APPLIED PHYSICS 187
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Activity 4

COLOR RENDITION

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Image from: https://images-na.ssl-images-amazon.com/images/I/71Icb3wd6DL._SL1500_.jpg

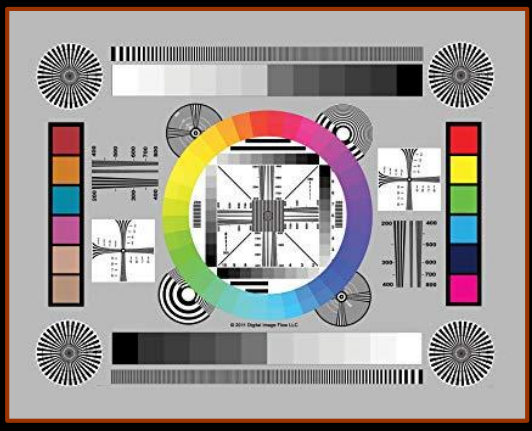
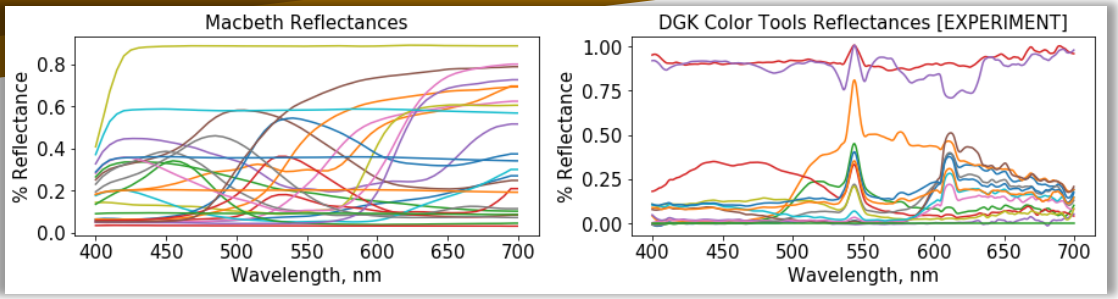


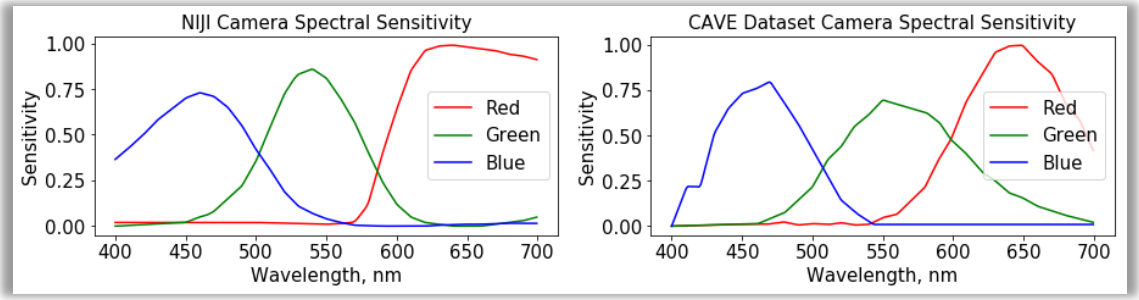
Image from: https://images-na.ssl-images-amazon.com/images/I/81tJ-K7vlfL._SX425_.jpg

