

Tobii TX 300

Tobii TX 300 is an eyetracker that has a high speed infrared camera and it emits infrared light. It can track eyedata at 60Hz, 120Hz or 300Hz. It chooses automatically between black pupil eye tracking and white pupil eyetracking. It prefers black pupil eyetracking.

In black pupil eyetracking the biggest black things the camera sees are supposed to be the pupils. In infrared light, eye makeup looks darker and bigger than the pupils. Eyemakeup should in all cases be removed by using a proper eyemakeup remover and eyepads. NEVER ever use ALCOHOL to clean eyes. This can cause BLINDNESS.

White pupil eyetracking uses more infrared lighting, that is reflected in the eye (red eye effect) to find the pupils. Since there is more infrared light shining into the eyes, the eyes might get a bit dry if this method is used for a longer period.

Both methods use reflection of infrared light in the eyeball, the position of the pupils and a calibration to determine where the subject is looking.

Experiment Room

Tobii uses an infrared camera that is located underneath the computerscreen. The infrared emitters are also located underneath the screen. It is important that there are no infrared sources or reflections shining into the camera. Turn off incandescent light bulbs (gloeilampen), including Christmas lighting. The fluorescent (TL-lampen) are fine. Avoid sunlight shining into the room. Changes in sunlight intensity (clouds) cause changes in pupil diameters, that can cause trouble in tracking the eyes. Sunlight is also a source of infrared light, sunlight must not shine into the cameras. Avoid that infra red light coming from the Tobii unit is reflected back to the Tobii camera.

Participant

The participant cannot wear any eyemakeup. Tobii will see mascara as the biggest black thing it can find. But it should find the pupil. Eyemakeup must be completely removed. It should be removed by using eyepads and proper cleaning liquid. Ask the ladies what they use 😊 Afterwards, clean with eyepad and water. Then, dry with a dry eyepad. NEVER use ALCOHOL to clean. This can cause BLINDNESS.

The eyes must be seen by the cameras. Hair in front of the eyes can block camerasight on the eyes. Hair can be removed from sight by using (non-reflective) hairclips. Try to avoid glasses, jewelry, metallic hairclips and anything else that can cause infrared reflections.

Remove oily/reflecting patches around the eyes; such as at the tearducts, on the eyelids and underneath the eyes. This can be done with a tissue or with an eyepad. These areas can also reflect infrared light back to the Tobii. Use proper cleaning liquid or water. After cleaning, dry with a dry eyepad. NEVER use ALCOHOL to clean. This can cause BLINDNESS.

Startup Procedure

Begin with switching on the Tobii eyetracker and the Tobii screen and wait for the beep that the Tobii makes. Then switch on the other computers. This is to prevent the other computers to turn off the external display: the Tobii screen.

After the computers have started up, wait until all network lights on the network device that have cables connected are on. This is to ensure that network communication is working. If the leds don't go on, wait a little bit more. If the leds are not on within 5 minutes, contact TSG for further assistance.

Then startup Tobii Studio and open your experiment file, if you already have one. Otherwise, startup Tobii Studio and continue reading the section *Settingup an Experiment using Tobii Studio*.

Setting up an experiment using Tobii Studio

Installing a participant

It is important to have a good measurement, without a lot of missing samples. Therefore it is important that there are no infrared reflections into the Tobii camera and that the participant is not wearing eyemakeup. (see section *Participant*). Also, it is important that the participant is comfortable during the experiment. Tobii allows a little bit of movement of the participants head, but movements are limited. If the participant is sitting comfortable, head movements are more likely to be within the range that Tobii allows. The participant should be sitting in a comfortable position before the calibration is done and should stay in that same position during the experiment.

Calibration

A good eyetracking measurement relies on a good calibration. And a calibration that stays good during the experiment. Factors that disturb the calibration during the experiment include:

- The participant moves too much, or changes position. Therefore it is important that the participant is sitting in a comfortable position that can be persevered during the whole experiment and is instructed to look at the screen in a natural way, without moving too much.
- Big changes in pupil size. Try to keep pupil size more or less the same during the experiment. That will result in a better measurement. To do this, avoid big changes in luminance. Sunshine in the room will change pupil size during the experiment if the sun is sometimes blocked by clouds or is shining bright. Avoid sunlight. Luminance of the screen can also influence pupil size. Try to keep luminance of stimuli more or less the same and try to have luminance of the screen during calibration more or less the same as during the experiment. Don't use a white background (small pupils) during calibration when your stimuli are mainly dark. Don't use a black background (large pupils) during calibration when your stimuli are mainly bright. Try to give the backgroundcolor during calibration the same luminance as the screen has during the experiment. When not sure, choose a middle luminant grey as a background.

