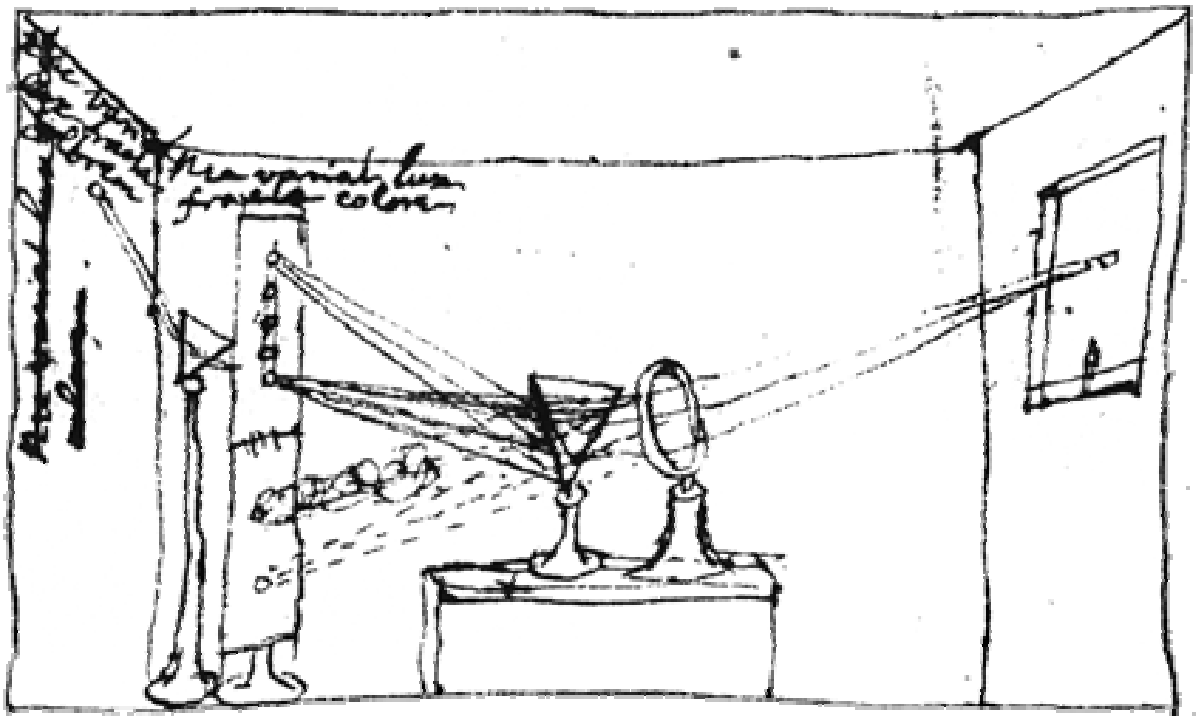
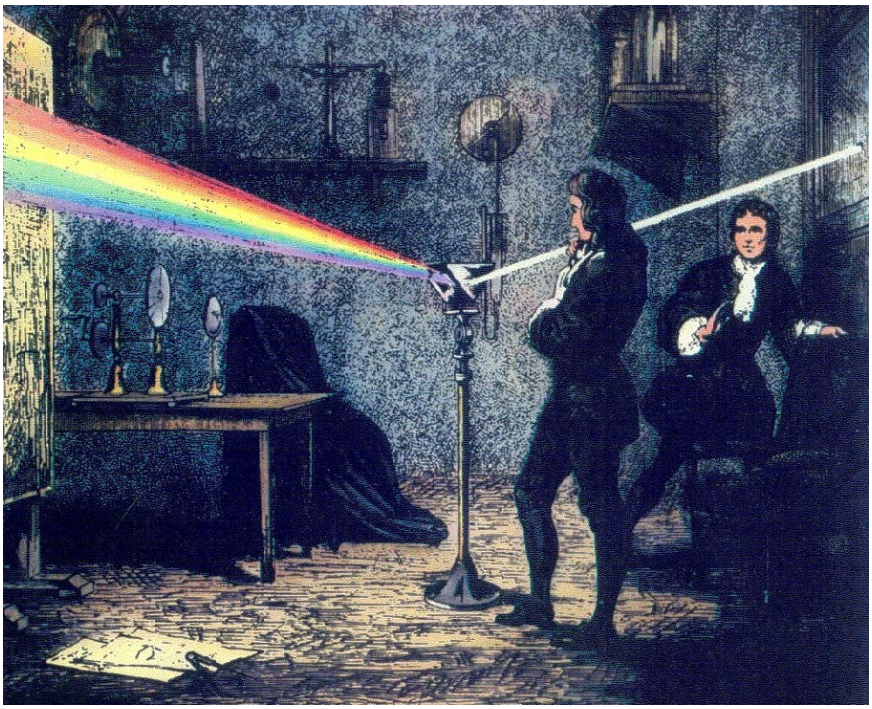
NEWTON AND HIS PRISM

Sir,

To perform my late promise to you, I shall without further ceremony acquaint you, that in the beginning of the year 1666 (at which time I applyed my self to the Grinding of Optick Glasses of other figures than spherical) I procured me a Triangular Glass Prism, to try therewith the celebrated Phaenomena of colours.

(from A Discourse of Mr Isaac Newton, containing his new theory about light and colours, sent by him from Cambridge to the Secretary of the Royal Society, 6 February 1671 /2. Original in possession of the Royal Society of London)



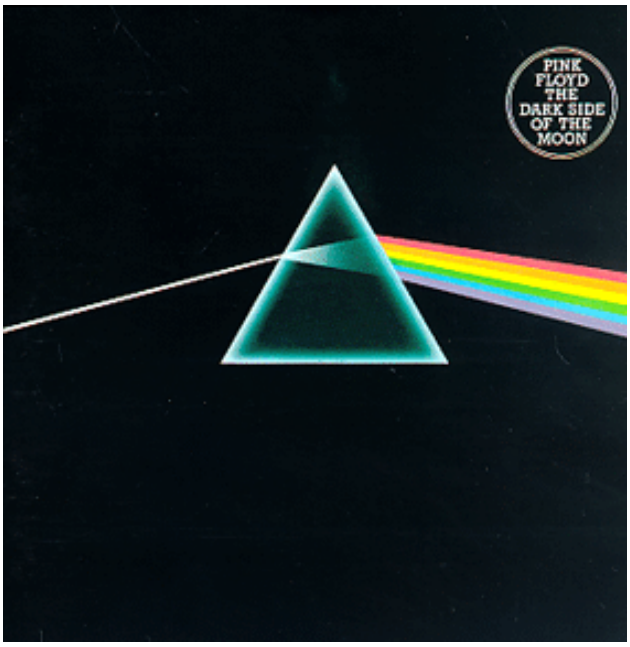


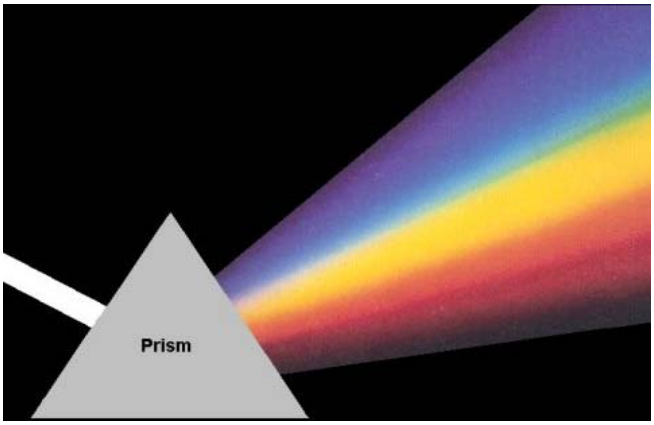
And in order thereto have darkened my Chamber, and made a small hole in my Windowshutts, to let in a convenient quantity of the Sun's light. I placed my prism at his Entrance, that it might so thereby be refracted to the opposite Wall. It was at first a very pleasing Divertisement, to view the Vivid and intense colours produced thereby, but after a while applying myself to consider them, more circumspectly, I became surprized to see them in an oblong form, which according to the received Laws of Refractions, I expected should have been circular

Comparing the length of the spectrum with its breadth. I found It above five times greater, a disproportion so extravagant, that it excited me to a more than ordinary curiosity of examining from wherever it might proceed.