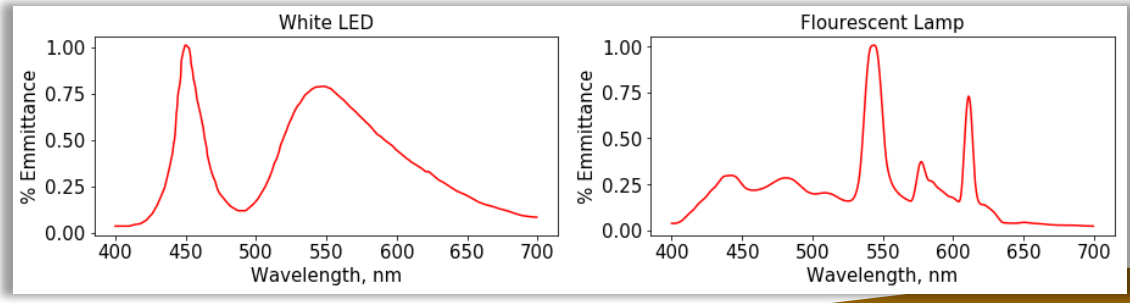
RENE L. PRINCIPE JR
2015-04622

specifications

02





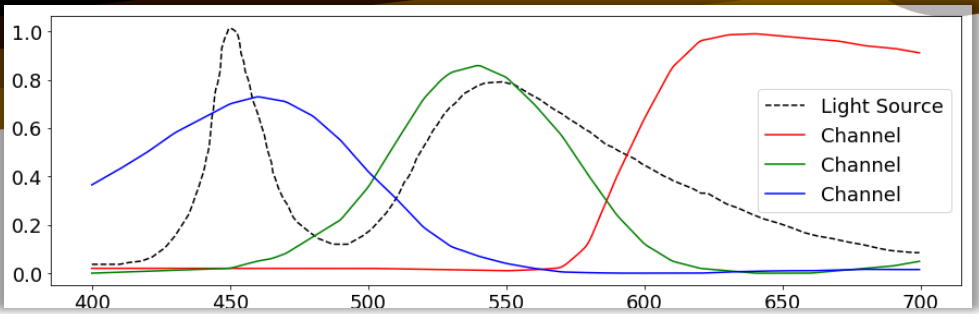


Two sets of reflectances were used in this activity. One is the literature values of Macbeth Color Chart Reflectances, and the other one's the reflectances obtained in the previous experiment where we acquired the intensity values of DGK Color Tools using a SpectroVis spectrometer. Two sets of camera spectral sensitivities shall be used as well, both (NIJI mesoscanner and CAVE dataset) sensitivities were used in my personal research. The emittance spectrum of a white LED and the fluorescent lamp used in the experiment were used as well.

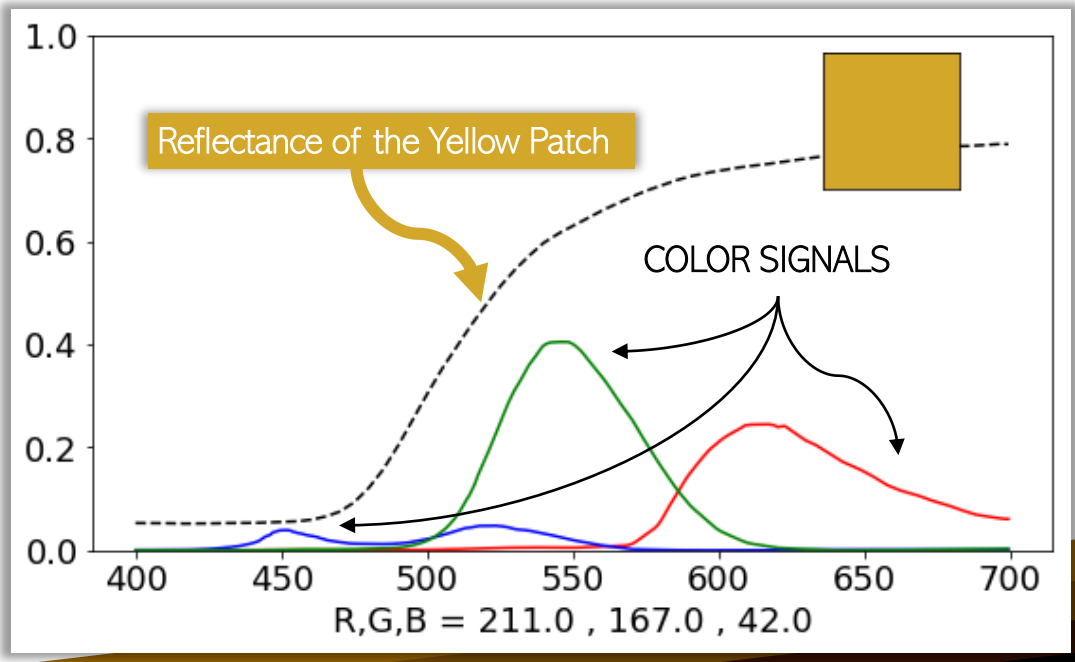
In this activity, color renditions using different combinations of these specifications shall show us that color is a subjective quantity, and it varies with different sensors and illuminant. Our of all the color components, the reflectance is the only universal property of the object.

