Tobii X1 Light Eye Tracker
Snap-on eye tracking system
for your portable lab

- **Eye track websites or ads directly on your laptop or PC monitor**
- **Study real-world interfaces, like ticket machines and ATMs**
- **Generate high-quality eye tracking data in real-life conditions**
- **Works on a large proportion of participants**

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www.tobii.com

Tobii X1 Light Eye Tracker

Collect eye tracking data in a coffee shop, mall or office—wherever your participants are. The compact yet full-feature eye tracking system snaps into place on your laptop so you can study websites or ads. Get instant, cost-efficient insights into visual attention and interest.

Compact eye tracker for your portable lab

The Tobii X1 Light Eye Tracker is the smallest of all our eye trackers. Mount it on a laptop or PC monitor for a compact, highly portable eye tracking solution. It is ideal for usability and market research studies in the field, allowing you to test participants in their familiar surroundings. The travel-friendly solution fits neatly into its carrying case so tests can be performed effectively in different locations.

The full-feature system builds on the same advanced technology as our other eye trackers with no compromise in quality. Maximum portability and a lower price make it possible to integrate eye tracking into every interface design or communication project.

**Versatile for a broad spectrum of studies**

The versatile eye tracking system can be used both in screen and real-world test scenarios, making way for a very broad spectrum of studies. Present stimuli on a laptop, an external screen or all-in-one PC. Perform studies like websites, software and ads or study physical interfaces like an ATM, a ticket machine or an information kiosk. The supplied mounting solutions support a variety of study designs (see image below).

Find out where test participants are looking

The Tobii X1 Light Eye Tracker is suitable for usability, market research and other studies that analyze visual attention, gaze patterns, and the like. Application areas include:

- Website and software usability studies
- Copy testing, digital campaigns and TV commercials
- Package design studies
- Real-world interface studies that require a small eye tracker, such as studies of an ATM machine, ticket machine, or control panel
- Neuromarketing studies combining biometric signals with gaze point data

Laptop setup   *Monitor setup*   *Real-world setup*
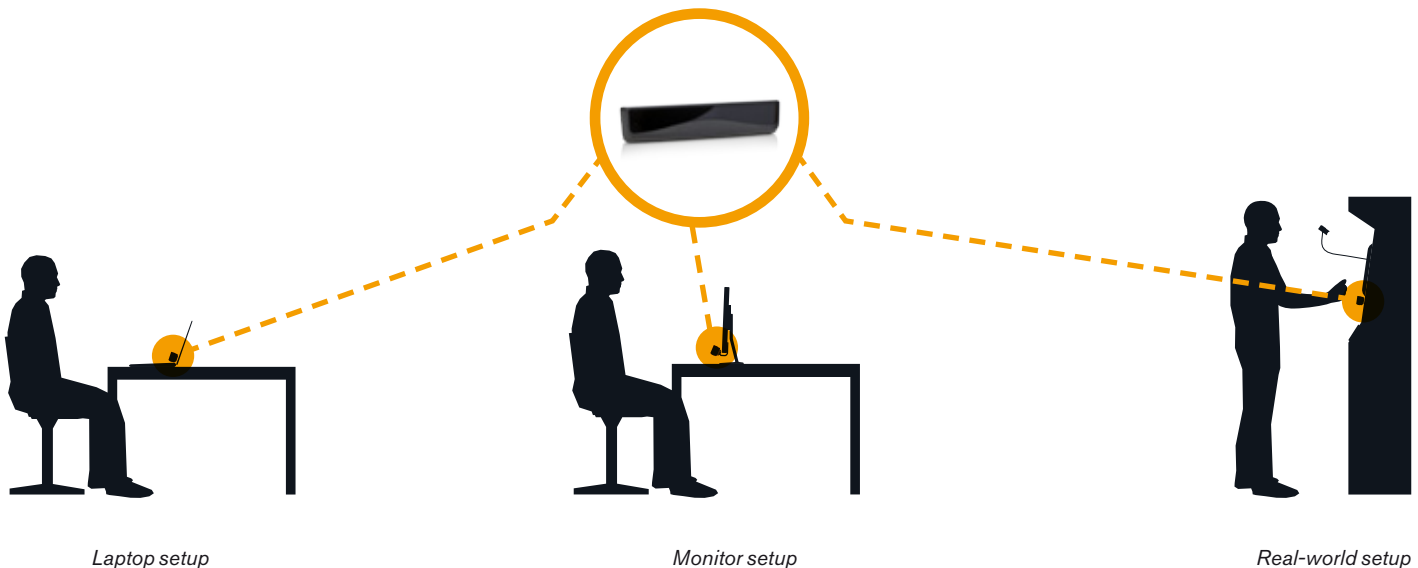
Study ticket machines, ATMs and other real-world interfaces in their actual use environments.

