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Neuroscience 290
Independent Project Write-Up
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Our Blue is Best:
Distinguishing Between Shades of Blue in a Two-Alternative Forced Choice Task

Introduction

Through this experiment, I wanted to test how well people could detect different shades of colors produced by computers, specifically blue in this task. Digital colors are produced in RGB color model according to three dimensions of red, green, and blue. Through the combination of differing amounts of red, green, and blue, millions of colors can be produced with varying hues, saturations, and lightnesses. Though this is a convenient model for producing colors, human color perception is based on the stimulation of differing cone cells, which respond according to light wavelength: short (blue), medium (green), and long (red). I wanted to test how accurately subjects could detect colors that had differing values of lightness—in the RGB model, identical red and green values but differing blue values. Most likely, subjects will be more likely to correctly identify shades of blue with larger differences, but the magnitude of how much is to be determined through this experiment.

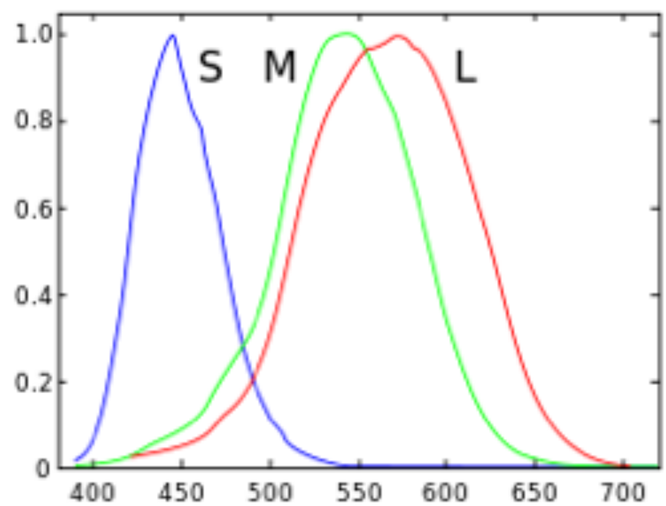

Figure 1. Responsivity of the three cone cell types in humans.

Methods

In a series of 50 trials, subjects were presented with two squares in a two-alternative forced choice task (2AFC), in which they had to select the square with the lighter shade of blue. The squares were the same size and distance from the center, and were presented on a grey background. Both squares had red and green values of -0.65, according to PsychoPy's RGB color model. For the values of blue, one square had a value of 0.5, while the other square had of 10 values according to 0.5 ± 0.00625, 0.0125, 0.025, 0.05, or 0.1. Which square possessed the constant blue value assigned randomly in each trial. Subjects were given two seconds to select a square, with the wait time between trials varying from 1 to 2.5 seconds. Recorded data included which square subjects indicated was lighter, whether the subject was correct, the colors of the squares (in RGB format), the percent difference in blue, and the time taken.

Figure 2. Stimuli presented in the task, two squares of different shades of blue.

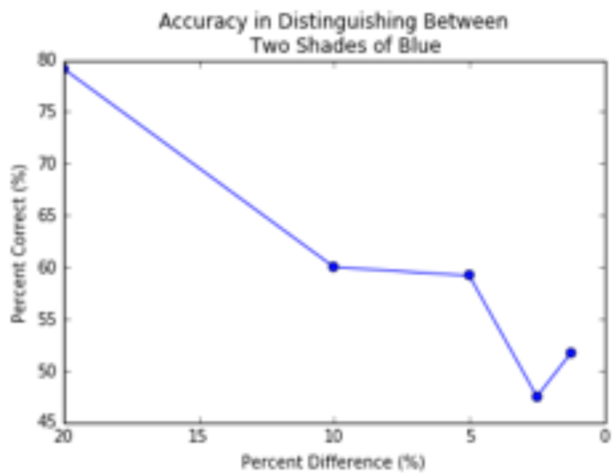

Figure 3. Aggregate data from 12 subjects, plotting the percent of correct selections by the difference between the two shades of blue.

Results

The general trend displays proportionality between the percent difference between the values of the two shades of blue and the accuracy in selecting the lighter shade. Though there was a large decrease in the percentage correct from 20% to 10% difference in color, the largest decrease indicated by slope occurred from 5% to 2.5%. The percent correct for 2.5% dropped below 50%, which would be the eventual result if subjects were randomly guessing. In addition, accuracy increased from 2.5% to 1.25%, despite the difficulty in perceiving a smaller difference in lightness.

Percent Difference	20%	10%	5%	2.5%	1.25%
Percent Correct	79.17%	60.00%	59.17%	47.50%	51.67%

Table 1. Rounded percentages of correctness.

Discussion

For the most part, the results matched the expectations. However, the observations made in the results at 2.5% and 1.25% that do not fit the trend, as well as the accuracy dipping below 50% at 2.5% difference, are most likely the result of a small sample size and can be improved with more subjects. Subjects frequently expressed difficulty in perceiving changes at all, even at large percents of difference. Methodologically, the conditions under which the experiment was taken could be both improved and made more constant. Background illumination, the distance of the subject from the computer monitor, and the angle of the monitor to the subject were not kept constant, due to the limitations in acquiring subjects for testing. Changing these aspects could result in better shade distinction. Interestingly, subjects displayed some adaptation to the

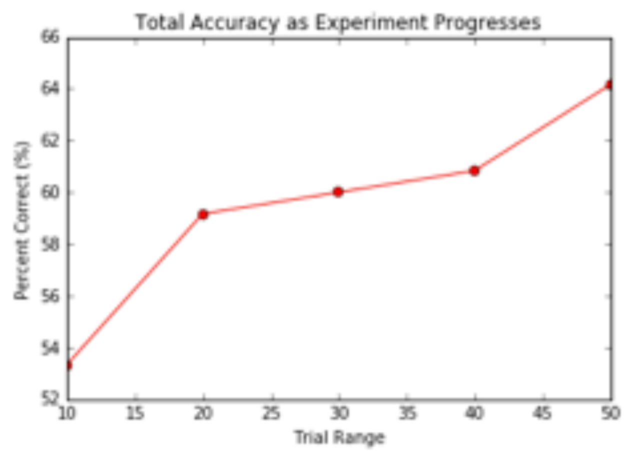

Figure 4. Aggregate accuracy as experiment progresses according to every 10 trials.

experiment, with overall accuracy increasing as the experiment progressed. Giving subjects the opportunity to become familiar with the objective with practice trials may lead to more accurate results.