Introduction to Psychtoolbox-3

http://psychtoolbox.org/

Dr Cyril R Pernet
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What is it?

- Toolbox running under Matlab and Octave to "synthesize and show accurately controlled visual and auditory stimuli and interact with the observer".

- Prepare your stimuli, display and collect data in Matlab + post-processing (stats) in Matlab – a single environment leads to less errors during data manipulation (rounding, averaging, sorting, etc) and a better control of the overall experimental process.

How does it work?

- Write a program with a loop in which you 1. present stimuli and 2. record the subject response

- Functions also allows to interface with MRI scanner, EEG, Eye tracker etc..

- Lots of C++ files for speed, uses openGL for graphics with double buffer (that it is loading the next stimulus in memory while your subject is looking at the current one = precise timing), openAL for precise control of audio etc ..

Testing hardware for better control

- **VideoRefreshFromMeasurement** - Alternative calibration procedure to find exact video refresh interval.
- **PsychCalDemoData** – lots of Monitor calibration tools. Also in **PsychGamma** - Fit monitor gamma functions.
- **PsychPortAudioTimingTest** is a script that we used for testing sound onset latency and accuracy.

Hardware trouble

- Flat panel and projectors: display time are computed based on the refresh rate and the actual time the 1st pixel of an image is leaving the video card – this all works well on CRT monitors but there is uncontrolled issues with eg LCD (non linear switch latencies)
- USB keyboards relies on interuptions = 30/50 ms + 10ms due to USB ; better to use to response box that acts like a keyboard or use the mouse (with movement disable).

A simple example

- Present a series of blue(ish) circles at random locations, subjects have to detect green ones.
- Record responses and RT.
- Sort responses to find the color threshold
- Send a beep when the subject is wrong

Display images

- [Screen](#) - Control the video display.

- Type: 'Screen' to list all associated functions

- Open or close a window or texture
- Draw lines and solids
- Draw Text
- Copy an image, very quickly, between textures
- Copy an image, slowly, between matrices and windows
- Synchronize with the window's screen (on-screen only)
- Load color lookup table of the window's screen
- Get (and set) information about a window or screen
- et/set details of environment, computer, and video card (i.e. screen):
- Movie and multimedia playback functions:
- Video capture functions:
- Support for 3D graphics rendering and for interfacing with external OpenGL code:
- Support for plugins and for builtin high performance image processing pipeline

Display series of blue-ish circles and green ones

- <u>Screen</u> - Control the video display.

EXERCISE: WRITE MATLAB CODE TO DISPLAY CIRCLES IN BLUE-ISH TO GREEN COLORS

HELP: Screen OpenWindow?
        Screen FillOval?

should have things like this:
win = Screen('OpenWindow', screenid, 0,[],32,2);
rect = [x y x+50 y+50];
Screen('FillOval', win, trial_color(t,:), rect ,50);
Screen('Flip', win); pause(1)
→ Make a for loop to display multiple trials

Collect data

- GetChar - Wait for keyboard character and return it.
- GetMouse - Get mouse position.
- GetSecs - Time since startup with high precision.
- IOPort - A I/O driver for access to serial ports.
- KbCheck - Get instantaneous keyboard state.
- KbName - Convert keycode to key name and vice versa.
KbPressWait - Wait for key press, make sure no keys pressed before.
- KbWait - Wait until at least one key is pressed and return its time.
- WaitSecs - Wait specified time.

Monitor responses and record

EXERCISE: add the while loop containing KbCheck, once the subject presses a button get answer type and RT

should have things like this:

```
success = 0;
    while success == 0
        pressed = 0;
        while pressed == 0
            [pressed, secs, kbData] = KbCheck;
        end
        %  if right key success == 1
end
```

Present audio

- [Beeper](#) - Play a nice beep tone of selectable duration, frequency and volume.
- [InitializePsychSound](#) loads the PsychPortAudio sound driver
- [PsychPortAudio](#)(),

Other cool stuff

- Quest - Threshold estimation procedure.
- Psychometric - Psychometric function fitting.
- PsychProbability - Probability and statistics.