ACTIVITY REPORT

VISIONAIR PROJECT

Gaze-contingent multi-resolutional displays in Human visual system research

Dr. Santiago Martín González

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1. Dates and objectives

The stay at UCL facilities take place between 7th and 18th of July. The objectives of the Project were:

a) The UCL facilities provide both a CAVE and an eye-tracking device. The second one has not been tested yet using our library, and that must be the first objective of the project.
b) The conjunction of both devices enhances the field of research. The system will be tested again in a scientific challenge. The results obtained thus far are related with the limits of visual acuity as a function of distance from the foveal region, in a binocular but plane scene (in the sense that viewed objects are at the same depth). Our intention now is to study how convergence reduces visual acuity (i.e. spatial frequency detection) in objects positioned in front or behind the fixation point.

2. Task carried out

A. Adaptation of the graphic library and test program to UCL facilities

A new test was designed to measure visual acuity in binocular scenes. The test is created through the graphic library GLSVe. As the test is designed at the University of Oviedo, it has to be adapted to the UCL devices, mainly (but not only) to use the eye tracking system.

a. The library VRPN C# Client (free available at sourceforge web page) was adapted to recover data from the eye tracker application, ViewPoint Arrington. This task involves these:
   - Understanding ViewPoint working procedure and data acquisition
   - VRPN Server code has to be recompiled. The Arrinton tracker is set as available, and the folder where the SDK is located is added to the code.
   - VRPN C# Client is modified to accept data through VRPN server.
   - VRPN C# Client demo is used to check the result
b. Eye tracking – Head tracking - Shutter glasses fixation. The quality of the eye tracking is highly dependent of the correct system fixation. Although it seems to be a simple task, it is not at all to find a good way to attach the three devices together.

Figure 1. Eye tracking and shutter glasses

c. Test code modifications
   - Head tracking. The IS900 is added to the code prepared at University of Oviedo
   - Wand tracking. The IS900 wand is added to the code. Although these tasks where carried out in a previous stay, a new calibration procedure of the head tracking is introduced. Moreover, the wand provides different data outputs, so that the test has to be adapted.
   - Eye tracking. The ViewPoint is added to the code using VRPN C# Client. Several calibration procedures are tested. A virtual calibration screen, attached to the head tracking, is used finally. The data recovered is used in different ways to check its quality. The angle between the eye tracking vector and the target point is finally used to measure the quality of the system.

Figure 2. Visual test example

Different problems, as failures in the communications between the computers, eye tracking failures and over- heating of the graphic cards, are also faced and solved.

The GLSVe library is also modified to manage systems without audio context, although finally the computer used provided an audio device.

B. Experiment

The complexity of the tasks carried out made almost impossible to carry out a set of binocular perception tests. Nevertheless, it was finally possible to obtain data from 4 tests that allows us to stablish the quality of the eye tracking. Those experiments show that the user tracks the point of interest within 3 degrees of error. This result justifies the procedure designed, so that the binocular perception test will be performed during September at the University of Oviedo.

C. Talk

Besides the technical and scientific interest of the stay, it was consider also the interest of a scientific talk about the project. The 8th of September the talk was delivered at the Department of Computer Science.

There were also other informal meetings with scientists at the UCL and other universities. We had a meeting with professors Alan Johnston and John Greenwood at UCL Vision Research Lab (Cognitive, Perceptual and Brain Sciences). We had another meeting with Frederic Fol Leymarie (Professor of Computing, Goldsmiths, University of London).

3. Conclusions

The stay, although short in time, has allowed a better understanding of the eye tracking methods applied to scientific research in virtual reality facilities. That is an invaluable output for those involved in this kind of research and makes the effort worth.

Santiago Martín González

martinsantiago@uniovi.es