

Getting a Tobii Eye Tracker to Work

This guide is based on using a Windows XP operating system, a Tobii eye tracker (T60) and Eprime Professional 2 so these instructions will probably not work for all set-ups but can be modified. If you have any questions contact me at k.d.hudson@reading.ac.uk

Version 1.2

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1. Introduction

This guide is intended to help you get a Tobii eye tracker working as I've learnt that this is harder than it first appears and it is far from just a plug and play machine! I've also learnt that most things that will help you get a programme running aren't in manuals or technical support online. I have therefore compiled this guide to hopefully get you through any difficulties that you might come across. I hope that this guide will be useful to you and will mean that you can get experiments up and running quicker and without needing to tear your hair out!

I've tried to cover many of the problems that I came across, although I've tried to cover many issues that might arise you might also still have difficulties. Even after trying all of these steps it might be worth contacting Tobii about any problems. They're happy to do remote sessions to get eye trackers working, so hardware help is at hand. Not all problems relate to software issues as I've heard stories of people battling with Tobii eye trackers only to find that there are no software problems and that there was a dead component in the eye tracker itself.

2. Connect the Eye Tracker to the Laptop

a. Update

Ensure that you have the most up to date versions of the Tobii firmware and software (i.e. Tobii Studio) for your eye tracker. Tobii recommend that you should be running the most recent version of all software and hardware in order to minimise the likelihood of bugs and issues.

Updates for Tobii can be found at:

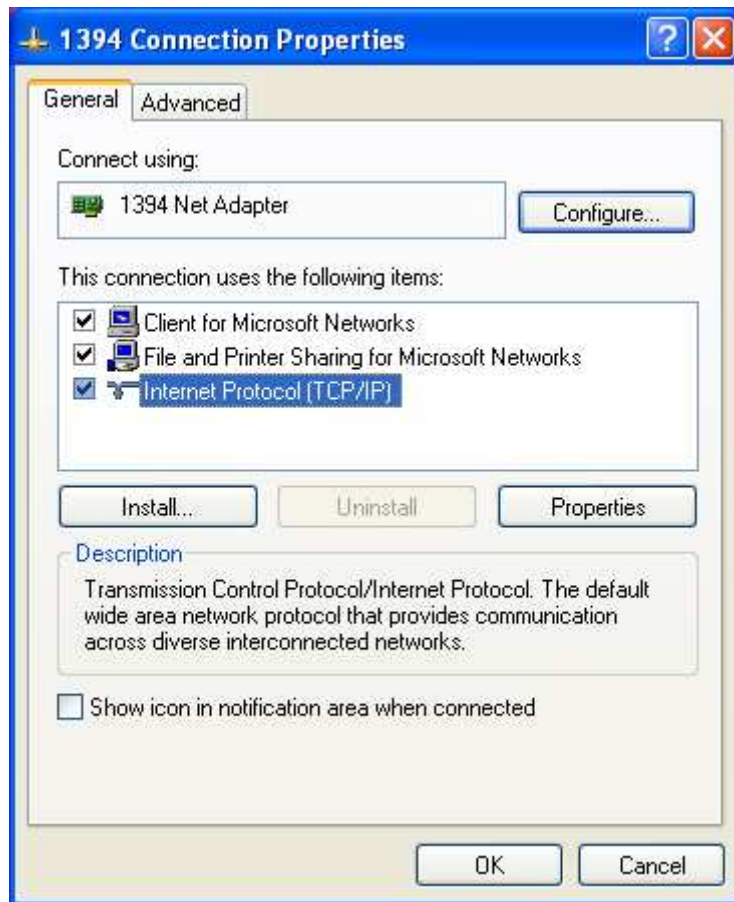
<http://www.tobii.com/en/eye-tracking-research/global/support-and-downloads/>

b. Set the IP address for the eye tracker to automatic assignment

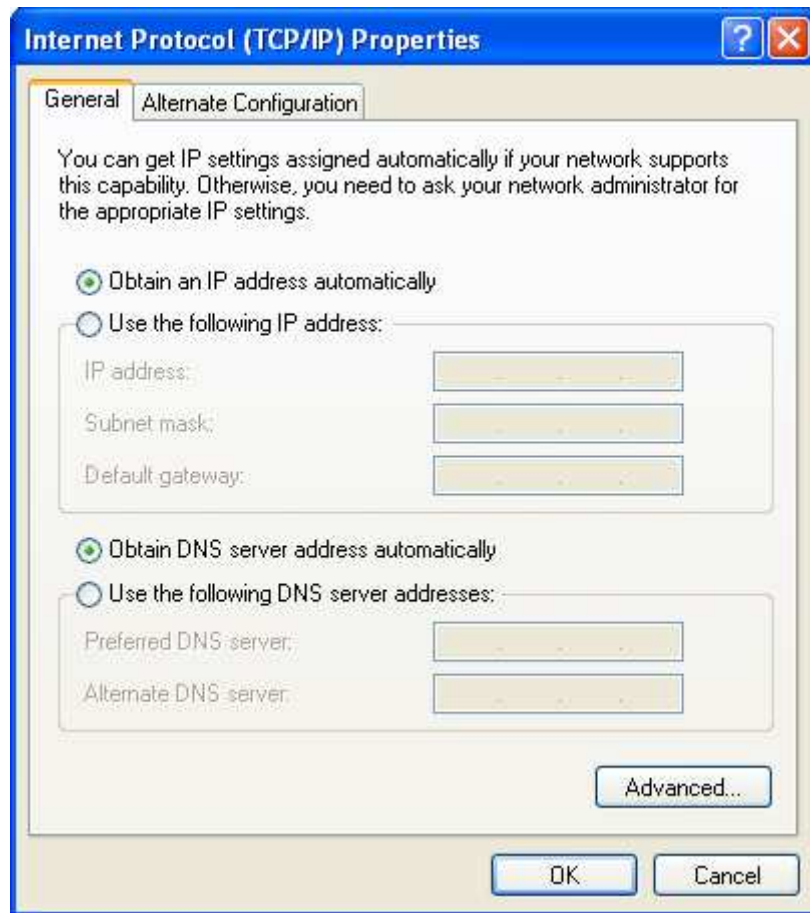
You should avoid using a fixed IP address for the eye tracker as this can cause problems. It's much better to let the eye tracker generate a new IP address every time it starts up. So, ensure that an IP address is acquired automatically and not a fixed IP address.

To do this:

- 1) Go to Start then Connect To then Show all connections. (or go to My Network Places and then View Network Connections in the blue panel on the left, this will skip the next stage).
- 2) A new screen will appear called Network Connections.
- 3) Right click on Wired Network Connection.
Click on Properties.



- 4) On the General tab click on Internet Protocol (TCP/IP).
Click the Properties button.
- 5) A new screen will appear called Internet Protocol (TCP/IP) Properties
Make sure that a green dot is next to 'Obtain an IP address automatically' and also 'Obtain DNS server address automatically'.



6) Once you've done this click OK on this screen and then the Network Connections Properties screen.

