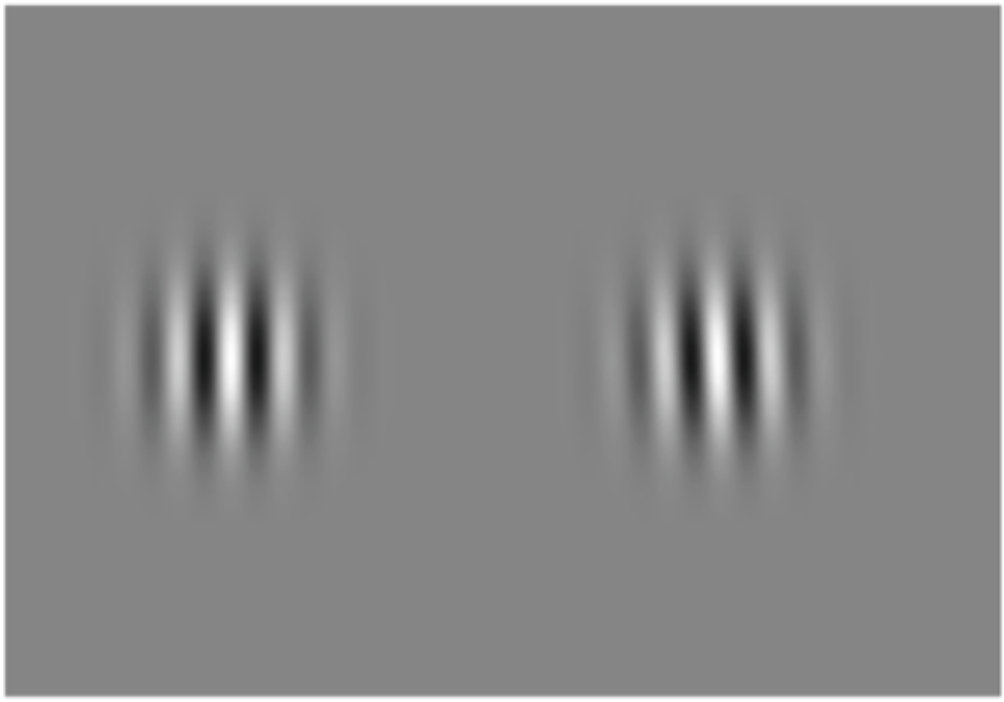
PSYC 4165-100, Spring 2018

Laboratory 0b

Introduction to Experimental Methods in Perception Research: The Oblique Effect

Part 1: Collecting Data



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Lab Overview

Classical methods of psychophysics involve the measurement of two types of sensory thresholds: the absolute threshold, RL (*Reiz Limen*), the weakest stimulus that is *just* detectable, and the difference threshold, DL (*Differenz Limen*), the smallest stimulus increment away from a standard stimulus that is *just* detectable (also called the Just-Noticeable Difference, the JND). Gustav Theodor Fechner (1801–1887), in *Elemente der Psychophysik* (Fechner, 1860) introduced three psychophysical methods for measuring absolute and difference (JND) thresholds: the method of adjustment; the method of limits; the method of constant stimuli. In the method of constant stimuli, a standard stimulus is compared a number of times with slightly different test stimuli. When the difference between the standard and the comparison stimulus is large, the subject nearly always can correctly tell the difference between the test stimulus relative to the standard. When the difference is small, however, errors are often made. The difference threshold is the transition point between differences large enough to be easily detected and those small and are difficult to detect.

