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Eye Movements and Visual Perception

Practical Session 2

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Introduction

The aim of this practical session is to set up an eye-tracking study, analyse, and visualize the eye movements recorded with an EyeTribe eye tracker. For this practical session we will be using the Eyetrace version bundled with this exercise sheet.

Submit your answers to ILAS on a single folder using the **Upload Multiple Files as Zip-Archive** option. This folder should contain all items marked in this document with (Answer in: example.txt) . Name the file **exactly** as specified in this document with your answer inside. No file upload is required for items not marked as such. **Upload a single submission per group.**

Exercise 1: Group Identification

Add the matriculation number of all group members, **one per line**. (Answer in: group.txt)

Exercise 2: Setup

1. Copy the *EyeTribe.exe* file to C:/Program Files (x86)/EyeTribe/Server/EyeTribe.exe
2. Connect the EyeTribe to an **USB 3.0** port.
3. Start Eyetrace and, on the top left *Recording* menu, start the *TheEyeTribeRecorder* (see Figure 1).
4. A new window will pop up. Make sure the *Path to the EyeTribe server* is correct and click the *Start EyeTribe* button.
5. The *EyeTribe Server* will run on a separate prompt window. If everything is working, you will get the *"The Eye Tribe Tracker stands ready!"* message in the prompt (see Figure 2) and see red leds light up near the edges of the eye tracker (you can ignore the *Tracker state* reported in the GUI since it is on Eyetrace's bug list at the moment).

6. Open the stimulus (*yarbus.jpg* image) on an image viewer and maximize the window. Take a screenshot and save it as a **jpg**. Don't close this window yet since we will use it as stimulus. (Answer in: self-stimuli.jpg)

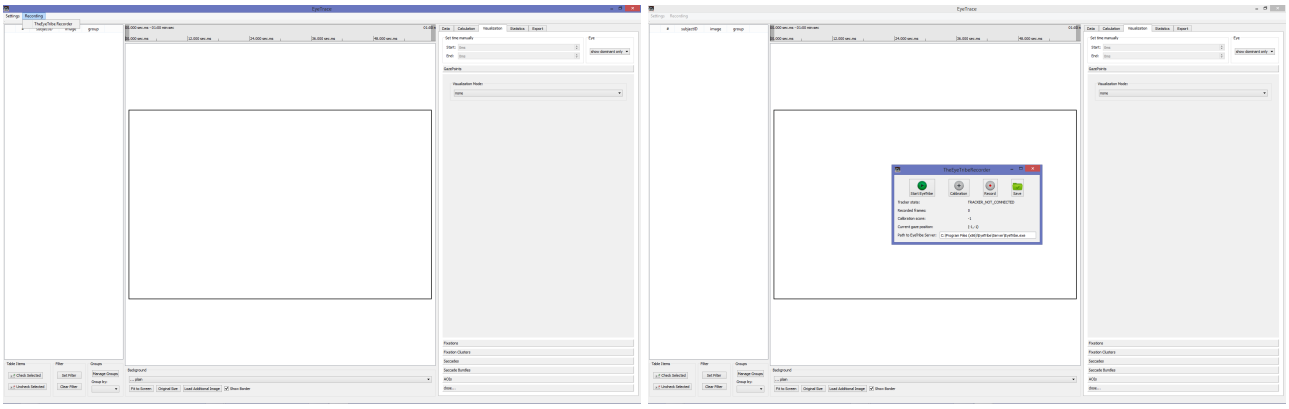

Figure 1: Starting Eyetrace's built-in recorder.

