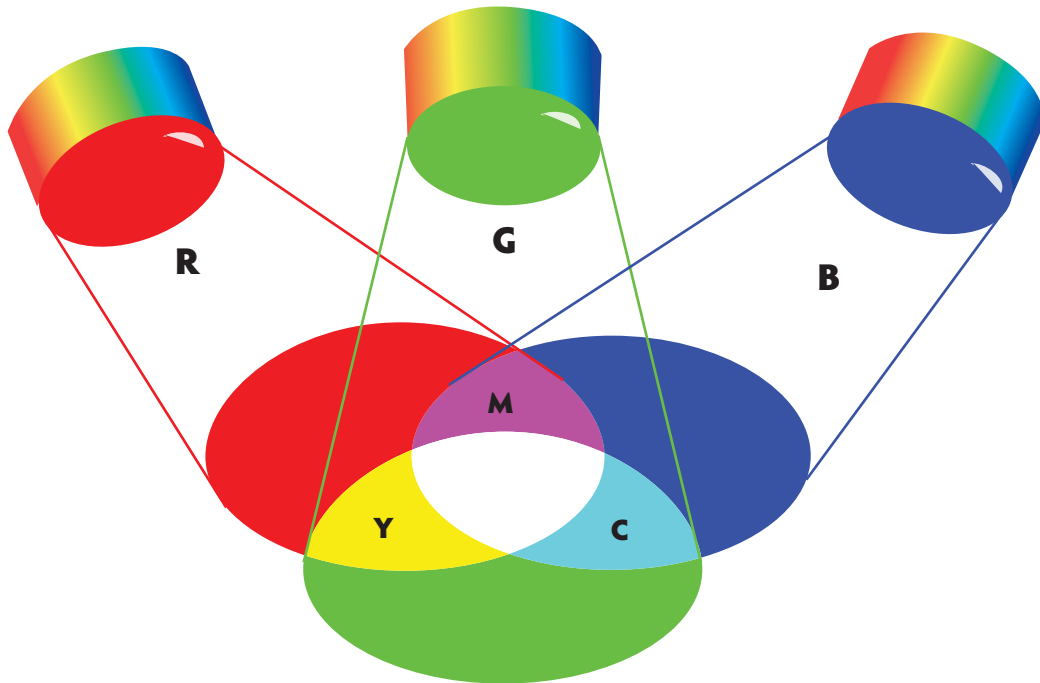


Additive System

The primaries of the additive system are RED, GREEN, and BLUE

The additive system are colors created with light. When R, G, and B lights are added together, white is created. The secondaries of the additive system are Magenta, Cyan, and Yellow (the primaries of the subtractive system). It's hard to envision, but green light added to red light produces yellow.

The additive system is in play when light passes through an object rather than when light is reflected back from an object. Additive colors are used for lighting as in stage lighting, television, and computer monitors.

