MultiplEYE Experimenter Script

Eye-Tracking Session

History of changes		
Version	**Date**	**Changes**
0.1	16/09/25	Work in progress - First version to be published on MultiplEYE website

This document contains the detailed sequence of events for an experiment session of the MultiplEYE data collection. Note that the experiment should already be installed and tested in the lab (through test runs, and/or pilot sessions). If you are running the experiment for the very first time for testing real participants, please carefully follow the guidelines provided in the README file within the Github repository to ensure proper setup and execution.
All experimenters should be familiar with this procedure before starting an experiment. We recommend having a paper copy of this document available at all times during the data collection.
It is also important to check the lab specifications described in the Data Collection Guidelines before starting with the experiment sessions.

Note: This script has been prepared specifically for **labs with EyeLink eye trackers**. If you are using a different eye-tracking device please contact us (multipleye@cl.uzh.ch, or multipleye.project@gmail.com).

General important remarks

- The participant should always feel comfortable while participating in the study. We always treat the participant in a motivating and appreciative way.
- Every participant has the right to stop and cancel an experiment at any time without providing any justification.
- To install the experiment on your computer please refer to the general Data Collection Guidelines and the guidelines in the experiment repository: general README, installing the necessary requirements, installing everything for EyeLink.
- When testing the experiment, please ensure that these keys work properly:
    - You should be able to press the “q” key in the HOSTPC to quit a fixation trigger during the fixation trigger screen;

    - You should be able to press the “esc” key on the HOSTPC to force a calibration between two pages of a text or during the fixation trigger screen;
    - You should be able to press the “ctrl+c” on the HOSTPC to terminate the experiment during the fixation trigger screen.
- **Never change the names of the data folders** (this refers to the log files - edf files) which are automatically written by the eye-tracker)**,** as the participant's ID will not be updated in other files required for data pre-processing.
- In the script, we sometimes refer to "keyboard/controller"; however, since the experiment was implemented to be run with a keyboard, it is strongly recommended to use a keyboard, though using a controller is also allowed.

Inventory list for the experiment sessions

Hygiene, make-up supplies and refreshments that are recommended to have in stock at the lab during the sessions.

- paper tissues (e.g., for placing on the chin rest to ensure hygiene)
- disinfectant wipes
- lens wipes
- contact lens solution
- eye drops (it the eyes of the participants gets dry)
- make-up remover without perfume and suitable for sensitive skin
- eye drops (if eyes of participants get dry)
- eyelash curler
- mascara
- measuring tape
- tape
- coffee, tea, fruit and cookies

Before the experiment

Arrive at least 10 minutes before the participant to ensure everything is prepared for a smooth session. Follow these steps to set up and prepare:

- Make sure you have **the printed** **Experimenter Session Documentation Sheet** (PDF sheet) at hand so that you can take notes during the session.
- Put your phone on silent
- Prepare reimbursement or participant gift (place it out of sight so that it is not distracting)
- Familiarize yourself with the participant's ID, name, and any other information provided through the registration process
- Start-up or switch on all required equipment and start the registration process:
    - Remove the protective cap from the eye tracker, if applicable
    - Switch on the display PC and host PC and log in
    - Start up the eye tracker by choosing “*eye-link”* on the host PC display

- Pick a new participant ID that you write down in your experiment notes and the Session Documentation Form that you will fill out for this session
  Note: IDs assigned during pilot sessions cannot be reused in core sessions. For example, if participant 1, 2, and 3 were involved in the pilot sessions, participant 1 cannot be reused for a core session. Instead, assign a new ID (e.g., 4) to the participant. This is because, if everything functions correctly during the piloting stage, the pilot data will be included in the core dataset. It is crucial **not to rename** the folders containing participants' data to "fix" ID overlaps, as this would create a mismatch between the folder name and the participant ID recorded in the data files, leading to inconsistencies in the dataset. Please ensure the IDs are handled properly to maintain data integrity.
  Note: It does **not matter if a certain ID is not assigned to any participant** (e.g., having participants with IDs 1,2,3,5,6 but no participant with ID 4 is ok).
- Before starting the experiment, **check the eye-tracker's sampling rate** to ensure it matches the required frequency (around 1000 hz), as it may have been adjusted by a previous user. **Set the correct sampling frequency.**
  To start the experiment, first ensure you have followed all instructions to install the experimental presentation . Then, activate the environment by running

