Graphic Design: Color Theory

Lesson 1: Additive Primaries

What are additive primary colors?

The color wheel looks like blocks of solid color. In actuality the color wheel is millions of colors that are blended into one another as you move around the color wheel. Some colors are solid and some are blended.

We see with our eyes the colors created by the natural light in the world. These colors are known as additive colors. The term "additive" refers to the mixing of light.

When equal amounts of red light, green light, and blue light are mixed together they produce white light. Because you add the colors together to get white we call these the additive primaries.

If one of the additive primaries are removed, the color of the light changes. For example, if the red light were removed, equal amounts of blue and green light would make cyan light. Equal amounts of green and red light would make yellow light, and equal amounts of red and blue light will make magenta light.

The absence of all light also means the absence of all color, creating black.

We can observe additive color when we see a rainbow form from light diffracted through a prism, or when we use RGB setting to create color in computer software programs like Photoshop® or Illustrator®.

RGB is the acronym which stands for red, green, and blue. All color computer monitors are RGB monitors.

The web site www.webopedia.com describes how RGB monitors work: "An RGB monitor consists of a vacuum tube with three electron guns -- one each for red, green, and blue -- at one end and the screen at the other end. The three electron guns fire electrons at the screen, which contains a phosphorous coating. When the phosphors are excited by the electron beams, they glow. Depending on which beam excites them, they glow either red, green, or blue. Ideally, the three beams should converge for each point on the screen so that each pixel is a combination of the three colors."

Lesson 2: Subtractive Primaries

What are subtractive primary colors?
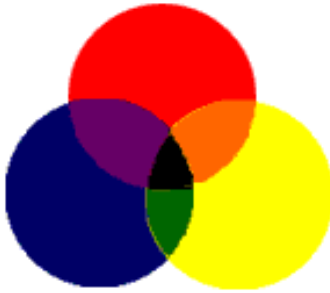
As a child we all mixed paint to make other colors. This mixing of pigment is called subtractive color because each time pigments are added to each other the mixed color is less pure than the colors used to create it. When we mix paints we are using the subtractive mixing color paradigm.

The subtractive primary colors are red, yellow and blue. When we mix these subtractive primaries together we get the secondary colors.

The **secondary** colors are:

- green (from mixing blue and yellow)
- purple (from mixing red and blue)
- orange (from mixing red and yellow)

Tertiary colors are the result of blending primary and secondary colors, for example:

- red-orange
- orange-yellow
- yellow-green
- green-blue
- blue-violet
- violet-red

CYMK is an acronym that is "short for Cyan-Magenta-Yellow-Black, and pronounced as separate letters. CMYK is a color model in which all colors are described as a mixture of these four process colors." -- Webopedia

CYMK is a subtractive mixing color paradigm that is computer based.

To the left is an illustration of a CYMK color wheel, which is another example of subtractive primaries.

Computer designs that will eventually be printed on paper should be designed in CYMK mode because the mixing of ink is done using the subtractive mixing color paradigm. Web interfaces should be designed in RGB mode because they will be displayed on RGB monitors. You can choose either RGB or CYMK mode using graphic software programs like Photoshop or Illustrator.

Lesson 3: Hue

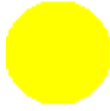## What is hue?

This hue is red.

This hue is light green.

This hue is turquoise.

This hue is navy blue.

This hue is yellow.

This hue is blue.

Each individual color in the color wheel is a hue. Hue is the name of the color for instance red, green, navy blue, orange, purple, lavender, turquoise. Hue is absolutely any color in the rainbow that you choose to pick. Hue is simply the name of the color.

When you opened that brand new box of 128 Crayola crayons and read the name on the wrapper of each new color, you were deciding what hue you wanted to use.

It doesn't matter if it is red, maroon, a shade of red, or pink, each one of those names is a hue.

Lesson 4: Shade

What is shade?

The terms **value** and **brightness** refer to the light or dark qualities of a color. The dark colors (**shades**) are low values. Below, the hue red is shaded in both RGB and CYMK modes.

