Erasmus+

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LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

Introduction to eye-movement research with PsychoPy

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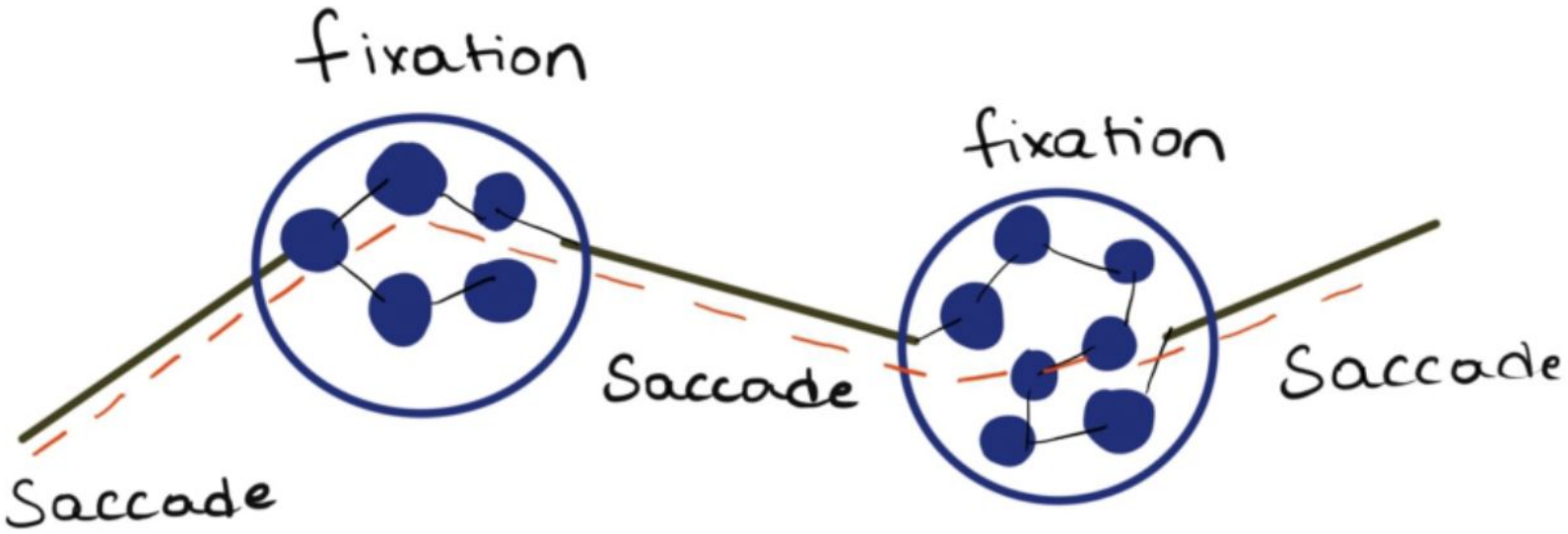
MSENSE

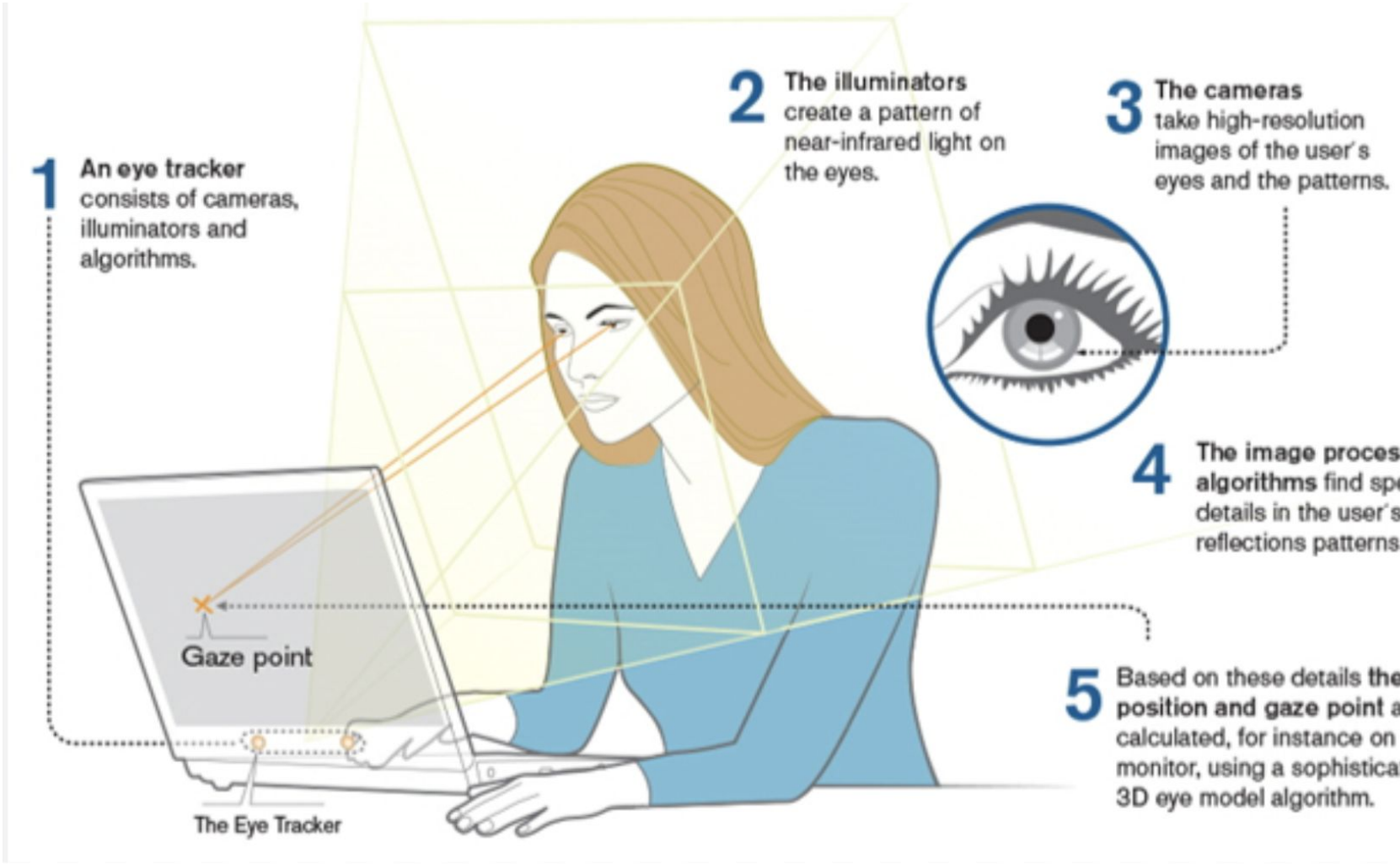
Saccades and Fixations

- Saccades are very fast eye-movements between gaze points

- Fixations are periods of relatively slow and small eye-movements (microsaccades)

