Eye Tracking Instructions

[1] Check to make sure that the eye tracker is properly connected and plugged in.

Plug in the eye tracker power adaptor (the green light should be on.

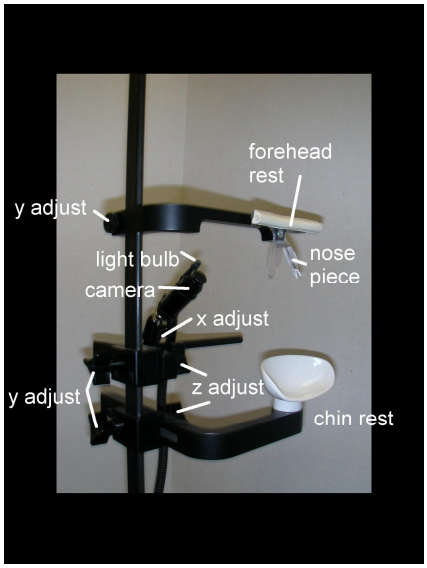
Make sure that the yellow cable is connected to the gold RCA plug, and the black cable is connected to the black power adaptor plug. The red cable should never be detached!

Remove the lens cap from the camera (if applicable).

[2] Know the parts of the eye tracker.

*forehead rest*/nose piece – helps to keep subjects still
*chin rest* – help to keep subjects still
*light bulb* – infra-red illumination
*camera* – infrared filter; only sensitive to IR light
*y adjust* – loosen these knob to move up/down
*z adjust* – loosen these to move towards/away from Ss
*x adjust* – loosen these knobs to move camera left/right

Always make sure y adjust knobs are well tightened!!!

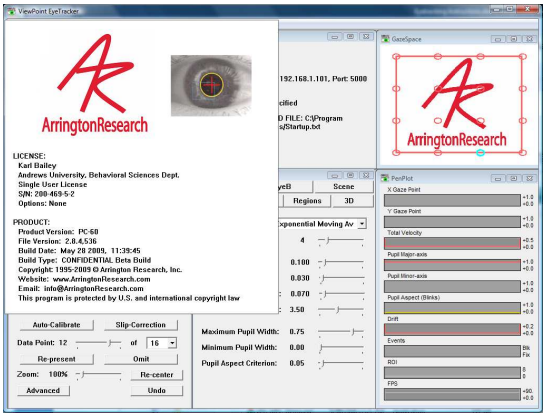


[3] Start the eye tracker / set up subject

Start the viewpoint eye tracker control program by clicking on the shortcut to viewpoint.exe.


You will see a welcome screen that looks like this:

Click on the white splash screen to start using the eye tracker.




Make sure that the eye tracker is clean. (Alcohol and cotton squares are on the back table).

Loosen all three y-adjust knobs.

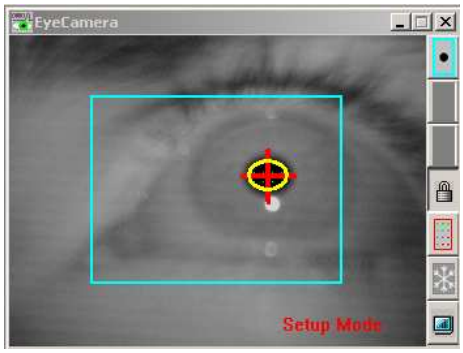
Have your subject sit (ideally) on one of the lab stools. This will prevent the subject from swinging back and forth. They should lean forward so that they are comfortable (not slouching) and you should move the forehead rest for them. Make sure that the forehead rest is tightened.

Next, adjust the chin rest (using both y and z adjust) to the subject's chin. You will need to move the camera out of the way for this.

Lastly, move the camera (using y and z, and x only if necessary) so that you can see the eye on the viewpoint eye tracker window.

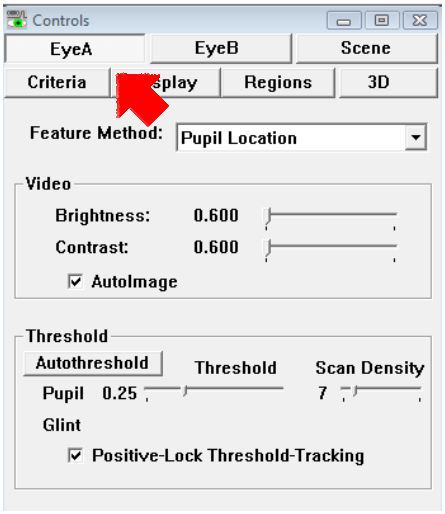
**If your experiment requires headphones, make sure they are positioned and sound-checked before you position the eye camera**!