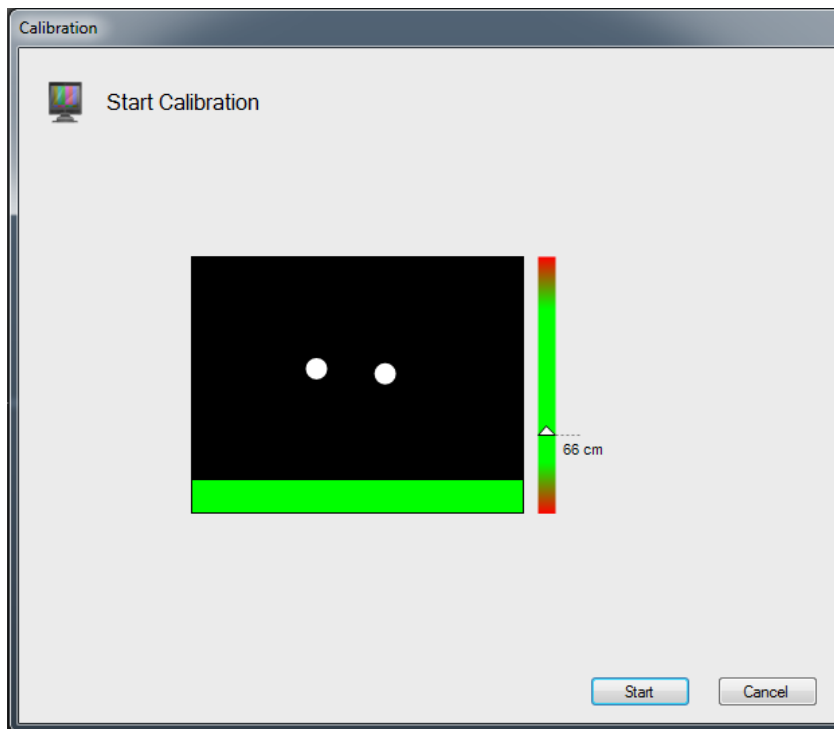
- The participant moves out of the bounding box that Tobii allows. Tobii allows a certain range in distance between the eyes of the participant and the camera. Typically the range is from 55 to 70 centimeters. Too close or too far away from the camera will result in bad or no measurement. Best is to have the participant in a comfortable position, using the back support of the chair at a distance of about 65 centimeters. This will allow the participant to move a little bit forward and a little bit backward during the experiment, without effecting the ability of Tobii to keep track of the eyes. The participant being comfortable is important! It is better to move the Tobii closer or further away than having the participants moving too much, because their position is not comfortable!
- Tobii tracks another pair of eyes. Make sure that only the participants eyes are visible in the Tobii camera. Don't look over the participants shoulder to explain the experiment. If more than one pair of eyes is visible in the eyetracker camera, it might lose track of the participants eyes and switch to the other pair of eyes.

The calibration procedure is started at the beginning of the recording. Press the red *Record* button and make sure that ... is checked. Once the participant is seated in a comfortable position, a quick explanation about what will happen on the screen is sufficient to have the participant look at the dots that are presented on screen. The participant will look at the dots in a natural way, by moving the eyes and moving the head a little bit, in the same way that the participant will look at the stimuli. It is important that the participant looks in a natural and comfortable way, and in the **same** way during calibration and during the experiment.