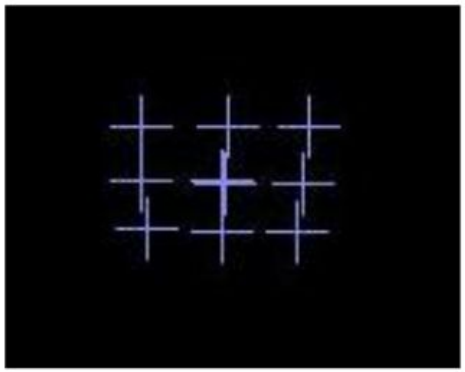


Eye-tracking principles

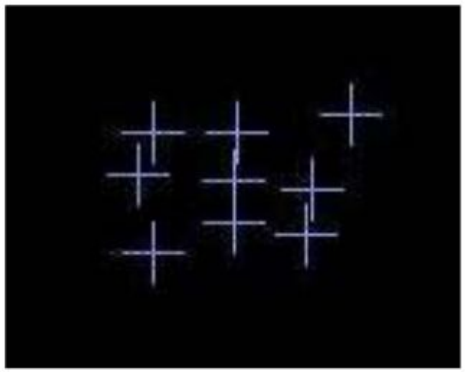


Eye-tracker calibration

- The algorithms need to be fine-tuned to a particular person and viewing situation
- For this reason the eye-tracker requires calibration at the start of an experiment
- Repeated calbiration may be needed (for example after breaks)



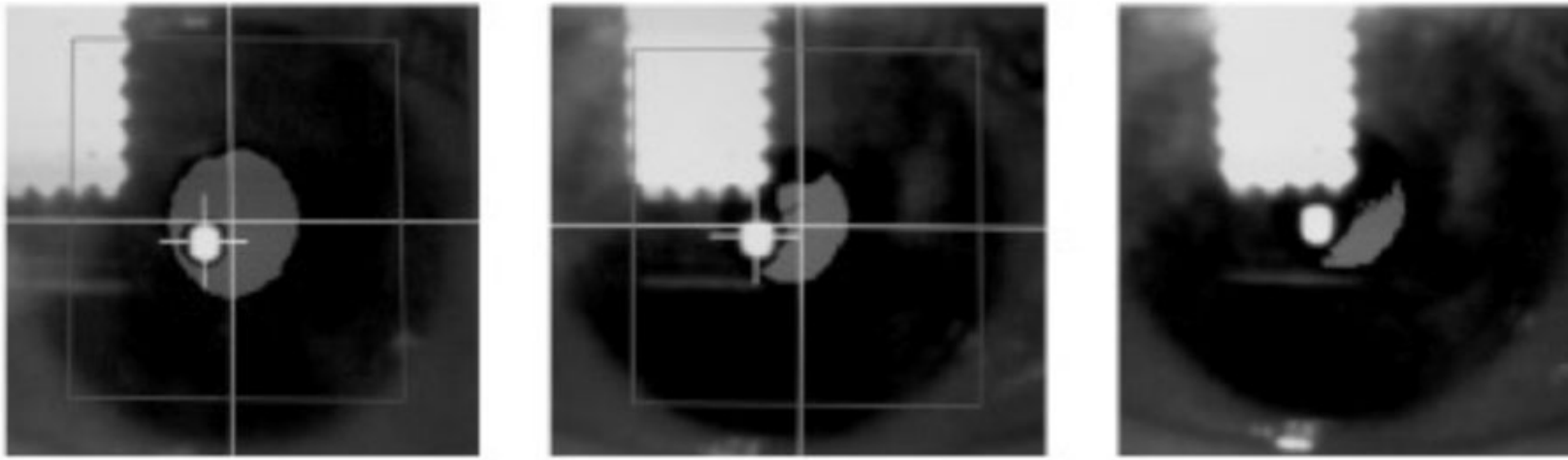
Good Calibration



Poor Calibration

Potential problems

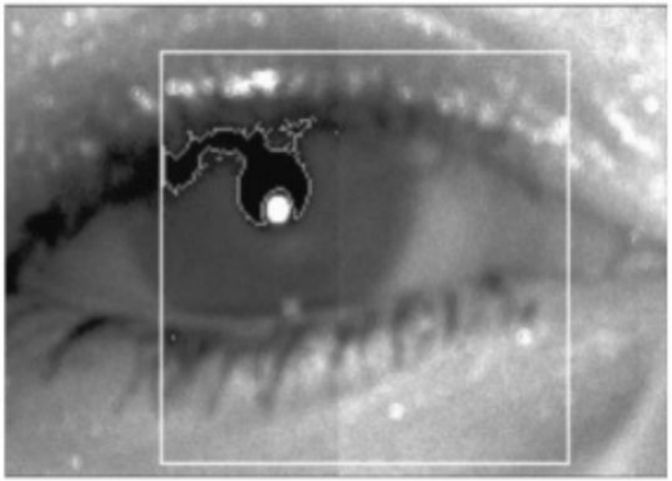
- Eye-glasses make eye-tracking more difficult if reflexes in the glasses cover the pupil
    - Adjusting the angle of the camera can help