HOW TO RENDER?

03



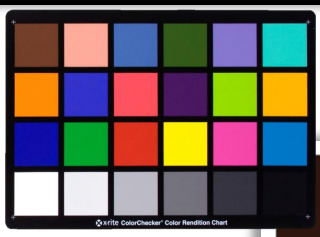
For example, using the specifications of NIJI sensitivity and LED light source, the signal strength at each channel can be defined. These will then be multiplied to the desired reflectance. The final product of SOURCE X EMMITANCE X SENSITIVITY are the three color signals shown in the colored plot below.



The RGB values that gives a pixel its color is just the area under the curve of these color signals. The rendered yellow patch from the Macbeth's reflectance of yellow has a rendered RGB value of 211, 167, 42. Strong signals of Red and Green and a less intense blue signal constitute to the Yellow color that we see. These RGB values is therefore dependent on the light source that was used and the spectral sensitivity of the sensor. Note that the actual area under the curve of these color signals are much lower than the RGB values that I presented. A white balancing step (and optional: Brightening step) must be employed to get a visually discriminable RGB value.

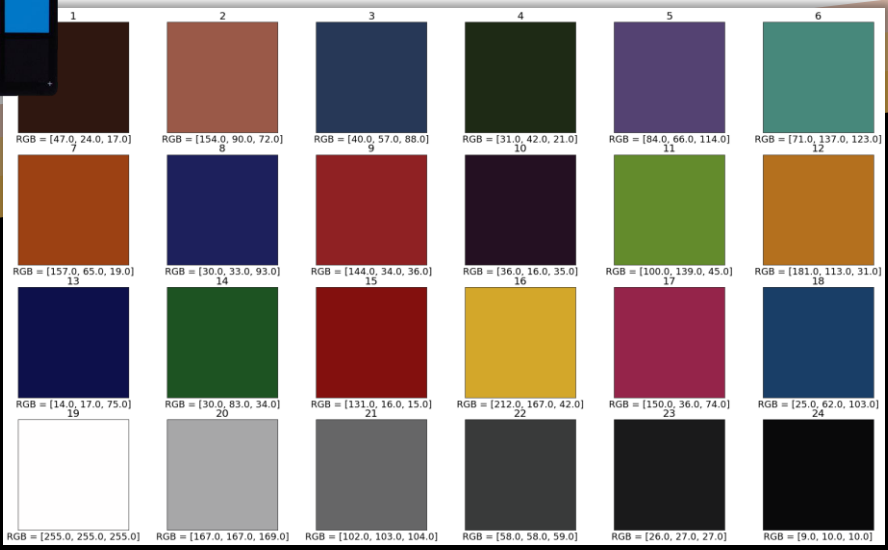
Macbeth Color Chart

04



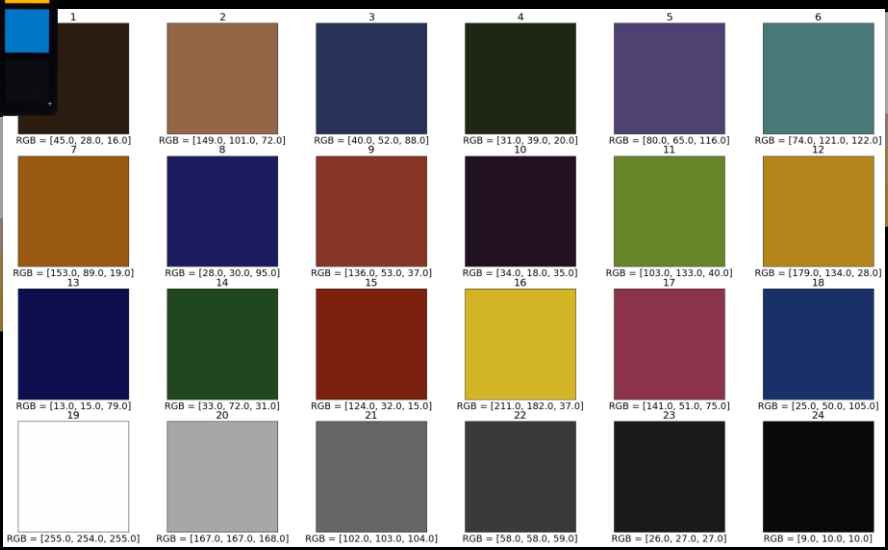
reference

SOURCE: WHITELED SENSITIVITY: NIJI



reference

SOURCE: WHITELED SENSITIVITY: CAVE



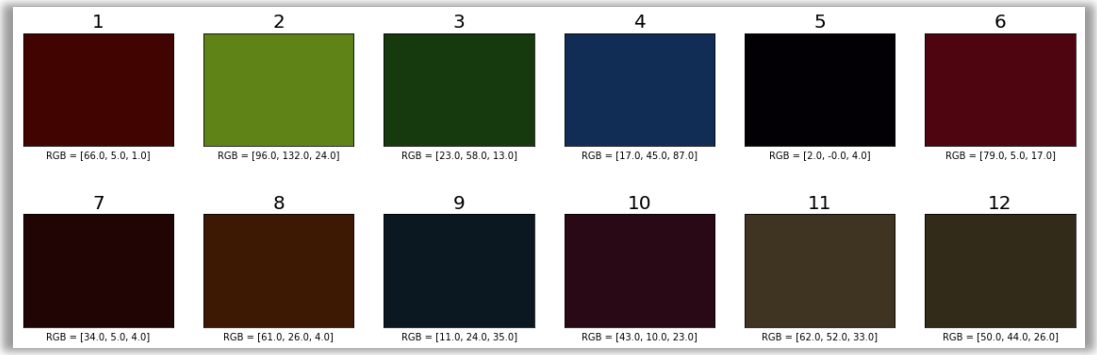
Using CAVE and NIJI sensitivities, the Macbeth CC was rendered on a white LED illuminant. The white patch algorithm was employed such that a “k” is multiplied to make the white patch very close to white (255,255,255). The different sensitivities resulted in a different color rendition (visually and numerically as per the RGB values). NIJI has an overextended red channel sensitivity which is why its rendered RGBs have greater R values.