The eye tracker will now generate a new IP address each time it is connected.

c. Disconnect all network connections except for the eye tracker

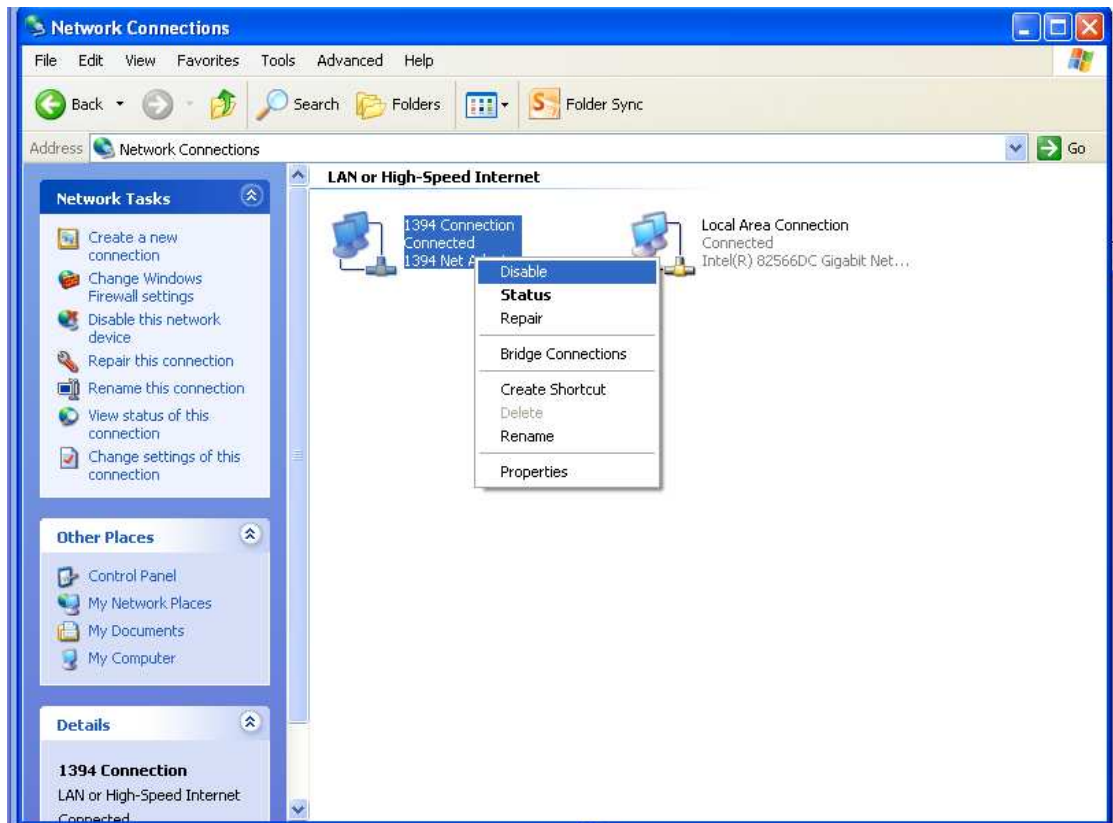
Disconnect any network connections either physical or wireless, that are not the wired connection between the eye tracker and laptop. Any network connections other than the connection to the eye tracker cause errors.

To do this:

- 1) Go to Start then Connect To then Show all connections.
- 2) A new screen will appear called Network Connections.
- 3) Right click on any network connections e.g. wireless.

Click on Disable.

(n.b. you can re-enable the network connection easily by following these instructions but click on Enable, you will not permanently remove a network connection by disabling it.)

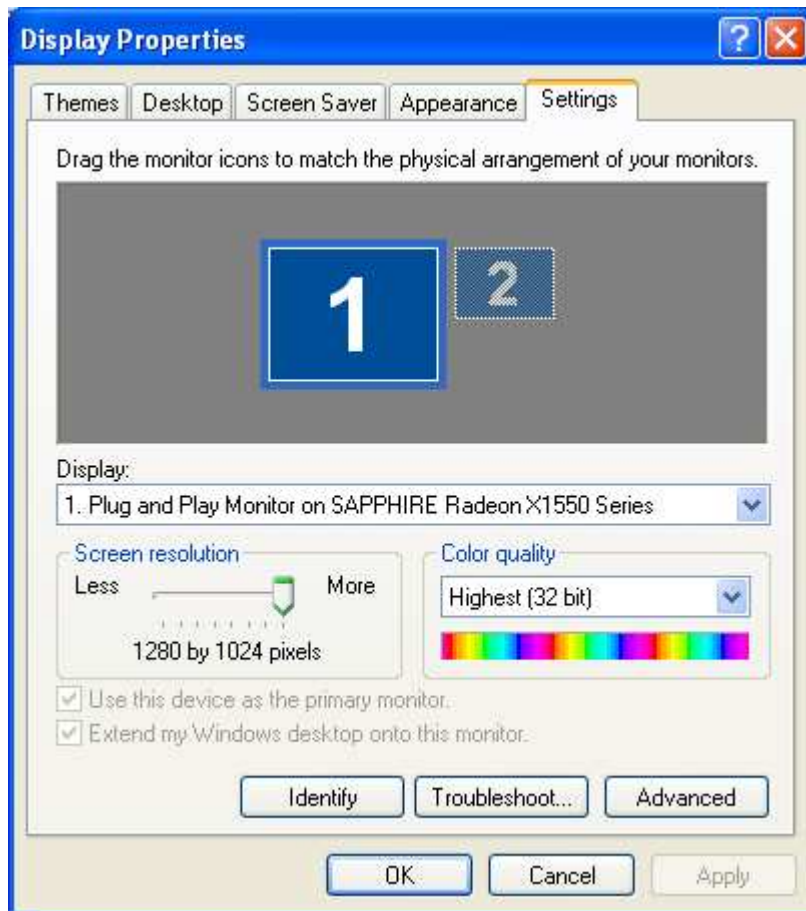


d. Set the eye tracker as an external display (DO NOT DO THIS IF USING EPRIME)