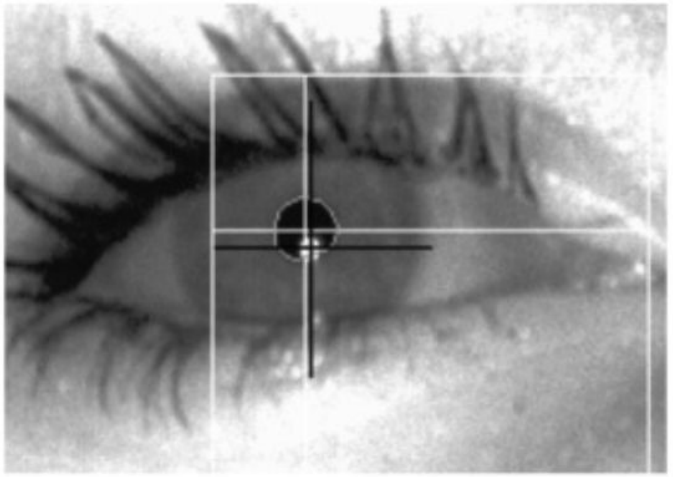
(a) Tracking works (b) Tracking with off-set (c) Tracking lost

Potential problems

- Mascara can interfere with detection of the pupil
  - Consider informing participants in advance not to wear mascara on the day of the experiment



(a) Participant with drooping eyelid and downward eyelashes. A thick, dark brush of lashes melds with the pupil and makes it impossible for the recording software to identify the pupil.

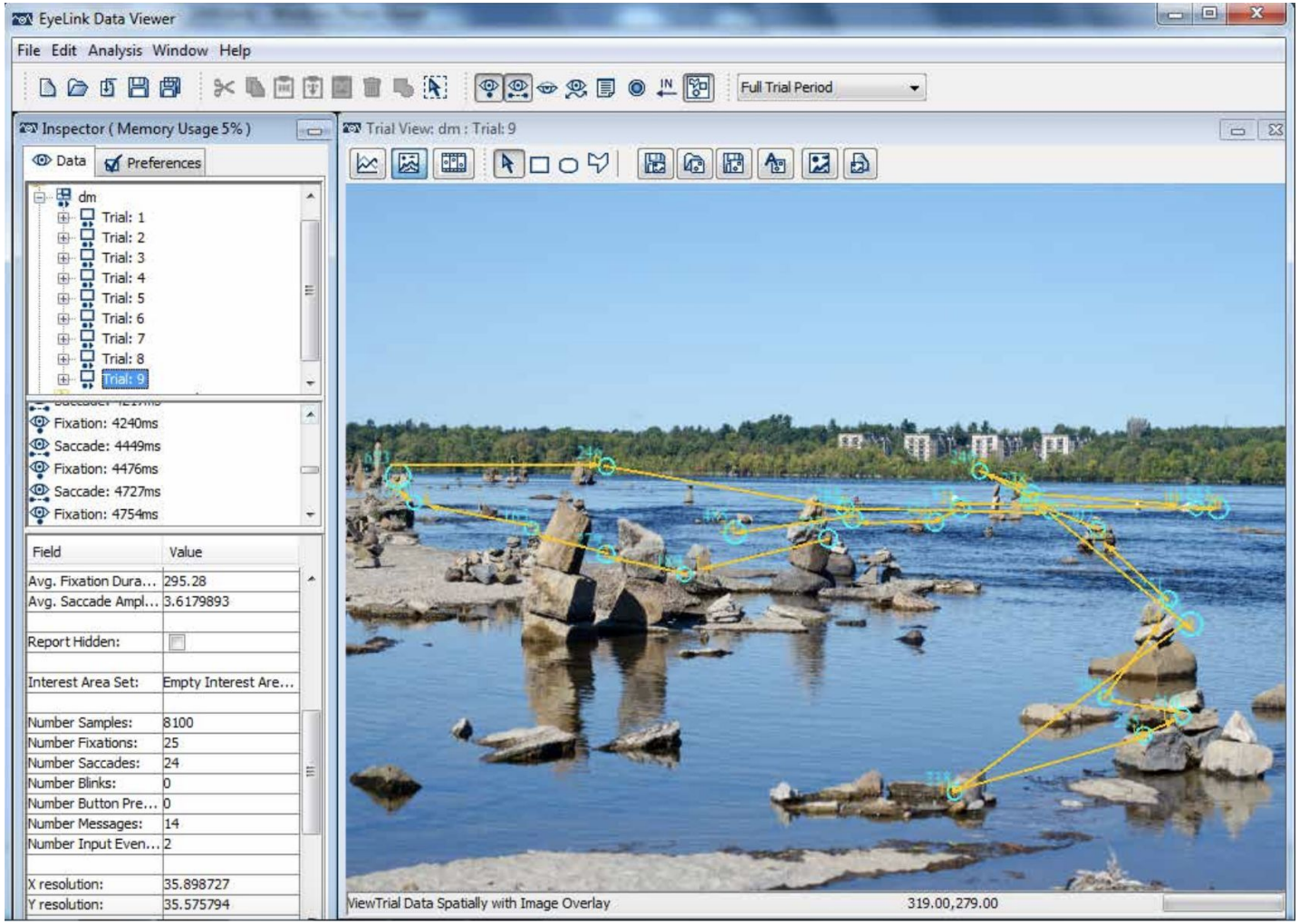


(b) Another participant with mascara, but with upward-pointing lashes; in this case the mascara is easy to exclude, and lashes like these seldom occlude the pupil.

Eyelink tower mount

Eyelink desktop mount

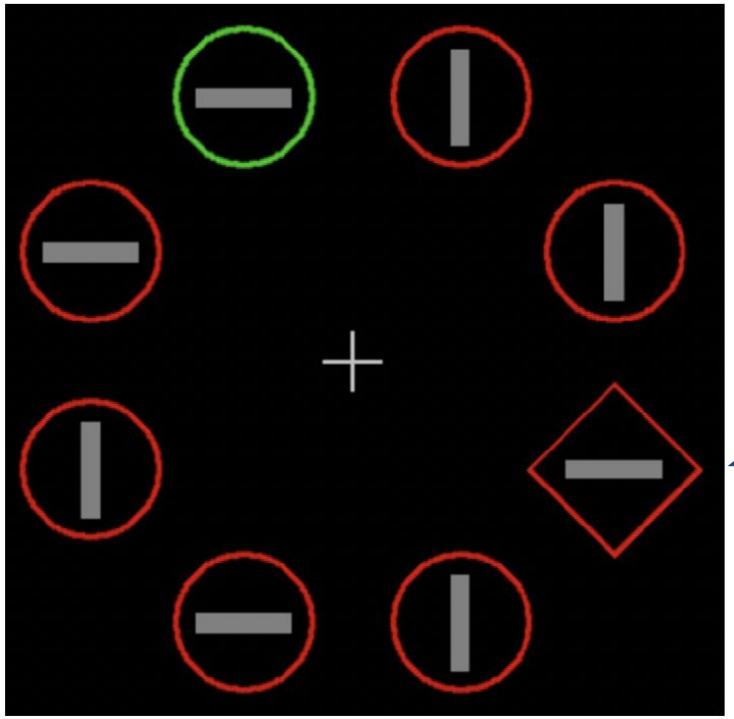
EyeLink Data viewer



Eye-tracking measures

- Scanpaths
- Number/frequency of fixations in an area of interest
- Fixation durations
- Saccadic onset latency
- Pupil size