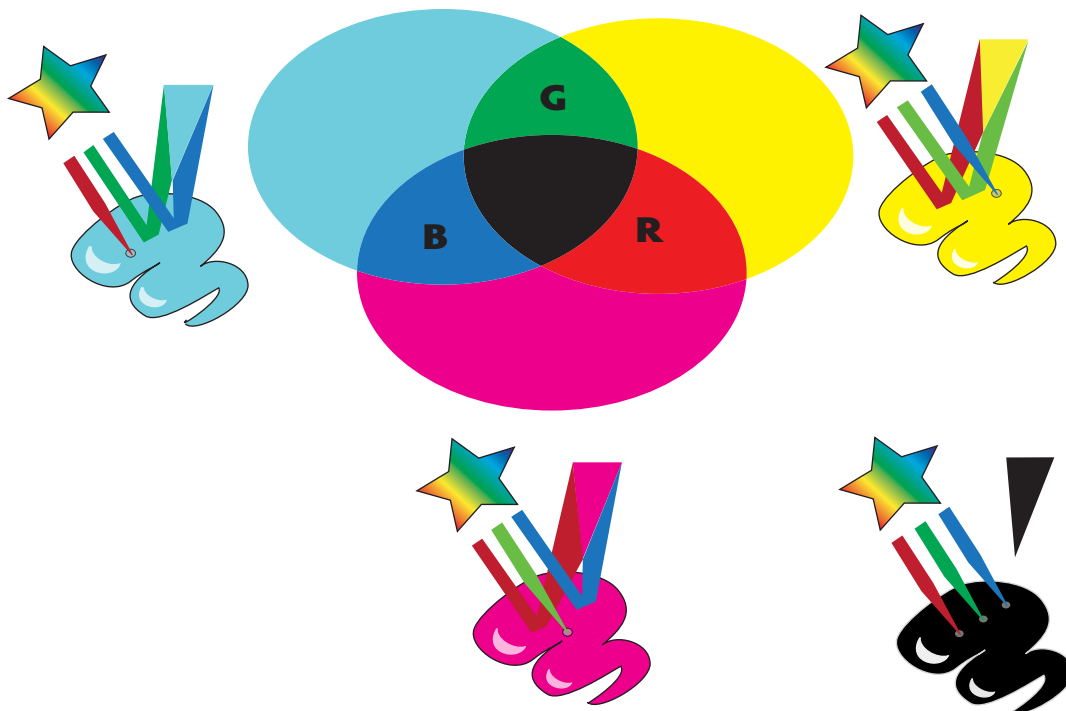


Subtractive System

The RGB model, called the additive system, describes color as it is perceived once it passes “through” a light source to the viewer. Weavers and painters are actually using the subtractive system in their work. This is the CMYK model in which the surface absorbs some or all of the light wavelengths—ink printed on paper, paint on canvas, or dye on fiber. As white light strikes translucent pigments, a portion of the spectrum is absorbed, the portion of spectrum not absorbed is reflected back to the viewer.

All visible wavelengths are included in white light. These can be divided into the three additive primary bands: red, green, and blue. When a colorant absorbs one wavelength band, the two remaining color wavelengths are reflected back to the viewer’s eyes. Combining the two reflected additive primaries creates the subtractive primary:

Additive Primary Absorbed	Additive Primaries Not Absorbed	Subtractive Primary created
RED	BLUE & GREEN	CYAN
GREEN	BLUE & RED	MAGENTA
BLUE	RED & GREEN	YELLOW



Combining cyan (C), magenta (M), and yellow (Y) pigments creates black (K) by absorbing, or subtracting, all colors. This system is commonly referred to as CMYK.