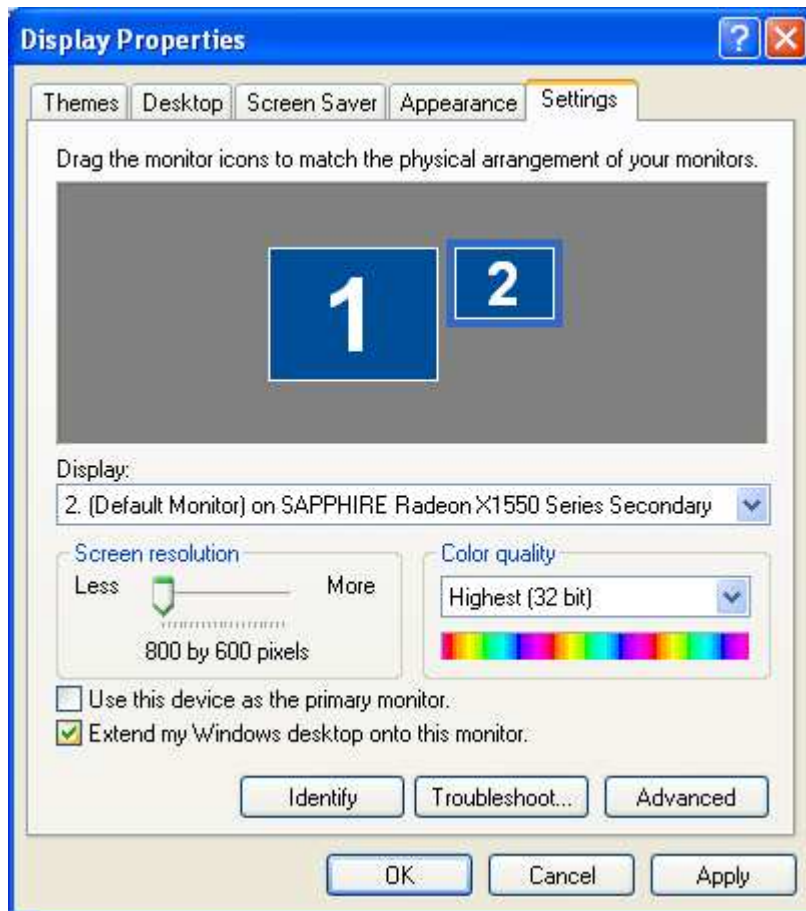
The eye tracker needs to be set as an external screen so that images can be seen on the eye tracker's screen. To do this you simply need to set the eye tracker as an extended desktop, enabling you to display stimuli on the eye tracker screen and record data.

To do this:

- 1) Right click anywhere on the desktop and click on Properties on the screen that appears.
- 2) Click on the Settings tab.



- 3) Click on the small screen with a “2” in the middle.
- 4) Check the box that says Extend my Windows desktop onto this monitor.



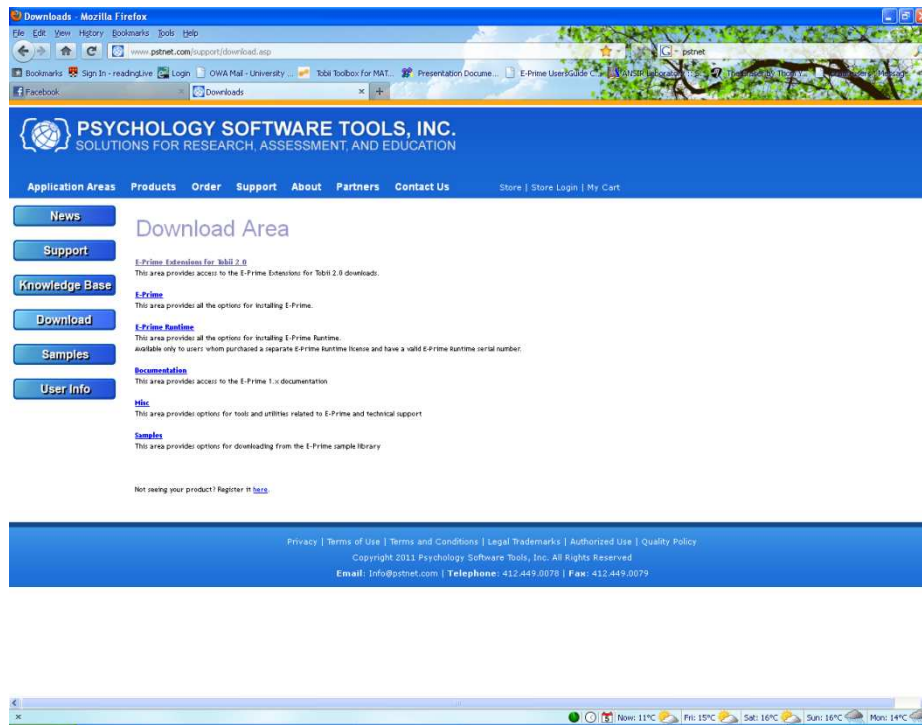
- 5) Click Apply, the window will then close and the desktop should appear on the eye tracker screen.

If you still can't see anything on screen try pressing the Source button on the eye tracker, this is the left-most button on the panel on the front of the eye tracker. Press it until you see an image. If you have a VGA cable attached the source should be Analog.

3. Eprime and the Eye Tracker

a. Updates

Ensure that you have the latest updates of Eprime and also the Extensions for Eprime, these can be obtained from logging in here <http://www.pstnet.com/support/login.asp> and going to the Download section.



b. Set external screen

You need to set the eye tracker monitor to mirror the desktop in order to record data, you cannot set the eye tracker to be an extended desktop as for some reason this causes errors for the HitTest that outputs which area of interest (AOI) participants are looking at.

To mirror the desktop on the ASUS machine:

- 1) Press the Fn key, which is blue and the second key from the left on the bottom row on the keyboard.
- 2) At the same time as pressing Fn press the F8 key until LCD + CRT appears on screen.



In a second or two the desktop will also appear on the eye tracker screen.

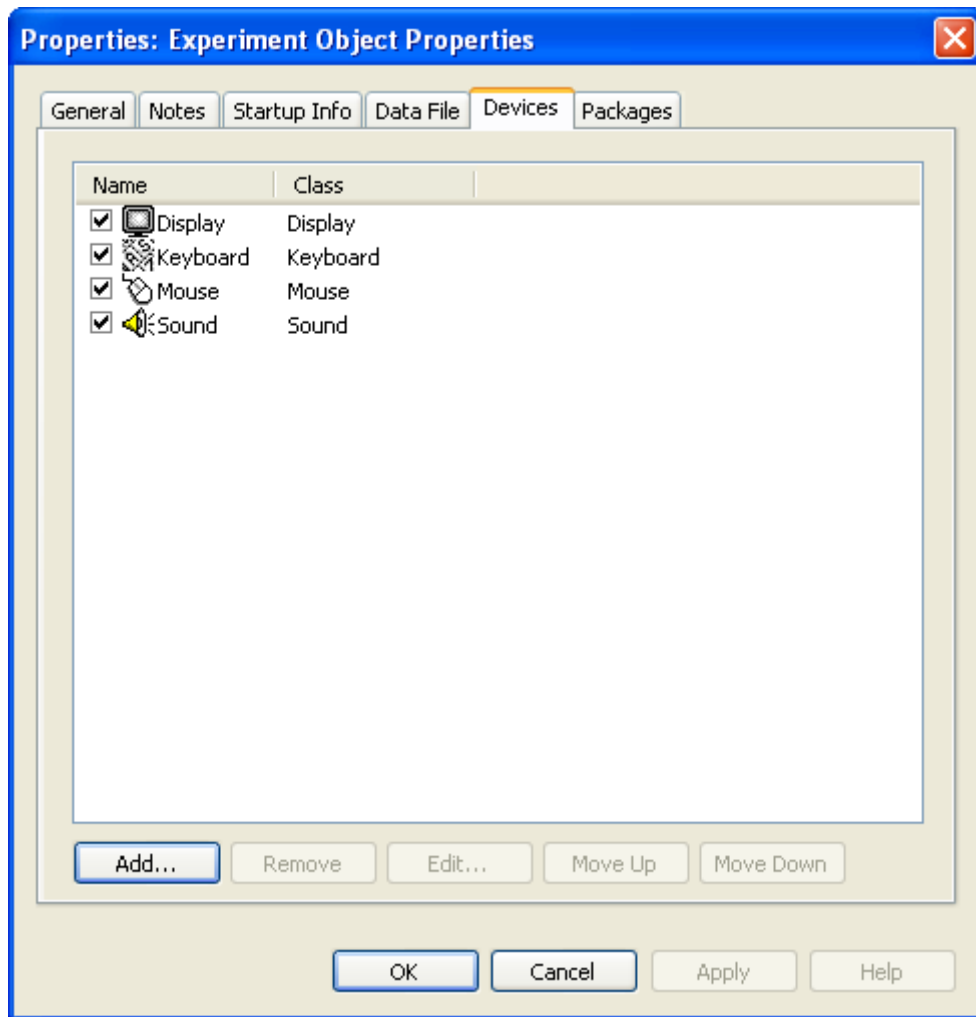
If you still can't see anything on screen try pressing the Source button on the eye tracker, this is the left-most button on the panel on the front of the eye tracker. Press it until you see an image. If you have a VGA cable attached the source should be Analog.