[4] Tracking the eye / how eye tracking works




The black circle (outlined in yellow here, meaning that the computer is tracking the pupil) is the pupil – where light enters the eye. The light doesn't reflect back out, so the pupil shows up as black. It is surrounded by the iris, which is colored under visible light, but grey under IR light. The white spot just below the pupil is a reflection (of the IR light bulb) off of the cornea, and is called the glint. The subwindow that shows the image of the eye is called the EyeCamera subwindow.

The eye tracker works most accurately by comparing the relationship of the location of the glint to the location of the pupil.



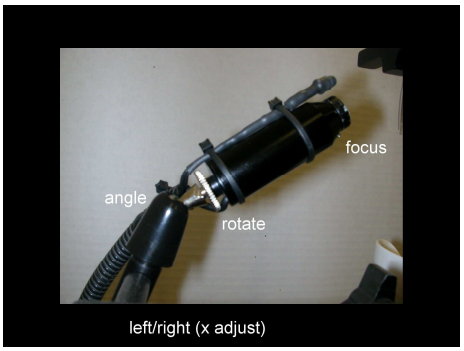

Activate this function of the eye tracker by switching to the EyeA dialog in the Controls subwindow. [Next, select 'Glint-Pupil Vector' from the Feature Method drop-down box at the top of the dialog. Have the subject look at the white circle on the upper edge of the monitor during this initial testing, or at the image of their own eye.]**
** As of 2/2010, this is pre-set in the start-up settings.

You will notice that the glint is now surrounded by a red circle (this means that the computer has found the glint), and that a blue line has been drawn out from the center of the pupil.


You may have trouble getting the computer to find the glint. Here are two trouble shooting techniques:

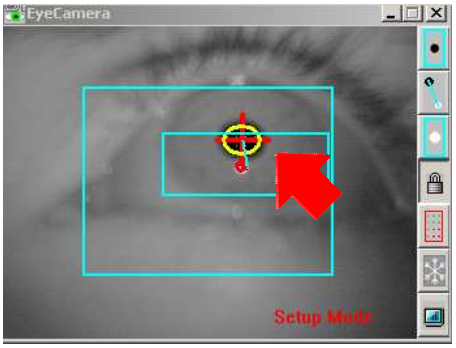
[A] Adjust the camera

**Be very careful when performing any of these operations.**




The camera can be adjusted in five different ways.

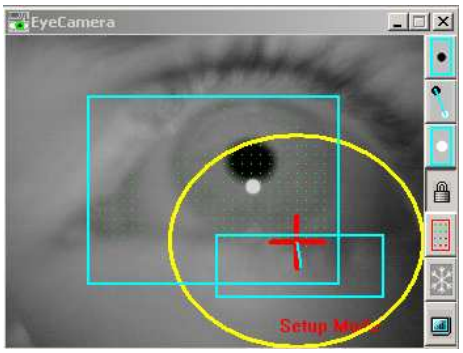
1. use the z adjust to move the camera closer or farther away from the eye (the glint should not be too large or doubled)
2. use the x adjust the move the camera left or right
3. change the tilt of the camera (about 30º above the horizontal is good)
4. change rotation of the camera (so that the eye is horizontal)
5. change the focus of the camera (the eye should be just out of focus)




When the subject looks to the upper left of the monitor (the initial test position), the pupil should be in the upper right quadrant of the larger box on the screen. Illumination should be good over the entire camera view. There should only be one glint visible and the pupil should not be occluded by eyelashes.

Note that glasses and screen printed contacts will cause the eye tracker to fail to track in most cases.

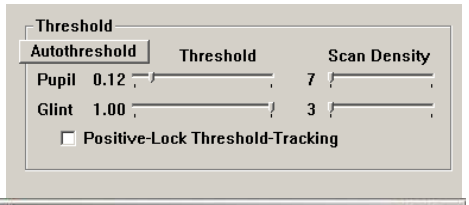
[B] Adjust the threshold and search region settings.