The eye tracking system is designed for studies primarily aimed at determining precisely where the participants are looking–the fixation point–rather than studying timing or duration of fixations, or eye movements such as saccades, for example.

Compatible with a variety of screens

Tobii X1 Light Eye Tracker can be mounted below most screens (highly accurate results for screens up to 21", depending on mounting solution). This gives you the freedom to present your stimuli on a screen that best meets the specific needs of the study at hand.

Studies of real-world interfaces

The eye tracking system can be used to study real-world interfaces. Its small size allows for studies of in-field devices that might not offer the space to fit a conventional full-sized remote eye tracker like an ATM, a ticket machine or a control panel.

Software options

Tobii X1 Light Eye Tracker enables you to work with Tobii Studio, the leading eye tracking analysis and visualization software.

Tobii Studio supports you through all stages of your project, from preparation and data collection to analysis and presentation of the results. Design your study, run test sessions, replay the eye tracking record, create visualizations such as heat maps and gaze plots, and calculate statistics—all in one integrated tool.

Tobii Plug-in for Morae allows users of the system to integrate eye tracking with Morae, the premier user experience software. Using a Tobii X1 Light Eye Tracker and Morae Recorder, users can capture eye tracking data that can then be replayed and viewed in Morae Manager. Tobii Plug-in for Morae is available for free download at tobii.com.

If you want to develop your own applications, the Tobii Software Development Kit (Tobii SDK) is available for free download.

Ease of use and automation

Supplied solutions for mounting the eye tracker along with step-by step configuration guides ensure user-friendly setup and configuration procedures. Quickly install the eye tracker software, mount the eye tracker and complete the configuration guide. In minutes, you are ready to perform your study. You only need to plug in a power cable and a USB cable.

- Supplied mounting brackets for laptops, PC monitors and real-world interfaces.

- Fully automatic tracking.

- Rapid and automatic calibration procedure.

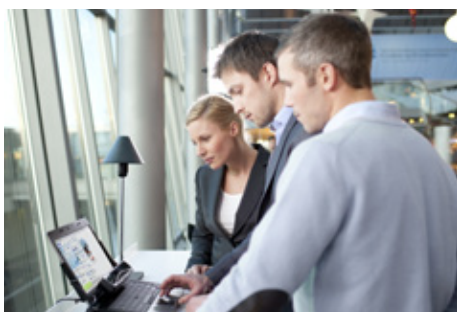- Runs on most Windows desktop or laptop computers (Windows XP and later).

Use the system together with an monitor.

> *We are excited about the release of Tobii's X1 Light Eye Tracker. Its compelling form factor, data quality and ease of use make it an excellent choice for new and conventional applications of eye tracking.*
>
> **Andreas Thölke, CTO, EYE SQUARE GmbH**

Eye track websites directly on a laptop screen.

The simple setups, configuration and automation means you can efficiently perform eye tracking studies in the field where you have easy access to participants.

Freedom of movement, unobtrusive

- The Tobii X1 Light Eye Tracker has a large head movement tolerance, as do all Tobii eye trackers. Participants can move freely and naturally, whether in front of a laptop, PC monitor or real-world interface.

- Its small size and only two cables allow unobtrusive studies of real-world interfaces that offer little space to fit a full-sized eye tracker.

- Stable and reliable calibrations eliminate the need for recalibration during long sessions and can be reused for repeat sessions with the same participant.

The unobtrusive technology creates a distraction-free test environment, ensuring natural participant behavior and valid research results.