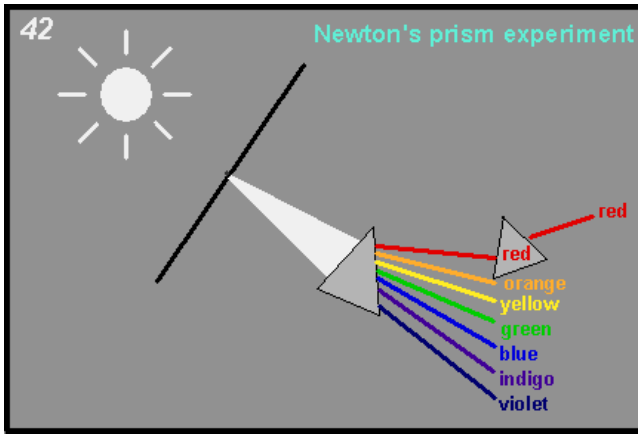
(The Royal Society of London, R.B.C. 3, 215, 1671/2)

INTERESTING INTERPRETATIONS

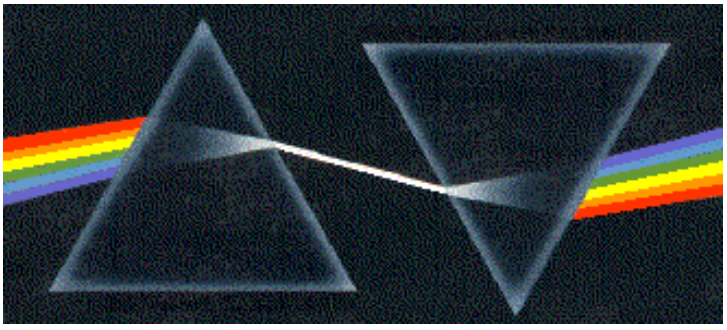




from Purdue



from MIT



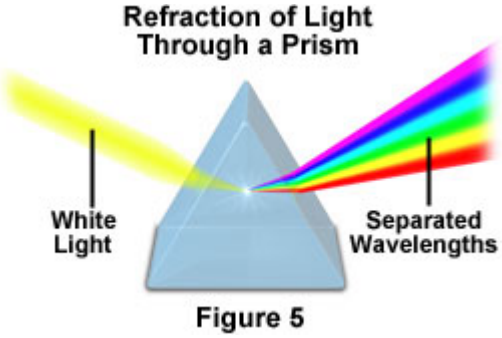
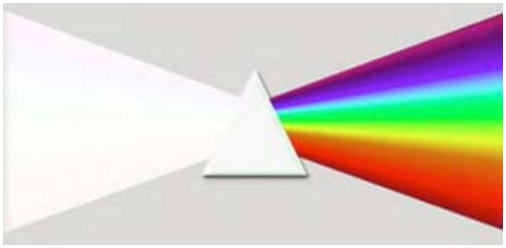
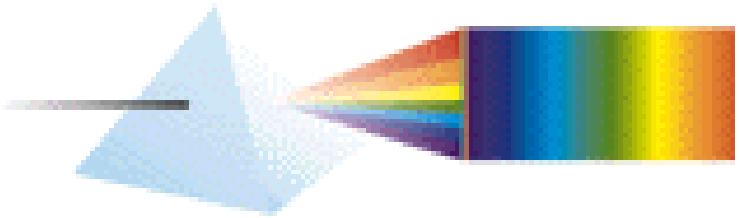


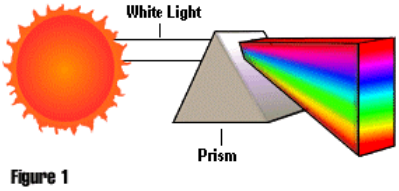
Figure 5

MORE INTERESTING PRISMS

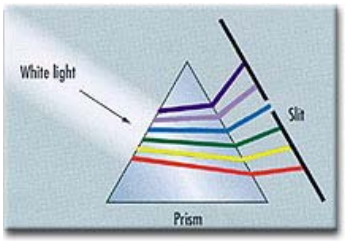




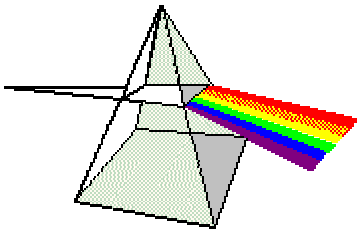
from Epson



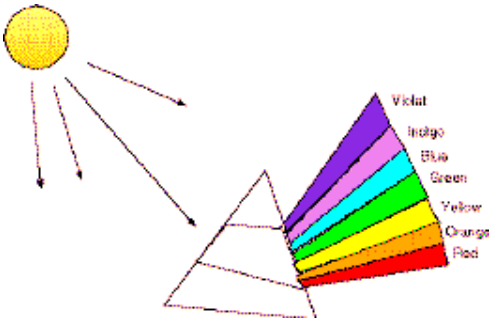
from US Ink



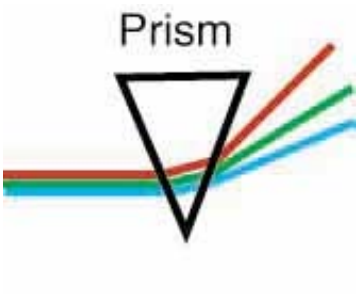
from Sensors Inc.