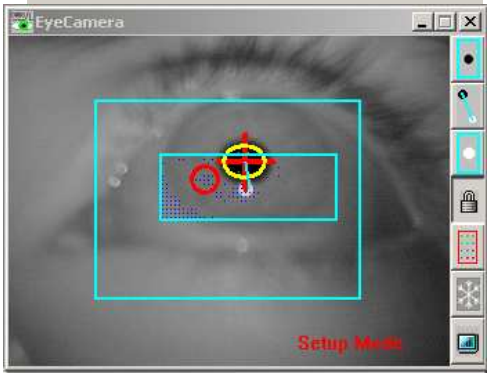

If the eye is positioned correctly, but the computer is still not tracking correctly, there may be a problem with the threshold or with the region that the eye tracker is searching.

Problems with the pupil threshold lead to the green dot mesh extending to areas beyond the pupil, and may result in the yellow pupil tracking circle moving or becoming very large. These occur because the computer is looking for dark areas (i.e. the pupil). You should set the threshold as low as possible while still being able to consistently track the pupil.

*Solution*: Use the Pupil slider in the Control subwindow to select the grey values that will be considered as pupil. This value will likely be 0.12 or below, but could be as high as 0.20 with a good image. **Positive-Lock Threshold Tracking should be off (unchecked).**

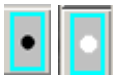


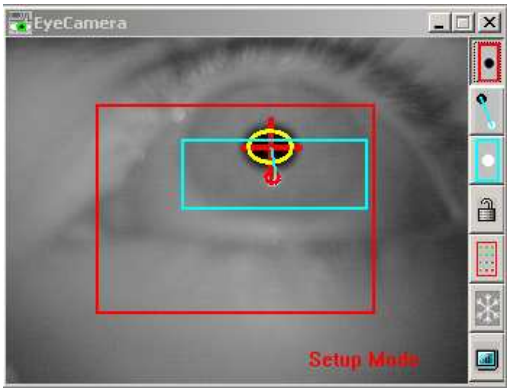

Problems with the glint threshold lead to the glint hopping from one location to another and to an expansion of the purple dot mesh. The computer is searching for bright (white) areas in this case; the threshold should be set as high as possible.



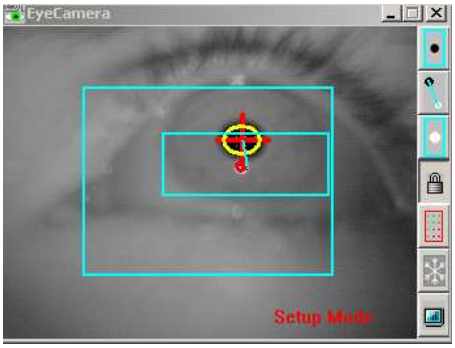

*Solution*: Use the Glint slider in the Control subwindow to select the grey values that will be considered as glint. This value will likely be 0.80 or above; in the majority of cases, this value will be 1.00.

Note that the green and purple meshes never extend beyond the two boxes on the screen. These boxes determine the area of the camera view that will be searched for the pupil and glint, and can be used to avoid dark/mascara –covered eyelashes (pupil) and extraneous reflections off of the skin or eye ball (glint).


The black dot in a box and the white dot in a box buttons on the right side of eh EyeCamera subwindow allow you to redraw these boxes. The button and the corresponding box will turn red when selected.

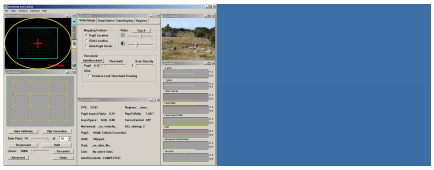


**Always draw boxes from upper left to lower right!**

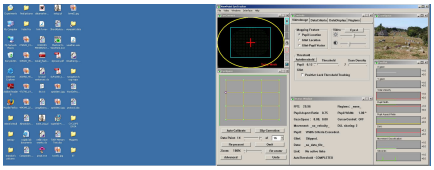



 Click on the lock button on the right side of the EyeCamera subwindow when you are done adjusting the boxes.

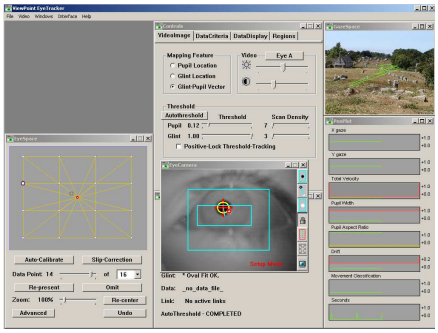
Note that the pupil must be within the pupil boxes no matter where the subject looks on the screen in order for the tracker to work (and likewise for the glint and the glint box). Have the subject look at all four corners of the screen to make sure that any boxes you redraw are acceptable. Use the letters and central eye on the stimulus display or your mouse cursor to accomplish this.