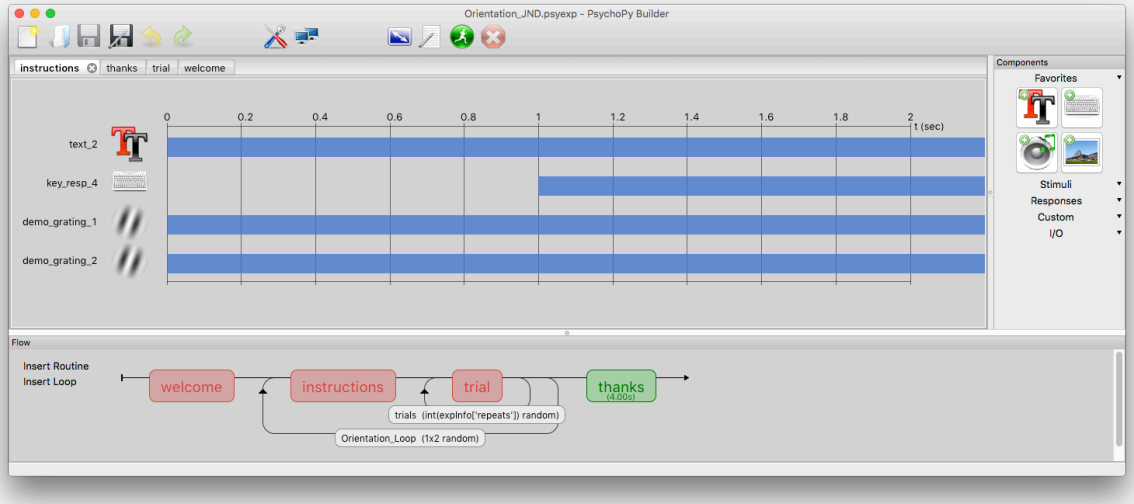
The purpose of this laboratory to provide participants (you) with an introductory experience to the method of constant stimuli, and also to introduce you to the software tools that we'll be using throughout the semester (PsychoPy, R and RStudio). We will use these software tools to observe the "Oblique Effect," a well-known and reliable phenomenon in visual perception (Appelle, 1972). This effect, that perception is often better for vertical and horizontal stimulus orientations than for oblique orientations, has been studied extensively (Freeman, Brouwer, Heeger, & Merriam, 2011; McMahon & MacLeod, 2003; Meng & Qian, 2005; Nasr & Tootell, 2012; Westheimer, 2003).

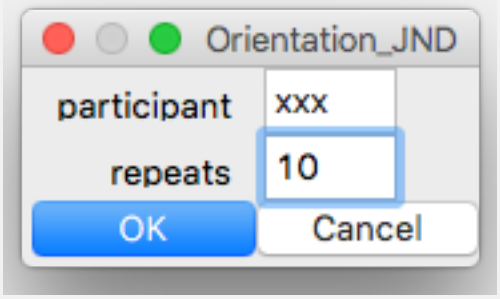
Today's lab activities present the entire lifecycle of a perception experiment in a single lab session, beginning with reading a classic review paper on the Oblique Effect, using PsychoPy to perform an experiment designed to measure the Oblique Effect, and finally tabulating and analyzing data in R. Throughout this lab you will find sample text provided as a model of each of the lab competencies. You will learn to:

- **Download "Lab Tools" folders from the class website and run scripts in PsychoPy and R.**
- **Generate, save, visualize (graphs) and analyze data in R.**

Lab Instructions

The experiment will be run under computer control using PsychoPy, a popular program written in Python by Jonathan Peirce, at the University of Nottingham, England (Peirce, 2007, 2009). PsychoPy allows you to run experiments with carefully controlled visual and auditory stimuli and to collect response data and reaction times. You'll need to download, then run the experiment file.

1.	**Download "Lab 0b Tools" from the course website:** 1. In a web browser, navigate to the course webpage through Canvas or directly; 2. Download *Lab 0b Tools.zip* from the course main page, Lab section 3. Unzip the *Lab 0b Tools.zip* by double-clicking the file (on the Mac it will be automatically unzipped). PROTIP: Keep all your working files in the Lab 0b Tools folder on the Desktop: that way you won't overlook a crucial file when you save your folder before you logout!
2.	**Launch the PsychoPy2 application** 1. Navigate to the Orientation JND Experiment folder. Locate the "Orientation_JND.psyexp" file and double-click on it. The application PsychoPy2 should launch and a window open. It should look like Figure 1. **Figure 1. PsychoPy Builder View** 

3.	**Enter your information in the info dialog.** 1. You will be shown the "info dialog," as shown in Figure 2. 2. Enter your own initials in the observer field 3. Verify that the value 10 is in the repeats field. This number tells PsychoPy how many blocks of trials to run. 4. Click OK to begin the experiment. **Figure 2. info dialog** 
4.	**Follow on screen instructions to do the experiment. Consider setting the number of repeats to 1 or 2 and running the experiment as a practice session. Then change repeats to 10 and run the complete experiment.**

The computer will randomly decide which of the two orientations to test first: 0 or 45 deg. On each trial you will first be presented with the standard stimulus (either 0 or 45 deg, depending on the condition) followed by a test stimulus. The test will be rotated slightly counterclockwise or clockwise relative to the standard. You must judge which by pressing the left arrow key (if you think the second stimulus is counterclockwise) or the right arrow key (if you think it was clockwise). On each trial the computer will record your responses. Some of the judgments will be easy and some will be difficult. The whole experiment should not take more than 30 minutes. On the cover of this lab are two examples of Gabor patches: the one on the left is oriented at 0.0 degrees (vertical) and the other is tilted clockwise by 2.0 degrees. Can you see the difference?

