Experimental Evaluation of Gaze Based Tracking Interaction

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ABSTRACT

In this work, a new style of interaction that uses eye tracking device thus replacing traditional input devices is realized. Analysis of relevant research along with some interactive systems based on eye tracking enabled us to design a number of new gestures, which has to be conducted by user's eyes in order to successfully execute specific instruction, thus providing easier and more natural interaction with computer. According to quantitative and qualitative measures acquired during experimental evaluation, it can be concluded that the feedback achieved from test users during usability testing matches assumed meaning of designed gestures.

KEYWORDS

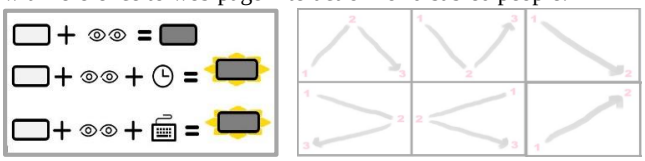
multimodal interfaces, eye tracking, usability testing

EXTENDED ABSTRACT

While graphical user interfaces (GUIs) use metaphors and base interaction on traditional input devices such as keyboard and mouse, multimodal interfaces enable more natural input modalities (visual, auditory, tactile). The research of existing eye tracking systems was conducted along with a study of related research papers to gain information about already existing gestures [1,2]. The aim was to design a number of new gestures conducted with eyes which can help disabled people in their interactions with computer, given that sometimes, due to their incapacities to use keyboard and/or mouse, are excluded from social interaction. These gestures can be used as a standard set of commands comparable to the traditional ways of interaction mechanisms in GUI interfaces, specifically pointing device and keyboard.

Consequently, we designed, implemented and evaluated a set of gestures based on eye tracking technology and we believe that in such way an easier navigation for end users is provided. Designed gestures are divided in two groups. The first group refers to user's eyes, which are simulating commands conducted with a pointing device, in particular pointing and clicking (see Fig. 1a). Pointing gesture is shown in the first row, while second and third rows present two different ways of clicking commands (*object + gaze = pointing, object + gaze + time/key = clicking*). These commands should enable user to familiarize with a scope of eye tracking functions. The second group represents newly designed gestures, (Fig. 1b) assumed to provide easy navigation through the interface. During a design phase, four diagonal directions were used along with one or two arrows enabling creation of six different gestures (twelve if different orientations are distinguished). After few iterations of brainstorming of the author and her colleagues, each gesture is given related "predefined" meaning. Proposed gestures from the first row (Fig. 1b) represent "page up", "page down", "minimize window", while from the second "forward, "backward" and "maximize window".

In an experimental evaluation, a usability testing was conducted [3,4]; related measures, measuring instruments and procedure were defined, test users selected and detailed analysis of results made. In order to perform the evaluation, a test application with eye tracking device Tobii EyeX Controller (www.tobii.com) was developed. Each gesture was tested separately and its meaning was analyzed during the interaction. An acquisition of users' opinion regarding the gestures' meaning in a context of a web page control was done through usability testing. During the assessment, the user had to accomplish with her/his eyes each gesture individually shown on the screen. A role of an implemented algorithm in the test application was to determine whether the test user performed the required gesture correctly. If she/he failed, the gesture should be performed again. After each accomplished gesture, the user had to select one or two potential gesture meanings from provided paper-based questionnaire. Twelve students (41,67% women, 58.33% men) from 4 different collages, aged from 19 to 25 were involved. Result of memory test in average was 75.8% and for error rate low. Analyzed results were satisfying since they showed that all the "predefined" meanings of newly designed gestures where confirmed in testing. Positive feedback from test users indicated that interaction based on eye tracking with designed gestures could be used in substitution or to complement classical GUI interfaces, with reference to web page interaction for disabled people.



a) **b)**

Figure 1: Proposed gestures based on eye tracking: a) pointing and clicking commands, b) newly designed gestures

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