Subtractive Primaries

Printers' Primaries:
Yellow
Cyan
Magenta

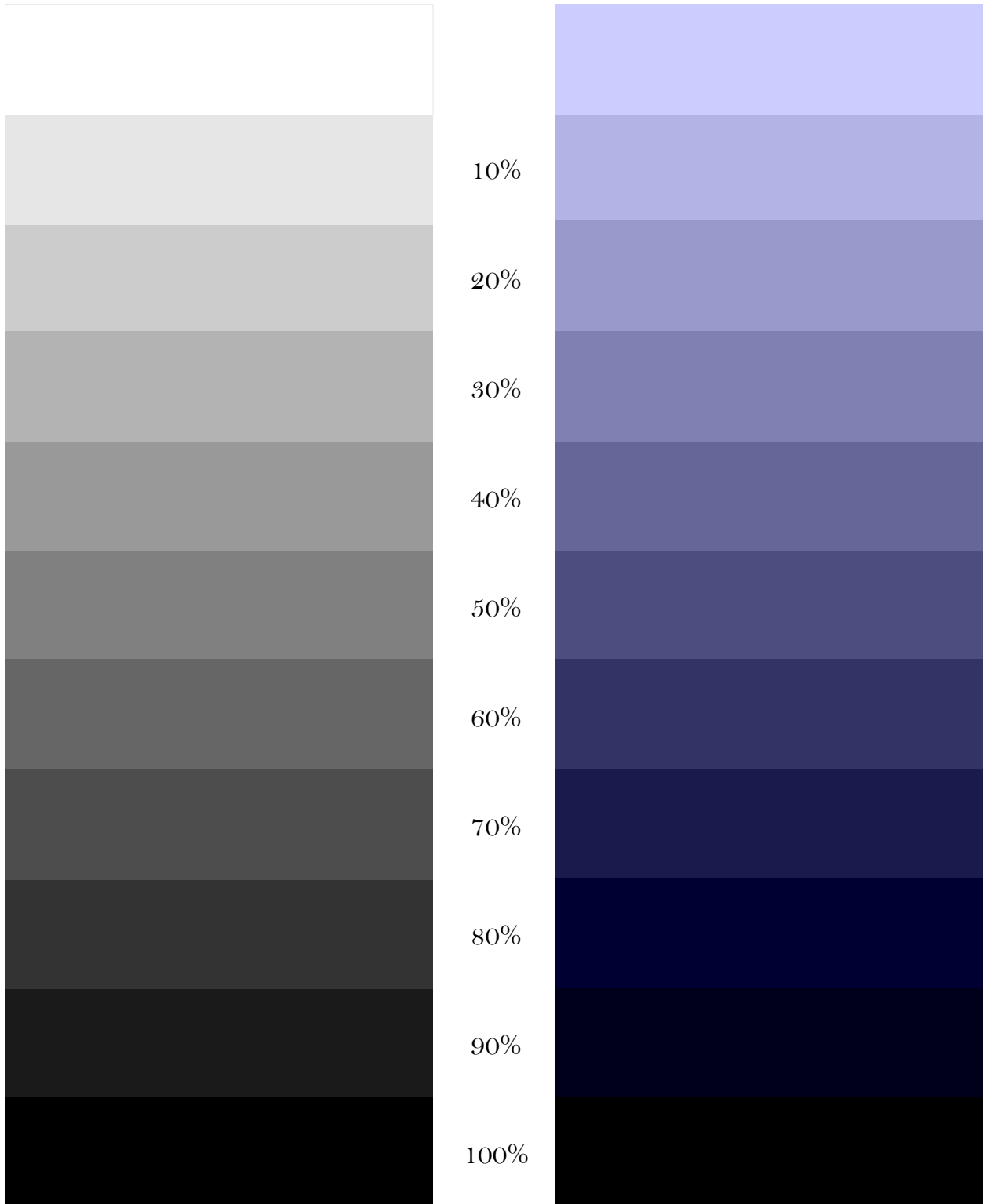


Painters' Primaries:
Yellow
Red
Blue



Value

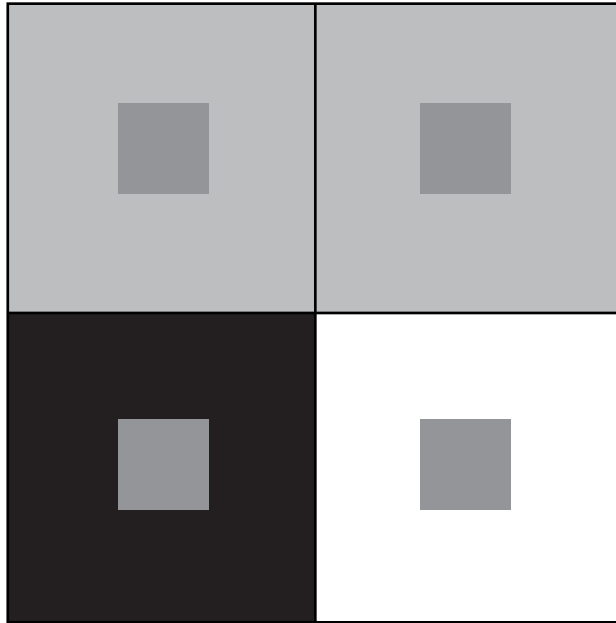
The value of a color refers to how much black there is in the hue. Some hues by nature are light, e.g., yellow. Differing values can add interest to a color scheme or can create confusion. Similarly, colors of the same or close to the same value can make a project appear bland, but close values can also unify or bring together disparate colors which otherwise together would not provide a pleasing scheme.



Simultaneous Contrast

When viewing two color as he same time (simultaneously), the appearance of one or both can be influenced. The black, grey, white, diagram below is an example of a type of simultaneous contrast called induction.