Your experimental data will be saved in the data folder in a text file whose name starts with your initials with the date and time added to it. The file extension is csv, for comma-separated values. If you double click on the file name, it will open in Excel. Do not modify this data file. It represents a lot of judgments and work on your part.

Using a web browser, log onto Canvas at https://canvas.colorado.edu, and upload your data csv file to the *lab0 csv data* dropbox in *Assignments* under *Lab Individual Data Files (upload csv data files)*. If you ran a practice run or two before running the proper experiment, only upload the final (latest) csv data file to Canvas. This file should contain all your data. The other files are incomplete and don't need to be saved. (But don't delete anything to make sure you don't accidently delete a critical and irreplaceable file!)

Part 2: Your Individual Data

Now that you have uploaded your own data to Canvas it is time to take a look at them. First make a folder for all your Lab 0 material. Move the Tools folder (*Lab_0b_Tools_Spring_2018*) that you downloaded from the course website into your main folder. Copy your PsychoPy csv data file (the one you uploaded) into the R Scripts folder. Double click the Lab0b_Individual_Data_Analysis.Rmd file that is in the R Scripts folder. Change the file name in the second r chunk to the full name of your data file (which should be in the same folder). Now work through the R markdown file to carry out the analysis. Make a pdf document and examine how the text and the R code relate to each other.

Part 3: Group Data

We have collected the data files from many students in previous classes. Download the Lab 0b Group Data Files folder from the course website and put it in your Lab 0 folder. There is a group data markdown script, along with the results of the individual analyses of each of the sets of data in a group data file called *lab0b_group_data_wide.csv.* Open the file in Excel to inspect its contents. Close Excel and run the group markdown script *Lab0b_Group_Analysis.Rmd*. This analysis of your group data is very similar to the analysis you did last week. Examine the R code in the chunks to see how the graphs and analyses are implemented. Explore and don't be afraid of modifying the graphs and carrying out other analyses as you see fit.

References

Appelle, S. (1972). Perception and discrimination as a function of stimulus orientation: The oblique effect in man and animals. *Psychological Bulletin, 78*(4), 266–278.

Fechner, G. T. (1860). *Elemente der Psychophysik*. Leipzig, Germany: Breitkopf and Härtel.

Freeman, J., Brouwer, G. J., Heeger, D. J., & Merriam, E. P. (2011). Orientation Decoding Depends on Maps, Not Columns. *The Journal of Neuroscience, 31*(13), 4792-4804. doi:10.1523/jneurosci.5160-10.2011

McMahon, M. J., & MacLeod, D. I. A. (2003). The origin of the oblique effect examined with pattern adaptation and masking. *Journal of Vision, 3*(3), 230–239.

Meng, X., & Qian, N. (2005). The oblique effect depends on perceived, rather than physical, orientation and direction. *Vision Research, 45*(27), 3402-3413. doi:http://dx.doi.org/10.1016/j.visres.2005.05.016

Nasr, S., & Tootell, R. B. H. (2012). A Cardinal Orientation Bias in Scene-Selective Visual Cortex. *The Journal of Neuroscience, 32*(43), 14921-14926. doi:10.1523/jneurosci.2036-12.2012

Peirce, J. W. (2007). PsychoPy--Psychophysics software in Python. *Journal of Neuroscience Methods, 162*(1-2), 8-13. doi:10.1016/j.jneumeth.2006.11.017

Peirce, J. W. (2009). Generating stimuli for neuroscience using PsychoPy. *Frontiers in Neuroinformatics, 2*(January), 1–8. doi:10.3389/neuro.11.010.2008

Westheimer, G. (2003). Meridional anisotropy in visual processing: implications for the neural site of the oblique effect. *Vision Research, 43*(22), 2281-2289. doi:http://dx.doi.org/10.1016/S0042-6989(03)00360-2