necessary to develop 360-degree VR for education in consideration of observation type and learning contents.

Keywords: eye-tracking, discussion learning, visual perspectives, 360-degree VR

Introduction

360-degree videos are recorded with omnidirectional or multi-camera systems enabling to simultaneously capture all directions and perspectives (Ranieri, Luzzi, Cuomo, & Bruni, 2022). However, 360-degree VR video has the inconvenience of continuously focusing on the intended target and refocusing on other targets (Lin et al., 2017). If the users feel uncomfortable observing the video, the intention to use it continuously decreases, and the learning effect decreases. Therefore, the type of observation the 360-degree VR videos presented to the learner intends and strategically guide the target to be focused on is an important consideration for the educational use of the 360-degree VR videos. Through this study, it is expected to present the implications for the development and application of 360-degree VR that are used educationally.

Methods

Participants

Participants in the experiment were 8 college students and graduate students (male = 1, female = 7), and randomly assigned to the participatory observation group (n=4) and the general observation group (n=4).

Discussion Learning video based 360-degree VR

The 360-degree VR video content was a part of a discussion on the pros and cons of the death penalty system, and features one host, two pro-debaters, and two anti-debaters . Debaters question and refute the opponent's

arguments after making arguments with or against the abolition of the death penalty. The discussion video was shot with Insta360 Pro 2, and there were two types of videos depending on the observation types. The running time of each video was about 10 minutes.

Observation Types (participatory observation vs. general observation)

The participatory observation video was filmed in a hemisphere form and the participant was assigned the role of a judge and he or she looked at the debaters from the perspective of the judge. Debaters provided verbal and non-verbal attention clues such as constantly giving eyes to the participant and asking some questions. On the other hand, in the general observation video, debaters interacted without providing clues. Participants in the experiment in the general observation group had to continue to change their focus to identify the debaters and hosts because they were arranged in a sphere form of him (her) when observing the 360-degree VR video.

Data Collection and Analysis

The participants wore VIVE VR headsets and observed 360-degree VR videos, and the real-time gaze data of participants were collected through iMotions. After the experiment, some eye tracking data onto each participant's time stamp was extracted from iMotions. Thereafter, the time stamps were aligned equally, and then eye tracking data were analyzed.

Results

Pupil Size

The pupil size of participatory observation participants has a large range of changes and then stabilizes after about 230,000ms. Following the timestamp, there was an individual difference in the pupil size for each participant, but excluding outliers, it was approximately 0.0005 to 0.0010. The pupil size of the general observation group could also be found to be stable after about 180,000ms. After the timestamp, the range of pupil size for each participant was approximately 0.0010 to 0.0020, excluding outliers. Through this, it took 3 to 4 minutes for both groups to adapt to 360-degree VR, and the pupil size changes of the general observation group were greater after the stabilized timestamp than in the participatory observation group.

Position of Gaze

The range of the x value of the gaze of the participatory observation participants was about 1,100 to 1,500, and the range of the y value was about 500 to 800. In addition, the x-value range of the participants of the general observation group was about 900 to 1,500, whereas the range of the y-value was about 400 to 900. It was observed that the range of the position x value of the gaze was larger than that of the general observation group, and the range of the position y value of the gaze was larger than that of the participatory observation group. Put differently, the perspectives of the general observation participants have a short range of horizontal gaze. Furthermore, the participatory observation participants observed the 360 VR video as a whole with a certain height composition, while the general observation participants observed the video based on the focused object.

Fixation duration

The total average value of fixation duration of the participatory observation group was 279.85ms (SD=217.55), and the general observation group was 265.83ms (SD=240.69). The participatory observation group's fixation duration

was longer when compared with the general observation group.

Conclusion

In the participatory observation group, the pupil size of the participants by timestamp was smaller and more stable than that of the general observation group. This means that there was no significant change in cognitive concentration when the participants of the participatory observation group watched 360-degree VR videos. Also, the participants in the general observation group felt more difficult in cognitive processing while watching VR vidoes. In addition, the range of the participatory observation participants' gaze was positioned widely throughout the debaters at a certain height. In the general observation group, the position of gaze was focused on one or two objects. This shows that the participatory observation group tended to look around with time in observing 360-degree VR, and the tendency of the general observation group was weaker than the participatory observation group.

Based on the above discussion, the following conclusions could be made. First, the clues for assisting the participants' focus in 360-degree VR can affect the learners' visual perspectives. Second, when developing 360-degree VR for education, it is necessary to consider the content of VR and the type of learner's observation.

References

Lin, Y. C., Chang, Y. J., Hu, H. N., Cheng, H. T., Huang, C. W., & Sun, M. (2017, May). Tell me where to look: Investigating ways for assisting focus in 360 videos. In Proceedings of *the 2017 CHI Conference on Human Factors in Computing Systems* (pp. 2535-2545).

Ranieri, M., Luzzi, D., Cuomo, S., & Bruni, I. (2022). If and how do 360° videos fit into education settings? Results from a scoping review of empirical research. *Journal of Computer Assisted Learning*. http://doi.org/10.1111/jcal.12683