



OWLET

**Online Webcam-Linked Eye Tracker (OWLET)
User Guide**

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About OWLET

OWLET is a new open-source methodology for automatically analyzing infant eye-tracking data collected on personal devices in the home. It was developed by Denise Werchan, in collaboration with Natalie Brito and Moriah Thomason, using algorithms from computer vision, machine learning, and ecological psychology. In experimental validations of OWLET, we found that it provides robust estimation of infants' point of gaze from smartphone and webcam recordings of infant assessments in the home.

For detailed information on the development and validation of this tool, please refer to our methods paper:

Werchan, D.M., Thomason, M.E., & Brito, N.H. (in press). OWLET: An Automated, Open-Source Method for Infant Gaze Tracking using Smartphone and Webcam Recordings. *Behavior Research Methods*.

Installing OWLET

System Requirements

The OWLET app only runs on MacOS platforms. Work is underway to update the app to run on Windows platforms as well. Stay tuned!

OWLET has currently been tested with MacOS 10.15 (Catalina), MacOS 11 (Big Sur) and MacOS 12 (Monterey). Compatibility with earlier operating systems has not been tested.

Download

The MacOS app for OWLET can be downloaded from denisewerchan.com/owlet. We also provide additional resources, such as calibration videos and sample tasks, on this website.

In addition, the source code for OWLET can be found on Github (github.com/denismw/owlet/).

Install

The first time you open OWLET, your Mac may issue a warning message that says “OWLET can’t be opened because it is from an unidentified developer”. This message comes from your Mac’s “Gatekeeper” service, which only allows installations to proceed if the application was downloaded from the App Store.

To bypass this restriction, Control+Click on the app in Finder, then select "Open." You'll see a new popup asking if you're sure you want to run the app on your Mac. Hit "Open" again and you should be set!

Note: You can also grant an exception for a blocked app by clicking the Open Anyway button in Privacy & Security settings. This button is available for about an hour after you try to open an app.

General Steps for Running OWLET

Video Requirements

Currently, videos processed using OWLET must have a **frame rate of 30 fps** or higher, and the videos should be cropped to a **16x9 aspect ratio**. They should also be in **.mp4, .mov, or .mv4** format. These are the only hard requirements for processing videos.

To increase the quality of gaze data produced by OWLET, follow these additional tips:

- The infant or child's whole face should be present in the video. If you can only see the baby's eyes, OWLET will have difficulty detecting a face to isolate the eyes.
- It's okay if the parent's face is in the video, as long as it is higher than the baby's face (e.g., the baby sitting on the parent's lap is okay). If the parent's face is side-by-side or below the baby's face, they should be cropped out of the video to ensure that only the baby's gaze is detected.
- Videos should be of decent quality (e.g., not extremely fuzzy), and the baby should not be backlit or in partial shadow.
- If calculation of spatial accuracy is desired, a calibration should be performed prior to the study, where the infant is cued to look at the top, bottom, left, and right of the screen. In addition, the dimensions of the testing device should be measured, as well as the distance of the infant from the screen.