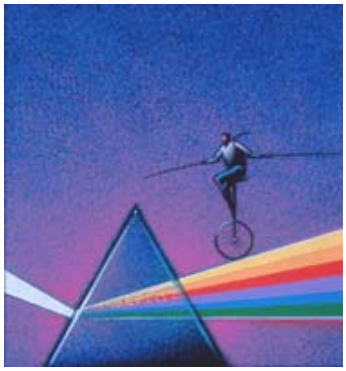
Dream analysis

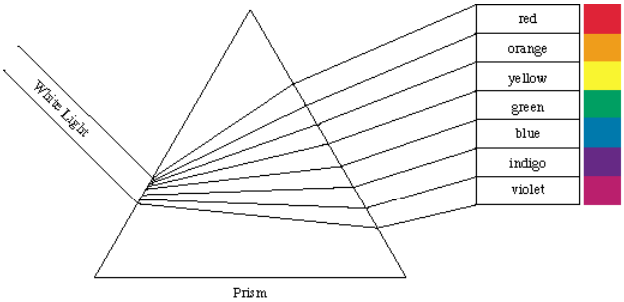


from UCSD

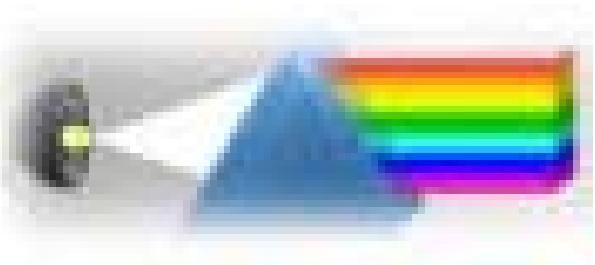


WDM tutorial



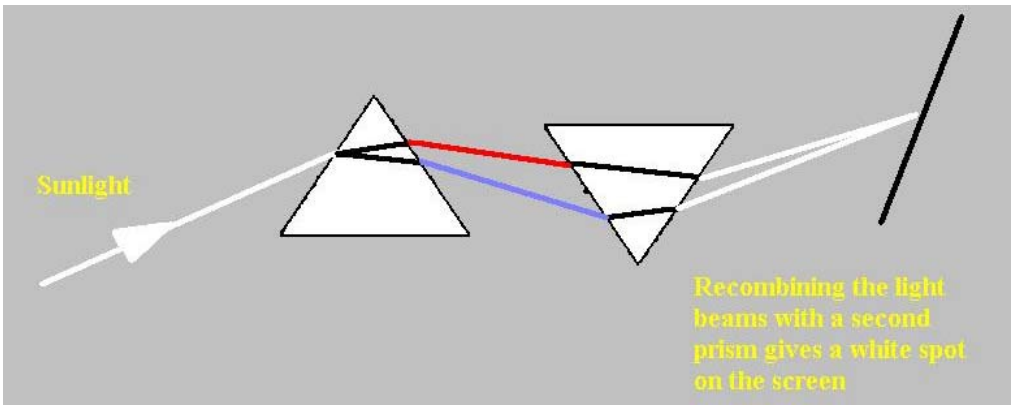


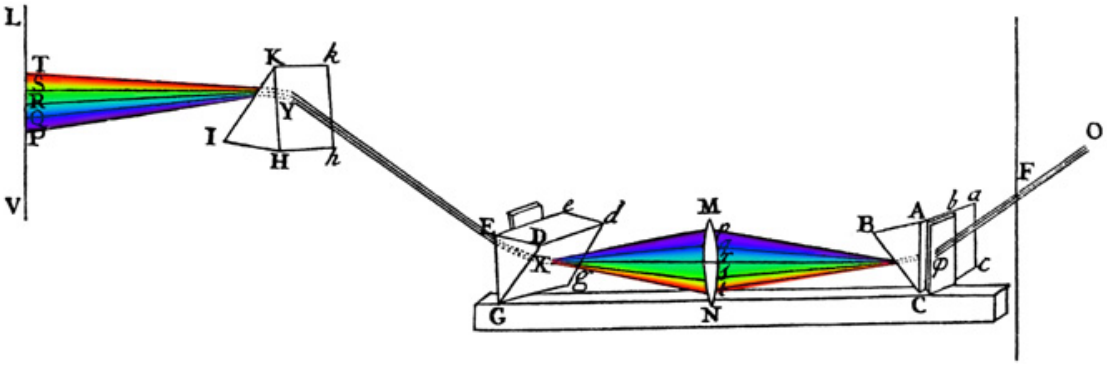
Quilters prism



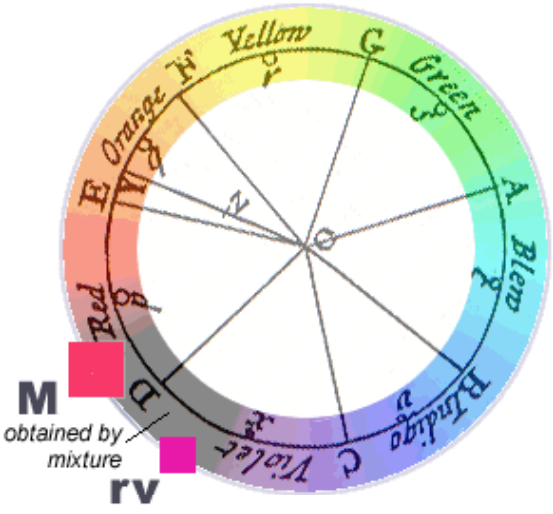
MORE NEWTON

Newton demonstrated that you could disperse a spectrum, then put it back together to reconstruct white light.

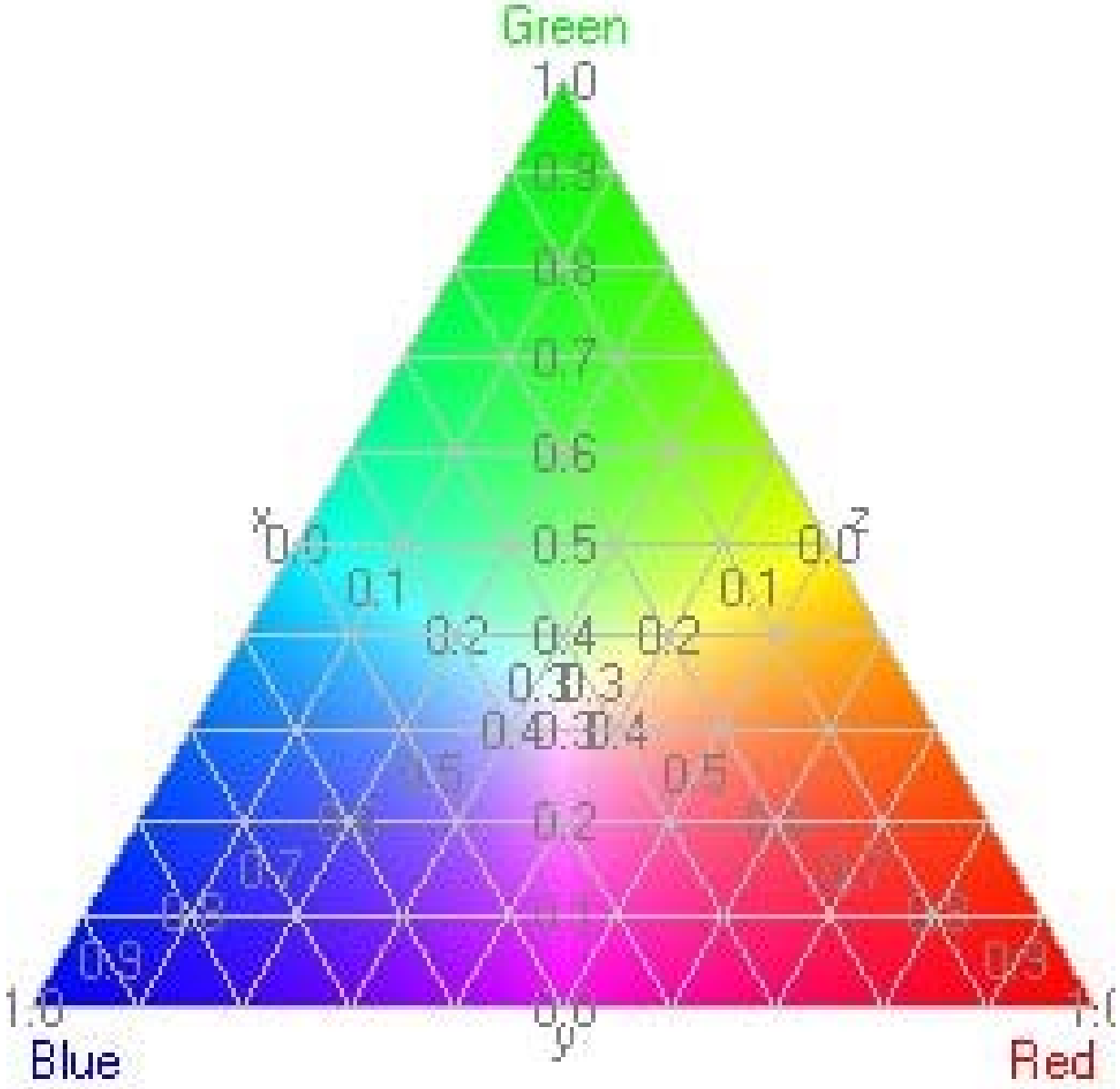




He constructed what is probably the first color circle.