  conda activate multipleye3.9

  then access the repository where the experiment is stored

  cd wg1-experiment-implementation

  and start the experiment with the command:

  python experiment_implementation/start_multipleye_session.py

  - Once the GUI appears, follow the on-screen instructions and enter the participant ID (the EDF data file name will be created automatically). Be sure to note the session type (test run or core session) and select the adds correct option when prompted:

  1. **Core session**: Use this for actual data collection sessions with real participants.
  2. **Test session**: Select this if you are conducting a test run (e.g., to familiarize yourself with the setup or check functionality). Data collected in this mode will not count as part of the core dataset, and participant IDs will not be marked as used.
  3. **Dummy session**: This mode allows the experiment to run without a connected eye tracker, typically used for testing purposes or to demonstrate the procedure. Ensure the 'Dummy version' tick box is checked for this mode.
- Additionally, if you do **NOT** want to run the dummy version, make sure to **uncheck** the tick box labeled 'Dummy version' in the GUI.

- The welcome screen will be shown upon the experiment's successful start. Leave it until the participant arrives.
- **NOTE**: We highly recommend turning off the Wi-Fi and closing any background applications on the host PC, as they may slow down the experiment software.

At the beginning of the experiment

- **Greet the participant** according to your local customs and current hygiene rules. Example: “Hi, are you [*PARTICIPANT’S NAME]*? Nice to meet you, I am [*YOUR NAME]*. Thank you so much for coming; we really appreciate it!”
- **Verify the participant’s identity** by checking the participant’s name or confirming details such as their participant ID number in this study.
- **Welcome the participant to the lab** and inform them that food or drinks are not allowed in the lab or booth.
- Allow them to look around, and briefly explain the equipment if they have any questions.
- Ask the participant to put their **phones on silent**, turn off vibration, and store it in their bags or out of sight to avoid distractions.
- **Provide the consent form** and ensure it is signed **BEFORE** (!!!) proceeding with any part of the experiment.
    - There will be a screen within the experiment reminding the participant and experimenter to sign the consent form—this is **only a reminder**. The consent form must be signed **immediately upon the participant’s arrival**.
    - Inform the participant that the eye-tracker camera will display their eyes and some facial features but will **not** record or photograph their face.
    - If preferred, this information can also be included in the consent form.
- **Test for dominant eye** (see the instruction video and the script in the box below).

Dominant eye test

When doing the dominant eye test, please ensure the participant stands at a distance from the wall that matches the **eye-to-screen distance**, as eye dominance can change depending on the distance to the target.

The following script for the dominant eye test refers to the instruction video where a sticker on a wall is used. However, you can use any medium-sized target object that is easy to identify.
Follow these instructions to find out which one is the dominant eye of the participant:

Experimenter: *Now, we’ll be checking which of your eyes is your dominant eye. Please stand here, and look at the sticker on the wall (with the eye image). Make a circle with the*

thumb and index finger of whichever hand you prefer, extend your arm, and position the sticker (or any other target) *inside the circle. Ensure both of your eyes are open.*
Now take your other hand and cover your left eye. Is the sticker still inside the circle, or has it moved?
Next, uncover your left eye and cover your right eye. Is the sticker still inside the circle, or has it moved?

The **dominant eye** is the one where the object (the sticker or any other target) does NOT move when the other eye is closed.

Take a note of the participant's dominant eye. This is the eye that will be tracked during the experiment. You will also need to insert this information in the "Experimenter Session Documentation Form" at the end of the experiment.