Example: proportion of first fixations



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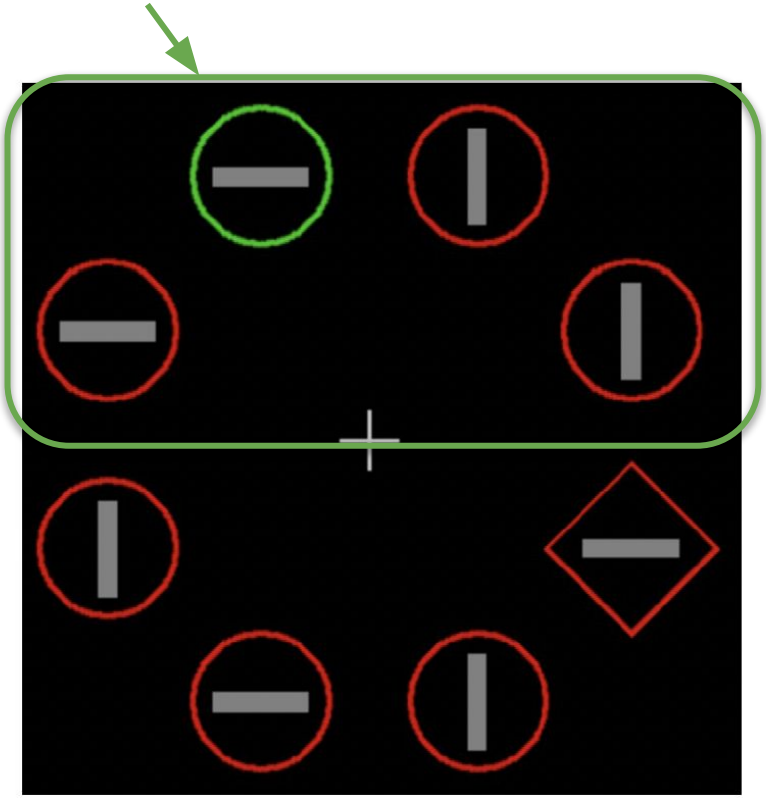
Distractor occurs more often in one region



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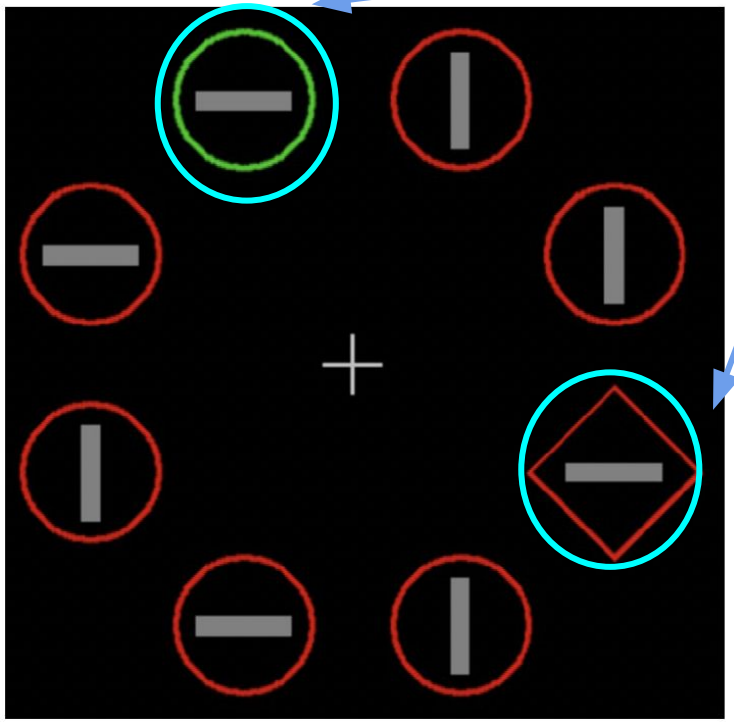
Example: proportion of first fixations

Regions of Interest (ROIs)