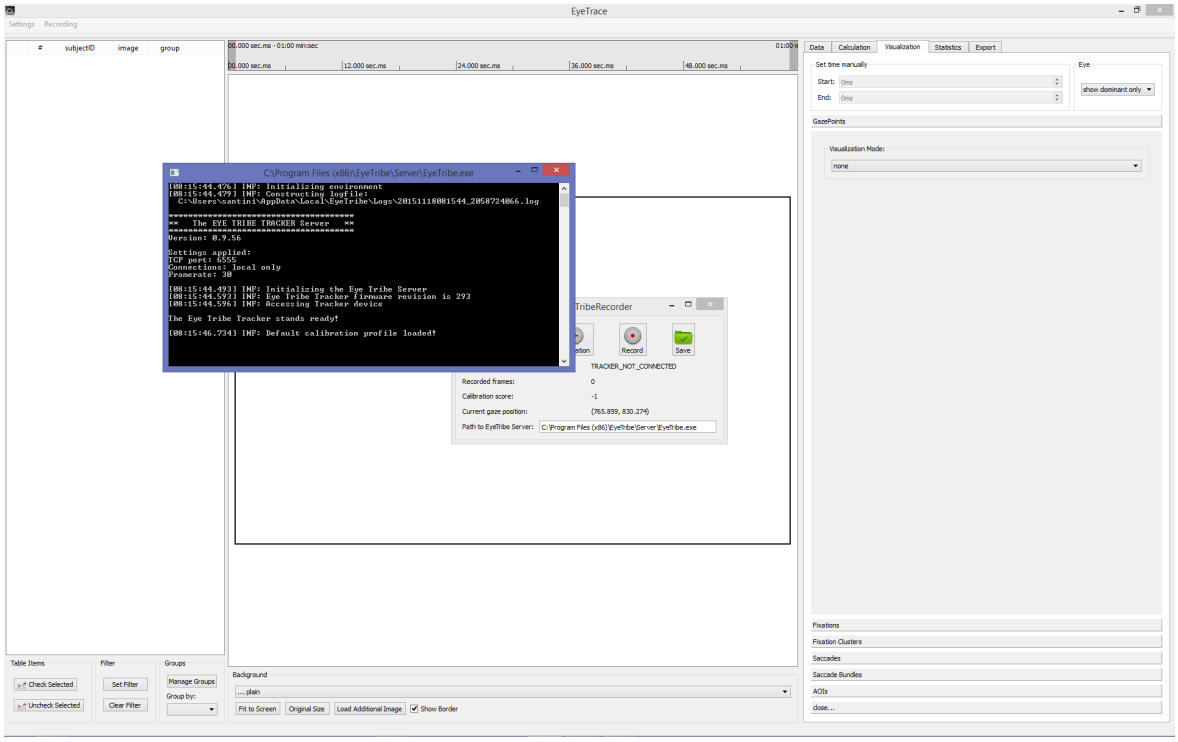

Figure 2: Starting Eyetrace's built-in recorder.

Exercise 3: Calibrating and Recording

1. **Please read all the instructions in this section before performing these section's steps.**
2. Pressing the *Calibration* button will start the calibration procedure; a grey background will be shown and two white circles will represent the eyes as detected by the eye tracker.
3. Adjust the eye tracker such that the circles lie are approximately centered relative to the screen. Tip: the EyeTribe's tripod legs are expandable.

4. **From this moment on, try to keep your head as still as possible**. Failing to do so can heavily affect the calibration!

5. You can use the space bar to advance through these steps. A white circle will be shown in the screen. Gaze at it and press space bar. After a small delay, the circle will be moved to another position. Repeat this process until no circle is shown, then press space bar to finish the calibration.

6. If the calibration was successful, we are ready to start recording. Otherwise, repeat the calibration until success. Press the *Record* button and change to the stimulus window. Look around the stimulus as you wish for around 25 seconds. Afterwards, stop the recording, and save the recorded data. (Answer in: self-gaze.data)

7. You can now move your head again and possibly gathered good data, hurray :-)

Note: in case you have problems to setup your data recording, you can perform the remaining steps using the files provided in the *data* directory (*gaze.data* and *stimuli.jpg*). You will still have to record your own data with the setup provided by the tutors afterwards, and it won't be necessary to redo the remaining steps.