- Ask the participant if they are wearing any mascara. If they do, provide them with make-up removal and ask them to remove it.
- Ask the participant if they have normal or corrected-to-normal vision at the time of the session. If they are wearing glasses, provide them with lens wipes and ask them to polish their glasses. If they are not wearing glasses, ask whether they are currently wearing contact lenses and specify if the lenses are soft or hard.
- Disinfect the chinrest (place a paper tissue on the chin rest to ensure hygiene), headrest, and button box according to the current hygiene rules in your lab and country.
- Ask the participant to take a seat in the experiment chair. The experimenter should make all adjustments to ensure proper positioning while maintaining a constant eye-to-screen distance. Adjustments should be made to the chair, desk, or monitor height - rather than the chin rest or headrest - to avoid affecting the participant's eye angle relative to the camera.
  Experimenter: "Please sit up straight and relax. I will now adjust the chair, table, or monitor height to ensure proper alignment. Once positioned, place your chin on the chin rest and lean your forehead gently against the top bar. **Please keep your forehead in contact with the bar throughout the experiment.**"
  Start with the oral instructions about the experiment (see box below).

Oral instructions

Give the participants an overview of the experiment:
First, we will prepare the experiment setup where you will read the instructions on the screen and clarify your questions and then we will set up the eye-tracking camera. After that you will start with the reading part of the experiment. At the end you will be asked to fill in a participant questionnaire.

Make sure to include the following information in your oral instructions:

- Instruct participants to **read silently**.
- Instruct the participant that they will read **different types of texts**, of different styles and different lengths. The texts are split into **multiple pages**.
- Instruct the participant to **read as normally as possible**, i.e., at their own speed with the only task being text comprehension.
- Each text is followed by a set of multiple-choice **comprehension questions**. There is always **only one correct answer**. Answer to the **best of your ability**.
- Instruct the participant to **avoid head and body movements** as much as possible.
- Inform the participant about **practice trials** and explain that they are designed to help them become familiar with the task. Let them know which buttons they will need during the experiment: the space bar for the left hand, the arrow keys for the right hand. No other keys will be required. Encourage the participant to use the practice trials to get accustomed to the **keyboard/controller**, so they won't need to look at it during the main experiment.
- Inform the participant about breaks (see below).

Breaks

There are two types of breaks throughout the experiment: **optional breaks** and **one obligatory break**. The participant will be shown screens that inform them of the breaks. Please offer the participant water, tea, or coffee to drink during the break.
It should be avoided to take breaks while reading a text and, most importantly, no breaks should be taken between reading the text and answering the corresponding questions.
You will need to recalibrate and validate after each break.

Optional breaks

After each trial (several pages of text and six comprehension questions), the participant will see a screen that informs them that they can take a short break if they want to or press space to continue. **If you notice that they are tired or not focused** anymore, you should encourage them to take a short break as soon as they see the break screen and close their eyes for a bit or quickly get up and stretch their shoulders, move their head, etc. In case they already pressed space but still need a break, this is still possible as the break screen is followed by a validation/calibration session. They can take the break before you calibrate and validate.

Obligatory break

There will be one obligatory break after half of the experiment (depending on the order of the texts, the break can be after trial 4, 5, or 6). The participant must take this break for at least 5 minutes. The participant should get up, close their eyes, move a bit, and drink some water.

