

Color Assignment

Use Matlab and the color tutorial to do the following calculations and to answer the questions. Write up a report that explains your solutions, including graphs, and the relevant snips of Matlab code. Please submit a single pdf file (not MS Word) that contains everything.

1) (a) Make a graph of the **18th** Macbeth surface illuminated by illuminant A (matlab variable `cie_a`). (b) Make a graph of the **18th** Macbeth surface illuminated by the fluorescent illuminant. (c) Calculate the cone responses for the **18th** Macbeth surface when illuminated by illuminant A. (d) Calculate the cone responses for the **18th** Macbeth surface illuminated by the fluorescent illuminant. (e) Which of these will look more blueish and why?

2) (a) Calculate the monitor intensities to match the color of the **1st** Macbeth surface when illuminated by illuminant A. (b) Assume that there's no limit to the maximum intensity that can be produced by your monitor. Can this color be displayed properly on the monitor? Why or why not?

3) Calculate the monitor intensities for an S-cone isolating stimulus. (a) Start with a neutral stimulus, with the monitor intensities set to be $[1, 1, 1]$. What are the cone responses for that stimulus? (b) Add an increment to the S-cone responses and compute the monitor intensities that would evoke the new cone responses with the S-cones incremented. What's the largest S-cone increment that can be added (again, assuming that there's no limit to the maximum intensity)? (c) What are the monitor intensities corresponding to the largest possible S-cone increment?

4) The CIE in 1939 set a standard for the color matching functions using 3 monochromatic primaries of 440 nm, 550 nm, and 700 nm. Calculate and graph what these color matching functions should be using the cone spectral sensitivities. Set the intensity of the 700 nm primary to be much larger (80x) more than the intensities of the other primaries to plot all 3 color matching functions on the same scale.

5) Imagine that you are to do the color matching experiment using the monitor phosphors as the primaries instead of the monochromatic primaries that the CIE used. (a) Write an equation (an actual equation, not code) for the new color matching functions in terms of the old color matching functions, the cone spectral sensitivities, and the SPDs of the two sets of primaries. You will have to use the cone spectral sensitivities but you must not use any test lights. (b) Compute the 3x3 matrix that converts the CIE color matching functions to the new color matching functions. What are the numerical values of the entries in that matrix? (c) Calculate and plot new color matching functions from the original CIE color matching functions.