Shade RGB Mode	Hue Red					
	R = 255	R = 204	R = 153	R = 102	R = 51	R = 0
	B = 0	B = 0	B = 0	B = 0	B = 0	B = 0
	G = 0	G = 0	G = 0	G = 0	G = 0	G = 0

As you move from left to right in an RGB additive color palette you create each shade of red by decreasing the amount of red and decreasing the amount of light.

Shade CYMK Mode	Hue Red					
	C = 0	C = 13	C = 24	C = 34	C = 53	C = 75
	Y = 100	Y = 100	Y = 100	Y = 98	Y = 79	Y = 68
	M = 100	M = 100	M = 100	M = 96	M = 71	M = 67
	K = 0	K = 4	K = 15	K = 53	K = 78	K = 90

As you move from left to right in an CYMK subtractive color palette you create each shade of red by changing the value of CYMK or in essence, adding black.

This illustration shows shades from white to black with oil paint. As you move from left to right the shades are created by increasing the amount of black.

Lesson 5: Tint

What is tint?

The terms **value** and **brightness** refer to the light or dark qualities of a color. The light colors (**tints**) are high values. Below, the hue red is tinted in both RGB and CYMK modes.

Tint
RGB Mode

Hue Red					
R = 255 B = 0 G = 0	R = 255 B = 51 G = 51	R = 255 B = 102 G = 102	R = 255 B = 153 G = 153	R = 255 B = 204 G = 204	R = 255 B = 255 G = 255

As you move from left to right in an RGB additive color palette you create each tint of red by keeping the same amount of red light and increasing the amount of both blue and green light.

Tint
CYMK mode

Hue Red					
C= 0 Y= 100 M= 100 K= 0	C= 0 Y= 91 M= 81 K= 0	C= 0 Y= 75 M= 51 K= 0	C= 0 Y= 50 M= 27 K= 0	C= 0 Y= 14 M= 11 K= 0	C= 0 Y= 0 M= 0 K= 0

As you move from left to right in an CYMK subtractive color palette you create each shade of red by by changing the value of CYMK or in essence, adding white.
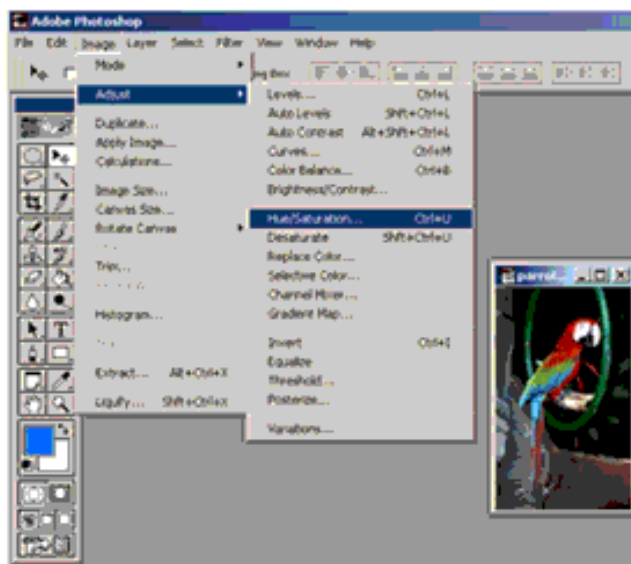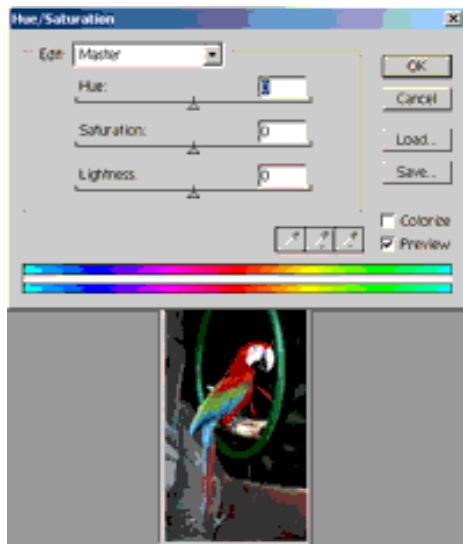
Lesson 6: Saturation

What is saturation?

