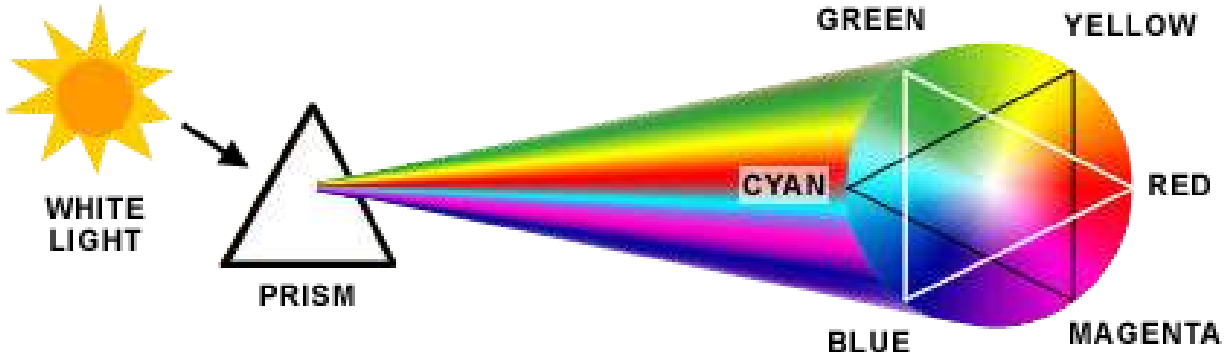
Color Theory for Digital Media

In order to understand color we need a brief overview of light. Without light, there would be no color.

Light is made up of energy waves which are grouped together in what is called a spectrum. Light that appears white to us, such as light from the sun, is actually composed of many colors visible to the human eye. The wavelengths of light are not colored, but produce the sensation of color to our eyes.

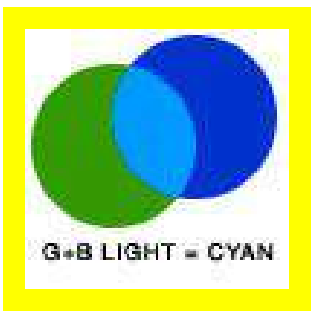


Visible light - The wavelengths our eyes can detect is only a small portion of the electromagnetic energy spectrum. Beyond the limits at each end of the visible spectrum are the short wavelengths of ultraviolet light and x-rays and the long wavelengths of infrared radiation and radio waves, which are not visible to the human eye.

The media and methods used to reproduce color include color paintings, printing presses, color film, color monitors, color printers, etc. There are two basic ways of reproducing color... additive and subtractive.

Additive Color (RGB) - The Primary Colors of Light

Television and computer monitors create color using the primary colors of light. Each pixel on a monitor screen starts out as black. When the red, green and blue phosphors of a pixel are illuminated simultaneously, that pixel becomes white. This phenomenon is called additive color.

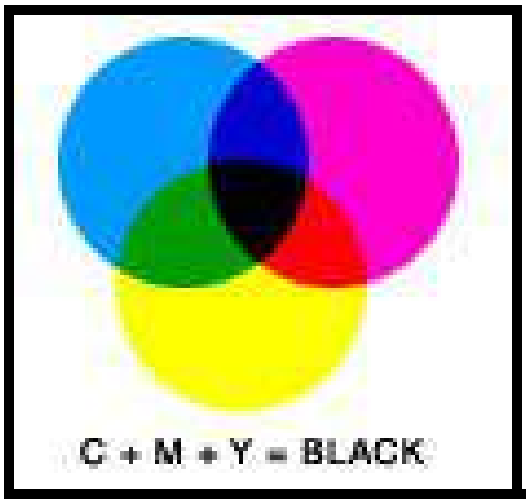


Additive color mixes various amounts of red, green and blue light to produce all other colors.
The primary additive colors are red, green, and blue.
The secondary additive colors are cyan, magenta, and yellow.

Subtractive Color (CMY) - The Primary Colors of Reflected Light
Reflected light is what we see with our eyes that make objects and photographs look colored, and how camera sensors record color.

Subtractive Color is the system used to create inks and dyes that make up photographs and other printed media.

If a photograph or an object reflects all the white light back to the viewer, it appears white. If an object absorbs (or subtracts) all the light illuminating it, no light is reflected back to the viewer and it appears black.



Printing inks are transparent, which allows light to pass through to and reflect off of the paper base. The white paper reflects any unabsorbed light back to the viewer. The offset printing process uses cyan, magenta and yellow (CMY) process color inks and a fourth ink, black. The black printing ink is designated K to avoid confusion with B for blue.

In theory, an overprint of all three process colors absorbs all portions of white light and produces the appearance of black. In reality, a muddy brown is produced. For this reason, black is used as a fourth printing ink.

Where is the Traditional Color Wheel from Art Class???
Some of you might be scratching your heads, asking, “Where is the Blue, Red, and Yellow model?” The artist color wheel (based in blue, red, and yellow) predates modern science. Scientifically, this does not adequately address the true range of visible light and color.

We DO, however, still use the RBY model for mixing paints, and for creating color schemes and in artistic design (for example, interior design) and it is the most common color wheel students will typically find in art stores.

1. Additive (Light Spectrum) Color Primaries = Red, Green, Blue
2. Subtractive Color (Pigments/Inks) Primaries = Cyan, Magenta, Yellow
3. Artist Color Wheel Primaries = Red, Yellow, Blue

Additive (Light) Cheat Sheet

- All colors added together = white.
- The absence of light = true black.
- Because computer graphics, websites, and other digital presentations are projected/transmitted with light, screen graphics should be saved in this color model, or “RGB Mode.”

Subtractive (Pigment) Cheat Sheet

- Color is absorbed by and reflected off of media.
- Inks are transparent.
- Because these colors are achieved via reflection, we need a pure white background as the base filter for the colors.
- All colors added together = near black.
- To achieve true black, pure black must be added, thus giving us the CMYK model (K=black). This is the standard color model for most printing,“CMYK Mode.”

ADDITIVE Color

SUBTRACTIVE Color