The two large squares containing smaller squares are exatly the same. The lower large squares contain small grey square of the same value as above, but they appear different vbecause of the shade with which each is surrounded

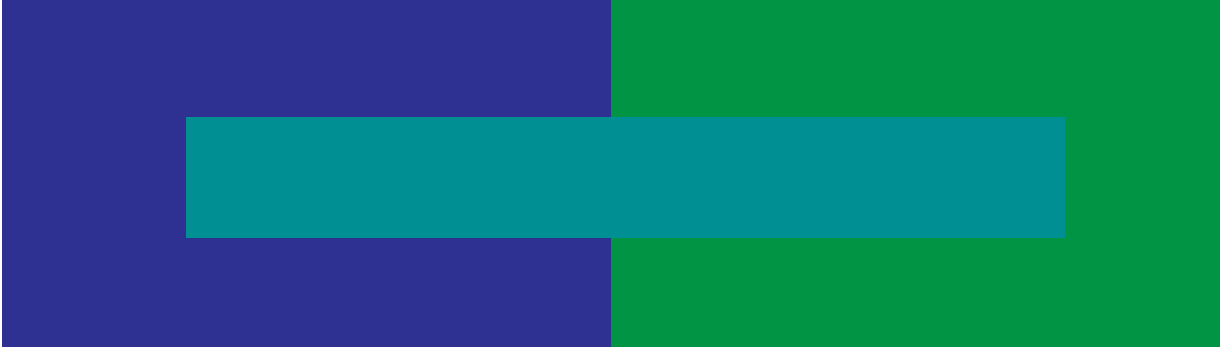


The yellow squares in each larger square below are identical, but each is surrounded by a different color. They appear different because of the contrast between the yellow and the surrounding colors.



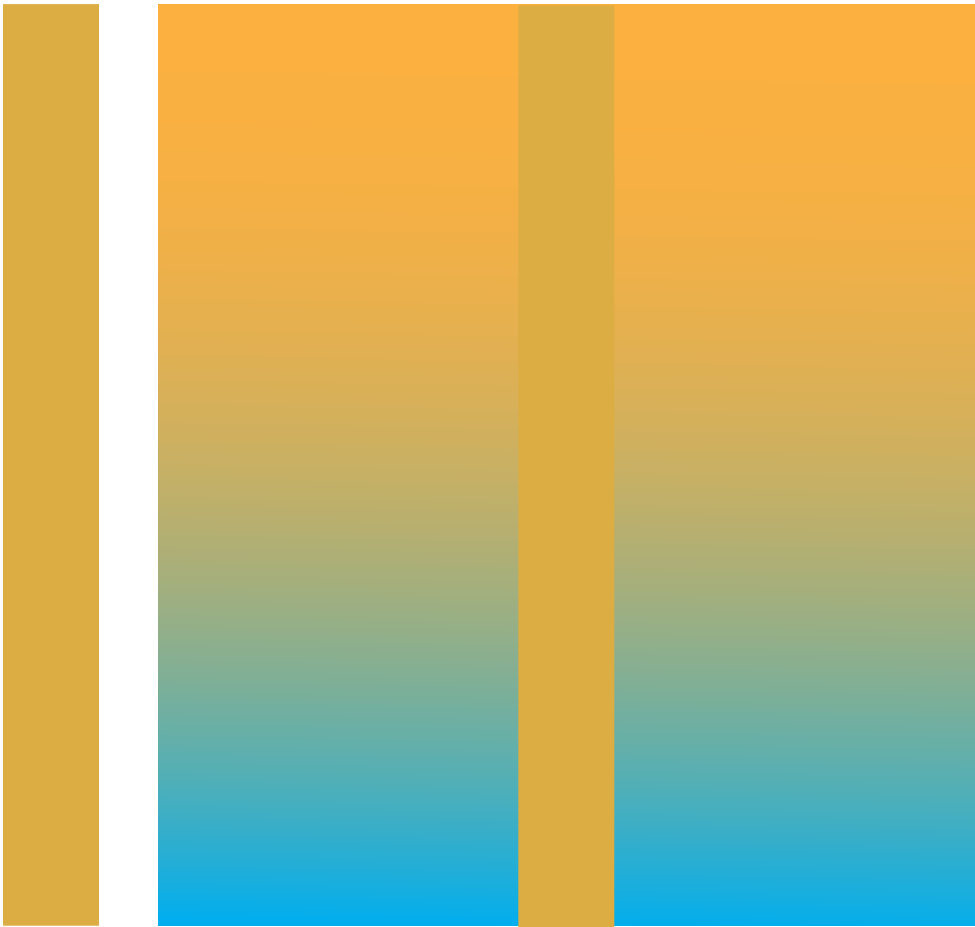
Simultaneous Contrast

Other examples:



Simultaneous Contrast

Other examples:



Simultaneous contrast practical application Warp Painting



Mathematics of Dyeing

Converting CMYK into Dye Formulas:



Dialogue box
from Adobe CS3
suite.



