The Standardized Eye Tracking Training Course

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The goal of the eye-tracking training course is to familiarize participants with the eye-tracking hardware and eye-tracking procedures at the Institute of Cognitive Science's Neurobiopsychology lab of the University of Osnabrück. The course consists of three parts: (a) the instructor explains and demonstrates all procedures in a first session, (b) trainees practice under supervision and on their own, and (c) trainees demonstrate their acquired skills to the instructor. Trainees use an example eye-tracking experiment for training.

Introduction to the eye-tracking lab
Trainees are invited to a first meeting of about one hour duration. The instructor gives a detailed tour and explanation of the procedure of a typical eye-tracking experiment. Trainees are encouraged to take as many notes as possible. The instructor demonstrates, with the help of a separate subject, how to set up the eye-tracker, and explains relevant settings and procedures. Special attention is given to the position of the eye-tracker and all cameras as well as to the need for accurate calibration and validation data. See below for more details.

Independent training sessions
After the introduction trainees practice their skills in independent sessions without the instructor. On average, trainees need around 5-6 hours of training sessions (completed within 7-10 days), in order to be fully capable of accurately setting up the laboratory and eye-tracker for an experiment.

Skill demonstration
Finally, trainees have to mimic the setup of an actual experiment (the training experiment) while the instructor is watching. If the instructor is satisfied with the performance of the trainee, he/she has passed the eye-tracking training course. If the instructor is not fully satisfied, the training participant has to repeat some training sessions and then show his skills again to the instructor. This is repeated until the training participant succeeds in the training course.

Procedures and default settings

Available hardware
Participants of the eye-tracking training course use the same equipment as used for real experiments in the Neurobiopsychology lab. The hardware is composed of an EyeLink II (SR Research) Eye-tracker with a sampling rate of 500Hz and an accuracy of better than 0.03 degrees of visual angle. The eye-tracking software runs on a computer, which is connected via LAN to a second display computer. The monitor of the display computer used in the training varies in size and resolution between 24“ (1920x1080 pixels) and 32“ (3820x2160 pixels) depending on the needs of the experiment. This aspect, however, has no influence on the training itself.

Preparing the lab for a session
The training participant is first instructed to prepare everything in the lab, in order to welcome the subject. This includes preparation of the lab proper, but also secondary aspects such as making sure that anyone passing the hallway during the experiment is informed of a currently running experiment. For this, a flashing light is switched on in the hallway reminding people to be silent in the hallway.

The Eye-Tracking Computer
The training participant learns about setting up the correct physical properties for a particular experiment. This involves the physical size of the display monitor, its resolution, as well as the

distance from the display monitor to the eyes of the subject. These mentioned properties are assigned in the file ‚final.ini' directly on the eye-tracking computer. A brief but clear statement about the necessity and importance of these properties is told to the training participant.

The Display Computer

On the display computer, the training participant has to make sure that the display resolution matches the resolution that has been assigned in the properties of the eye-tracking software as described above. Later, the usage of the software-console (terminal) is shortly explained, in order to access the right folder on the computer - that locates the experimental scripts - and additionally to correctly run the script. Once the experimental script has started, the correct subject-number and filename must be entered.

The Eye-Tracker

After finishing the pre-setup, the subject is asked to take a seat in front of the display monitor. Now, the trainee is instructed about how to correctly put on and set up the eye-tracking hardware on the subject's head. The EyeLink II eye-tracker contains three cameras (one world camera and two eye cameras). The instructor shows the trainee to correctly set up the world camera as well as one eye camera. The instructor states the criteria for a good camera position and shows typical variations in camera setting to cope with glasses or other potentially occurring problems. Then the trainee sets up the second eye camera under supervision by the instructor. The setup of the eye cameras is not easy and needs some experience and skill. Therefore, trainees have ample time to ask questions and practice to achieve good setting.

The Eye-Tracking Software

In the eye-tracking software, the correct positioning of the three cameras can be checked one more time. Next, the right options have to be assigned, including the number and structure of fixation dots in the calibration and validation (described below). Also the pacing interval of these fixation dots has to be assigned correctly. Then, the correct sampling rate (500Hz) and tracking mode (Pupil) must be applied.

After that, the calibration procedure starts. Fixation dots in a random sequence have to be fixated for a certain time (pacing interval) by the training subject. The training participant learns about the procedure and the structure of the calibration output and how to interpret the result. After calibration, a validation of the previous result follows. Again, the training subject has to fixate subsequently following fixation dots. Now, a drift error is calculated for each of the dots. The training participant learns how to interpret the drift error and to correctly maintain and readjust the cameras and recalibrate the system to achieve an average drift error of better than 0.03 degrees of visual angle.

Next, the experiment starts with a simple button press. Before each trial, a fixation dot has to be fixated by the subject in order to do a quick drift correction, individually for each trial. Hereby, the trainee has to manually click a button, when he/she notices that the training subject is fixating the presented dot. The trainee is advised not to accept a fixation too fast, to prevent false hits and not to wait too long, to avoid the subject getting nervous. A usual presentation time of the fixation dot should be 1-3 seconds, depending on the circumstances. During the actual stimulus presentation within each trial, the trainee learns about the information provided on the screen that is shown on the eye-tracking computer, including the trial time, current fixation position, pupil detection, and live screening of the camera setup.

Finishing

After the experiment, the eye-tracker is detached from the subject's head. Then, the computers have to be logged out. However, the trainee is advised to wait a few minutes, as the eye-tracker has to copy the raw data files to the display computer, which can take some time depending on the data size. Afterwards, the warning lights in the hallway have to be switched off.

Additional Information

While setting up the hard- and software, the training participant also learns how to switch display monitors before the experiment if necessary. This also includes resetting of the eye-tracking sensors that are captured by the world camera, in order to filter out head movements. Hereby, the training participant is also told about the financial value of the whole system and advised to work as carefully and concentratedly as possible to avoid any damage or wrong setting to the hard- and software.