You may also want to show the subject their own eye. Note that the eye tracking computers use a two monitor setup. The monitor that the subject will be viewing stimuli on is monitor 2. Click, hold, and drag the title bar of the Viewpoint EyeTracker window over to monitor 2. **You will need to press F2 first to turn off the stimulus display before moving the window.**



When you have the subject look around the stimulus display (at the letters), read the letters in random order, or the subjects will try to guess and won't hold their eye steady. The yellow pupil circle and the red glint circle should be stable no matter where on the screen the subject looks. If it is unstable in one of the far corners, calibrate will extra points (25 or 36) and omit the points that don't work.



If the circles are stable, is time to teach the computer how the eye is moving relative to the screen. If not, use the trouble shooting steps above.

[Lastly, set up monitor 2 for the subject. Under the Stimuli menu, select 'View Source' and then 'Viewpoint Stimulus Window' (not Interactive Computer Display). Pressing F2 will toggle whether or not the subject's (stimulus) screen is visible. Press F2 and more the Viewpoint EyeTracker window back to monitor 1.]
** As of 2/2010, this is pre-set in the start-up settings.

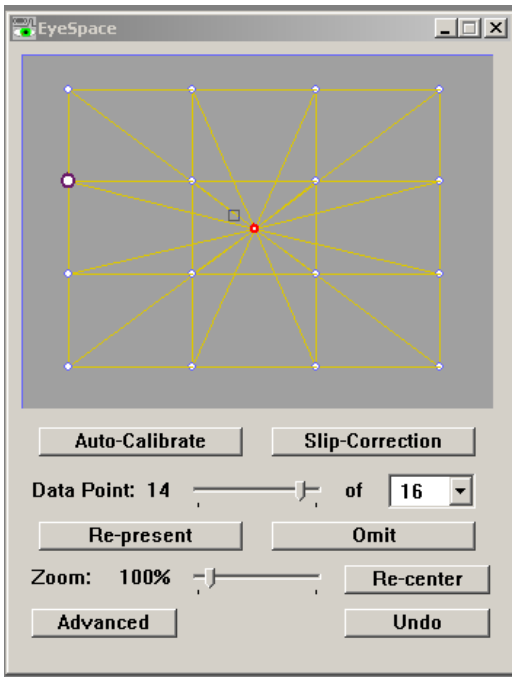
 (optional) If you are running a High Precision study, press the Mode button on the EyeCamera window and switch the Mode to High Precision.

[5] Calibrate the eye tracker

Calibration is the process of teaching the computer how the eye moves relative to where a person is looking on the screen.

For a good calibration:

1. The pupil and glint must be tracked successfully in all regions of the screen.
2. The computer must record images of the eye while the subject looks at known points on the screen.
3. The eye must be stationary when those images are recorded.

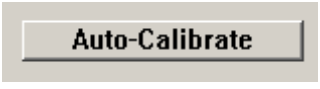



Below the EyeCamera subwindow is the EyeSpace subwindow. It records how the computer is translating images of the eye into locations on the screen. It starts out as a very large, regular grid. You should have a much smaller, but still regular grid when you are done calibration.

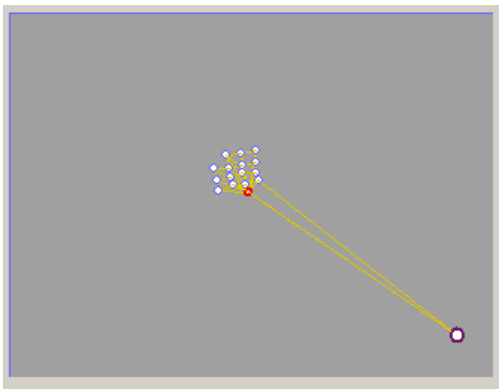
Read the following to your subject to prepare them for calibration:

"We are now going to give the computer information about how your eye is positioned when you look at different points on the screen. This is called calibration. In a moment, the screen in front of you will turn grey. You will see a 'Get Ready' warning sign, and then a green box will appear on the screen. Look at the center of the box. The box will get smaller and smaller until it disappears into a white dot, then it will get larger again. Keep looking at white dot in the center of the box while this happens! This process will re-occur a total of sixteen times. Don't try to guess where the box will appear next – it's totally random. I'll monitor the computer's progress, and we may redo some points if necessary. Once we are done with this procedure, you need to remain as still as possible. Try not to talk or move your head. Give me a thumb's up sign if you are ready."