You will also need to check which display the experiment will be run on. The default setting in Eprime is to run the task on the primary screen (i.e. the laptop screen), but it's best to check that this is the case.

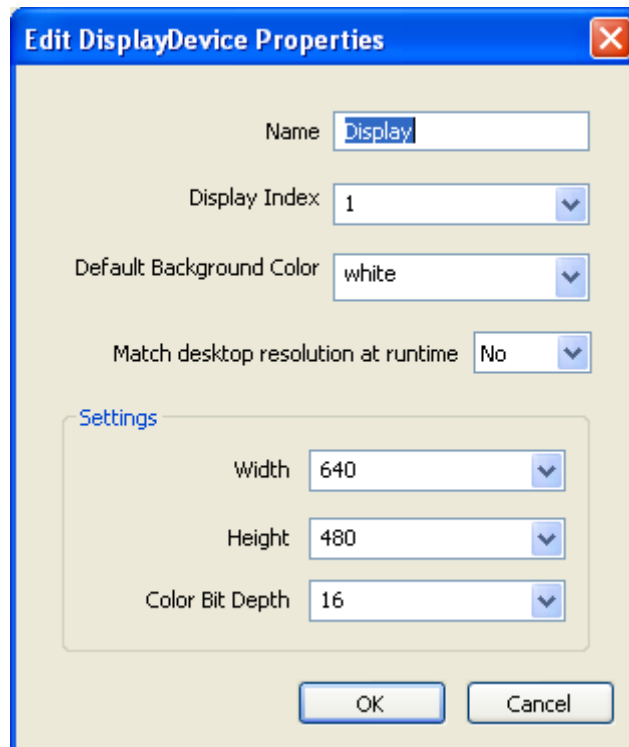
To do this:

- 1) Double click on Experiment Object (or go to Edit in the top bar and then Experiment).

This brings up a new window.



2) Double click on Display to bring up a new window.



- 3) In the drop-down box Display Index make sure you see a 1 if not select it.
- 4) Also set Match desktop resolution at runtime to yes.
- 5) Click OK on this screen and Apply on the next screen (which will be the as in step 1).

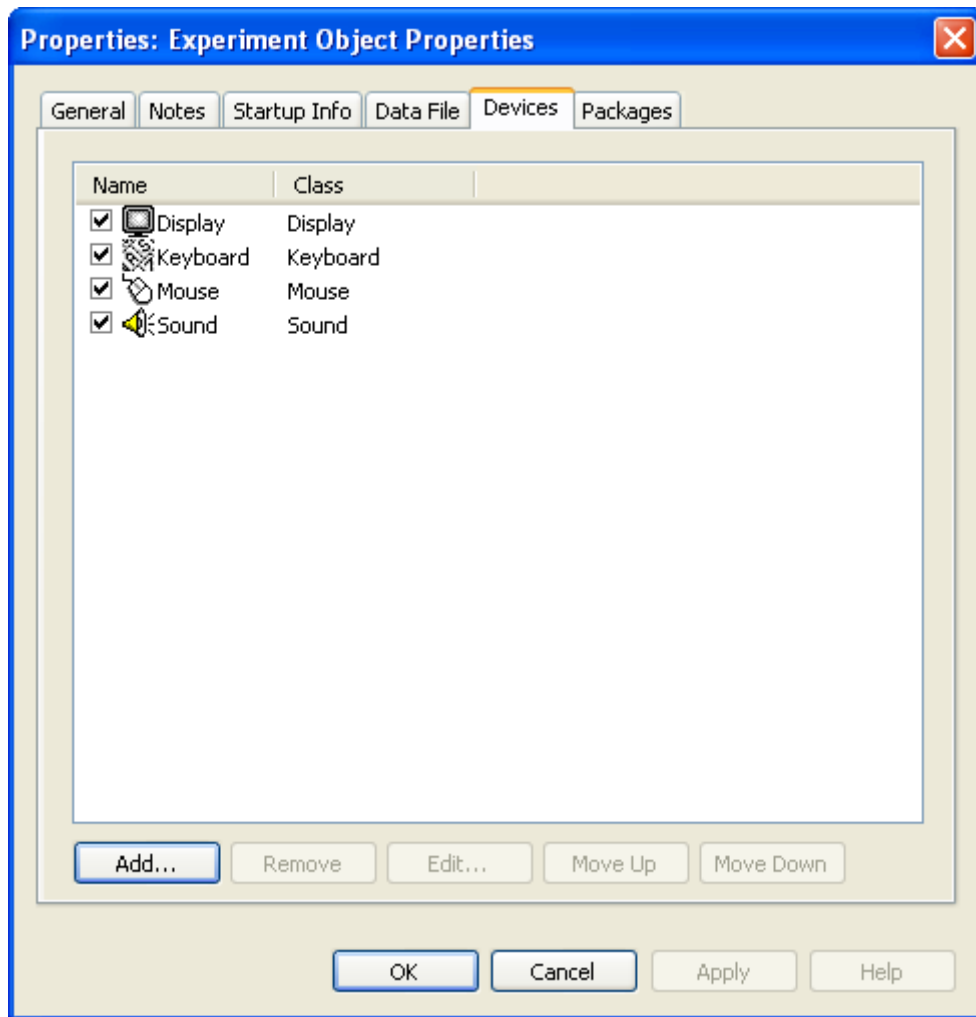
c. Ensure Tobii Extensions for Eprime are enabled

You need to make sure that Eprime and the eye tracker can communicate, this is done using Tobii Extensions for Eprime. Ensure that the Tobii Extension for Eprime are enabled so that the computer and eye tracker can communicate.

