Eye tracking for Usability Analysis and Application to Rehabilitation

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Abstract

This Plenary Session presents several studies carried out by the CHICO group of the University of Castilla - La Mancha and the AIR group of the same University. These studies were conducted using eye tracking techniques and, in the cases presented, these techniques were used in order to observe the usability errors found in different applications developed within the research group and in related groups that have collaborated with CHICO. After analyzing the usability errors found, the user interfaces were reworked to take into account the usability errors detected.
The article presents different developments mainly in collaborative systems and in immersive augmented reality interfaces, and it ends with the work carried out in the area of rehabilitation.

Keywords
Usability, CSCL, CSCW, Computer - Human Interaction, Rehabilitation.

1. Usability studies using Eye Tracking techniques

Eye tracking techniques have been widely used in marketing studies to find out on which parts of an image potential buyers focus their attention. These techniques have also been widely used in order to redesign static or dynamic web pages according to how their users focus their attention.
Most of the studies conducted primarily use heat maps (Figure 1) that show which parts of a figure, website or application have been prioritized by a given user or by a group of users in an aggregation of the individual results. The areas in red indicate the most viewed parts, whereas the graduation towards green, and ultimately white, are the least viewed areas.

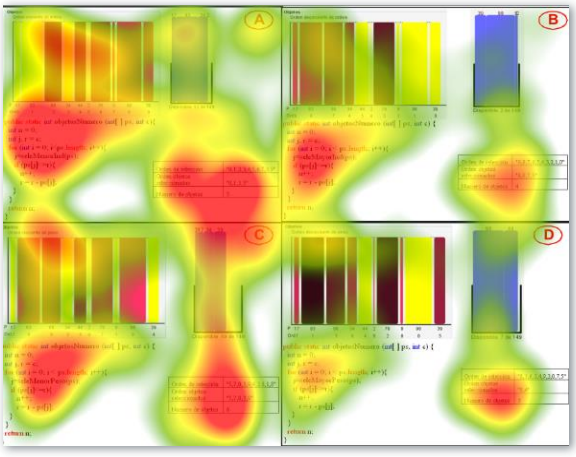

Figure 1: Head Map of the Greedex Usability Study

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It is also important to know the observation path of a user when they access a graphic, a website or an application (Figure 2). This scan path gives us much more information than that provided by heat maps since it represents the path that the user has followed to perform a certain task, usually proposed by the team developing the usability analysis.

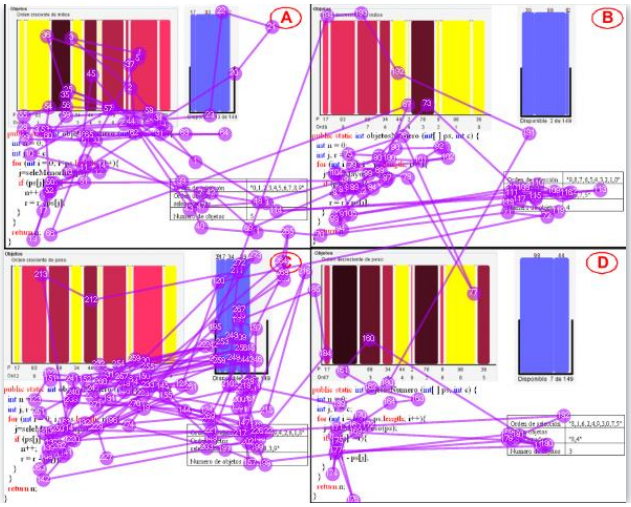

Figure 2: Scan Path of the Greedex Usability Study

In the following sections, we will present some studies carried out with the eye tracking technique and how this technique has allowed us to improve the user interfaces previously conducted.

2. Case Studies

The first case study we explain is the one carried out in order to improve the user interface of the Greedex system [1]. This system is a desktop application developed in the LITE group of the Rey Juan Carlos University of Madrid which was redesigned so that the users of the system, students of the Computer Science degree, would take more into account the graphical possibilities of the environment, since by means of eye tracking it was observed that the students preferred to use the tabular version of the problem resolution rather than the graphical help or the observation of the resolution algorithm. This application helps the students to understand algorithmic problem-solving schemes known as greedy methods.

Successive improvements were made to the Greedex system [2, 3] through usability studies developed using eye trackers, improving both the user experience and usability of the system significantly. These new applications were named GreedexTab (Figure 3) and GreedexTab Version 2.0 (Figure 4).

Other redesign case studies presented at the Plenary were those carried out to improve the programming learning support environments Collece (Figure 5) and Collece 2 (Figure 6). In this case, we present a collaborative programming learning environment [4] that has also enabled the use of augmented reality systems (Figure 7).

