Noldus
Information Technology

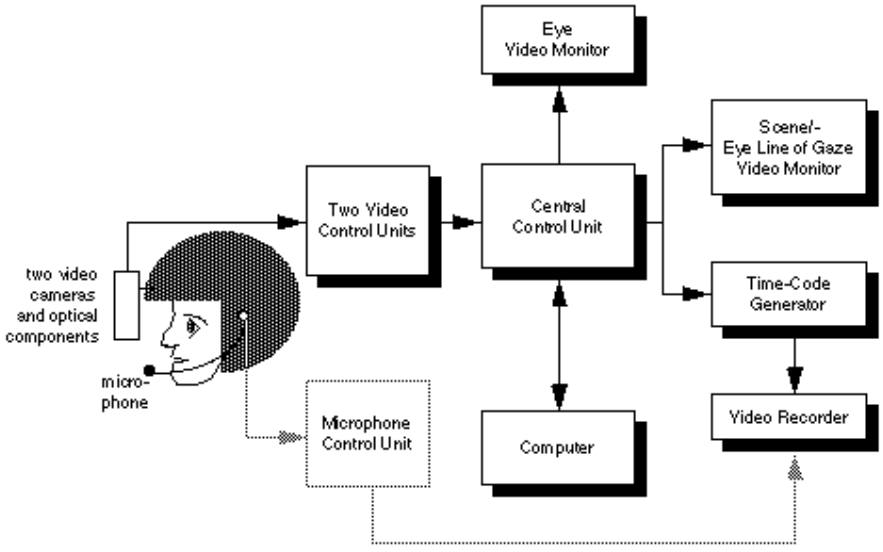
For your eyes only: Eye tracking offers new ways to analyze human behavior

Using The Observer for Usability Testing

Psychologists generally agree that a person's viewing habits are an indication as to where his attention is focused. Measuring where a person is looking thus provides important information about what triggers his interest. This has important implications. For example, a detailed understanding of how people using computer systems mentally process the information presented to them is essential for the design of efficient user interfaces. The human ability to acquire task-critical information and translate it into appropriate control decisions is a key contributor to safety and effectiveness. To be able to analyze this process, one can use an *eye tracking* system. A good example is EyeCatcher, developed by Mooij & Associates, an engineering and consulting company in Oegstgeest, the Netherlands.

EyeCatcher

When using EyeCatcher, a test person wears a light-weight helmet on which an infrared camera and light source are mounted, as well as a mirror and a miniature video camera. The light is reflected by the mirror onto the person's eye and subsequently reflected into the camera. Since infrared light is not visible to the human eye, the person is completely unaware of this process. The image of the eye thus obtained shows the orientation of the pupil and therefore the orientation of the eye in relation to the head. Since no two eyes are identical, the system is calibrated for each person. The eye line-of-gaze is determined in the computer. The miniature camera is focused on the area within the person's view. Therefore, when he moves his head, the video image coming from this camera simply moves along with it. The eye line-of-gaze is mixed with the image from the miniature camera. This results in a video image of the person's field of view, containing a cross-hair cursor on the point in the image where his eyes are fixed (the point-of-gaze). The video signal can be recorded on tape to allow analysis at a later stage. By adding time code to the tape, it can readily be analyzed with The Observer. The person's eye fixation can then be coded and timed, so that frequencies, duration and sequential structure of visual orientation can be assessed.



EyeCatcher and The Observer at the European Astronaut Centre

In 1996, Mooij & Associates and Noldus Information Technology worked together on an evaluation of the user interface of a computer-based training (CBT) course developed by the European Space Agency / European Astronaut Centre in Cologne, Germany. Dr. Heralt Mooij explains: "As manned space missions become longer in duration, a new approach in terms of training is required. Crew members will have to adapt to a changing environment and deal with new situations like on-board refresher training, using updated training material which is sent to them by datalink. The aim of the study was to test if the CBT platform, a combination of multimedia, equipment simulation and web technology, is able to cope with these challenges." In the context of preparing for the MIR '96 mission, eye tracking followed by video tape analysis was used to evaluate a CBT on the operation of instruments present on the MIR Space Station. The training course was developed in computer languages commonly used on the Internet (HTML, JavaScript) and run in a Netscape web browser environment on an IBM ThinkPad notebook computer. The EyeCatcher system was used to record the eye line-of-gaze of the test person while operating the CBT program. During subsequent coding of the video tape with The Observer, the analyst scored the following variables: (1) what the person was looking at (i.e. different parts of the screen: page header, course text, illustrations, status bar and various buttons), (2) the position within the course, (3) what the computer was doing (e.g. downloading information, building up graphics) and (4) what was visible on the screen. After the tape had been coded, The Observer was used to calculate how often and for how long various screen parts were looked at. Sequential analysis was used to count the transitions between the activities. It turned out that users spent most of their time reading and that pictures were not studied thoroughly. Based on the analysis, recommendations were given regarding typeface, font size, layout of buttons, etc.

Applications

Besides the case study described here, the powerful combination of EyeCatcher and The Observer has many other applications. To name a few: usability of software user interfaces; cognitive ergonomics of instrumentation in a car, aircraft or control room; consumers searching products in supermarkets; or people reading advertisements on TV, in a newspaper or on a web page.