Start the experiment

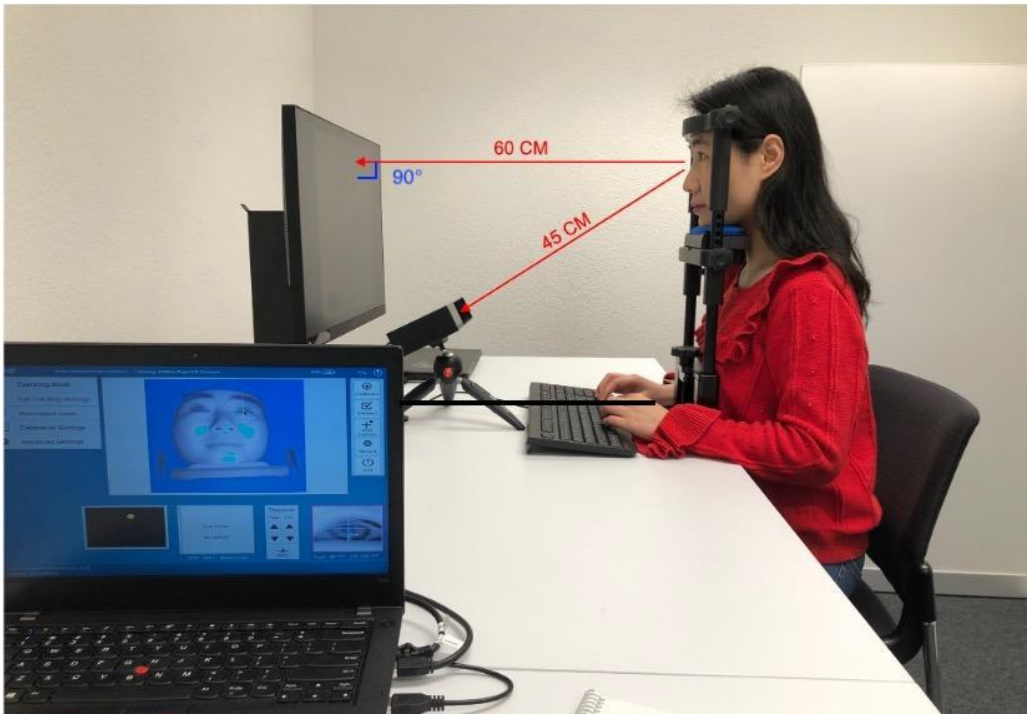
- Camera set up & calibration: Follow the steps from the instruction video and from the next section.

Camera set up & calibration

Explain to the participant that you will now adjust the eye-to-screen distance if necessary.

1. Adjust the eye-to-screen distance

- Please seat the participant correctly in front of the eye-tracker. The set-up must be adjusted such that the participant sits as they will be seated for the experiment.
- The distance between the participant's tracked eye and the screen should be measured at a 90-degree angle! Keep the measuring tape horizontal to ensure accuracy.
- Please adjust the position of the monitor **if the eye-to-screen distance is not 60 cm** and repeat the measuring.
- When the eye-to-screen distance is 60 cm, position the eye-tracker directly in front of the participant (centered) and adjust its position back or forth so that the distance between the participant's eyes and the eye-tracking camera is 45 cm.[1] Maintaining this distance is crucial to ensure that the number of characters within X degrees of visual angle is comparable across languages, allowing for un-biased analyses of saccade length and related metrics.
  However, if there are any reasons why it may not be possible to adhere to this measurement, please indicate them in the session documentation sheet.
  Please note (!!!): The 45 cm eye-to-camera distance applies to EyeLink Portable Duo. For **ss** with a 35 mm lens, the recommended eye-to-camera distance is **50-55 cm**. For other setups and eye-trackers, please use the eye-to-camera distance recommended by the manufacturer.



[1] This does not apply to Tower Mount systems, which have fixed positions and do not require manual adjustment of the eye-tracker's distance.

- Please refer to the image below to see the measurements.
- **Please confirm that the distances are correct for each participant.**

- Explain to the participant that you will now calibrate the eye-tracker.
- When calibrating, **verify that the correct eye is being tracked**.

2. Set Up on Host PC

- If necessary, adjust the camera to focus on the dominant eye.
- Press **r** or **l** on the host PC keyboard to select which eye to track as the dominant eye. **Verify that the selected eye is displayed in the correct (left or right) panel.** Note: The panel arrangement may differ depending on the EyeLink model being used (older vs. newer models).
- Press on the center of the eye location on the top panel of the host PC such that it is in the center of the red circle/ellips (search area for the eye-tracker to detect the tracked eye).
- Double check on the host PC eye-image **if you are really tracking the dominant eye** by asking the participant to move their finger close to their dominant eye.
- Double check if in the settings of the host PC, the correct eye is selected.
- Press *enter* and manually adjust the focus of the camera.
- Adjust pupil and corneal reflection thresholds. We highly recommend using your eye-tracker's **Auto Threshold** feature. If manual adjustments are necessary, please refer to your eye-tracking device's manual. If you are using an EyeLink device (i.e. EyeLink 1000, EyeLink 1000+, EyeLink Portable Duo), please see further instructions on adjusting the thresholds manually in this tutorial video on *Calibration with Eyelink eyetrackers* (minute 2:15): https://multipleye.eu/tutorials/
- Ask the participant to look to the left, right, top, and bottom corners of the stimulus presentation area to make sure the eye is being tracked and the corneal reflection is stable.