Accurate and reliable

The eye tracking system captures data at approximately 30 Hz. It delivers the same high data accuracy and participant tracking capability as other Tobii eye trackers.

- Highly accurate gaze-position data in real-life conditions like when participants move relative to the eye tracker or under varying light conditions.

- Robust tracking capability ensures very low data loss in real-life conditions.

- Dual camera system with automatic selection of bright or dark pupil tracking, accommodates for large variations in experimental conditions and ethnicity.

- Tracking of both eyes.

Accurate data produces highly reliable research results. Robust tracking capability ensures very low participant data loss and allows you to work with a wide cross-section of the population.

Tobii X1 Light Eye Tracker is available for purchase or for rental.

Tobii X1 Light Eye Tracker mounted on a PC monitor.

Tobii X1 Light Eye Tracker mounted on an all-in-one PC.

Technical innovations

Tobii has developed a number of clearly distinguishable technological innovations that contribute to the superior performance of our eye trackers. Below are a few:

TrueEye. Creates a unique physiological 3D model of each individual's eyes. Enables much more accurate compensation for head movements and pupil drift than any other product on the market.

Dual Sensor Technology. "3D vision" using double image sensors enables an accurate

measurement of the distance from the sensor to the participant's eyes. Improves accuracy, precision, tracking robustness and contributes to the TrueEye model.

High Quality Sensors. High resolution of each eye is critical to reduce noise and obtain good precision. High sensitivity is a prerequisite for a large track box.

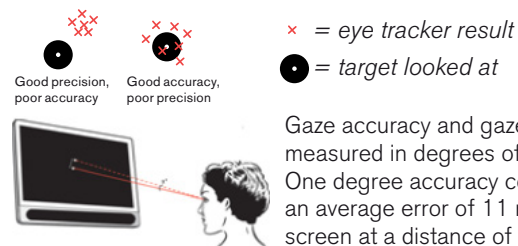Precise Sensor Control. Provides accurate timestamp of each data point.

Embedded Processing. The eye tracker has its own dedicated processor and operating system integrated in the system. Because the system runs completely independent of computers and other software it is independent from, for instance, Windows upgrades (as long as the upgrade does not interfere with USB or TCP/IP communication parts).

Read more about Tobii's eye tracking technology at tobii.com.

Specification of Gaze Precision and Gaze Accuracy, Tobii X1 Light Eye Tracker

Tobii Technology has adopted a comprehensive method for gaze accuracy and precision measurements to facilitate performance comparisons of different remote eye tracking systems. This Tobii X1 Light Eye Tracker specification is a condensed version of the results from these measurements. The test specification and the complete test report for Tobii X1 Light Eye Tracker can be downloaded at tobii.com.

Gaze accuracy describes the angular average distance from the actual gaze point to the one measured by the eye tracker. Gaze precision describes the spatial variation between individual gaze samples.

× = eye tracker result

● = target looked at

Good precision, poor accuracy   Good accuracy, poor precision

Gaze accuracy and gaze precision are measured in degrees of visual angle. One degree accuracy corresponds to an average error of 11 mm (0.45") on a screen at a distance of 65 cm (26").

In the figure above, the dashed red line represents the subject's actual gaze direction, whereas the solid line represents the gaze point measured by the eye tracker. Gaze accuracy is expressed as the deviation in degrees between the two lines, with the point of origin determined by the position of the eye.

Gaze precision

Precision measurements are done using dark pupil [1] artificial eyes to eliminate artifacts from human eye movements. Tobii specifies precision both with and without noise reduction filters. All precision measurements are done at a variable sampling rate and a distance of 65 cm (26"). Precision is calculated as root-mean-square (RMS) of successive samples.

	Binocular [2]	Monocular [2]
Precision with raw data [3]	0.20°	0.27°

Precision is related to frequency. Due to the variable sampling rate of the Tobii X1 Light Eye Tracker, not all low pass filters can be used to reduce actual noise.