Saturation is a measure of a color's pureness and brilliance. In subtractive color processing like CYMK, the more we mix colors the less pure they become; therefore, the color appears dull.
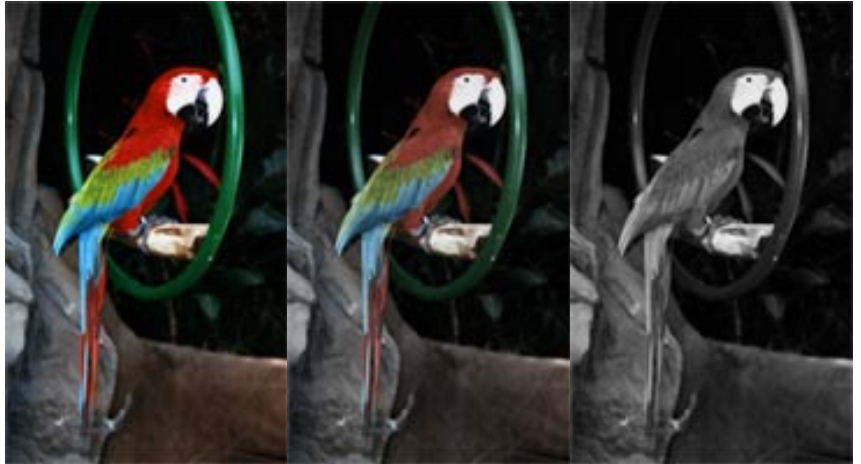
The illustration above demonstrates the change that will occur if the saturation of the color is decreased. The first parrot on the left is at 100% saturation, all colors are brilliant. The middle parrot has a saturation of 50%; the colors are very dull. The third parrot has no saturation, creating a black and white image.

(You can try this in Photoshop if you have the software program. Open an image in Photoshop, from your top tool bar select Layer, New Adjustment Layer, Hue/Saturation. Slide the saturation bar (the triangle below the saturation line) to your right and left and see what happens.)
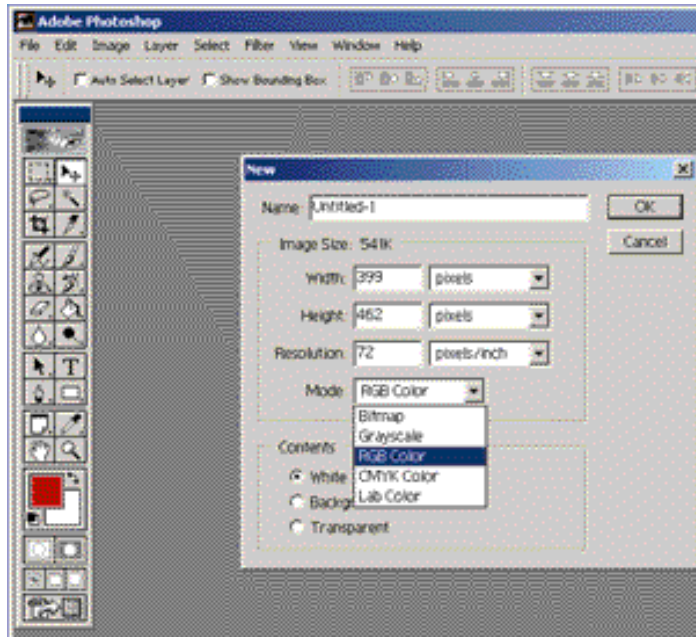
Lesson 7: Mode

What are modes?

When you use any graphic software program, colors are interpreted in one of three modes, RGB (Red, Green, and Blue), CMYK (Cyan, Magenta, Yellow, and Black), or HSV (Hue, Saturation, and Value).

In Photoshop you select the mode as soon as you open a new document.

If your design is meant to be seen on the web, always pick RGB mode. If your design is meant to be printed, use CYMK mode. This is based on the principle of additive and subtractive color.