When the subject is ready, click the 'Auto-Calibrate' button in the EyeSpace subwindow. The calibration sequence will begin.



Often the subject will not hold their eyes stationary during one or more calibration points, so the expected evenly-space grid does not form. This is readily evident in the EyeSpace window because one or more points will be out of place on the grid.. The cursor that the subject is moving with their eyes (on monitor 2) will also track poorly (relative to what they are looking at).

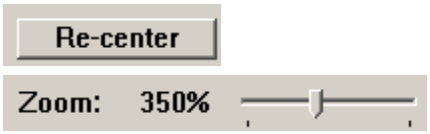


You can click directly on the out of place points to select them for recalibrating.

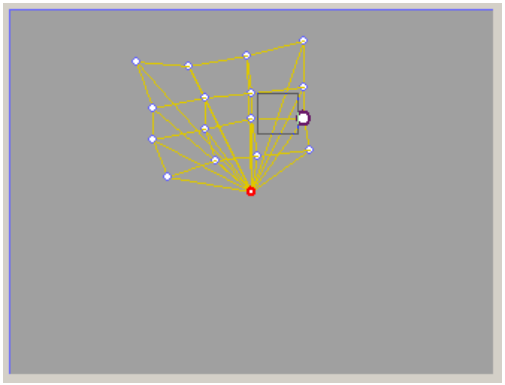
Press the 'Re-present' button to present the trouble points a second (or third, or fourth) time.


If the point will not move into the grid, watch the EyeCamera subwindow – you may be losing either the pupil or the glint at that point. If it is impossible to track that particular corner (it usually is one of the corner points), press the omit button to leave that point out of the calibration. This will lead to poor tracking in that corner, but we using display stimuli with a safety border around them anyway.


Use the Re-center button and the Zoom slider to get a better look at your grid.

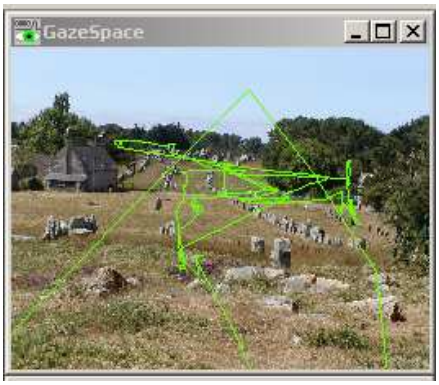



This grid is pretty wicked good. The box represents the location of the subject's eye.

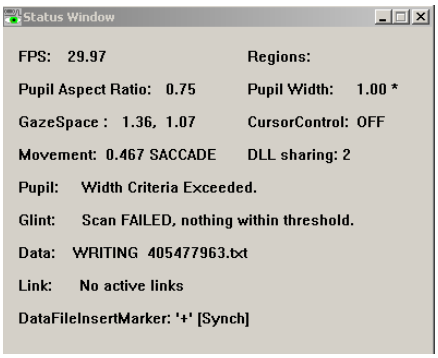


Move your mouse cursor around monitor 2 and have the subject follow it to check calibration.

[6] Run the start-up test file (currently MAPS). This will help you get used to monitoring monitor the eye in the EyeCamera subwindow, and the subject's eye movements in the GazeSpace subwindow (these will show up as green lines and spots). The subject will also get used to seeing displays change – most tracking failures occur early on, so this will give you a change to correct things.




Press CTRL-L to open up the settings file dialog. Navigate to the 'MAPS' folder and choose the first settings file "listA.txt". Give the subject the following instructions:




"You will now see a series of maps on the computer screen. Simply look at the maps while I monitor the computer equipment to make sure that it is running correctly. This is a test of the equipment, not part of the experiment."

A series of images will be displayed on the monitor. Simply monitor the subject's eye and eye movements to ensure that nothing seems odd.

A data file will be opened automatically by the program. The name of that file will be listed next to 'File' on the Status Window. **Write down the name of the data file.**

When you see an exclamation mark after the series of pictures has been completed, you may start your experiment.

[7] Now start the your experiment.

Press CTRL-L to open up the settings file dialog. Navigate to the correct folder and choose the appropriate settings file.

Always remember to write down the data file name. The program should close your data file automatically when done. Press CTRL-W to close the data file if it does not.