3. Calibration

First, in the top left panel of the host PC, choose the 9-point calibration type.
Explain the procedure to the participant as you are calibrating: "Before we start, I will calibrate the eye-tracker.
Please focus on the CENTER of each dot when it appears on the screen."

- ❏ [c to calibrate].
- ❏ [v to validate] [enter to approve validation].

We will now begin the experiment. You can go ahead and try the first practice text. Please ask in case you have any questions. Remember to keep your head still."

- ❏ [o to start the experiment]. In case "o" doesn't not work, please try if another key works (f.ex. "q").

[Average error should be below 0.3; for some participants, it is possible to achieve an even lower error. Always aim for an error as low as possible. If the error is above 0.3,

recalibrate unless the participant is very difficult to track and it appears impossible to achieve a lower error. TIP/SUGGESTION: If a participant is difficult to track, try changing the height of the screen, this could help with calibration. Do not change the setup for the chinrest, because this can affect the distance. Check the Data Collection Guidelines (Section 11.3) for details about the accepted and recommended calibration error values.]

Please make sure to count only the successful calibrations performed throughout the experiment. Discarded calibrations that are immediately redone do not need to be counted.This information needs to be reported in the Experimenter Session Documentation Sheet. Note that calibration and validation must be performed at the start of the session. Validation is then performed before each of the 10 experimental texts, once after the second practice text, and once at the end of the reading task (before the participant questionnaire). Experimenters must ensure that this final validation is not skipped;) and at the end of the session. **Due to validation results, re-calibration must be performed if needed. Avoid calibration within a text unless accuracy is visibly decreasing.**

During the experiment

Whenever the program interrupts or shuts down during an experimental session, copy the output from the interface window with the MultiplEYE logo in the top right corner and save it on your laptop in a text file (.txt or a Word document). Please provide this document together with the data files. **You can try and continue the core session following the procedure described at the end of this document.**

- For **EyeLink** devices: Press the “Record” button on the top right panel of the host PC to show the practice texts.
- First, the participant will read the practice texts. During this time the participant can ask questions (if needed even during the reading), e.g., about the buttons in the keyboard/controller, or how to switch to the next page, etc.
- You need to press the “Record” button to proceed to the next trial. Between two pages, there will be a fixation trigger. Please read the box below.
- Upon completion of the practice texts, **clearly inform the participant that** the practice session is ending and **the actual experiment is about to begin**.
- Keep a **constant check on the quality of the eye-tracking data** (by observing gaze overlay and checking the fixation trigger on the experimenter PC). For data quality, it is crucial that you follow the experiment closely at all times.