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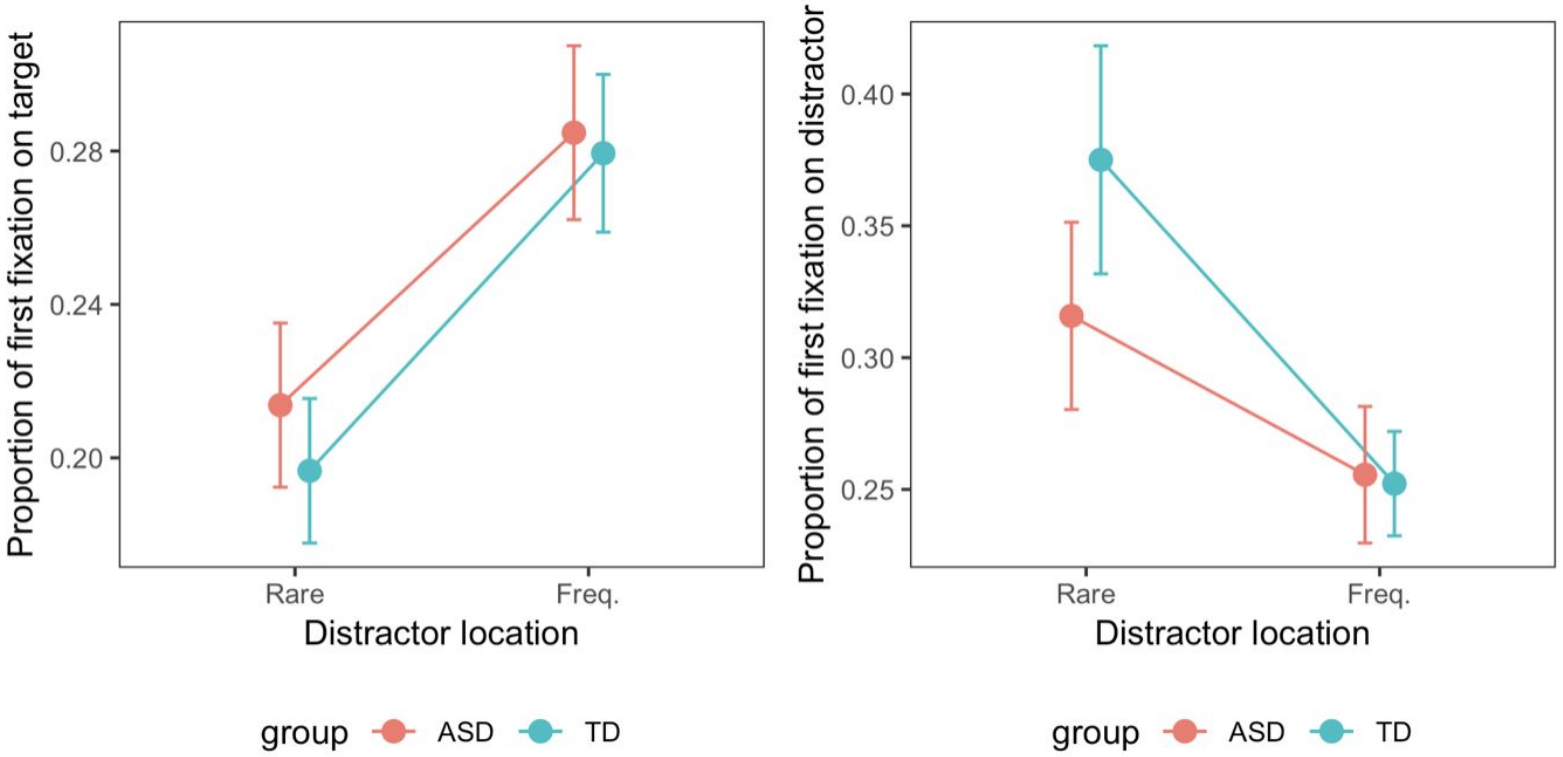
Example: proportion of first fixations

First saccades less frequently landed in the distractor ROI for distractors in the frequent region: evidence for proactive distractor suppression



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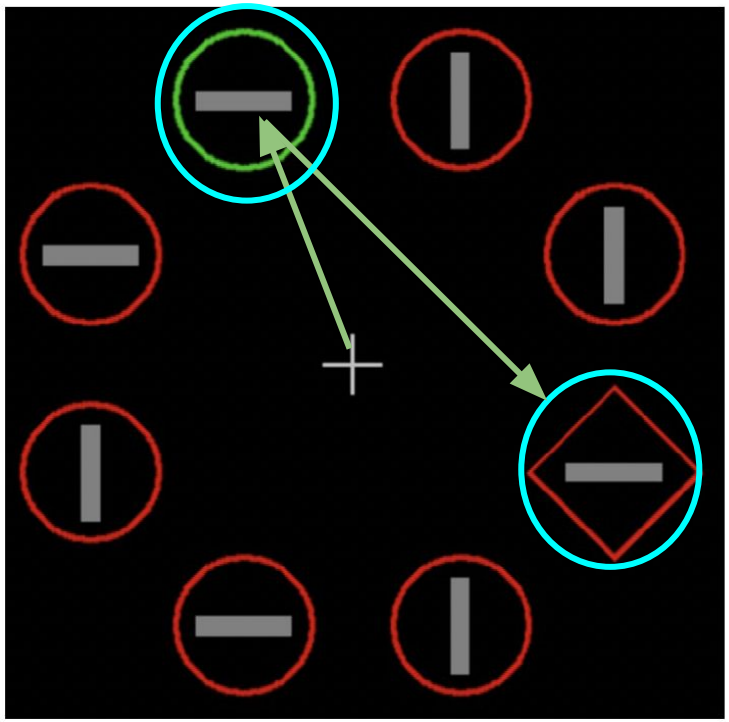
Example: fixation durations

How long does the fixation in distractor ROI last?



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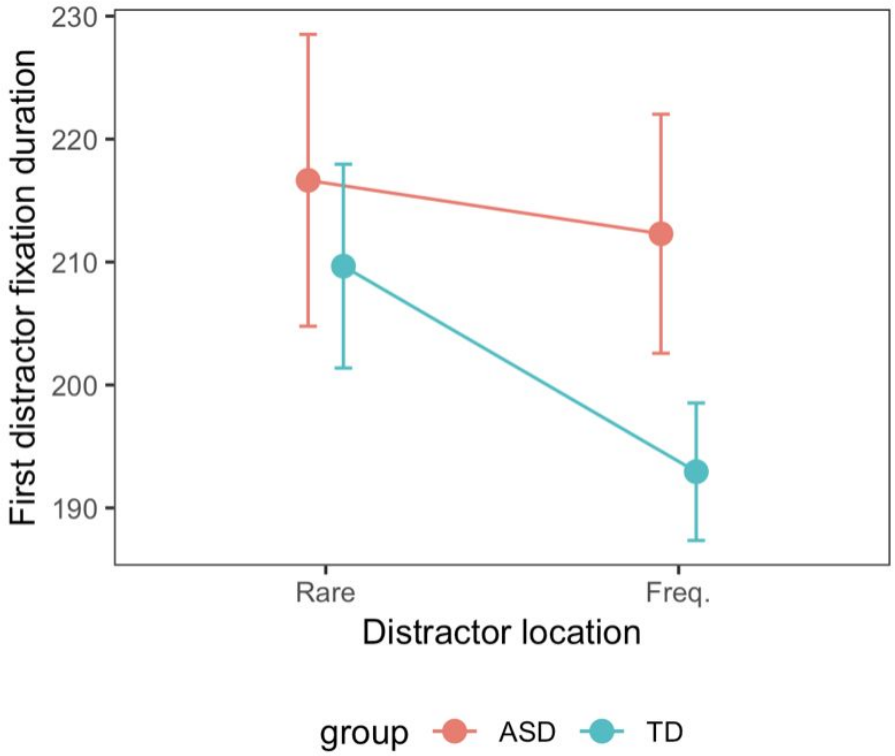
Example: fixation durations