Precision at varying distances

Precision is dependent on distance from the eye tracker. The graph below illustrates precision results for different distances. Data shown is binocular, based on two artificial eyes.
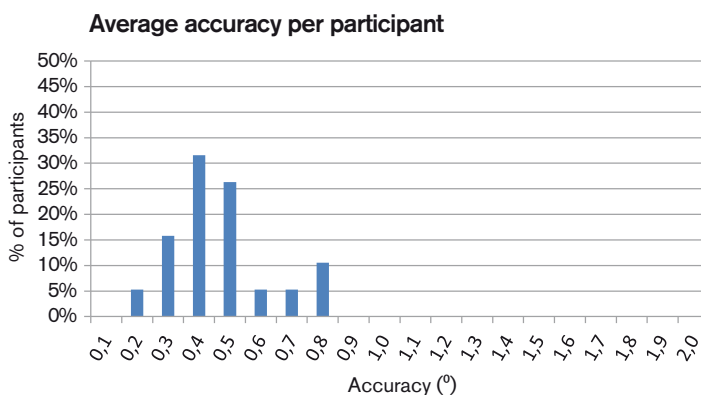
Precision at varying distances
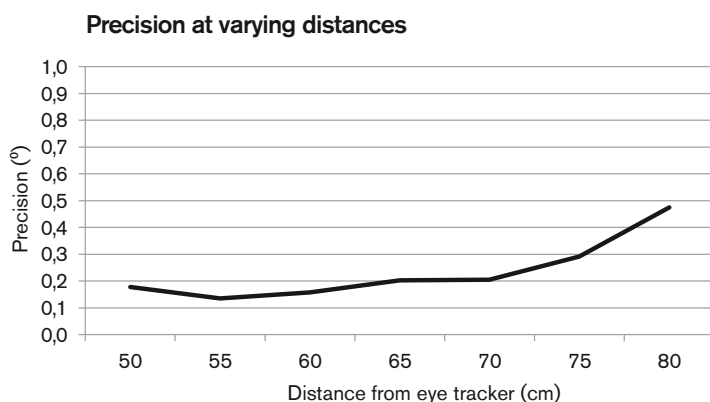
Gaze accuracy

Accuracy is measured under ideal conditions, as well as under various conditions that influence a non-restrictive eye tracking test, e.g. change of gaze angles, light conditions or head position. All measurements are performed in a carefully controlled lab environment. [4]

	Binocular	Monocular
Accuracy under ideal conditions [4]	0.5°	0.5°

The graph below illustrates distribution of accuracy under ideal conditions for each subject. Data shown is binocular.

Average accuracy per participant

Accuracy with large gaze angles [5]	Binocular	Monocular
25° gaze angle	0.3°	0.4°
30° gaze angle	0.3°	0.4°

Accuracy with varying illumination [6]	Binocular	Monocular
1 lux	0.9°	1.4°
300 lux	0.5°	0.5°
600 lux	0.5°	0.8°
1000 lux	0.5°	0.9°
White stimuli background (300 lux)	0.5°	0.5°

Accuracy at varying distances [7]

The diagram shows average accuracy for all test subjects at varying distances from eye tracker to subject. The total average accuracy for each distance is illustrated with a line. Max/min and standard deviation from mean is presented with boxes and vertical lines. Data shown is binocular.

Average accuracy per participant over distance
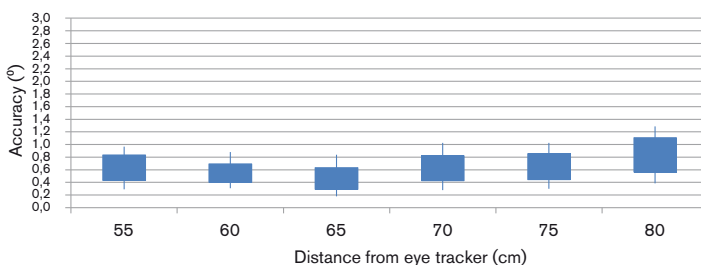
) Please see next page for footnotes and comments.

