

5 The Psychophysics of Binocular Rivalry

5.1 Introduction

Download the archive file “hw8.zip” or “hw8.tar” from the homework web page and expand the file onto a computer with matlab installed (It has been tested under Windows and Unix with Matlab 6.x. It may not work with Matlab 5.x or earlier. At least Mac 5.2 version did not work). The expanded folder contains the program, a gui, and a few images to work with. Red/blue glasses will be handed out in class.

NOTE: YOU HAVE TO RETURN THE GLASSES WHEN YOU SUBMIT THE HOMEWORK (If you don't 1 % will be deducted).

In this experiment we will be manipulating the quality and content of an image to see how its saliency affects its perception during binocular rivalry. We will also manipulate attention to see if the change in perception comes under conscious control. Binocular rivalry has been studied a great deal and this reference by R. Blake and N. Logothetis. Before starting this homework, you should read Prof. Koch's Chapter 16 “When the Mind Flips” and the more detailed Blake and Logothetis 2002's *Nature Neuroscience Reviews* article that's posted on the web-page.

5.2 Predictions [1%]

What effects will the following manipulations have? Describe briefly (at most three lines for each).

- using a more salient image
- using an image with higher spatial frequencies
- using an image with spatial noise introduced
- using an image where only part of the picture contains useful information
- asking the subject to focus their attention on one image only

5.3 Experiment [8%]

Change your current matlab directory to the directory where the file hw8_rivalry.m resides. Start the program by typing “hw8_rivalry”. If it didn't work make sure “pwd” gives you the directory that contains hw8_rivalry.m. We would like you to get a strong feel for the binocular rivalry effect and how it is affected by different manipulations. While looking at the program window through the colored glasses push the “start/stop” button to begin the image display. As soon as you have a dominant percept press the “percept change” key (the first time will be left out of the analysis) and make a note of which picture was your first percept. Then press the “percept change” key again every time your dominant perception changes. When you have enough perceptual switches to plot the distributions of dominance times for each picture

press the “start/stop” key again to end the trial. When the trial is stopped the perceptual dominance times for each of the pictures (your first percept and your second percept) will be shown in the matlab command window along with the current contrast values for each of the pictures. Plot the distribution of the dominant perception times.

Is the distribution gaussian, if not what shape is the distribution? Hold the contrast of the red image constant and manipulate the contrast of the other blue image until you have found two points, where their mean dominance times are 1. statistically distinguishable and 2. statistically indistinguishable. You should check the assumptions (shape of distribution, equal variance etc) of any statistical method you use). Provide your statistical criterion.

Note that this procedure requires that you use a consistent criteria for judging when one or the other image has achieved dominance. Play around at first to experience this before you attempt to collect data to be used for analysis.

Finally, set one image, say the red one, to a low contrast (e.g., 20%). Now adjust the contrast of the other, blue, image until the average dominance times associated with the two images is equal. What is the relationship between the two contrast values?

5.4 Results [3%]

Provide graphs showing the distributions you plotted and describe the statistics you used in your analysis. Also describe any other experimental variants you performed and what your results were.

5.5 Conclusions [1%]

Are the results of manipulating the contrast what you predicted (explain or generate a new hypothesis)?