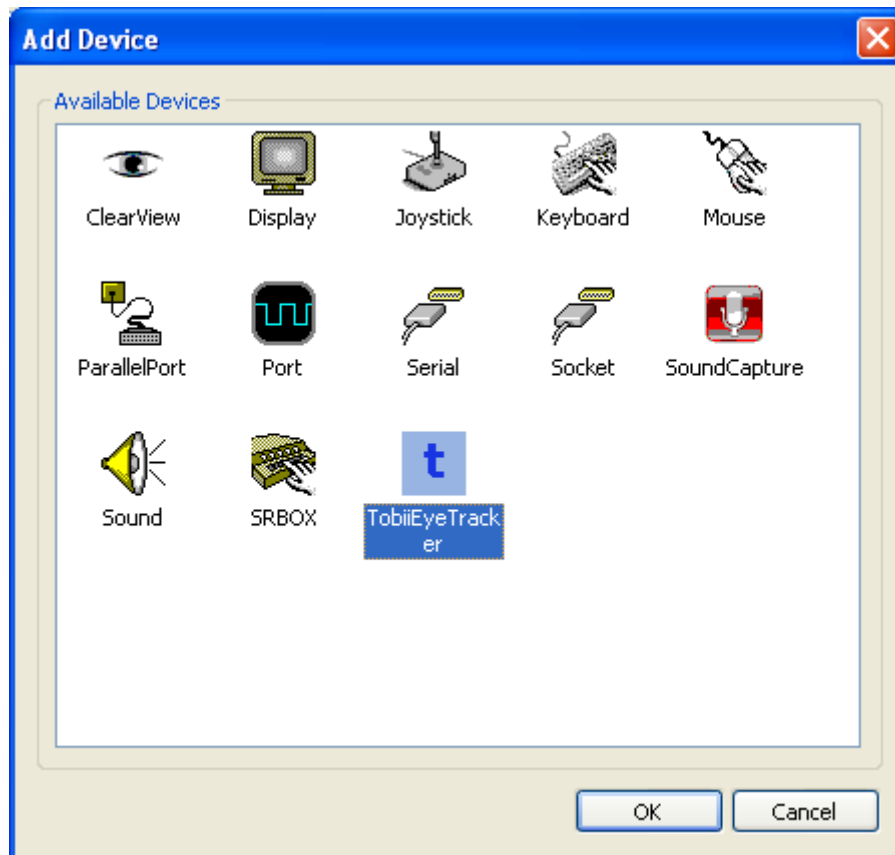
To do this:

- 1) Double click on Experiment Object (or go to Edit in the top bar and then Experiment).

This brings up a new window.



2) Click on the Add button, new window called Add Device will appear.



3) Double click on TobiiEyeTracker. This icon will then be added to the list seen in Step 2.

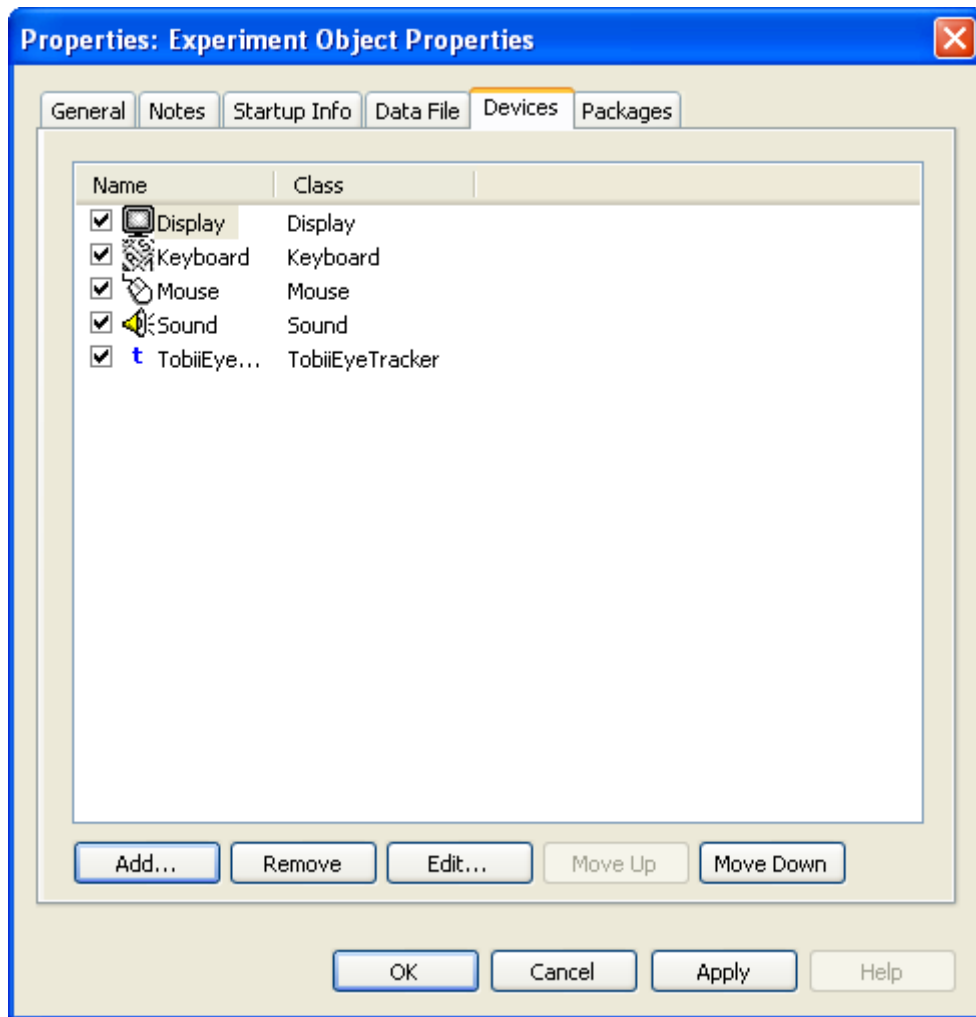
d. Set serial number to connect Eprime and the eye tracker

Ensure that Eprime is linking to the eye tracker for your experiment.

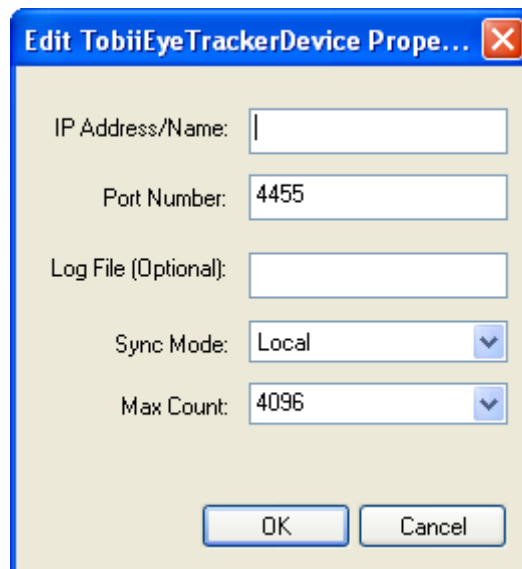
To do this:

1) Double click on Experiment Object (or go to Edit in the top bar and then Experiment).

This brings up a new window.



2) Double click on TobiiEyeTracker. This brings up a new window.