- Recalibration between the pages of a text is possible, but strongly dispreferred over calibrations between texts. If you observe that calibration quality is poor, e.g., from the gaze overlay during reading or because the fixation trigger does not fire, that calibration, you can press **esc** when the fixation trigger is shown and re-calibrate (reassure the participant that recalibrating is a routine procedure and does not reflect the participant's performance). Press record again to continue after the recalibration.
- At the end of the reading task of the experiment, the experimenter must validate the data and then press "**record**" again to proceed to the **participant questionnaire phase.**
- It is essential to clearly emphasize that no additional actions should be performed on the presentation PC during the experiment. The PC should remain untouched except for moving the keyboard or mouse if necessary—without clicking or pressing any keys. This precaution is important, as interacting with the system in other ways could potentially cause it to freeze. While this issue is not critical, avoiding unnecessary interactions ensures the experiment runs smoothly.
- After the participant has completed the last reading task, perform the final validation. Once the final validation is completed, press **"Record"** on the host PC. This will trigger the transition screen leading to the participant questionnaire. On the **participant PC,** press the **spacebar** to proceed to the participant questionnaire**.**
- After the reading task of the experiment, the **participant questionnaire** will be presented on the screen. Let them take a break, then have them sit down again and answer the questions. Stay close by in case they have any questions. Offer water or something else to drink to the participant during the breaks.
- The break between the end of the reading session (finishing with the participant questionnaire) and the psychometric tests session must be **at least 30 minutes**. If possible, encourage the participant to have some food and go for a walk outside. Advise against engaging in reading activities or other cognitively intensive tasks during this break. It is also possible to conduct the psychometric tests in a separate session on a different day.

Fixation Trigger

Before each text page, there will be a fixation trigger. A black dot with a white center will be shown in the top left corner of the screen. The participant is instructed in the instructions to look at this dot's center such that the next page screen appears. It will trigger if there is a fixation on the dot and normally you do not have to press any button. In case the trigger does not fire, you can do one of several things:

- Press **q** on the host keyboard. This will quit the trigger page and continue the experiment with the next page.
- Press **esc** on the host keyboard. This will lead you back to the setup screen in case you'd like to validate and/or calibrate.

❗ *Important:* If you press q or esc **while the participant is reading** the page (i.e. before the trigger actually shows up), it will consider this and do the corresponding action **after the participant finished reading the page** (no interruption during reading)!
This means that, in case you observe from the stimulus-gaze-overlay that **calibration quality** on the current page is **very poor,** you can **press esc** while the **participant is still reading** to trigger a **calibration after this page**.

Along the same lines, in case you have to **recalibrate although you expect the trigger to fire**, for example because you observed that there is a calibration drift towards the end of a line while calibration is still ok at the location where the fixation trigger appears, you can force a calibration by **pressing esc** while the participant is still reading.

When to recalibrate?

Please apply common sense when the trigger does not fire (i.e. the calibration seems to be off). If it is the last text page of a trial before the questions, it is probably not sensible to recalibrate but you should continue the experiment. In that case, you should recalibrate before the next trial in any case! If the participant has only read one page so far of a trial, it makes sense to calibrate right away such that the rest of the trial has good calibration quality.
Note that there is no option to show a read page again.
We also advise to revisit our recommendations on calibration thresholds on the average error in the Data Collection Guidelines (in Section 11.3.2).
ALSO: During the calibration and validation steps, please ensure that the participant fixates on all calibration dots, especially the **bottom right one**, which is sometimes missed. If the participant does not look at it, kindly remind them to do so.

What to do if the fixation trigger takes too long?

Please try the following troubleshooting steps:

- Turn off the internet or close any background applications running on the Host PC.
- Ask the participant to refocus on the fixation dot.
- As a last resort, you can skip the fixation trigger—however, this is not recommended. If you do skip it, make sure to document this in the session documentation sheet.