Many computer programs provide the coordinates for the colors we see on our screens, but how do we convert this information for use in dyeing?

It requires a combination of knowledge—objective (simple mathematics) and subjective (the dyer's experience).

Using the turquoise swatch above for the exercise, the simple mathematics:

1. Take the CMYK coordinates and add them together:

$$C = 57$$

$$M = 2$$

$$Y = 23$$

$$K = 0$$

$$57 + 2 + 23 + 0 = 82$$

2. Divide each individual number by the total to determine the percentage each color has to the whole:

$$C = 57/82 = 70\%$$

$$M = 2/82 = 2\%$$

$$Y = 23/82 = 28\%$$

$$K = 0/82 = 0\%$$

This turquoise is composed of 70% Cyan, 2% Magenta, 28% Yellow, & 0% Black. Verify the calculations by determining that they total 100%. I said the math was simple!

The percentages are the starting point. Percentages of what?

The percentages are the amount of each of the subtractive primary colors required to produce the hue in the illustration.

To calculate dye quantity, the dyer has to decide the depth-of-shade (DOS) of the hue. This is where subjectivity and experience come into play.

With acid dyes 1% is generally considered the saturation level of a pure hue (2% for fiber reactive dyes)—many dyers have their own preferences.

Only experience tells a dyer the total percentage of dye needed to obtain a specific DOS of a specific hue on a specific yarn.

Solely for the purposes of this exercise, we will assume that our turquoise can be obtained at 2% DOS on the yarn we're using.

To make the calculation of the dye color formula a little more interesting, let's use:

Skein of yarn = 248 grams

Depth-of-shade = 2%

Stock solution = 1%

The dyer now knows that a total of 496 ml (248 x 2) of 1% stock solution is required. The calculations for the individual colors are:

$$C = 248 \times 70\% \times 2 = 347 \text{ ml}$$

$$M = 248 \times 2\% \times 2 = 10 \text{ ml}$$

$$Y = 248 \times 28\% \times 2 = 139 \text{ ml}$$

A quick check: $347 + 10 + 139 = 496$ proves that the calculations are correct.

*This article assumes some knowledge of stock solutions and their role in dyeing.
For further information refer to the Precision Dye workshop handouts and the MoA spreadsheet.*



Vocabulary

After Image: The color sensation from one's eyes after light has been removed.

Analogous Colors: An analogous color scheme is one composed of any three or four adjacent colors on a color wheel. Their proximity contributes to a harmonious scheme.



Complementary Colors: Two hues with balanced or opposing color characteristics; opposite to each other on a color wheel: purple/yellow; green/red; orange/blue.

Hue: The names of colors: Red, Blue, Green, Yellow, etc.

Value: The amount of lightness/darkness of any color.

Chroma/Intensity/Saturation: The quantity of color within the hue. A bright red may be termed "fully saturated," whereas the same red toned down to a maroon would be less intense, less saturated.

Monochromatic: One color.

Neutral: The colors obtained by mixing two complementary colors together (frequently a grey-brown).

Polychromatic: Of more than one color—frequently used to describe many colors.

Tint: A hue mixed with white

Tone: A hue mixed with grey

Shade: A hue mixed with black

Primary Colors: Base colors from which all other colors can be mixed. There are many different primary systems. The diagram's on this chart are the painters' primaries:



Secondary Colors: The colors obtained by mixing two primaries: orange, green, and purple.



Simultaneous Contrast: Describes the effect obtained by one color on another when viewing two colors at the same time.

Tertiary Colors: The color obtained by mixing a primary with one of the secondary colors adjacent to it on a color wheel: red orange, orange yellow, yellow green, green blue, blue purple, and purple red.



Value: The lightness or darkness, or amount of white or black, in a color: pink is a light value of red, navy-blue is a dark value of blue.

Visual Mix: One definition of this term (and there are others) is the mixing of colors visusually, that is, by one's eyes. When viewing small amounts of two different colors juxtaposed to each other and viewed from a distance, they mix together to create a third color. Visual mix is particularly applicable to weaving.

