This is a set of Matlab scripts that calibrates the eyetracker and runs a simple Psychtoolbox experiment from within Matlab. It requires two Matlab packages - t2t and Psychtoolbox. The calibrator is directly adapted from one created by Fani Deligianni; I've updated it to work with the current (early 2012) version of Talk2Tobii and modified it for developmental experiments (prompted starts for each point and an option to play an attention-getter instead.) The experiment itself is just a very short preferential looking paradigm.

Luca Filippin at the T2T Google Group was very helpful as I was getting started using the T2T package. Many thanks also to Celeste Kidd and Johnny Wen for sharing an example of eyetracker/Psychtoolbox experiment - I've borrowed some functional/organizational scripts (mostly parameter handling) from them.

I've tried to make this script runnable without the Tobii – if you’re not connected to the Tobii, the script should skip the calibrator and go onto the experiment, ignoring subsequent Tobii-related functions. That makes it easier to work on designing your actual experiment somewhere other than at the Tobii (displays should just play on your laptop screen in this case.)

The biggest goofy thing about the current version is that I was unable to find a way to get the Tobii’s built-in webcam to talk to my mac laptop. I’m not sure whether that’s a platform incompatibility, or if there’s some command to turn the webcam on that I can’t access. We tape a $20 webcam on top of our fancy eyetracker and watch it in Apple’s Photobooth app in order to monitor the baby’s attention during the study. Fancy.

I don’t guarantee that all this code will be correct, bug-free, or work on your system, but nevertheless I hope it will be useful for those looking to use Matlab for eyetracker experiments!

**RUNNING THE SCRIPT**

To run this, you need both t2t and Psychtoolbox, and Matlab needs to know where to find them (I put them the Applications folder.)

To run this script, you'll need to make sure you have the appropriate software installed on a Macintosh (Psychtoolbox is unreliable on PCs!). You'll also need to be sure your Tobii/server configuration is set up correctly (see T2T documentation for guidance here – though note that if you have a newer Tobii you don’t need a separate computer server because it's onboard the Tobii on some models.) This code runs on our Tobii T60.

For the following instructions, I'm assuming that you can successfully ping your Tobii from the computer that’s running Matlab (try both the IP address and the named address that's on the barcode of the Tobii – our setup really wants the IP address, but I know of at least one other lab that can only get this working with the named address.)

These scripts work best by running Matlab from the command line rather than the
normal GUI. Start by opening up an XTERM window and entering the following mysterious commands:

```
export DYLD_LIBRARY_PATH=$DYLD_LIBRARY_PATH:/Applications/t2t/lib (or wherever your t2t directory is)
launchctl setenv DYLD_LIBRARY_PATH $DYLD_LIBRARY_PATH
```

Now you’ll open up Matlab in the command line (set this to your Matlab location)

```
/Applications/MATLAB_R2010aSV.app/bin/matlab -nojvm -v=maci
```

You’ll get the familiar Matlab prompt. You need to cd into the directory where your matlab scripts are located:

```
cd /Users/Melissa/Documents/Projects/TOW/
```

And then enter the following to run the script (and cross your fingers)

```
TW(99,'Transitive')
```

(That’s subject number, plus conditions entered by the user. 99 is reserved as a special ‘practice’ subject, for other subject numbers the script will complain if you try to run a subject for which datafiles already exist.)

The tobii screen should start displaying something; meanwhile click several times to get control of your mouse back on the laptop screen.

After a big you’ll get a black box, and if you move your/someone else’s face in front of it, you should see 2 big green dots that represent the eyes. This lets you know that you have your subject roughly in the right position. It’s definitely worth the time to get those dots firmly onscreen and steady (not flickering, which probably means the participant is either too far from or too close to the eyetracker.)

Press ESC to start the calibration (the terminal will prompt you for this), and then you’ll be prompted to display each of the calibration points by hitting the space bar. You can also hit “X” at any point to play the classic laughing baby movie if your subject’s attention has wandered. There’s some code you can just comment out if you’d rather this section play through unprompted.

Once this has finished you’ll get a summary of the data quality between 0 and 1 – this is just the mean of the 0/1 values in the quality matrix that Tobii generates (found eyes/didn’t find eyes). Unfortunately I’ve found that if calibration wasn’t successful the first time it’s unlikely to work the second (I just turn everything off and start over – not ideal with kids); if I find a workaround here I will update the code. But the script will let you go ahead and run the experiment no matter how the calibration went.
In the example script I've provided, there's a laughing-baby at the beginning of every trial, you'll hit the space bar to move on once the participant is looking.

I get a "Bad Device" message that pops up during the experiment whenever a soundfile starts playing, it doesn't seem to be interfering with the actual audio playback.

UNDERSTANDING THE OUTPUT

This script produces four files for each participant. There are examples (TTW_99x_*) in the Data folder. They are:

**Info:** Information about trial counterbalancing, stimuli displayed, subject number, etc. You can put anything you like in here that you'd want to know about what was displayed on a particular run of your experiment.

**Quality:** Information about the calibration. Take a look at the talk2tobii manual to see what each of these columns mean: the ones you probably care about are the plotted points vs. measured gaze locations and Tobii's level of surety that it has found an eye.

**Tracking:** The actual gaze samples from your experiment, from the call t2t('START_TRACKING') to t2t('STOP_TRACKING') (Note, you shouldn't need to be inserting many t2t calls of this kind, they are handled in the startup/closeout scripts for the most part.) This has many measurements related to a single gaze sample, plus the timestamp of when that gaze was recorded. See manual again for interpretation.

**Events:** A list of interesting time stamps that you specify – you'll see these sprinkled throughout the Trial script whenever a movie starts, stops, etc. Use this to find out which Tracking stretches you want to analyze.

USING/MODIFYING THE SCRIPTS

Put any parameters you might want to change (e.g. video files, numbers of trials) in para.txt. Have anything you'll change with different subjects (such as subject number, conditions) as arguments to the main function. Put any other static parameters (IP address, screen parameters, anything you want to stay constant and un-messed with) in SetParameters.

To insert your own experiment, you'll want to just comment out the single Do_TW() command and run your experiment instead! I like having a single script (Jump_Trial in this case) which is essentially just the experiment logic with no Psychtoolbox code exposed, so you'll see several scripts like "PlayCenterMovie" which encapsulate PTB code to display a stimulus in a standard way that was useful for me – there's additional flexibility available in these kinds of functions that you can of course access by meddling
with the PTB code inside.

TROUBLESHOOTING

If anything goes wrong, close the xterm and open a new one! In general, restarting matlab or even rerunning the calibrator from the same terminal is unsuccessful – I assume there's some process somewhere that's not exiting correctly. I also open a new xterm for each new subject.

When coding, tread carefully around any changes to the t2t calls – they are very particular about ordering and having flags set correctly. Check_status is your friend, use it liberally around places where things tend to go wrong…it will block the script until some condition (e.g. RECORDING) is met by the Tobii server.