DGK Color Tools

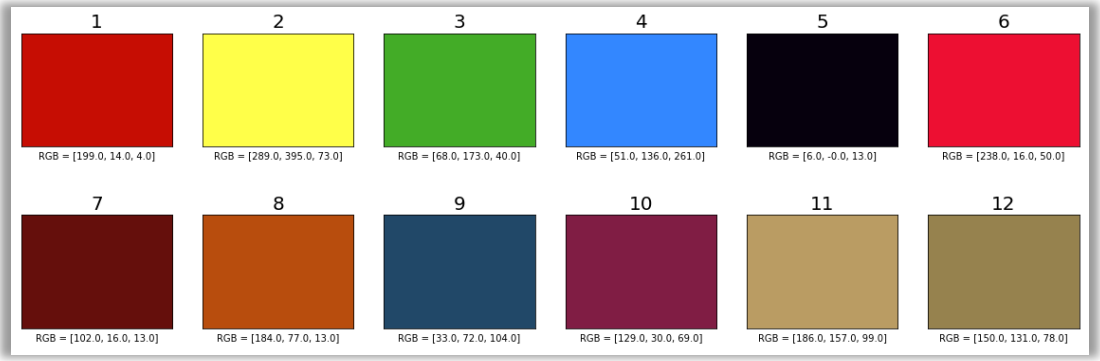
05

SOURCE: WHITELED
SENSITIVITY: NJI

after white balancing

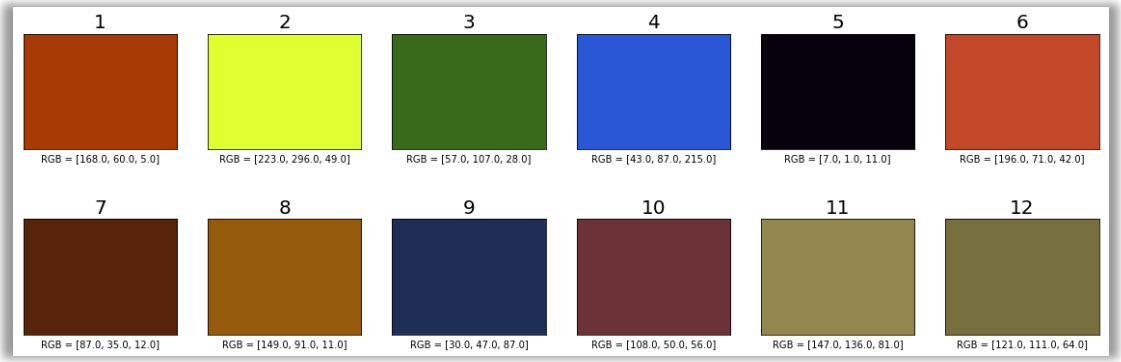


after brightening (3x)



SOURCE: UNIFORM
SENSITIVITY: CAVE

after white balancing and brightening (2.5x)

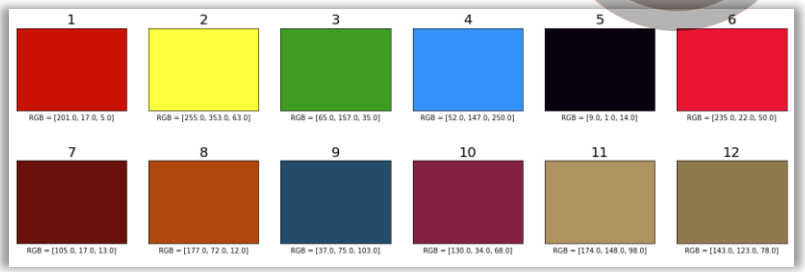


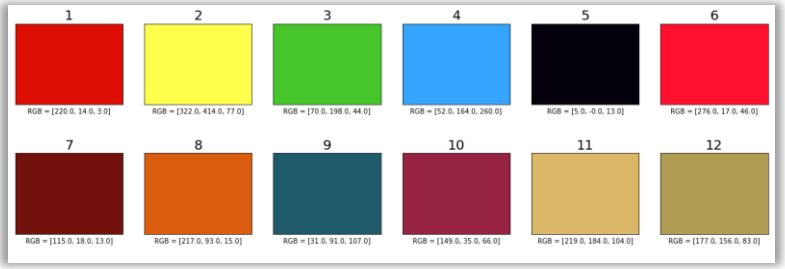
DGK Color Tools

06

SOURCE: UNIFORM
SENSITIVITY: NJI

after white balancing and brightening (3x)





SOURCE: FLOURESCENT
SENSITIVITY: NJI

after white balancing and brightening (3x)

Using the reflectances obtained experimentally, the DGK color tools patches (reference on upper right) were rendered. The reflectances we recorded were of low intensity which is why a brightening step was needed. As expected, different combinations of source and sensitivity turned out to render different RGB values for the same reflectance data. Some of the colors I rendered were far from the expected color, maybe due to the data acquisition errors. Nevertheless, this activity has successfully shown that any color can be rendered given an object's property which is **reflectance**, multiplied to the **illuminant** and sensor **sensitivities**. Indeed, "color is trinity"

I widely use the color simulation in my research, and I would like to thank Ma'am Jing for training me intensively in this method.