✗ Too dark/shadowy



✓ Good lighting



✓ Device on a flat surface



✗ Too far



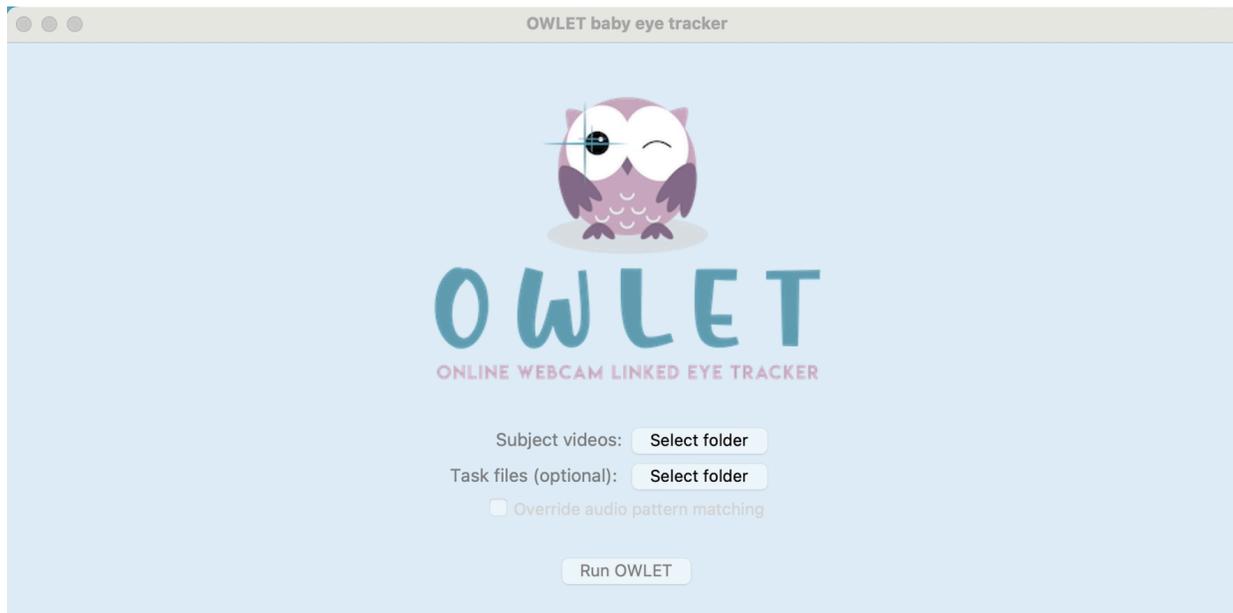
✗ Too close



✓ Good distance



Overview of User Interface



The OWLET app has two main components: (1) Subject videos and (2) Optional task files. These are described in detail below.

Subject Videos

The paths to the subject video must be specified by the user prior to running OWLET. The user is required to select a folder that has the subject video(s) and the optional corresponding calibration video(s). Please note that:

- If calibration files are included in the directory, they should have the same name as the subject videos with ‘_calibration’ added at the end
- If calibration files are not included in the same directory, OWLET will process the videos using default settings.

After running OWLET, an annotated video and csv file will be saved in the same directory as the subject videos. The csv file will contain the timestamp, frame number, x/y gaze coordinates, and tags for whether the infant is looking at the screen or away from the screen for each frame of the video. Additional information can be added through the “Task files” described below.

Optional Task Files

OWLET offers a number of optional settings for you to automatically link the frame-by-frame eye tracking data with information about the task. The task file folder can include the following additional files:

Task video (.mov or .mp4 format with maximum frame rate of 30fps)

The user can also upload a video of the task presented to the infant. This video will be integrated with the subject video in the annotated video output. In addition, the infant's estimated point-of-gaze for each frame will be shown on the task video.

Trial markers

The user can upload a csv file with time markers for trials or stimulus presentation. This is integrated with the CSV output produced by OWLET so that users can easily assess infants' gaze during specific trials. The 'trials.csv' file should have the following format:

Label	Time
Trial 1	10000
Trial 2	15000
...	...
Trial 20	100000

X/Y areas of interest (AOIs) tags

OWLET automatically adds tags indicating whether infants' were looking to the left, right, or away from the screen in the CSV output. However, custom regions of interest can also be specified by including an additional 'aois.csv' file specifying the start (x1 and y1) and end (x2 and y2) coordinates of the regions of interest at a resolution of 960x540:

AOI	X1	Y1	X2	Y2
Upper left	0	0	480	280
Upper right	480	0	960	280
Lower left	0	280	480	560
Lower right	480	280	960	560

Override Audio Pattern Matching

The user may want to override the audio pattern matching option if the subject video(s) is already trimmed to the start and end of the task. The user may also want to override audio pattern matching when using a task that does not have sound.

Please note that the entire subject recording will be processed if you choose to override audio pattern matching. If you have issues with audio matching but still wish to automatically link the subject recordings with task information, please manually trim the subject recording so that only the task of interest is in the video.

Additional Information

Citing OWLET

If you use OWLET in your research, please cite our methods/validation paper as:

Werchan, D.M., Thomason, M.E., & Brito, N.H. (2022). OWLET: An Automated, Open-Source Method for Infant Gaze Tracking using Smartphone and Webcam Recordings. *Behavior Research Methods*.

License

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Contact Information

Please get in touch if you have any questions or comments!

- Website: denisewerchan.com
- Twitter: [@DeniseWerchan](https://twitter.com/DeniseWerchan)
- Email: denise.werchan@nyulangone.org
- Link to Source Code: <https://github.com/denisemw/OWLET>