MAXWELL ALSO STUDIED COLOR



COLOR DESCRIPTION

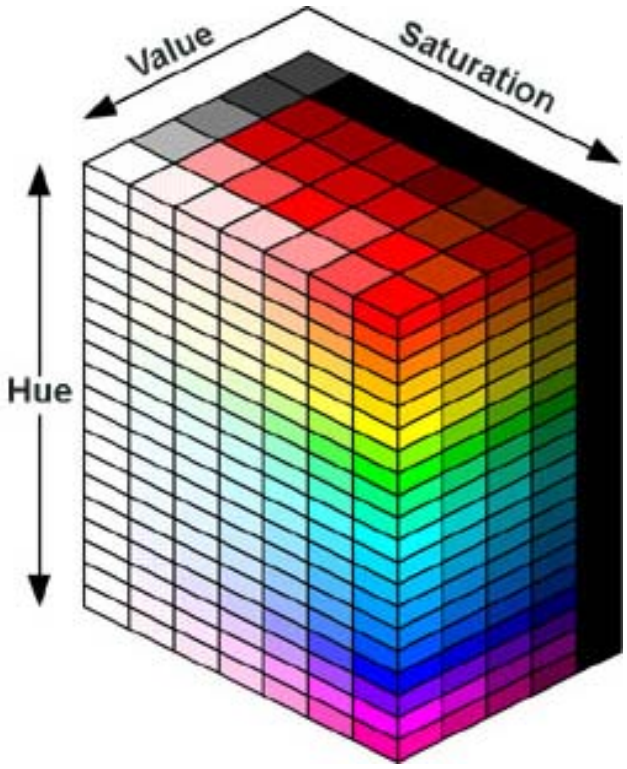
DEFINITION: That aspect of visible radiant energy by which an observer may distinguish differences between two structure-free fields of view of the same size and shape, caused by differences in spectral composition.

THREE ATTRIBUTES

HUE - attribute denoted by blue, green, red, etc.

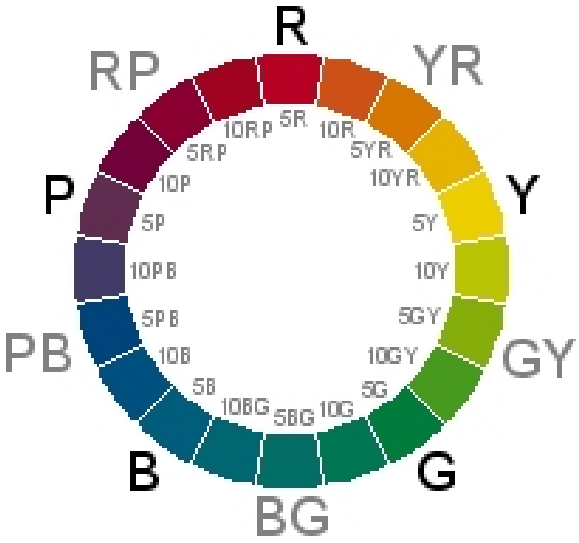
SATURATION (chroma) - degree of difference from achromatic

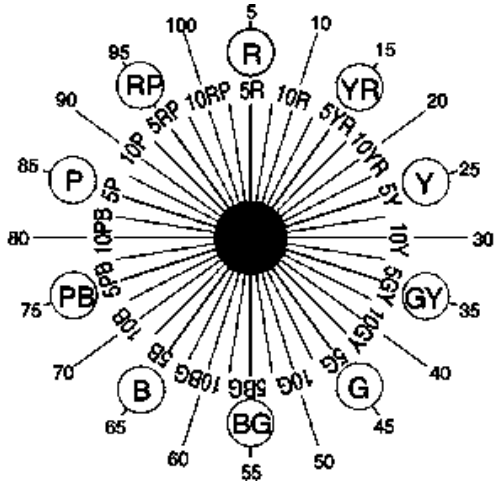
VALUE (lightness) - comparison with achromatic gray scale

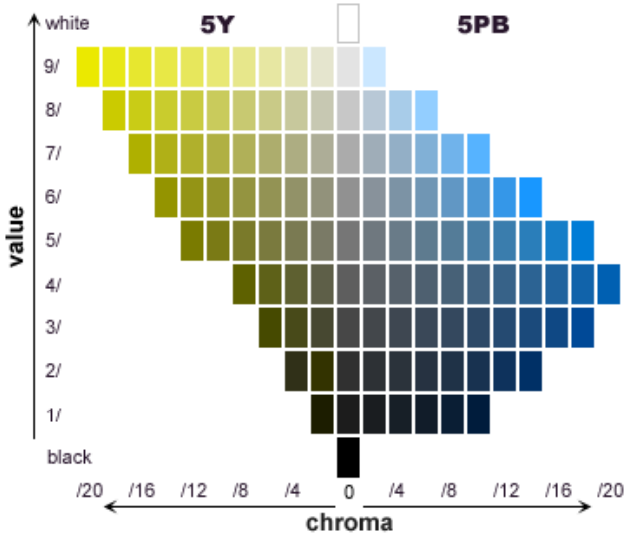


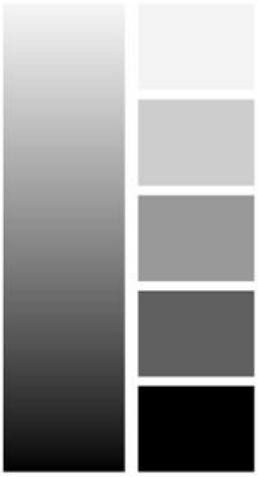
MUNSELL COLOR SYSTEM

Early system based on hue, saturation and value. Still in use.

