User Interface Design of E-learning: Focused on the Automatic Speed Control of Multimedia Material by Learner's Head Angle

Minjae Park[1], Joohee Kang[1], Seongwon Park[1], Kwangsu Cho[*]

[1] Sungkyunkwan University,
25-2, Sungkyunkwan-ro, Jongno-gu, Seoul 110-745, Korea
[2] Graduate School of Information, Yonsei University,
50, Yonsei-ro, seodaemun-gu, Seoul 120-749, Korea
{vrotoss, kangjooing, seongwon.ellie.park, kwangsu.cho}@gmail.com

Abstract. There are no previous experimental researches of the automatic speed control based on NUI and distinguish note-taking with watching lecture by nodding. This research conducted two experiments. First of all, in experiment 1, there were quite relevancy between participant's head down and note-taking. Second, nodding below 2 seconds had no relations with note-taking. In experiment 2, the automatic speed control of multimedia material E-learning system reported less learner control than the regular E-learning system.

Keywords: E-learning, Natural User Interface, NUI, Head Gesture

1   Introduction

According to predictions made by Tech Navio, USA, global E-learning market will grow 7.9 % over the period 2012-2016 [1]. In the future, on-line learners will be increased, because of advanced technology such as smart mobile devices and learning network. The characteristic of media learning makes individual learner empower to do self-directed learning and allow learner to take more responsibility for various decisions associated with the learning endeavor and satisfaction [2]. Moreover, media player allows students to interact with lecture. For examples, students manipulate a keyboard or a mouse to put pause and backward button on media player. Recently, the fields of education promise that the adoption of new interaction paradigms, Natural User Interface (NUI). It is promising direction towards more natural and effective learning experiences [3]. The NUI environment enables learners to handle the media interface via natural gesture in accordance with intrinsic pattern of behavior [4]. John and Steve (2008) demonstrated that 47% of the students mentioned that the purpose of using 'pause button' is for note-taking, and 63% of them said that the purpose of using 'backward button' is for go over material that was not clear[5]. In other word, controlling media player during watching lectures is an important feature in media learning. Chou & Liu (2005) reported that learner control is related to learning

---

[*]corresponding author

effectiveness and learning satisfaction [7]. Because the media control is for adjusting the speed of media to learners and allowing them to take a note easily, it is important for learning effects [8]. Diverse studies reported that learning through NUI more enhance the learner's sense of presence and enhance the flow rather than the regular learning interface [4]. There are no previous experimental researches not only suggest a new way of using 'Pause and Backward' functions based on NUI and distinguish situations of note-taking with those of watching lecture. The purpose of this study is to research the effect of controlling media material automatically, like a NUI, on learners.

Research Question1: Does the leaners' head angle distinguish the situations of note-taking with those of watching lecture?

Research Question2: Does the automatic speed control of multimedia player by learner's head angle have an effect on learner's satisfaction?

2   Literature Review

2.1 Interaction in E-learning

Interaction is one of the key elements to influence learning. Moore (1989) has identified three types of interaction that are important in learning: learner-content interaction, learner-instructor interaction and learner-learner interaction [9]. As the computer technologies emerge, learner-interface interaction is proposed as an additional important interaction in E-learning [10]. Because learner-interface interaction is a process of manipulating tools to accomplish a task, using 'pause and backward' button is an element of learner-interface interaction [11]. Therefore, learner control has effect on a variety of concepts for examples, goal and content selection, time management a scale of tasks, etc. [12].

2.2. Natural User Interface

The advance of computing technology has affected on the way of human-computer interaction. Nowadays, NUI (Natural User Interaction) has highlighted intuitive actions. Gesture recognition is considered with a representative example of NUI. [13]. The development, especially use head gesture among various body gestures, is prevalent in the field of study about drowsiness [14]. Furthermore, it is also has studied for disabilities [15]. In the field of education, learner-computer interaction through gesture is frequently used for E-training. E-training refers to education training that acquires and enhances the necessary capabilities to perform tasks by using communication and information technology, such as virtual reality and augmented reality, and device, such as head mounted display. It allows learner to increase their sense of flow and presence as they experience participatory learning system [5].

Through the previous research, learner-interface interaction via natural gesture will effective to learning. This research designed the automatic speed control of media material system by learner's head angle, without a direct manipulation using a mouse or keyboard in order to put 'pause and backward' button, and analyzed effectiveness of this system for learners.

3   Research Methodology

In this research, we conducted two experiments. In experiment 1, it was measured that participants' nodding time and head angle in order to analyze relevancy between a note-taking and a nodding. Experiment 2 was going along, after the result of experiment 1 had been confirmed. In experiment 2, how automatic speed control of multimedia material affected to the number of backwards and pause buttons control in regular E-learning system.

3.1   Experiment 1

Ten participants took part in experiment 1. Six of them were male and four of them were female. And five of them were university students and five of them were graduated students. All Participants watched a lecture via a 21 inches monitor, and there were no limitation for using a keyboard and a mouse. There is an A1 size side-striped paper on the wall beside the participant. The number of participant's head-down was counted. These were analyzed how many times participant's do head-down and note-taking at the same time. All experiment process was recorded by video clips. The lecture subject was English by a famous TOEIC instructor. English grammar content was chosen because there is a large number of note-taking in grammar lecture and note-taking is very important in grammar lecture. And English is one of the popular subjects in Korea. The Gom player was used as a media player for E-learning because it is most popular media player in Korea and easy to control buttons. In the Gom player, playback speed was increased when the button 'x' pushed and playback speed was decreased when the button 'c' pushed.

