CptS 543 Assignment #2

Critical Review of Improving User Experience of Eye Tracking-Based Interaction: Introspecting and Adapting Interfaces

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Summary. This article is mainly to propose a new input approach of interface introspection and adaptation under Web environment, in order to reduce the interaction and visual overhead. To begin with, the authors gave brief background information about eye-tracking input methods including gaze-based pointing and typing, and emulation of mouse and keyboard. Also, considering on improving web accessibility with gaze-based interaction, the authors argued that the interface introspection and adaptation can plays an important role on adapting interaction for input method of eye tracking in terms of the challenges such as precision and accuracy of eye-gaze estimation and the double duty of eye-gaze input. Moreover, the authors provided methods including reducing the input action and the inspection overhead to improve the users experience of gaze interaction.

Besides, the authors continued to propose a methodology in GazeTheWeb to improved gaze interaction experience through applying interface introspection to retrieve the semantics and also adapt the interface of Web elements. In order to check the effectiveness of the improvement on users experience compared to emulation methods, a task-focused lab study with 20 participants had been conducted. The lab study aims at testing the completing time of browsing tasks and gather comments within the participants when they used GazeTheWeb and OptiKey associated Google Chrome. Results show that users spent less overall task completion times and have better experience when they use GazeTheWeb compared to OptiKey associated Google Chrome. Furthermore, another controlled lab study about testing long-term usage of GazeTheWeb in home environment was conducted in order to checking the feasibility of GazeTheWeb. Results show that GazeTheWeb is feasible on the accomplishment of daily browsing activities among people with motor impairment.

Critical Review. Three authors have been listed for this research including Raphael Menges, Chandan Kumar and Steffen Staab. Raphael Menges used to be the project lead of Institute for Web Science and Technologies which researched about capturing Web sessions of the University of Koblenz. Moreover, he is one of the researchers of UDeco Research Projec at Analytic Computing in the filed of Web. Chandan Kumar, a researcher, is leading a group in the filed of human-computer interaction and artificial intelligence in Analytic Computing, and he used to be a researcher in Interactive Web and Human Computing at the institute for web science and technologies of University of Stuttgart. Furthermore, he earned his Ph.D. in Computer Science from the University of Oldenburg. As for Steffen Staab, he is the chair for Web and Computer Science at University of Southampton since 2015. Before that he was a professor on databases and information systems at Universität Koblenz-Landau.

All of the authors have a great deal of experience in the field of Web and Human-computer interaction; specifically, both Raphael Menges, Chandan Kumar are researchers in institutes and Steffen Staab is professor working for universities in the field of Web. It means that the paper has a certain authority. However, based on my researchers, only Chandan Kumar established with extensive experience in this area of human-computer interaction, while other two authors are specifically pioneers on Web. This may cause bias since Chandan Kumar's word is one-sided.

One weakness of the article is that the researchers did not conduct experiments about other usual Web behaviors such as looking for pictures when they evaluated between GazeTheWeb (GTW) and OptiKey with Google Chrome (OK). To explain, in the study, the authors only conducted a lab study which is mostly about searching and typing. As we can see from the screenshots of both systems from

the first evaluation, GTW adapts Web page interaction elements in the left and right side, while OK's interaction elements only are placed on the very top side. Obviously, GTW sacrifices screen horizons to reduce workload; however, the evaluation tasks including searching and typing do not related to screen horizon. Which may causes biases on the results. The most common way to test screen horizon is video-watching. However, the author had explained the reasons, which is related to the limitation of OK. Therefore, my suggestion is to add another task about screen horizon such as looking at pictures.

Another obvious weakness is about the second phase trials of the MAMEM project. As there are only 30 participants, the sample number could be a significant problem of generating reliable results. What is more, among these participants, 20 are from Greece with 12 males and 8 females and 10 of them are Israelis with all males. To explain, with such a small sample number of participants and such a unequal number of different genders, it would be hard to generate convincing data form the project. Furthermore, the project used Greek to represent layout with left to right direction of text and used Hebrew to represent layout with right to left direction of text. As we known that there are many differences within two languages even thought they are write in the same direction. Therefore, using these two language as writing layout can not represent all of writing layout. At least, there should be some participants who use English text layout since English is a worldwide language.

Integration with Related Work. Comparing to previous works, this paper proposed a new approach of using interface semantics to adapt interaction in Web environment. Same to aim at helping disable people, in the previous paper of Lupu, Bozomitu and Ungureanu et. al (2011), they developed a new technology that can be applied to have communication with major neuro-locomotor disability people. This technology can help those who are disable to communicate verbally through tracking people's eyes. Another related work is the paper of Chin, Cremades and Adjouadi (2008), they researched a system that combines electromyogram signals from face muscles and eye-gaze tracking signal. They found that the system can help disable people control cursor effectively because there are no limitation on simulating a click and on spatial accuracy. According to this paper, fitted it in developing Web, it would be a useful method to reduce eyes' workload by tracking eyes as well as recognizing face. What is more, the paper that published by Chandra, Sharma and Schindler et.al (2015) explored that the eye-tracking results of human and computer interaction (HCI) are independent from whether people wear bifocal glasses or not. Fited in the paper of Menges et al. (2019), Mengers et al can ignore the effects of bifocal glasses when they conducted the first lab study.

After the paper had been publish, several works has explored the topic further. To explain, one of those further work is in the paper by Li and Hu (2020), the authors preliminary develop a eye-tracking assisted interaction system to achieve e-shopping rather than achieving simple browser tasks, and they found that eye-tracking HCI not only can reduce workload and completing speed of tasks but also increase users' focus of the tasks.

Implications for HCI. A major implication for HCI researchers is that the article proposed introspection method to retrieve and adapt the interface semantics of Web pages. Before the article was published, HCI researchers only knew to emulate mouse and keyboard functionality, and there is

no such a Web system applying introspection and adaptation of an WEB interface. After the article had been published, researchers would clearly know that introspection method in WEB development is more acceptable than emulation method. Therefore, rather than keeping researching on interactions that mimic mouse and keyboard, the article explored a new direction on eye-tracking input in Web.

One main implication of the article for HCI practitioners is that it leads HCI practitioners to apply introspection and adaptation method in Web interface. Comparing to emulation method, as the article shows, applying introspection and adaptation method in Wed has higher rate within users in terms of task completion time, perceived workload and usability. As a results, HCI practitioners get the sense that introspection method can bring better user experience than the traditional emulation method. In this case, they would tend to be more willing to develop Web UI implementing the method as the article proposed than applying emulation method in terms of eye-tracking input.

One of the implications for users of the technology is that the article points what kind of eye tracking-based interaction method in Web can enhance user experience. For this reason, users of the technology, especially those disable people, can have the sense to choose the Web UI applying with introspection and adaptation method. Such that they can have nice user experience. What is more, they are also benefit form the implication for HCI practitioners. To explain, as more and more practitioners think highly of the new method, there would be more UI that applying the introspection and adaptation method. Due to this reason, users' experience can be improved indirectly.

References

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