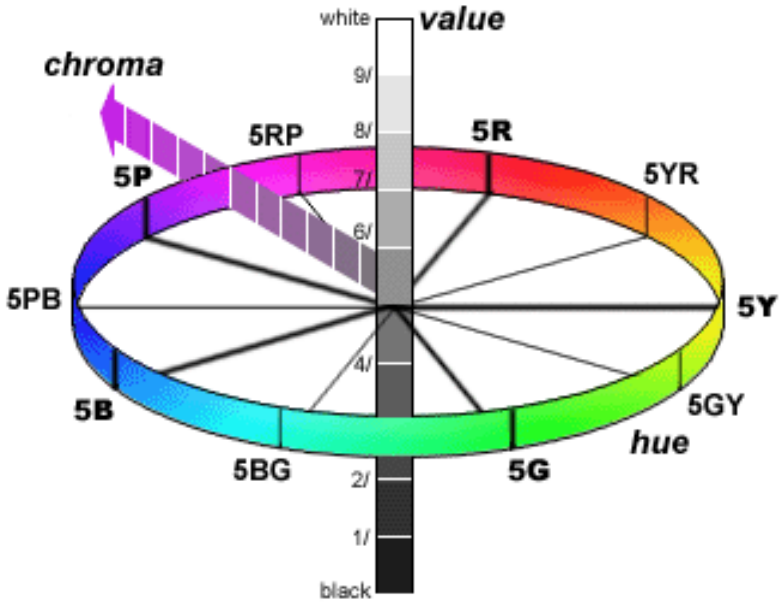


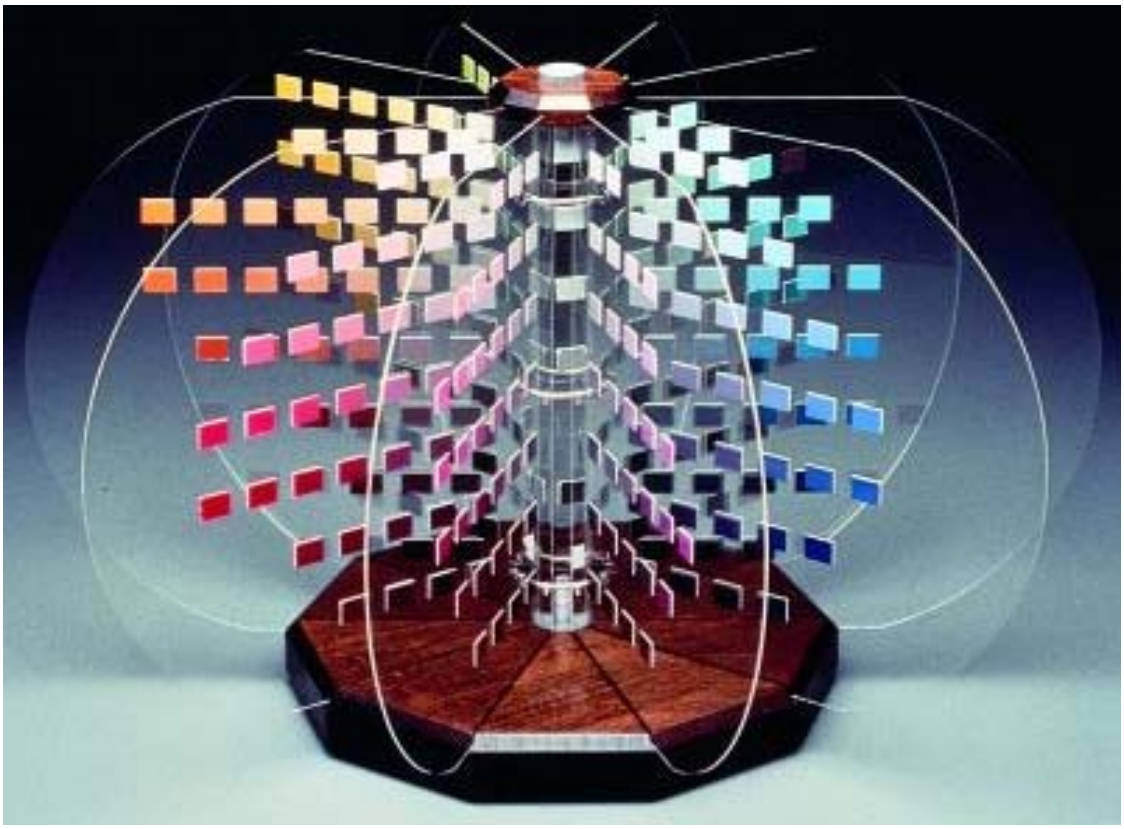






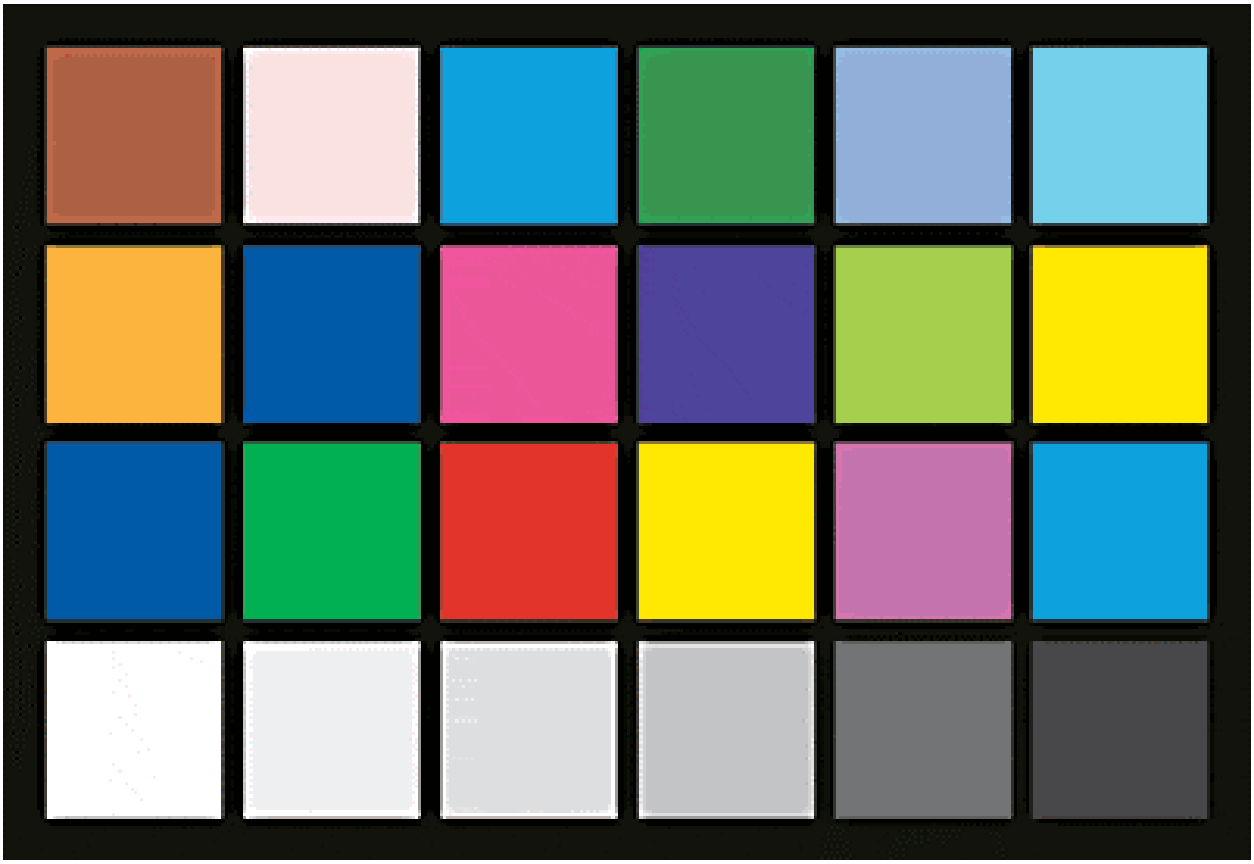
MUNSELL COLOR TREE





MACBETH COLOR CHECKER

Used for color photography (place it in the scene and crop it out later), monitor adjustment, and general-purpose color control.

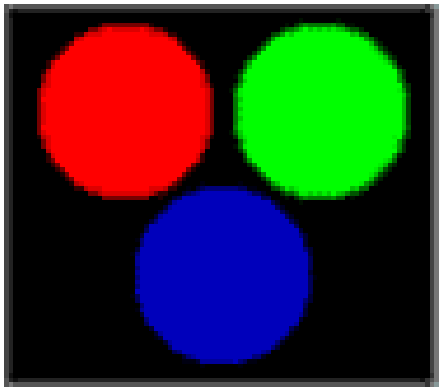


PRIMARY COLORS

When primary colors are added in suitable proportions, one can produce all other colors. Theoretically, three are required.