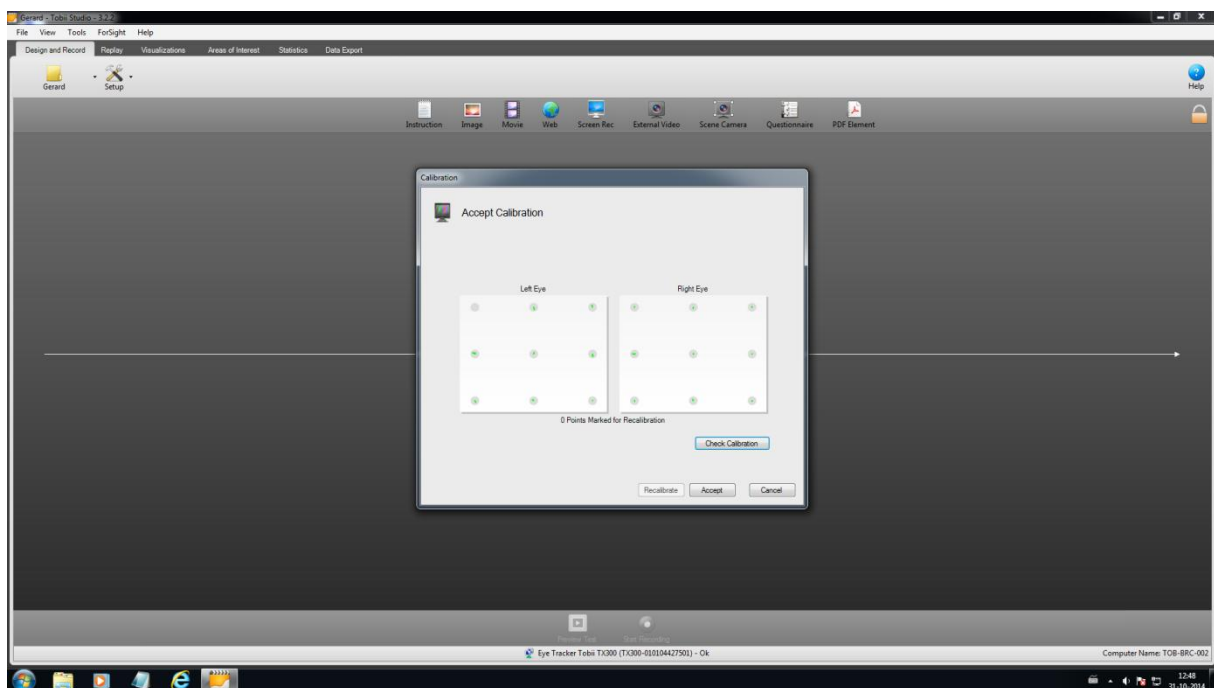
Just before the calibration is started, Tobii Studio will present a display with a distance measure and two dots that represent the eyes. Make sure that the distance is within the green area, and that during movements, the participants distance stays within the green area. In the figure below, the participant was sitting in a chair close to a table. Therefore it was more likely that movements were going to be towards the eyetracker than away from the eyetracker, so the Tobii was placed at a distance that allowed more freedom of movement towards the eyetracker than away from the eyetracker. If the participant is sitting comfortable and doesn't move too much, adjust the distance by placing the eyetracker closer or further away from the participant.

The dots represent what Tobii sees as the eyes of the participant. Make sure that the dots are in the middle of the display. This can be done by placing the eyetracker more to the left or more to the right and by tilting the eyetracker if the dots should be lower or higher on the display. Use both hands, one on the top of the eyetracker and one at the bottom, and tilt the eyetracker so that the dots appear in the middle of the display.

When distance is within the green area and is likely to stay in that area during the recording and the eyes are in the middle of the display, press the *Start* button to start the calibration.



When the calibration procedure has finished, Tobii Studio will present a feedback screen that contains lines, starting at the dot that was presented and was supposed to be the point of gaze, and ending at the point of gaze that was measured.



A very good calibration shows short lines, indicating that the supposed point of gaze is very near to the measured point of gaze. The longer the lines are, the more offset there is between the supposed point of gaze and the measured point of gaze. When the lines at a supposed point of gaze are more pointing towards different directions, there is more noise in the calibration and also in the measurement. How valid or useful the actual calibration is, depends on the position on screen of the calibration points and the position of your stimuli and it depends on the size of your areas of interest.

Typically, the bottom of the screen has worse calibration. That is caused by the eyelids, partially covering the pupil when the participant looks down. Therefore, it is advised not to use the lower 5 centimeters of the screen for presenting stimuli. Usefulness can be checked by using the Validation procedure. The feedback screen can show a square around a presented dot. That means that there was no data for that point. When there are one or more squares, or if the validation shows that the calibration is not good enough, something should be done to make the calibration better. Check the bulletlist above. Tobii can ask to recalibrate one point, but it is advised to do something (such as remove more mascara, reseal the participant, make sure there is no hair blocking the camera's view on the eyes, ...) to make the calibration better. That will invalidate all calibrated points, so the calibration procedure must be totally redone.

Validation

The validation procedure is used to check how good the calibration was and to check whether use of contactlenses disturbs the tracking of the eye. Tobii Studio will present a grid of dots. Ask the participant to look at the dots and Tobii Studio will present a circle indicating where Tobii Studio thinks the participant is looking at. In a very good calibration, the circle is exactly around the dot. In most calibrations, the circle is very well near the spot. In bad calibrations there is a bigger difference between the location of the circle and the position of the dot. It depends on the location of the stimuli, the size of the areas of interest whether a calibration can be accepted or not.

To check the influence of contact lenses, the participant should make a large saccade. Ask the participant to look at the lowerleft dot. Then, ask the participant to look at the upperright spot. This will ensure that the participant makes a big saccade. See how the circle settles around the dot. If it overshoots and then slowly settles towards the spot, there is an influence of contactlenses. This overshooting will occur after every saccade.

