

RealEYES – Usage of Eye Tracking Technologies in Usability Labs

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Introduction

Eye tracking technologies are being used for human-computer interaction since about twenty years. They were developed to track a person's eye movements in order to use the gained information for analysis purposes or for controlling devices. The idea of using eye trackers in usability tests of software is based on the hypothesis that eye movement and eye fixation allow conclusions on the user's anticipation regarding what's happening next as well as on problems in using the application. Finding out about discrepancies between the user's expectations and the actual implementation of the user interface is the key for an improved, user-friendly, and hence successful design.

the next page or site. This »hunting« for information is performed so fast, that not even the user himself remembers what was done in which order, or even if certain actions were performed at all. After all, it is of no interest to the user how the information were found, but only if and how fast the information could be located. This new user behavior brings usability tester into the unpleasant situation that even the best-developed questionnaire can not reflect all of the users experiences, simply because the user isn't aware of all his activities.

Another problem is that video-taping isn't accurate enough to determine what the user is looking at, and forcing him to comment all his activities leads to an unrealistic slow-down of the whole process.

In contrast to this, eye tracking devices allow an accurate location of the user's focal point. Using this technology, it is possible to get detailed information on what the user is looking at, how long his eye rests on a certain area, or how long it takes him to find the wanted information.

The RealEYES system is based on this technology and provides a novel test environment for usability tests.

The RealEYES system

The test machine of the RealEYES system is equipped with a webcam for capturing the user's mimics, a microphone to get acoustical information, and the optical (infra-red) eye tracker.

As can be seen in picture 1, all information necessary for later evaluation of the test are displayed on the test screen. The main part of the screen, of course, is reserved

German Abstract

Usability als Benutzer- bzw. Benutzungsfreundlichkeit von Gebrauchsgegenständen wurde in den letzten Jahren als Qualitätskriterium von Softwareprodukten bedeutsam und somit zu einem entscheidenden Gestaltungs- und Bewertungsziel in der Softwareentwicklung. Ein Weg zur Sicherung der Qualität von Benutzungsschnittstellen ist das systematische Testen durch typische Anwender in einer Laborumgebung. Gegenstand des vorliegenden Artikels ist der Einsatz von Eyetracking-Systemen zur erweiterten Aufzeichnung und Analyse der Mensch-Computer-Interaktion im Usability Test. Für die Untersuchung der Blickbewegung des Nutzers bei der Nutzung von beliebigen Software-Anwendungen wurde das im folgende beschriebene RealEYES System entwickelt.

Usability tests and eye tracking

The growing e-business market with web-pages as the main information source revealed that the results of conventional usability tests don't necessarily reflect the actual usability of the tested web site. The reasons for this are manifold. One of them is that a web user -other than a reader of a newspaper- doesn't really *read* the web page, but rather *scans* it for information. Searching information on a web page is hence performed much faster than it is done on a physical medium. Additionally, online-users like to first get an overview, and than – maybe – pick some information which they might have rated as being potentially interesting to go for a more detailed read. For instance, they first read the headlines of the current page, then take a brief look at the first lines of some chosen articles to finally read one or the other to the end or proceed to

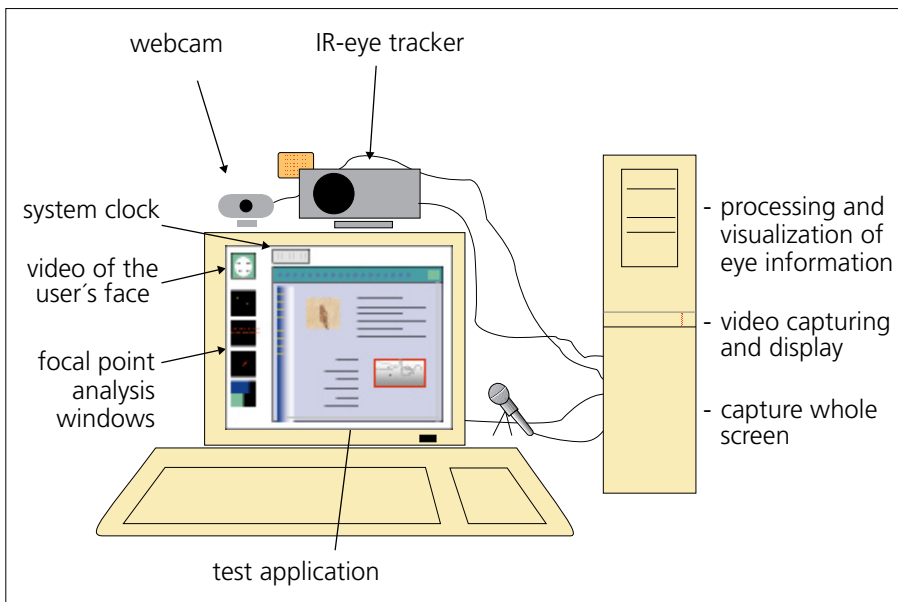


Figure 1: Principal outline of the RealEYES system

for the test application. On the left hand side is a small area in which the captured eye information are shown, together with the video stream. The first window shows the current eye focus point and the location of the mouse pointer. The next one visualizes a summation of all views during the test. In the third window can be seen where the user was looking at during the past n seconds, where n is adjustable according to the desired time resolution of the test. Finally, in the last window, a bar shows the actual distance between focal point and mouse pointer and a second bar indicates the speed at which the eye scans the screen.

Those information allow very accurate conclusions not only on the user's behavior, but also on his motives and intentions, as well as on what attracts user attention for how long. For instance, it can be said that a fast eye movement signals a search for something, the mouse pointer being close to a fixed focal point might indicate the intention to click, and an uncoordinated, fast movement of the mouse suggests some impatience of the user.

The reason those information are shown together with the test application is that, in order to get as much an objective result as

possible, the data have to be logged time-synchronously with the application, together with the video and the audio stream, ideally in a single file and in an easily accessible format. This is realized by simply capturing the whole screen and storing it as an .avi file.

For the evaluation one simply watches the movie, seeing at once where the user is looking at, what is being done with the mouse, which buttons are being clicked on, and which regions of the page were seen how frequently and for how long. By simply using the system clock, which is displayed on the screen as well, it is possible to analyze the user's behavior with a time-accuracy down to the second. Having the mouse- and eye statistics right on hand, it is very easy to evaluate the user's actions and hence to infer to the usability of the tested application.

Summary

The described RealEYES system presents a novel usability test environment with an unprecedented accuracy. Not relying on the user's ability to retrospect the test session, it allows an unbiased evaluation of the tested application. In addition to tracking the user's eye movement and displaying it on the screen, the system also provides real-time analysis data for later

evaluation. The test data are stored very conveniently in a single video file together with time information accurate to the second, which is not possible with traditional tests.

The gained information allow an objective evaluation of the tested program. They allow far more accurate recommendations concerning the layout of a web site or a user interface than it is possible with traditional usability tests. Thanks to its high accuracy and easy handling, the RealEYES system uniquely meets the challenging requirements of a new, fast growing class of applications.

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