ADDITIVE PRIMARIES

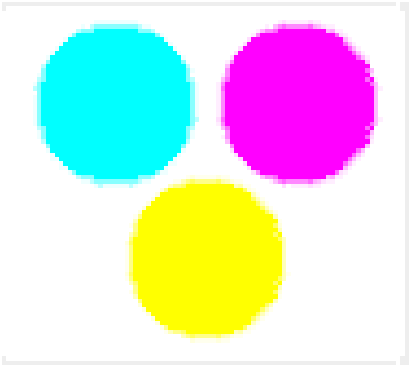
Red
Green
Blue



Used in stage and general lighting, television, computer monitors & screens. Addition of all three creates white.

SUBTRACTIVE PRIMARIES

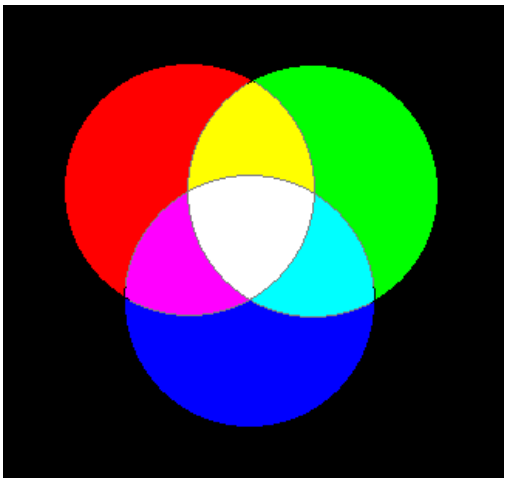
Yellow
Cyan
Magenta



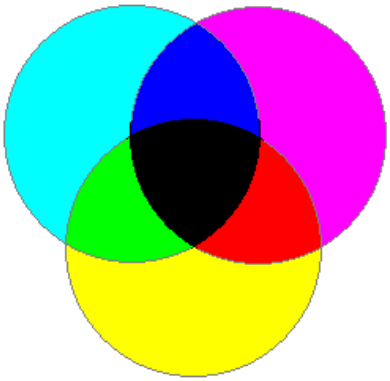
Used in photography, textiles, printing, dyes, paints and crayons. Subtraction of all three from white yields black.

COMPLEMENTARY COLORS

ADDITIVE

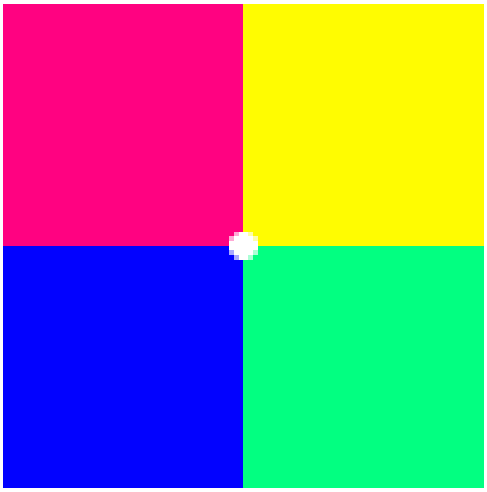


SUBTRACTIVE



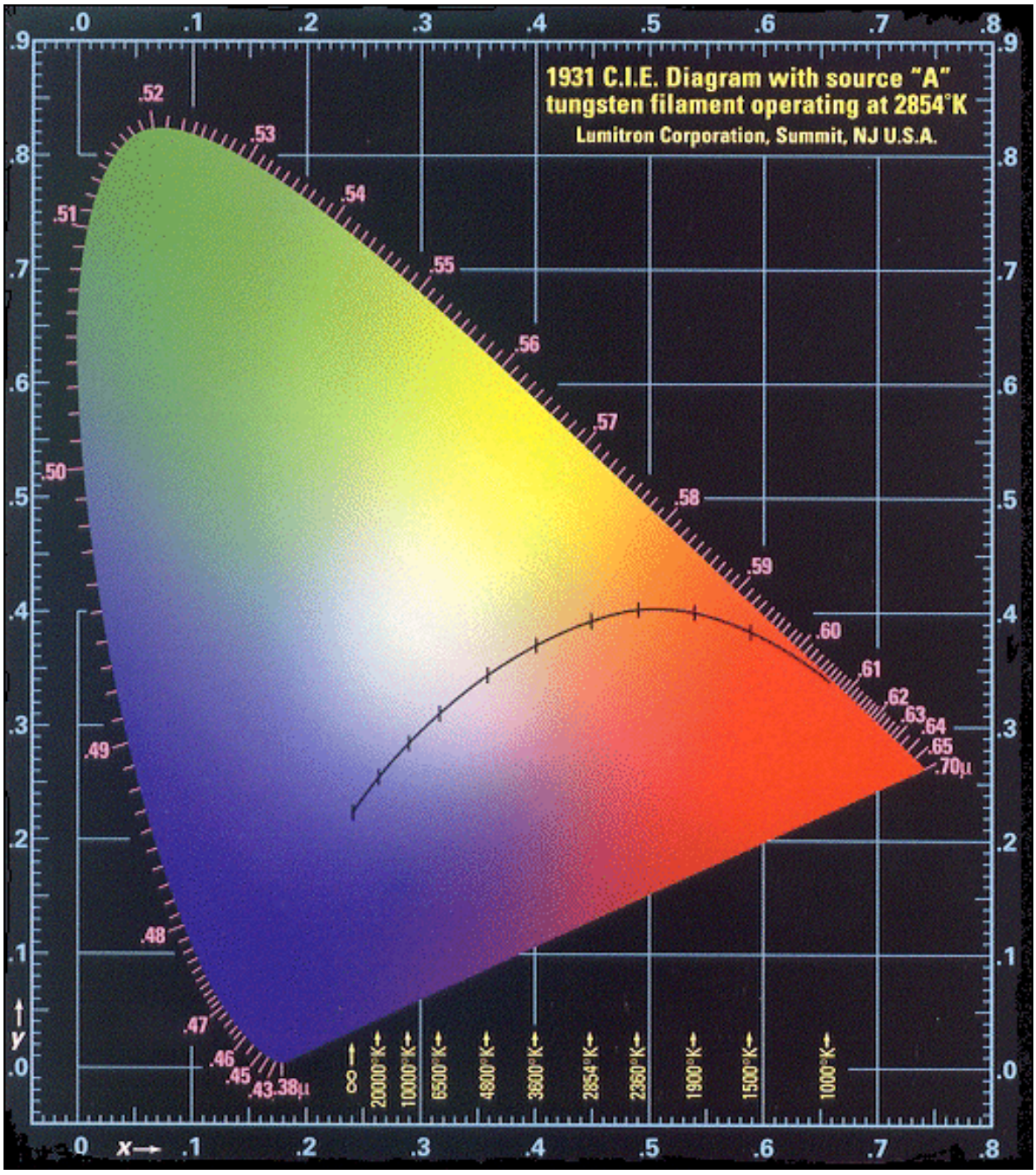
Notice that these additive and subtractive primaries are complementary