After the experiment

- Make sure the data is saved.
  You should be able to see a .edf file and a folder named `logfiles` in this location: `experiment_implementation > data > eye_tracking_data_[LANGUAGE_CODE]_[COUNTRY_CODE]_[LAB_NUMBER] > core_dataset > [PARTICIPANT_ID]_[LANGUAGE_CODE]_[COUNTRY_CODE]_[LAB_NUMBER]_ET1`
- If there is no .edf file, please copy it from the host PC as specified in the SR Research manual for your EyeLink eye-tracker. See this SR Research forum thread for instructions on how to do this: https://www.sr-research.com/support/thread-8513.html
- Reimburse the participant according to the rules in your lab and country.
- Thank and say goodbye to the participant:
  "Again thank you so much for your time! Please tell your friends about our experiment! Have a great day!"
- If not agreed upon yet, ask the participant to participate in the additional psychometrics test session (if applicable).
- Transfer (i.e., drag + drop) the complete data folder from experiment_implementation > data > eye_tracking_data_[LANGUAGE_CODE]_[COUNTRY_CODE]_[LAB_NUMBER] > core_dataset > folder name with *participant ID* to your password-protected SWITCHdrive folder and in that folder to the folder named `eye-tracking-sessions`. If it is a pilot session, it should be stored in a subfolder called pilot sessions. **Please refer to Section 14 in the MultiplEYE Data Collection Guidelines.**
  Please note that at this stage, all collected data has been only stored locally. Therefore, we strongly advise ensuring that you copy the **entire** folder containing the output files and upload it to the drive (we recommend to **zip the folder** first, and upload the zipped folder to your password-secured SwitchDrive folder).
- Make sure to download this Excel file (blank template) on the MultiplEYE SWITCHdrive and save it locally.
  This **Excel file** should be used to enter the notes you have taken on your printed version of the Experimenter Session Documentation Sheet. Please complete this file after every session. **Note**: Once you have downloaded the (blank) file from the SWITCHdrive, always complete and update the same file on your device. Add a new row for each new eye-tracking session (for each participant). For adding psychometric test sessions, see the additional sheet within the same excel file. **Upload this file as well to the SWITCHdrive folder.** The upload needs to be done when **your entire data collection is complete** (the sheet must include all participants from your data collection). Please make sure that you always (regularly) save a copy or have a **backup** of the digital sheet on your local device.
- Switch off the devices, incl. the host PC, eye-tracker, display PC, and monitor.

Continue a core session after an unexpected interruption

In case a core session was **interrupted due to an unexpected error** (for example a hardware problem) and you want to continue the session where you left off please follow this procedure:

1. It will take a few minutes to restart the session. Please tell the participant that they have to wait a moment. If the process takes considerably longer please ask them if they still have enough time to complete the session.
2. Very important: **Use the SAME participant ID** that has been used for the interrupted session for the next steps.
3. Go to the result folder of the interrupted session. This folder is located at `wg1-experimental-implementation/experiment_implementation/data/eye_tracking_data_[LANGUAGE_CODE]_[COUNTRY_CODE]_[LAB_NUMBER]/core_dataset/[PARTICIPANT_ID]_[LANGUAGE_CODE]_[COUNTRY_CODE]_[LAB_NUMBER]_S1`. Note that the participant ID will always be a three-digit number (i.e. 001 for ID 1).
4. In this folder, there should be an `.edf` file that is named `[PARTICIPANT_ID][LANGUAGE_CODE][COUNTRY_CODE][LAB_NUMBER].edf`. For example: `gb1en014.edf`. Please copy this file to another location on your PC (in case something goes wrong with the restarting) but do NOT delete the file in the original location.
    a. What if the file is not there but the participant has already read at least one page of the first practice trial: in that case the `.edf` file has not been transmitted correctly from the host EyeLink PC to the display PC when the program was interrupted. You will have to copy the file from the host PC **manually** (please refer to your EyeLink manual, there is a section on the Host PC file manager or check out this forum post). If you do not know how to do that we advise you not to continue the session and not to follow the following steps. If you do: **Please copy the `.edf` file from the host PC to the location described above where the `.edf` should have been and also make an additional copy to a different location.**
5. You can now safely restart the session. Please start the session as you did before such that the interface opens. The lab settings should still be correct but make sure that they are. Scroll down to the **Danger Zone** section.
6. Tick the box where it says you want to continue the core session (“enable”).
7. Select the same participant ID from the dropdown list and start the experiment.
    a. If the participant ID is not on the list, this means the program was interrupted before any data was written. You will need to assign a new participant ID to the participant and restart the session normally (i.e. without the settings in the

danger zone). Please make sure to write this down in your notes (Session Documentation)!

Thank you for following the protocol! *Your attention to detail ensures consistency and reliability across all sessions, contributing significantly to the success of MultiplEYE.*

Each session you conduct is a valuable step toward achieving our research goals. Your efforts are truly appreciated—thank you for being an essential part of this collaboration!