

# Psychophysics toolbox

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# Psychtoolbox

- Psychtoolbox is a collection of Matlab functions for presenting visual stimuli easier
- with the Psychtoolbox you can run your experiments from Matlab
- use the full flexibility of Matlab (general purpose, high-level, interpreted language) to generate your stimuli
- display them with millisecond timing using the Psychtoolbox (well-defined interface to graphics hardware)
- Run code with little interruption `>> help rush`

<http://psychtoolbox.org>



David Brainard



Denis Pelli

... don't thank them, cite them!

***"We wrote our experiments in MATLAB, using the Psychophysics Toolbox extensions (Brainard, 1997; Pelli, 1997)."***

Brainard, D. H. (1997). The Psychophysics Toolbox, *Spatial Vision*, 10, 443-446.

Pelli, D. G. (1997). The VideoToolbox software for visual psychophysics: Transforming numbers into movies, *Spatial Vision*, 10, 437-442.

# Psychtoolbox is free, but

- the syntax of commands is special; almost everything is done with the Screen command; to get help, `>> help Screen` does NOT show much; instead, type `>>Screen`
- developed primarily for Apple Macintosh; support for other OS (Linux, Windows) is ok, but not perfect
- development is cumbersome: any error freezes the screen, and you have to do  
Alt-tab; `>> Clear Screen;` `>> close all (Windows)`  
(sometimes even to close and restart Matlab)
- documentation partly outdated (e.g., Tutorial for the recent version PTB3)



You should also bear in mind that you are entering the murky world of non-professional code. This code is written by people like you, in the middle of trying to do real science. This means that commands may not work as stated, help files may be out of date, commands may not even exist. This is especially true in the case of Psychtoolbox, which is essentially a collaborative effort between lots of people and has been through lots of reincarnations.

**Ione Fine**

<http://faculty.washington.edu/ionefine/Matlab%20Class%20Chapter%206.pdf>

# Controlling the hardware

- The nice thing about Matlab is that it is more or less completely independent of the hardware
- This is no longer the case using the Psychtoolbox; all sorts of things can go wrong (e.g., `help SyncTrouble`)

# What is...



- **OpenGL** is the premier environment/API for developing portable, interactive 2D and 3D graphics applications (GL: graphics library)
- **API** application programm interface
- **double buffering** is a practice to use a front and back image frame buffer to achieve smooth animation. The back buffer is not displayed, but swapped (flipped) with the front buffer.
- **Synching to VBL** will wait for the display to enter its vertical blanking (VBL) interval between frames before swapping its internal buffers to update the display
- **VBL** (vertical blank) is the small gap in time that occurs when the display has updated its last scanline and before it starts redrawing its display surface starting at the first scanline again.
- **Vertical retrace signal** Synonym for vertical blank

# Installing the Psychtoolbox

Follow the instructions on <http://psychtoolbox.org>:

1. Install subversion <http://subversion.tigris.org/>;  
**reboot machine**
2. Create a folder `C:\toolbox`
3. **Download Download** `DownloadPsychtoolbox.m` to this folder
4. **Start Matlab**  
`>> cd C:/toolbox`  
`>> DownloadPsychtoolbox('current', 'C:/toolbox')`  
**restart Matlab**

# Getting started

```
>> ScreenTest % verify that PTB is working on your machine
```

```
>> help Psychtoolbox
```

```
>> help PsychDemos
```

```
>> ScreenDemo % not available in PTB3
```

```
>> Screen
```

```
>> Screen('OpenWindow?')
```

# Screen

- Main command of the toolbox
- 50 subfunctions 😊
- Typical structure of your program:

```
w = Screen('OpenWindow')    % initialize window
Screen('FillRect', w, ...)  % draw to screen
GetChar                       % get response
Screen('Close', w)         % close window
```

- Common mistake: open window **w** in loop of trials, but forgot to close it (run out of memory); instead: open all windows out of loop, and `Screen('CloseAll')` at the end

# Keyboard input

- `CharAvail` Simply checks whether there is a key press in the event queue
- `GetChar` Checks or waits for a key press in the event queue. Returns what the key was, and when it was pressed (dubious accuracy)
- `KbCheck` Tests whether a key has been pressed at that moment in time
- `KbWait` Waits for a key press to occur

# Further readings

- <http://faculty.washington.edu/ionefine/MatlabCourseNotes07.html>
- <http://argentum.ucbso.berkeley.edu/PTBtutorial>
- Mario Kleiner's presentation at ECVP 2007  
[www.psychtoolbox.org](http://www.psychtoolbox.org) — Tutorial  
[http://svn.berlios.de/viewcvs/\\*checkout\\*/osxptb/trunk/Psychtoolbox/PsychDocumentation/Psychtoolbox3-Slides.pdf](http://svn.berlios.de/viewcvs/*checkout*/osxptb/trunk/Psychtoolbox/PsychDocumentation/Psychtoolbox3-Slides.pdf)