Demo of complementary colors

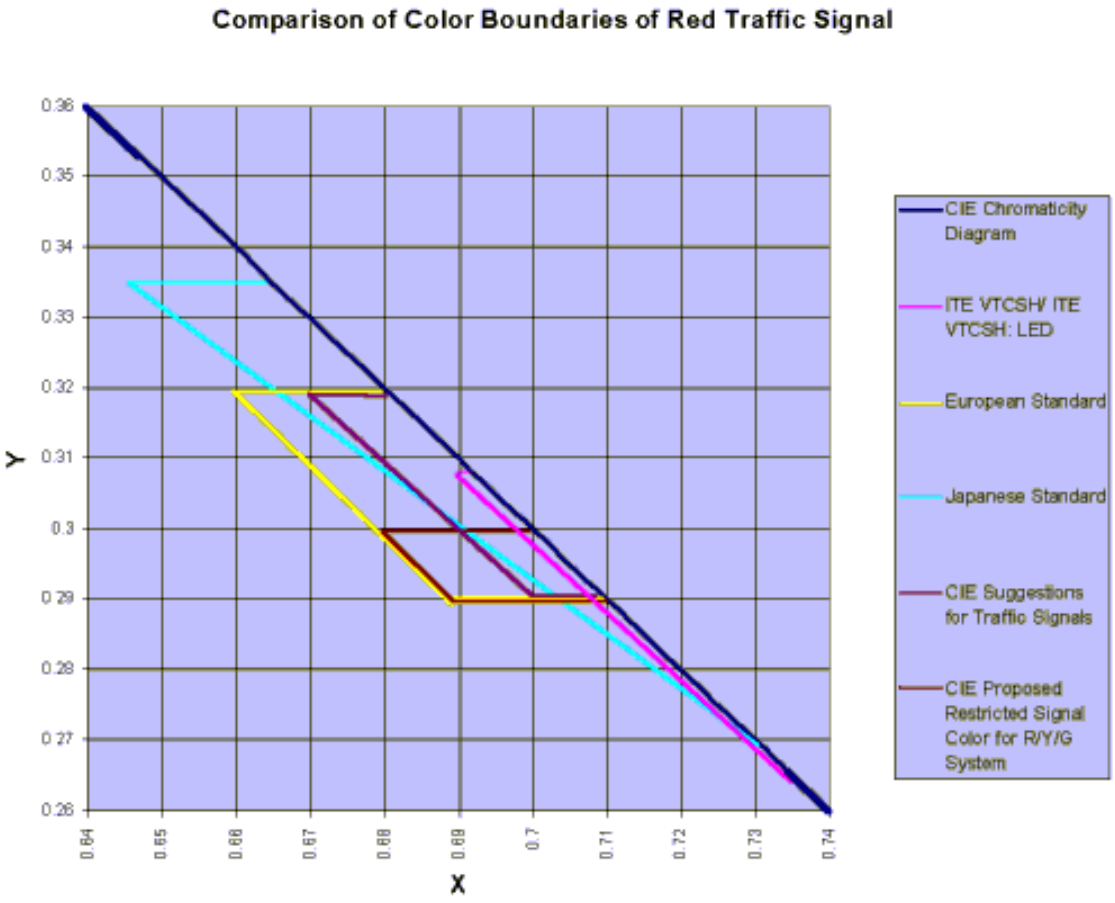


Stare at white dot centered in colored squares for 20-30 seconds, then shift your gaze to the black dot. What do you see?

BLACKBODY LOCUS

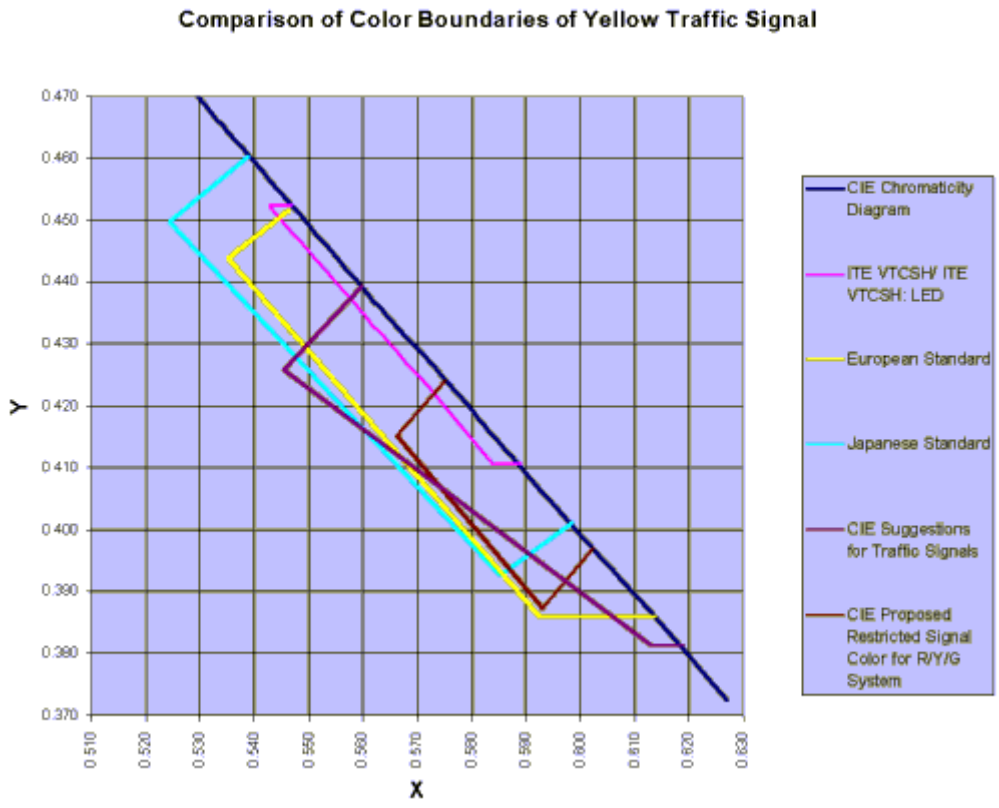


SIGNAL LIGHT SPECIFICATIONS - RED



x and y data refers to 1931 CIE diagram.

SIGNAL LIGHT SPECIFICATIONS - YELLOW



x and y data refers to 1931 CIE diagram.

SIGNAL LIGHT SPECIFICATIONS - GREEN

x and y data refers to 1931 CIE diagram.

COLOR SPACES

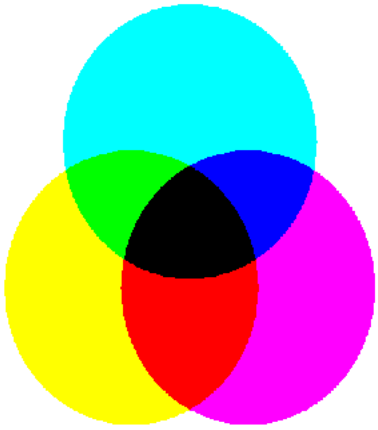
- **CIE-XYZ** - the international standard capable of representing all colors
- **CIE-xyY** - a variant of the CIE standard using two color components plus luminance (Y)
- **CIE-uvY** - Another variation of the CIE standard using two color components plus luminance (Y)
- **PhotoYCC**™ - Kodak system for PhotoCDs™
- **U*V*W*** - a precursor of L*u*v*
- **CIE L*u*v*** - popular perceptually uniform space for additive applications
- **L*C*Huv***
- **L*a*b*** - A popular perceptually equalized space, i.e., numerical distance in the space is proportional to perceived color difference. For subtractive applications
- **L*C*Hab***
- **CMY** - Cyan, magenta, yellow, for low-end color printing
- **CMYK** - Cyan, magenta, yellow, key (black); for four-color printing

