

## Coding for Psychology Studies

Depending on the research question, cognitive psychology and neuroscience studies may incorporate eye tracking, pupillometry<sup>1</sup>, reaction time, response accuracy, galvanic skin response<sup>2</sup>, self-report questionnaire, EEG, and many other types of data. For split-second control over the stimuli presented on the screen and the data collected from a wide variety of research equipment, most cognitive psychologists learn how to code.

All of our studies are written in MATLAB by our research personnel. Other languages frequently used in psychophysics studies include Python and E-Prime.

## Data Analysis

To interpret neuroimaging, eye tracking, EEG, and quantitative behavioral data, psychologists use programming languages like MATLAB or R. Some psychologists also use specialized statistics software like SPSS or Stata. If you're thinking about pursuing a career in psychology (or any science), it's increasingly useful to know how to write your own data analysis scripts. You can find some beginner-friendly resources below.

Neuroimaging studies produce a large volume of raw data unintelligible to a human observer. Processing and analyzing fMRI data typically requires specialized software packages such as AFNI (Analysis of Functional Neuroimaging), SPM, or Freesurfer. You can find out more about these packages in the Further Information section.

## Coding Resources

### *MATLAB*

*MATLAB for Neuroscientists (2<sup>nd</sup> edition)* – Accessible through the TAMU academic library.

This textbook is one of the most comprehensive introductions to the types of experiments a cognitive neuroscience lab might run with MATLAB, including classics like the Posner pop-out paradigm.

*MATLAB for Psychologists* - <http://www.antoniahamilton.com/matlab.html>

Dr. Hamilton's tutorials take the reader through some basic data analysis in MATLAB.

*Psychophysics Toolbox Tutorials* - <http://peterscarfe.com/ptbtutorials.html>

Dr. Scarfe's tutorials demonstrate how we display objects on the screen with split-second timing using Psychophysics Toolbox. In particular, Dr. Scarfe's code for detecting mouse position is very similar to how we detect eye position using the (x,y) coordinate system.

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<sup>1</sup> The study of pupil dilation in response to stimuli.

<sup>2</sup> A measure of salt levels on the skin, and by extension, sweaty palms/sympathetic nervous system activation/emotional arousal.

## R

*Using R for Psychological Research* - <http://personality-project.org/r/>

An extended look at using R for data analysis and visualization, covering most of the common statistical tests used in psychology and cognitive neuroscience.

*Learning Statistics with R* - <http://www.fon.hum.uva.nl/paul/lot2015/Navarro2014.pdf>

Similar to the above site, but with a heavier emphasis on basic statistics.

### Further Information

#### GENERAL NEUROIMAGING

*What is fMRI? (UC San Diego)* - <http://fmri.ucsd.edu/Research/whatisfmri.html>

A beginner-friendly explanation of the principles behind fMRI.

*Introduction to fMRI: Experimental Considerations and Data Analysis* -  
[http://cogprints.org/6193/1/fMRI\\_intro.pdf](http://cogprints.org/6193/1/fMRI_intro.pdf)

A longer and more technical explanation, including some of the physics behind fMRI research.

*Functional MRI: Methods and Applications* -  
[https://users.fmrib.ox.ac.uk/~stuart/thesis/chapter\\_6/contents.html](https://users.fmrib.ox.ac.uk/~stuart/thesis/chapter_6/contents.html)

An introduction to analysis considerations for fMRI data.

#### NEUROIMAGING SOFTWARE (advanced)

*The Milwaukee AFNI Workshop* - <https://www.youtube.com/watch?v=Qe4LcNuaG64>

An introduction to AFNI, the neuroimaging analysis software we use in our lab, presented by the author of a popular resource for learning neuroimaging (Andy's Brain Blog).

*MindHive* - <http://mindhive.mit.edu/imaging>

An archive of FAQs, scripts, and troubleshooting tips for fMRI analysis. Spend some time clicking through these to get a sense of how analysis scripts are put together and what problems neuroscientists might encounter during analysis.