Fixations in the distractor AOI had shorter duration for distractors in the frequent region: evidence for reactive distractor suppression



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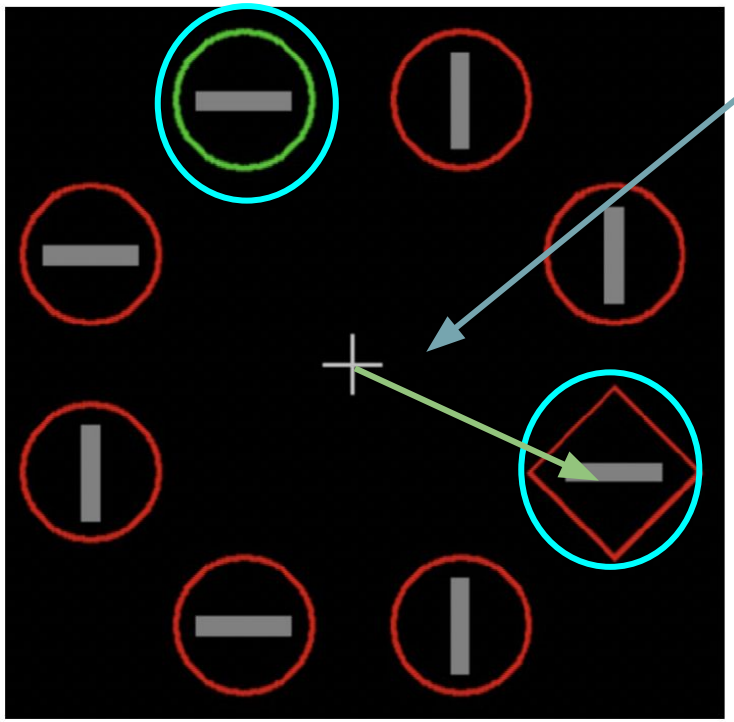
Example: saccadic onset latency



How long time after stimulus appearance does the first saccade start?

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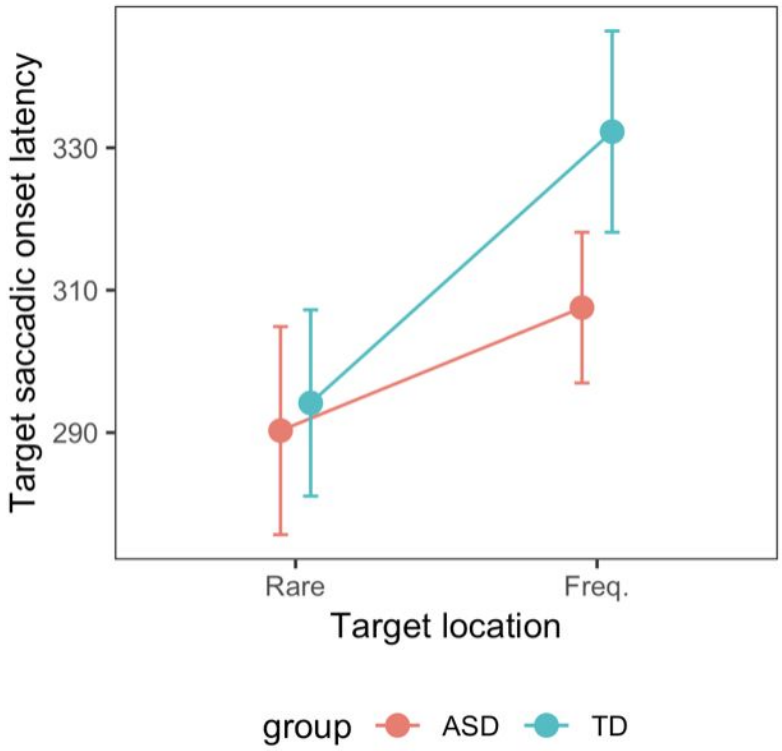
Example: saccadic onset latency

Slower saccades to target when it appeared in the frequent (distractor) region: distractor suppression also affects the target



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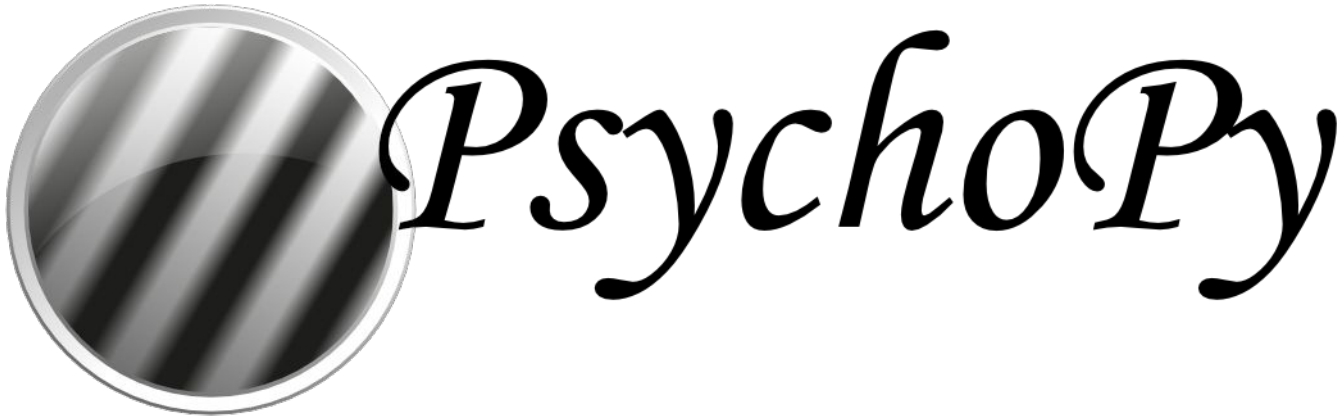
Creating an eye-tracking experiment

Most important extra steps needed for an eye-tracker experiment:

- Start and stop recording
- Calibration at start of exp.
  (repeat as needed)
- Send messages to eye-tracker at critical time points
  (e.g. appearance of stimulus, disappearance of stimulus)
- Optionally define ROIs
  (this can also be done later during analysis)