3) In the IP Address/ Name field add the serial number of the eye tracker that you are using. If it's the T60 eye tracker then the serial number is TT060-205-

85200513 so that Eprime knows where to look the serial number has to be followed by “.local.” So, using the T60 machine the IP Address/ Name field should have TT060-205-85200513.local. typed in to it.

If you don't know your eye tracker's serial number, open Tobii EyeTracker Browser select the eye tracker that you are using and click on the Copy button. The serial number and .local. can then be pasted (ctrl + p) in to the IP Address/ Name field.

- 6) Click OK , then click Apply on the screen that appears again that was seen in Step 1.

e. Calibrate the eye tracker in Tobii Studio

When using the eye tracker with Eprime the Tobii Extensions for Eprime offers a built-in calibration package. This can be problematic so the best option is to calibrate the eye tracker in Tobii Studio and then run your experiment in Eprime. The eye tracker retains the last calibration in “memory” so there is no need to worry that calibrating in Tobii Studio and then exiting Tobii Studio will cause a problem- the calibration will be retained.

To calibrate in Tobii Studio:

- 1) Open Tobii Studio.
- 2) Open a project (either create a new one or use an existing experiment, this won't affect the experiment). It may take a little while for the experiment to open.
- 3) Go to Set up, a drop down menu at the top left of Tobii Studio.
- 4) Then click on Calibrate.
- 5) The calibration routine will then be run, accept the calibration if you're happy with it (the green lines are within the green dots) or reject the calibration and recalibrate.

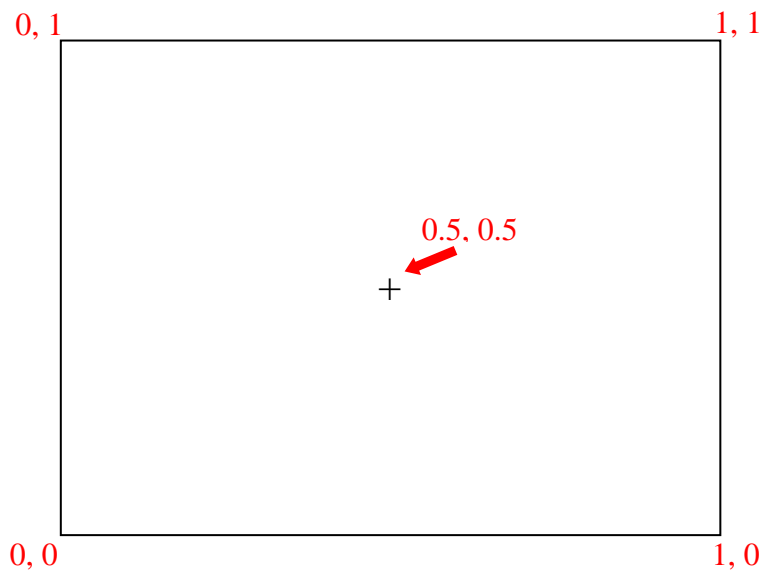
You can change the calibration routine to a more child-friendly version by going to:

- 1) Go to the Design and Record view of Tobii Studio.
- 2) Click on Setup.
- 3) Click Settings in the drop-down list.
- 4) Click on the Calibration tab.
- 5) Change the calibration routine with the Calibration Type radio buttons. The infant routines are especially designed for children and are more appealing than the standard black and red dots used by Tobii Studio.

f. A note on screen coordinates from Eprime files

When you get an output file for an Eprime experiment from the eye tracker you might be surprised to see that the x,y coordinates for eye position are not integers. You find the x,y coordinates in the XGazePosLeftEye and YGazePosLeftEye columns (or also the XGazePosRightEye and YGazePosRightEye columns). I was certainly expecting to see values like [-250, 500]! This coordinate system is actually a u, v coordinate systems but can be easily understood once you understand where the origin is onscreen.

The coordinates that Eprime (and indeed MATLAB) gets from the eye tracker are based on the origin being at the centre of the screen and having a value of [0.5, 0.5]. The coordinates are based on the following system:



This coordinate system allows for a good degree of accuracy and more importantly use of this coordinate system means that different screens/ eye trackers can be used

for a task as the origin will always be at the centre of the screen. This is not possible where coordinates are defined from screen resolution.

4. Presentation

a. Installing and Licensing

The ASUS laptop is currently using Presentation and has the necessary extensions installed.

If you are not using this machine:

Presentation can be downloaded at <http://www.neurobs.com/>

The necessary extensions can be found at <http://www.visionspace.at/index.php?id=3&L=1>

The documentation for the extension contains sample programmes that contain the code that is needed to run an experiment with the eye tracker.

b. Checking that the eye tracker and Presentation are connected

You can check that the extension is working correctly in the extension manager of Presentation. If you don't get any data through this check all connections and cables.

- 1) Go to Tools and click on Extension Manager.
- 2) Click on the Tobii extensions, and the test extension option. This will bring up a new window.
- 3) In the Send Command box, first type the serial number of the eye tracker followed by “.local” e.g. TT060-205-85200513.local. Then click send command.
- 4) In the Send Command box, type port 4455 and then click send command.
- 5) Click on the Start buttons at the top left of the window.
- 6) Click on the recording button for eye movements. This section should now fill with x,y coordinates in red if the eye tracker is recording eye movements if you are sat in front of the eye tracker. If no data fills here, check your connecting cables and that you typed the correct serial code. If values appear, you have successfully connected the eye tracker and computer.

c. Coding synchronisation with the eye tracker

The following code must be included to facilitate communication between the eye tracker and computer. Add these lines to the PCL section of your code:

```
# get an instance of the eye tracker extension
eye_tracker Tobii = new eye_tracker( "Tobii" );

# set the host IP address that the Tet_server runs on- remember to set the IP to
generate automatically
Tobii.send_command( "host TT060-205-85200513.local" );

# set the port the Tet_Server sends the data to
Tobii.send_command( "port 4455" );

# set the screen resolution used by the Tobii eye tracker
# Default: Screen Resolution settings
#Tobii.send_command( "width 1280" );
#Tobii.send_command( "height 1024" );
```

When setting the IP address use the serial number of the machine, this can be obtained as in Step 3 above.

d. Using the mouse instead of the eye tracker for testing code

What's really handy about Presentation is that you don't need the eye tracker connected to test script as you can use the mouse to emulate eye movements. This saves the need to get hold of the eye tracker or the need to connect/ move equipment.

To use the mouse instead of the eye tracker, add these lines to your PCL section:

```
# get an instance of the eye tracker extension
eye_tracker Tobii = new eye_tracker( "Tobii" );

# set the host IP address that the Tet_server runs on- remember to set the IP to
generate automatically
Tobii.send_command( "Mouse Test Server" );

# set the port the Tet_Server sends the data to
#Tobii.send_command( "port 4455" );

# set the screen resolution used by the Tobii eye tracker
# Default: Screen Resolution settings
#Tobii.send_command( "width 1280" );
#Tobii.send_command( "height 1024" );
```

e. Calibration –setting up and changing the routine type

You have two options available to you when calibrating the eye tracker when using Presentation. You can either use the built-in routine or use Tobii Studio as in Step e of using the section above.