3.2   Experiment 2

All participants experienced both the A session and the B session of experiments in a within-subjects design. In the A session, participants studied the lecture as usual in a regular E-learning system. And In the B session, participants studied the lecture in the system with the automatic speed control of multimedia material. Twenty participants took part in experiment 2. Sixteen of them were male and eight were female. And fifteen of them were university students and five were graduated students. Researchers controlled the playback speed depending on the angle of participant's head angle. When the participant get lower his head, researcher controlled the playback speed to 0.8x. It was 0.2 times lower than the lecture's normal speed. After the participant raised his head, the playback speed was returned. The A1 size side-

striped paper beside of the participant was used to identify the head angle. Two researchers observed in the same time, and four researchers reviewed the video clip.

4   Results

4.1   Experiment 1 Result

In Experiment 1, we counted how many times they were nodding. And it was checked whether participants took a note or not in duration of head down.

First of all, there were quite relevancy between participant's head down and note-taking. Participants were taking notes, checking the spelling and grammar or preparing their own note-taking. But some nodding was unrelated. For example, some participants were nodding to give a nod of agreement and to pick up a pen. Participant's nodding timing and the number of times varied each other. But it was for note-taking that participants got lower their head more than about two seconds.

Besides, nodding below 2 seconds had no relation with note-taking. It was just checking their note-taking or nodding for agreement. In duration of head down below 2 seconds, only 5% participants take a note. And in duration of head down more than 2 seconds and below 5 seconds, 62% participants take a note. But in duration of head down more than 5 seconds, 89% participants take a note. Also in duration of head down more than 2 seconds and below 5 seconds, participants do a short note-taking. So the table provides that the minimum-time applying automatic speed control system of multimedia material is 2 seconds.

4.2   Experiment 2 Result

Table 1 shows a comparison between regular E-learning system (A session) and E-learning system with the automatic speed control of learning material (B session) on use of a media player's pause and backward buttons. In the A session, ten participants pushed pause and backward button. Total comes to thirteen times and average is one time per participant. In the B session, only one participant pushed backward button one time.

The proposed system with automatic speed control of multimedia material in E-learning environment reported less learner control than the regular E-learning system.

5   Conclusion

This study has demonstrated for the first time, the research revealed that the situation of learner's head down while watching lecture is related to the situation of note-taking. Second, nodding within 2 seconds is not relevant to a situation of note-taking. Third, in the situation of the automatic speed control of multimedia material E-

learning system, the number of using pause and backward buttons has dramatically decreased.

This research can suggest not only the effect of NUI but also improvement points to researchers as well as developers and companies in E-learning environment.

However, our research has several limitations. First, all participants are twenties. Second, there are few learning materials.

In the future, this research has to analyze data with more diverse learning materials and participants. And it is necessary to use actual device embedded the automatic speed control of multimedia material. At present this device is in progress of create, therefore future work is needed to perform experiments on a device with the automatic speed control of multimedia material for more elaborate experiments.

References

1. Tech Navio: Global E-learning Market 2013-2016. Infiniti Research Limited (2013).
2. Knowles, M.S.: Self-directed learning. New York: Association Press (1975).
3. Cantoni, V., Cellario, M., Porta, M.: Perspectives and challenges in E-learning: towards natural interaction paradigms. Journal of Visual Languages & Computing, vol. 15, no. 5, pp. 333-345, (2004).
4. Lim, C. J., Lee, N. H., Jeong, Y. G., Heo, S. I.: Gesture based Natural User Interface for E-training. Journal of the Ergonomics Society of Korea, vol. 31, no. 4, pp. 577-583 (2012).
5. Bassili, J. N., Joordens, S.: Media Player Tool Use, Satisfaction with Online Lectures and Examination Performance. Journal of Distance Education, vol. 22, no. 2, (2008).
6. Chou, S. W., Liu, C. H.: Learning effectiveness in a Web-based virtual learning environment: a learner control perspective. Journal of Computer Assisted Learning, vol. 21, no. 1, pp. 65-76, (2005).
7. Hong, D. P., Woo, W. T.: Recent Research Trend of Gesture-based User Interfaces, Telecommunications Review, vol. 18, no. 3, pp. 403-413, (2008).
8. Kearsley, G., Moore, M.: Distance education: a system view. California: Wadsworth, (1996).
9. Hillman, D. C., Willis, D. J., Gunawardena, C. N.: Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. American Journal of Distance Education, vol. 8, no. 2, pp. 30-42, (1994).
10. Williams, M. D.: 33. Learner-control and instructional technologies (1996).
11. Niemiec, R. P., Sikorski, C., Walberg, H. J.: Learner-control effects: A review of reviews and a meta-analysis. Journal of Educational Computing Research, vol. 15, no. 2, pp. 157-174 (1996).
12. Wigdor, D., Wixon, D.: Brave NUI world: designing natural user interfaces for touch and gesture. Elsevier (2011).
13. Vural, E., Cetin, M., Ercil, A., Littlewort, G., Bartlett, M., Movellan, J.: Drowsy driver detection through facial movement analysis. In Proceedings of the IEEE international conference on Human–Computer Interaction, pp. 6-18. Springer Berlin Heidelberg (2007).

14. LoPresti, E., Brienza, D. M., Angelo, J., Gilbertson, L., Sakai, J.: Neck range of motion and use of computer head controls. In Proceedings of the fourth international ACM conference on assistive technologies, pp. 121-128 (2000).