Psychopy installation



https://www.psychopy.org/download.html

PsychoPy history

- PsychoPy was originally developed in 2002-2003 by visual neuroscientist Jonathan Peirce at University of Nottingham for use in his lab

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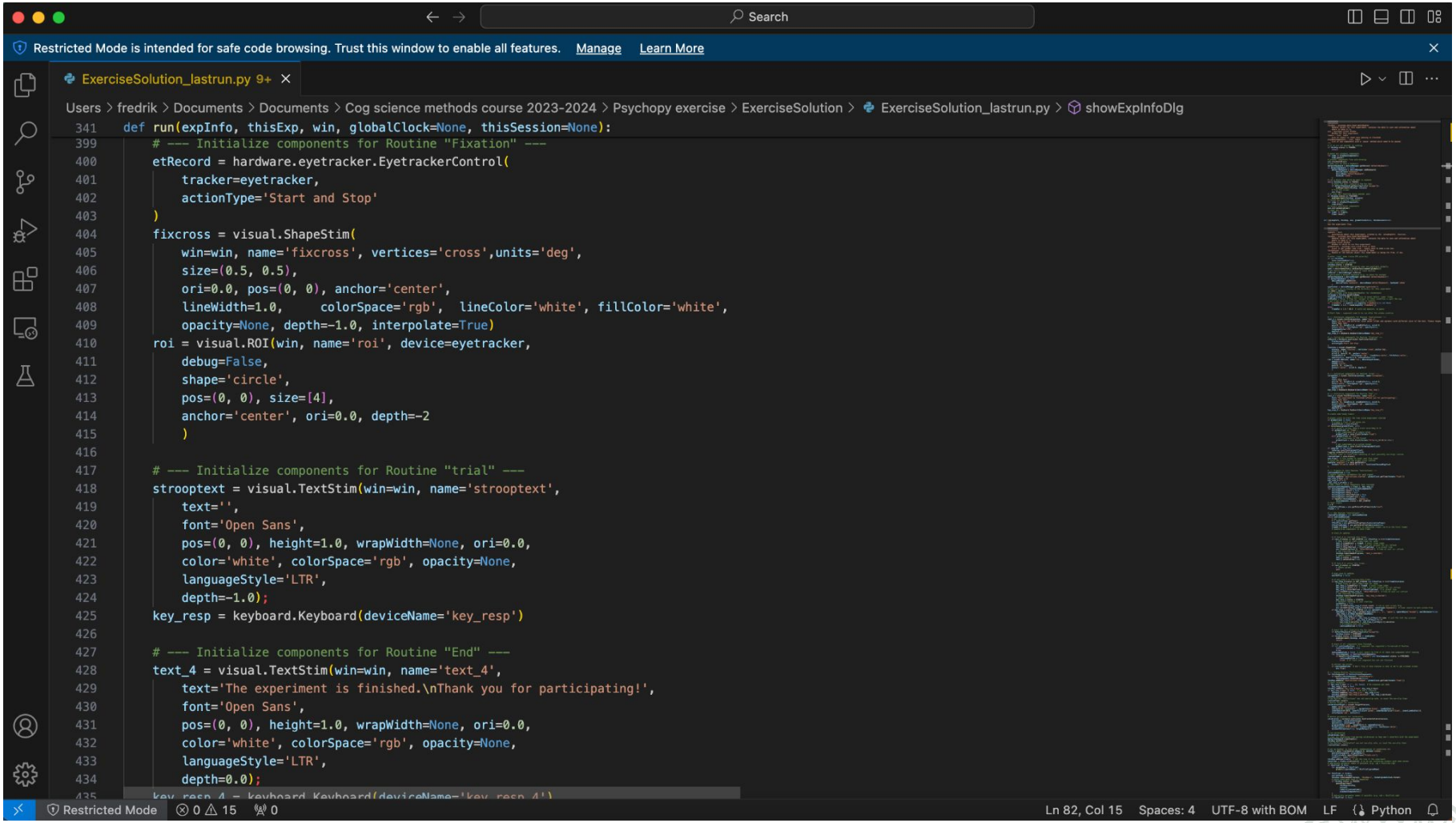
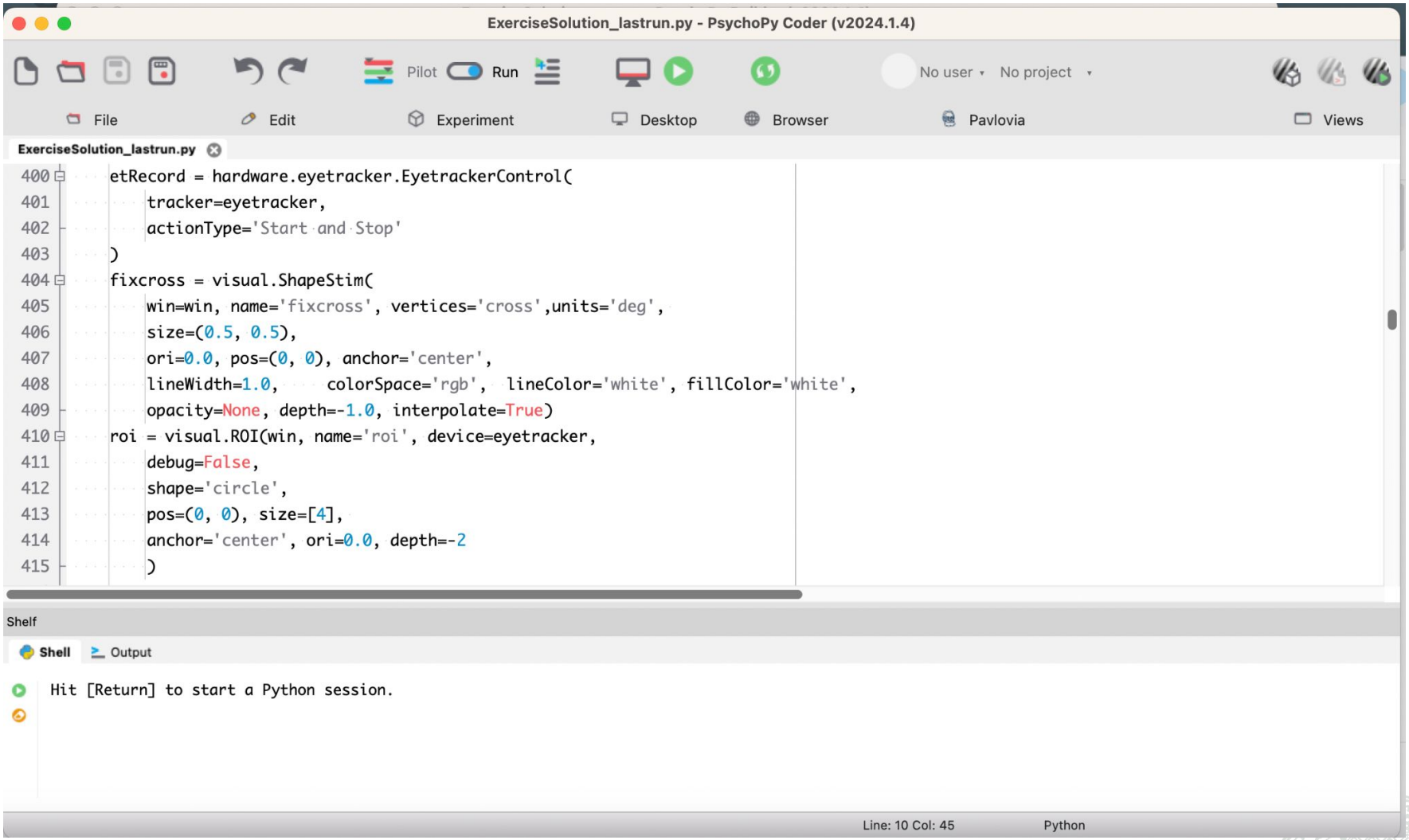
- Originally, PsychoPy was a Python library, not an application with a graphical user interface (GUI)