The built in routine consists of a five point cross-hair calibration. The programme will automatically end if calibration is inadequate. You can also change the colour and object used for calibration in the SDL section of your programme.

To run the built-in routine:

- 1) To add to the SDL section:

```
#for automatic calibration
picture {
background_color = 0,0,255;
box { height = 10; width = 1; color = 255,0,0; };
x = 0; y = 0;
box { height = 1; width = 10; color = 255,0,0; };
x = 0; y = 0;
} et_calibration;
```

- 2) To add to the PCL section:

```
# start calibration
tracker.calibrate( et_calibrate_default, 0.0, 0.0, 0.0 );
```

This screenshot shows definition of the eye tracker serial number and also calibration.

```

Presentation
Experiment Editor Tools License Help
Main | Scenarios | Settings | Editor
Encoding: UTF-8
All Files
  getting_processed_file.sce
  PEPS_C_Revised_Familiar
  working_PEPS_C_task_wi
  working_PEPS_C_task_wi
  Test_of_ET_of_calls13.sce
  Familiarisation.sce
  responses.sce
  PEPS_C_Revised_Exp_Tr
  PEPS_C_Revised_Familiar
  test_of_resp.sce
  test_of_ET_added.sce
  PEPS_C_REVISIED.exp
Recent Files
  Dot_Mon_EXPERIMENTAL_TRIAL.sce
  demo_save_rebuild7_working
  WORKING_EXPERIMENTAL
  working_PEPS_C_task_with_a
  exp_not_working_T0_1.sce
  strippedDUAL.sce
  demo_save_rebuild4.sce
  working_PEPS_C_task_with_a
  working_PEPS_C_task_with_a
  Dot_Mon_EXPERIMENTAL_1
  exp_not_working_T0_1.sce
  demo_save_rebuild5.sce
  demo_save_rebuild.pcl
  rebuild.sce
  demo_save_rebuild.sce
  demo_save_rebuild2.sce
  PEPS_C_MAIN_TRIAL_pupils
  demo_save_rebuild3.sce
  PEPS_C_MAIN_TRIAL.sce
  PEPS_C_MAIN_TRIAL2.sce
Dot_Mon_EXPERIMENTAL_TRIAL.sce
229 end;
230
231 /*
232 ----- EYETRACKER STUFF -----
233 ----- */
234
235 # get an instance of the eye tracker extension
236 eye_tracker Tobii = new eye_tracker( "Tobii" );
237
238 # set the host IP address that the Tet_server runs on- remember to set the IP to generate automatically
239 Tobii.send_command( "host T060-205-85200513.local" );
240
241 # set the port the Tet_Server sends the data to
242 Tobii.send_command( "port 4455" );
243
244 # set the screen resolution used by the Tobii eye tracker
245 # Default: Screen Resolution settings
246 #Tobii.send_command( "width 1280" );
247 #Tobii.send_command( "height 1024" );
248
249 #set size of buffer for position data
250 Tobii.set_max_buffer_size( dt_position, 100000 );
251
252 # start calibration
253 Tobii.calibrate( et_calibrate_default, 0.0, 0.0, 0.0 );
254
255 # start the eye tracker recording
256 Tobii.start_tracking();
257
258 # Start getting position data
259 Tobii.start_data( dt_position, true );
260
261 # Wait, takes a while for the eye tracker to fire-up
262 wait_interval( 100 );
263
264
265 /*
266 ----- EXPERIMENTAL TRIAL -----
267 ----- */
268
269 #-----arrays-----
270
271 #about arrays: array <arrayable_type> name[integer_valued_expression]
272 #value between square brackets is the size of the array

```

5. MATLAB and Cogent

Both MATLAB and Cogent are currently installed on the ASUS machine.

A licence and installation of MATLAB can be obtained from IT technicians or at <http://www.mathworks.co.uk/> Cogent can be found at <http://www.vislab.ucl.ac.uk/cogent.php>

I'm only just learning to use MATLAB and the eye tracker so as I learn more this section will get added to!

6. Troubleshooting

a. Check cables (especially the VGA connection)

If the eye tracker says Check Cable on its screen you probably have trouble with the VGA cable's connection. Ensure what the VGA cable is attached as many laptops (including the ASUS machine) do not have screws- the cable can be supported by a rubber or something small to lift the connector behind the laptop. This should make

the screen come on if you have seen the Check Cable message. It's probably also a good idea to check that all the cables are properly connected.

If you're still getting errors then it's sensible to try replacement cables just to check that the cable hasn't broken and is causing your problems. The cables don't need to be a specific brand or length as long as you're replacing the right cables.

You'll need:
a VGA cable.
an ethernet cable.
a type A to B USB cable.

b. Run a sample script

A good way to test if the problem a connection is because of your experiment or something else, is to run a sample script provided by the software that you're using. If this is Eprime you can go in to File, Open, My Experiments, Tobii, Samples, TET, TETFixedPositionAOI. Then make sure that you set the IP Address/ Name field to the serial number of the eye tracker (as outlined in Step 3d).

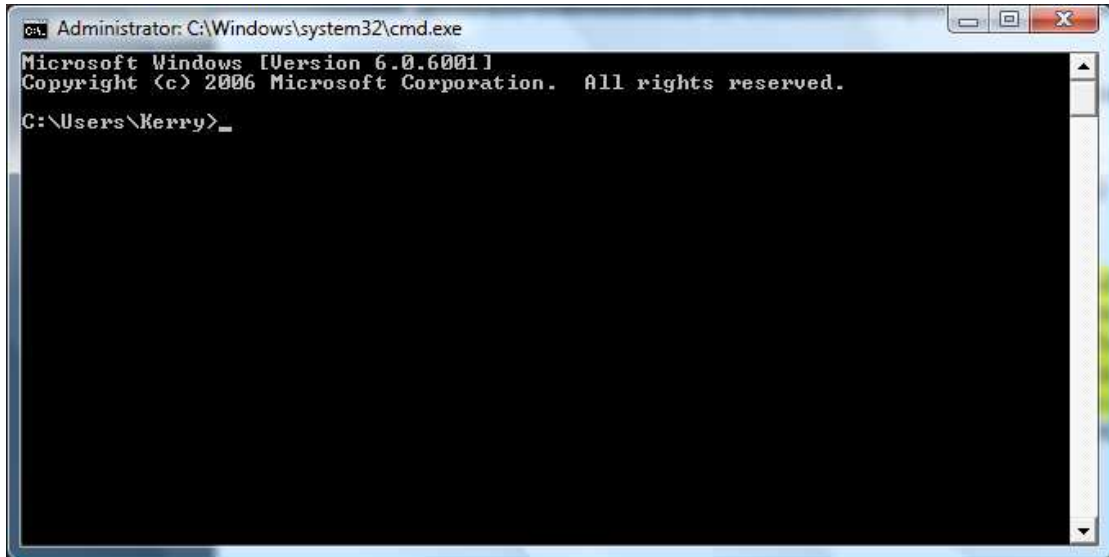
In Presentation this can be found by going to the folder for the extensions and running the SaveAndReplayDemo ensuring that you send the `Tobii.send_command("host TT060-205-85200513.local"); command` (or replace this with your serial number).

c. Try to send a signal to the eye tracker

To test whether there is a physical connectivity issue with the eye tracker it's a good idea to try to ping the eye tracker, if the signal is sent and received you know that the eye tracker is physically connected to the computer.