Eye tracking specifications

Variable sampling rate	Typically 28-32 Hz
Total system latency [8]	50 - 90 ms
Time to tracking recovery	For blinks: immediate After lost tracking: 100-300 ms
Freedom of head movement at 65 cm [9]	X (at least one eye): 44 cm (17.3") Y (both eyes): 32 cm (12.6")
Operating distance (eye tracker to subject)	See Tobii X1 Light Eye Tracker Accuracy and Precision Test Report for details
Recommended largest gaze angle	27°
Accuracy	See previous page and Tobii X1 Light Eye Tracker Accuracy and Precision Test Report for details
Precision	See previous page and Tobii X1 Light Eye Tracker Accuracy and Precision Test Report for details
Data sample output (for each eye)	Timestamp Eye position Gaze point [10] Pupil diameter [11] Validity code [12]
Tracking technique	Bright/dark pupil tracking

Eye tracking unit

Eye tracker processing unit	Embedded—no external eye tracking at host PC necessary
Connectors	Embedded—no external eye tracking at host PC necessary
Weight	350 g (12.3 oz)
Size (without fixture)	24.9 x 5.0 x 4.8 cm (9.8 x 2.0 x 1.9")
Mounting alternatives	Laptop mounting bracket, VESA mounting bracket, adhesive mounting bracket, desk stand, tripods

Software options

Tobii Studio
Tobii Plug-in for Morae
i2 Visualizer Implicit System, Eyesquare
Attention Tool, iMotions
E-Prime, Psychology Software Tools (PST)
Other applications, built on the Tobii SDK [13]

Hardware package

Tobii X1 Light Eye Tracker
Bracket & screws for VESA to mount the X1 Light on a screen
USB cable (PC to eye tracker)
Power supply unit (eye tracker)
Spacer bag including a set of screws and torx key
Zipper bag for eye tracker
Eye tracker software CD
Printed manual

Accessories

Tobii X1 Light Laptop Case Accessory Package	Package to mount and use the eye tracker on a laptop, including case for easy transport. See tobii.com for details.
Tobii X1 Light Monitor Case Accessory Package	Package to mount and use the eye tracker on a screen, including case for easy transport. See tobii.com for details.
Suction knob tripod	For mounting of scene camera or eye tracker
Tobii X1 Light Adhesive Mounting Bracket	Adhesive mounting bracket for mounting without VESA
19" Dell display monitor	Recommended external screen

1) Because the Tobii X1 Light Eye Tracker tracks with both dark and bright pupil technique, precision is to be measured using eyes of each property. However, there is no bright pupil data at this time as such artificial eyes have yet to be developed. Typically, tracking with bright pupil has significantly better precision than dark pupil.

2) Monocular data shown is based on data from the dominant eye of each subject. Binocular data is the average of the two eyes.

3) Raw data from the SDK after individual calibration, without any noise reduction filters.

4) Accuracy under ideal conditions is measured in the center of the head movement box with normal office background illumination (300 lux). The nine stimuli points are placed within a 20° visual angle. See detailed information in the "Accuracy and precision test method for remote eye trackers" specification at Tobii.com.

5) Good accuracy is difficult to achieve at large gaze angles, but is important when testing large stimuli. For instance, the upper corners of a 23" screen with a test subject at a distance of 65 cm (26") corresponds to a 32° visual angle relative to the center of the eye tracker unit (when the eye tracker is placed right below the screen).

6) The luminance of the stimuli and the illumination in the lab are manipulated in order to reveal accuracy effects of pupil dilation and varying surrounding light effects.

7) Calibration is performed at the center of the head movement box. Measurements are performed with the test subject at precise and specific distances relative to the eye tracker, measured along the axis of the eye tracking sensors.

8) Total system latency describes the time required by the eye tracker processor to perform image processing and eye gaze computations.

9) Describes an area where at least one of the eyes is within the field of view of the eye tracker. Specified as width x height.

10) Both as absolute coordinates in mm relative to stimuli plane, and as normalized coordinates in the stimuli plane. From the eye position and the gaze point, the precise gaze angle can be calculated in degrees.

11) Pupil diameter, with accurate algorithms to compensate for the spherical corneal magnification effect as well as the distance to the eye. Robust compensation for gaze angle changes.

12) The validity code indicates the system's confidence in whether it has correctly identified which eye is the left and right eye for the specific sample.

13) The Application Market for Tobii Eye Trackers (appmarket.tobii.com) has many applications that build on Tobii SDK 2.4.X and 3.0 that you can search for and download.

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