Exercise 4: Visualizing

- Import your recorded data into Eyetrace. You will get an error (because there is no stimulus image with the data), which you can ignore.
- Load the previously made screenshot from the stimulus window as Eyetrace background.
- Create a heatmap from all gaze points from the dominant eye and take a screenshot of the Eyetrace window (see Figure 3). (Answer in: heatmap-screenshot.png)
- The data points include two non-relevant periods: 1) from recording start until you first start gazing at the stimulus, and 2) from your last stimulus gaze until you stopped recording. Eyetrace allows you to exclude these from the analysis (see Figure 4). Create a heatmap using only dominant eye gaze points from the relevant period (i.e., roughly from first to last stimulus gaze) and take a screenshot of the Eyetrace window. (Answer in: heatmap-relevant-screenshot.png)

Exercise 5: Fixations

- Compute fixations in the eye-tracking protocol.
- Display the fixations as ellipses on the stimulus image (different color for each eye).
- Try different algorithms and parameters for the calculation.
- Export your fixation data.
- Which algorithm and parameters did you choose? (Answer in: fixation-alg.txt)
- How many fixations are found for both eyes? (Answer in: fixation-count.txt)
- Which fixation contains the most gaze points? (Answer in: fixation-largest.txt)

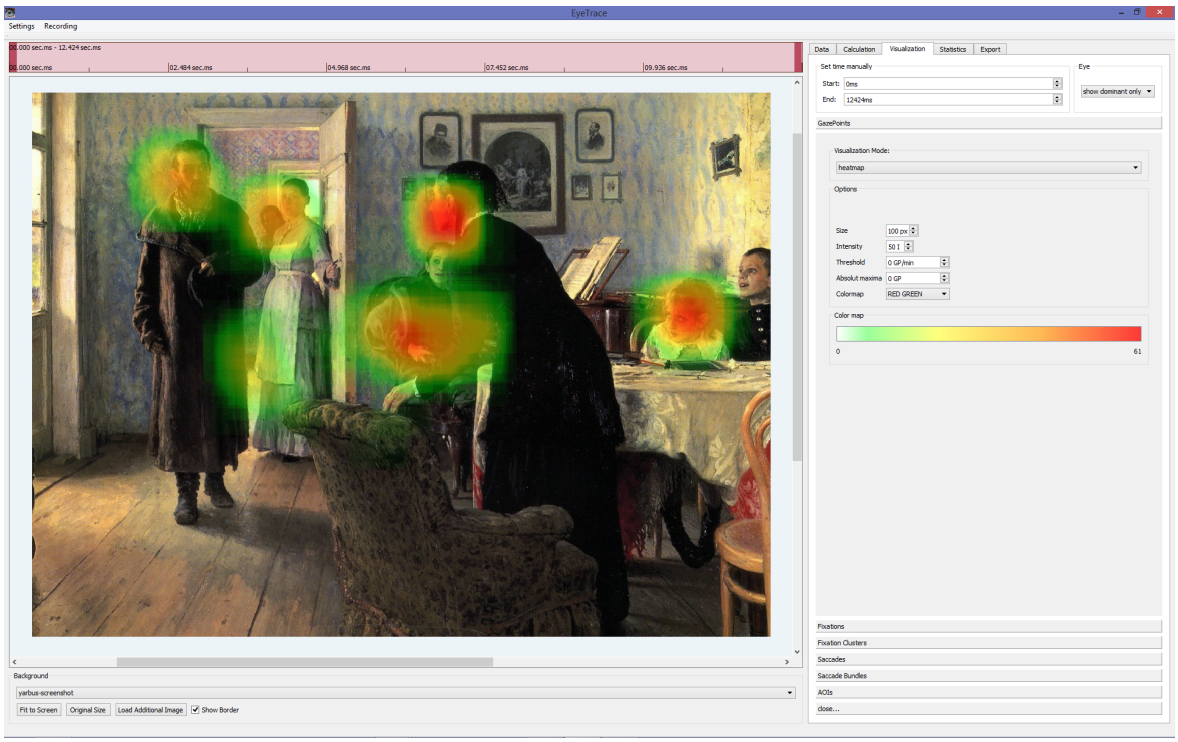

Figure 3: Heatmap of all data points from the dominant eye overlaid on top of the stimulus image.