- **DIN FSD** - German standard
- Munsell HVC - US standard; hue, value, and chroma
- **RGB** - Red, green, blue; for color monitors and scanners
- **HSV** - Hue, saturation, value
- **HLS** - Hue, lightness, and saturation
- **YIQ** - Luminance, in-phase, quadrature; NTSC color TV broadcasting. Made by a linear transformation of the RGB cube.
- **YUV** - Also called YCbCr. Initially for PAL analog video, now used in CCIR 601 standard for digital video
- **National Bureau of Standards Dictionary of Color Names** - Thousands of popular and commercial color names (like mauve, teal, cobalt, etc.)
- **National Bureau of Standards Color System** - A stylized system of about two hundred names encompassing all colors

COLOR PRINTING

Start with white paper

Overlay with subtractive primary inks



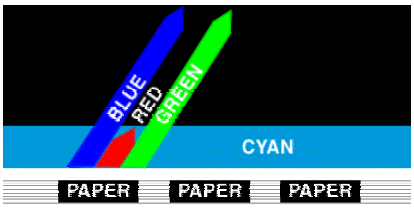
CYAN (absorbs red)

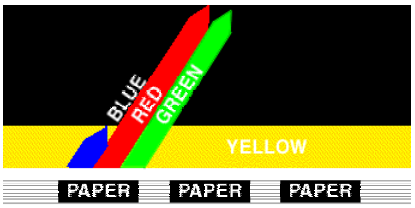
YELLOW (absorbs blue)

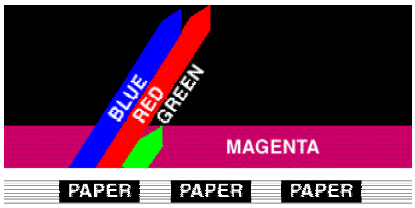
MAGENTA (absorbs green)

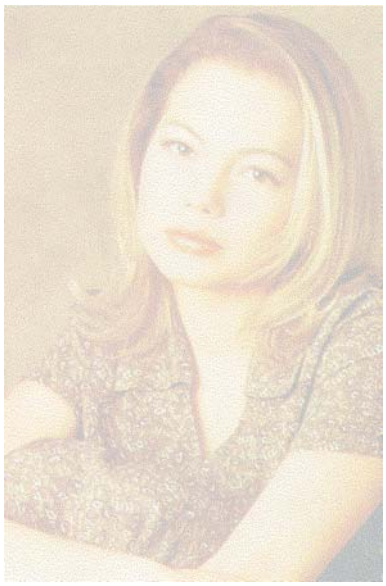
Available inks do not produce sufficiently dark color.

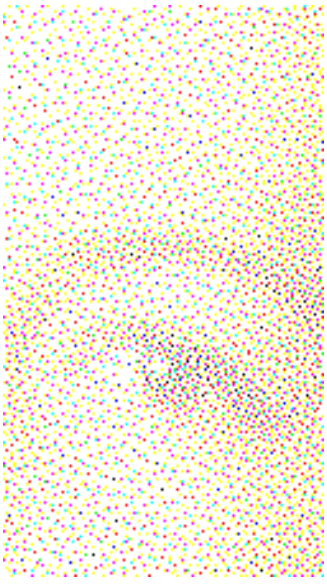
Layer of black ink added for better definition and darker blacks. This system is **CYMK**.





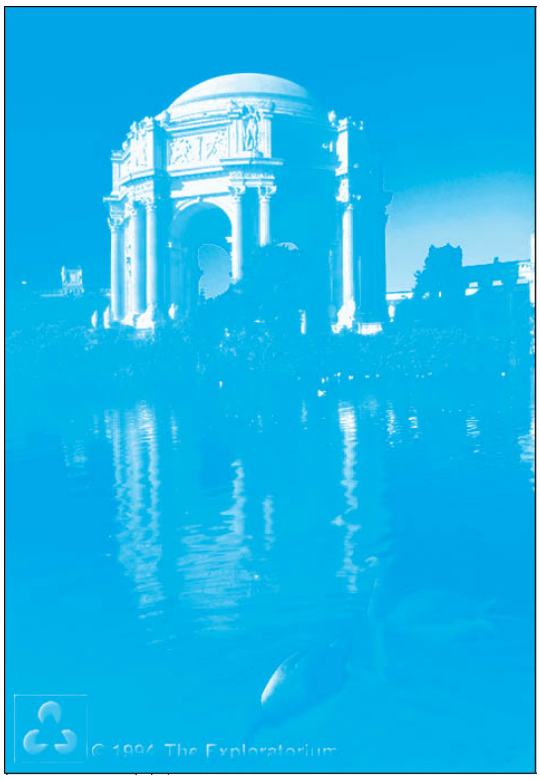


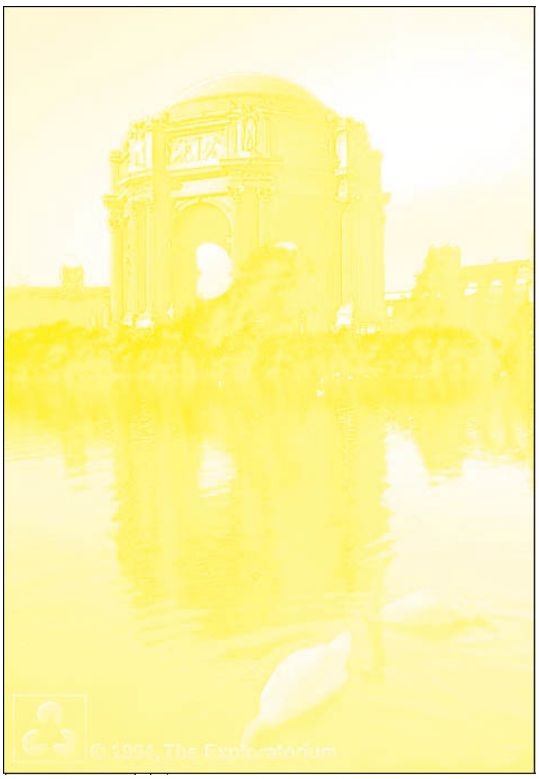


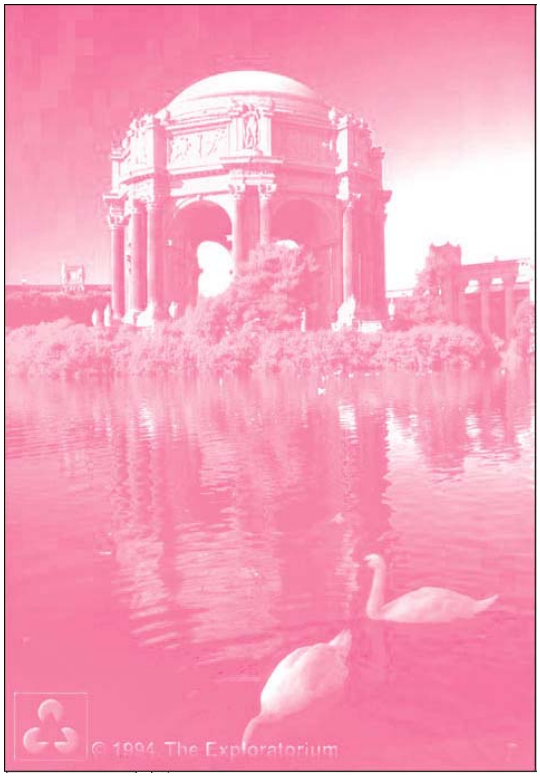


MICHELLE WILLIAMS

CYMK LAYERS







THE RESULT