PsychoPy library



PsychoPy code view



Psychopy history

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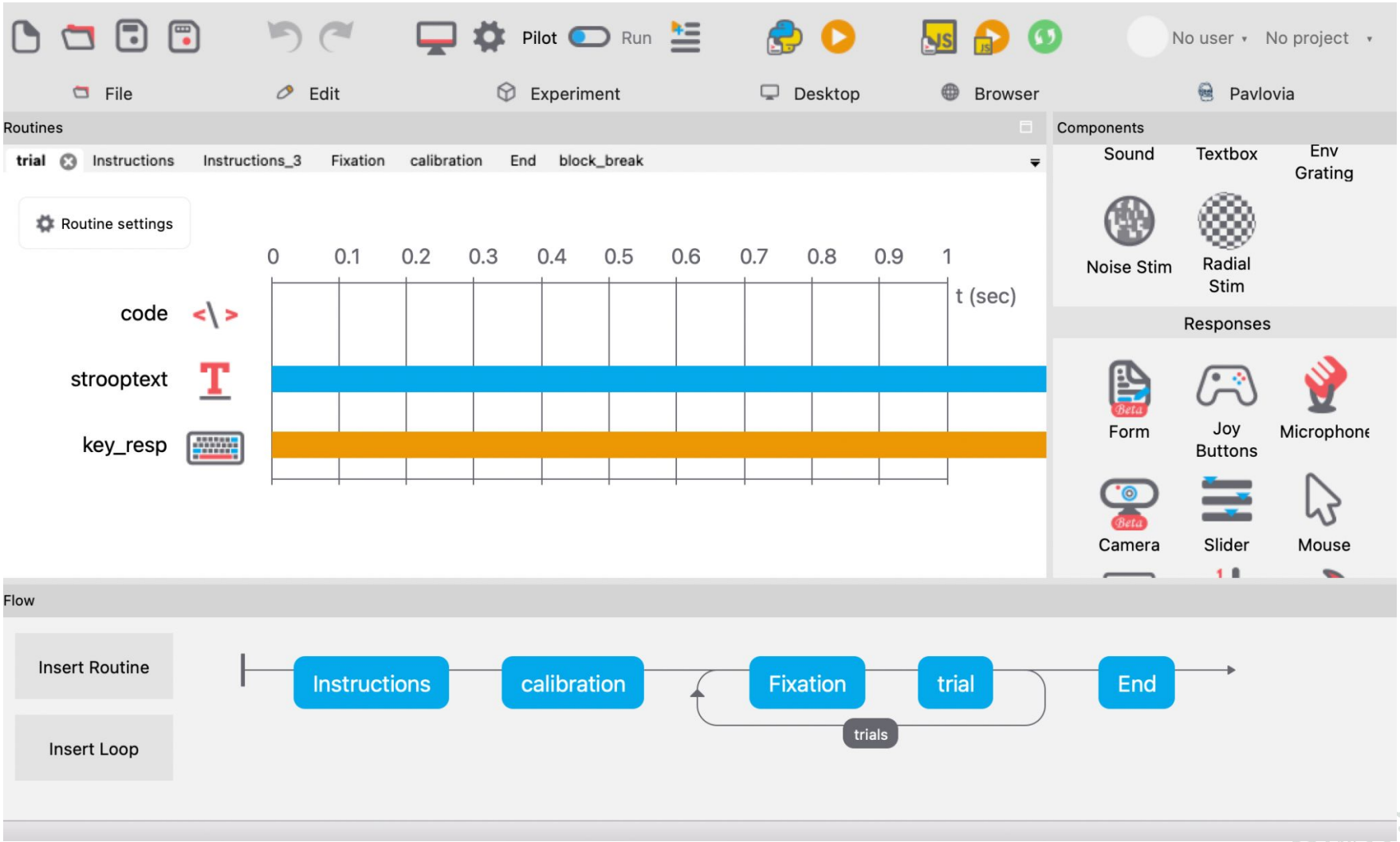
- Originally, PsychoPy was a Python library, not an application with a graphical user interface (GUI)

- Since then, PsychoPy has become a widely used tool for creating psychological and cognitive neuroscience experiments, which can still be used as a Python library but can also be used with a GUI (“builder view”) with little or no programming

Psychopy builder view



Creating an Experiment

- We will now build an experiment using PsychoPy builder view

- Please install the latest PsychoPy version (if you did not already)

https://www.psychopy.org/download.html