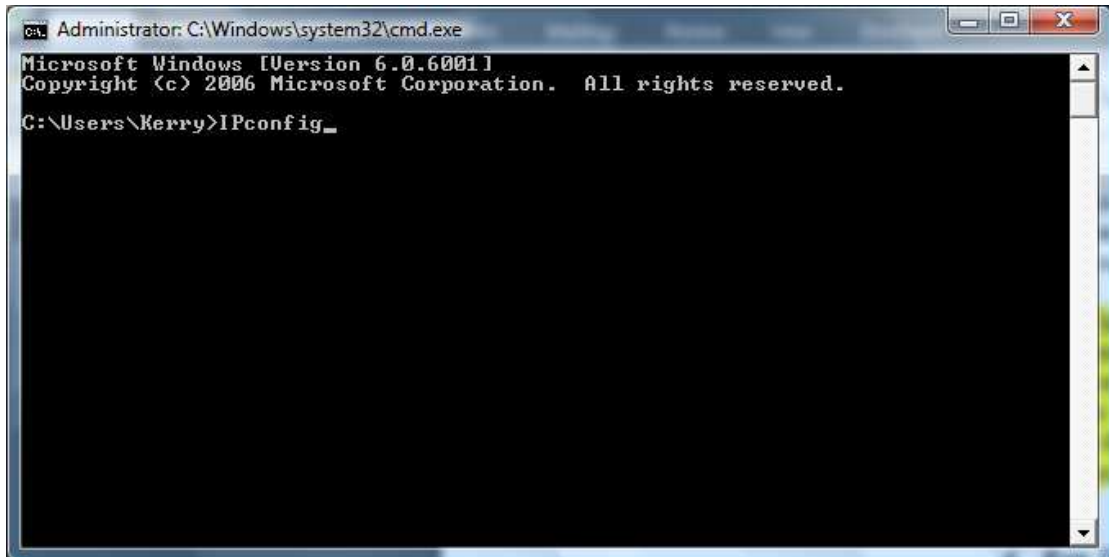
To ping the server on the eye tracker (these instructions were made on my home computer so will look different to what you see on a laptop or computer connected to the network):

- 1) Go to Start click on Run.
- 2) In the small box type `cmd`. This will bring up a black DOS window. Don't be worried by this, you can do no harm to the computer. All you will be doing is sending a signal to the eye tracker and see if it gets sent back.



```
Administrator: C:\Windows\system32\cmd.exe
Microsoft Windows [Version 6.0.6001]
Copyright (c) 2006 Microsoft Corporation. All rights reserved.
C:\Users\Kerry>
```

3) Type IPconfig and press return.



```
Administrator: C:\Windows\system32\cmd.exe
Microsoft Windows [Version 6.0.6001]
Copyright (c) 2006 Microsoft Corporation. All rights reserved.
C:\Users\Kerry>IPconfig
```

This will bring up a list of wired and wireless network connections to the computer. You will see lots of numbers, there's no need to be intimidated by this.

- 4) Find the IPv4 Address for the eye tracker, it is usually connected via a wired LAN connection.
- 5) When you have found the right IPv4 Address type Ping and then the IPv4 Address for the eye tracker. Press return.

Here is an example from my home computer:

```
C:\Windows\system32\cmd.exe
Windows IP Configuration

Wireless LAN adapter Wireless Network Connection:

    Connection-specific DNS Suffix . : cable.virginmedia.net
    Link-local IPv6 Address . . . . . : fe80::acf5:edf0:970b:6ef2%11
    IPv4 Address . . . . . : 192.168.1.101
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.1.1

Ethernet adapter Local Area Connection:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix . :

Tunnel adapter Local Area Connection* 6:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix . :

Tunnel adapter Local Area Connection* 7:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix . : cable.virginmedia.net

Tunnel adapter Local Area Connection* 12:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix . :

Tunnel adapter Local Area Connection* 13:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix . :

Tunnel adapter Local Area Connection* 14:

    Connection-specific DNS Suffix . :
    IPv6 Address . . . . . : 2001:0:5ef5:79fb:3803:34db:3f57:fe9a
    Link-local IPv6 Address . . . . . : fe80::3803:34db:3f57:fe9a%15
    Default Gateway . . . . . : ::

C:\Users\Kerry>ping 192.168.1.101_
```

You will see a number of lines appear.


```
C:\Windows\system32\cmd.exe
Windows IP Configuration

Wireless LAN adapter Wireless Network Connection:

    Connection-specific DNS Suffix  . : cable.virginmedia.net
    Link-local IPv6 Address . . . . . : fe80::acf5:edf0:970b:6ef2%11
    IPv4 Address. . . . . : 192.168.1.101
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.1.1

Ethernet adapter Local Area Connection:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

Tunnel adapter Local Area Connection* 6:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

Tunnel adapter Local Area Connection* 7:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . : cable.virginmedia.net

Tunnel adapter Local Area Connection* 12:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

Tunnel adapter Local Area Connection* 13:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . :

Tunnel adapter Local Area Connection* 14:

    Connection-specific DNS Suffix  . :
    IPv6 Address. . . . . : 2001:0:5ef5:79fb:3803:34db:3f57:fe9a
    Link-local IPv6 Address . . . . . : fe80::3803:34db:3f57:fe9a%15
    Default Gateway . . . . . :

C:\Users\Kerry>ping 192.168.1.101

Pinging 192.168.1.101 with 32 bytes of data:
Reply from 192.168.1.101: bytes=32 time<1ms TTL=128
Reply from 192.168.1.101: bytes=32 time<1ms TTL=128
Reply from 192.168.1.101: bytes=32 time<1ms TTL=128
Reply from 192.168.1.101: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.101:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\Kerry>
```

- 6) If the number of packets sent and received matches (see four lines up from the bottom) then you know that the eye tracker is properly connected- your problem is not a connectivity issue.

If there is a mismatch between the number of packets sent and received your connection to the eye tracker is incomplete. Try changing cables and checking the connections are tight to the laptop and from the eye tracker.

d. Run Tobii diagnostics

Running Tobii diagnostics is another way of checking for connectivity issues.

- 1) Go to the Tobii Eyetracker Brower.
- 2) Find your eye tracker, if it's the T60 machine in the department it'll have the serial code TT060-205-85200513.

- 3) Make sure that you sit in front of the eye tracker as it will be trying to pick up your eyes.
- 4) Follow the on screen prompts to check the eye tracker's performance.

e. Try restarting the laptop and eye tracker

The TET Server running on the eye tracker can sometimes need to be reset, this can simply be done by restarting the eye tracker (connected to the laptop) and laptop at the same time. I was told by a tech support worked at Tobii that restarting three times can sometimes fix problems with the TET Server.

To do this simply restart the laptop and the eye tracker connection will be reset while the laptop restarts.