Exercise 6: Fixation clusters

- Calculate fixation clusters.
- Display the fixation clusters as ellipses on the stimulus image (different color for each eye).
- Try different algorithms and parameters for the calculation.
- Export your fixation cluster data.
- How many fixation clusters are found for both eyes? (Answer in: fixation-cluster-count.txt)
- Which fixation cluster contains the most fixations? (Answer in: largest-fixation-cluster.txt)

Exercise 7: AOIs

- Define AOIs by hand for the first 5 seconds using an appropriate visualization (but none of the previously used).
- How many fixations are in each of these AOIs.
- Delete your defined AOIs and calculate AOIs automatically from the heatmap.
- Draw the transition diagram.
- Export the transition matrix.
- What does the transition diagram show? (Answer in: transition-diagram.txt)

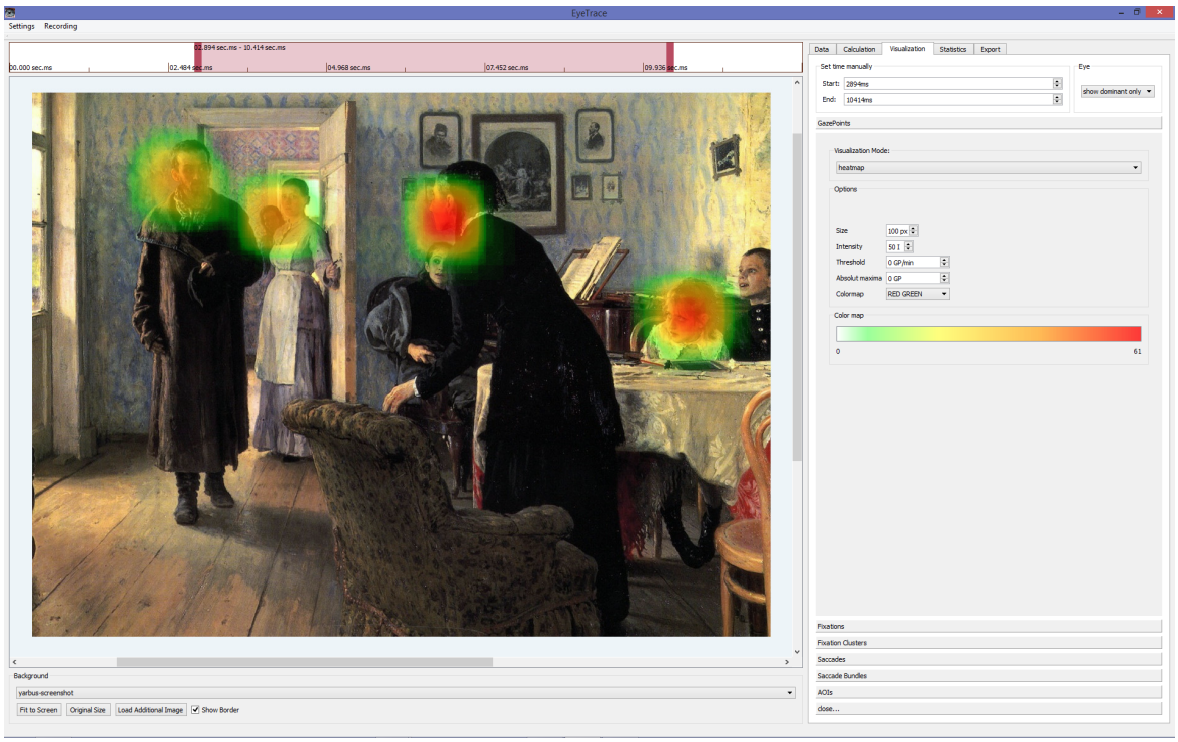

Figure 4: Heatmap of relevant data points from the dominant eye overlaid on top of the stimulus image.

Exercise 8: Saccades

- Draw saccades with arrow tip.
- Set the time slice from the beginning to half the recording.
- Compare the result with the time slice from half the recording to the end.
- Draw the anglestar diagram for the first two seconds with the parameter duration.
- Compare the anglestar diagram to the arrow visualisation for the first two seconds.
- What does the anglestar diagram show? (Answer in: anglestar.txt)

Exercise 9: Statistics

- Export the general gaze statistics.
- Export the AOI statistics.
- What is in the general gaze statistics file? (Answer in: statistics.txt)
- What is in the AOI statistics file? (Answer in: aoi-statistics.txt)