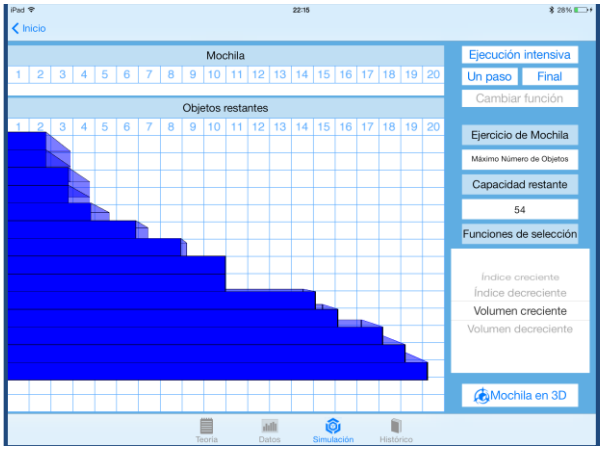

Figure 3: GreedexTab Application for iPad

Figure 4: GreedexTab v2.0 Application for iPad and Android

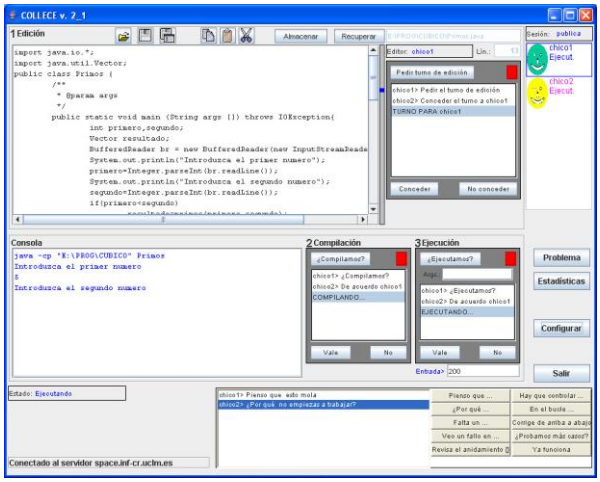

Figure 5: First Version of Collece

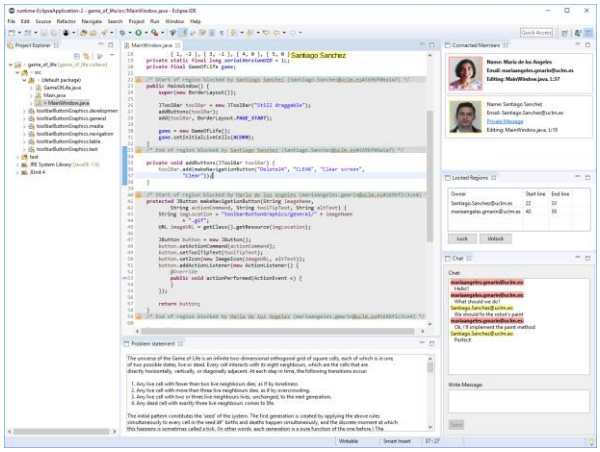

Figure 6: Redesigned version of Collece in the Eclipse Platform

Figure 7: Augmented Reality Collece Application

This programming environment and the use of Microsoft Hololens Augmented Reality glasses enabled the development of rehabilitation applications [5] that were presented at this Plenary Session (Figure 8).

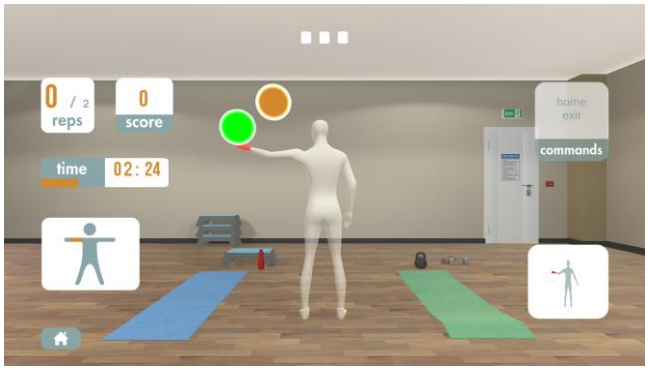

Figure 8: Visual Aspect of an Exergame Application

Figure 8 shows that by means of a Kinect based Position Recognition System of the different parts of the body, people in need of rehabilitation perform exergames that have been previously produced and stored in a language that allows the definition of all the exercises to be performed, thus making the generation of different rehabilitation games very simple.

3. Conclusions

The use of eye tracking techniques has allowed the CHICO group to rework and improve user interfaces developed by the research group or by other related groups that have been presented at the Plenary Session. Other case studies of the CHICO group can be found in [6].

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