

Color Theory

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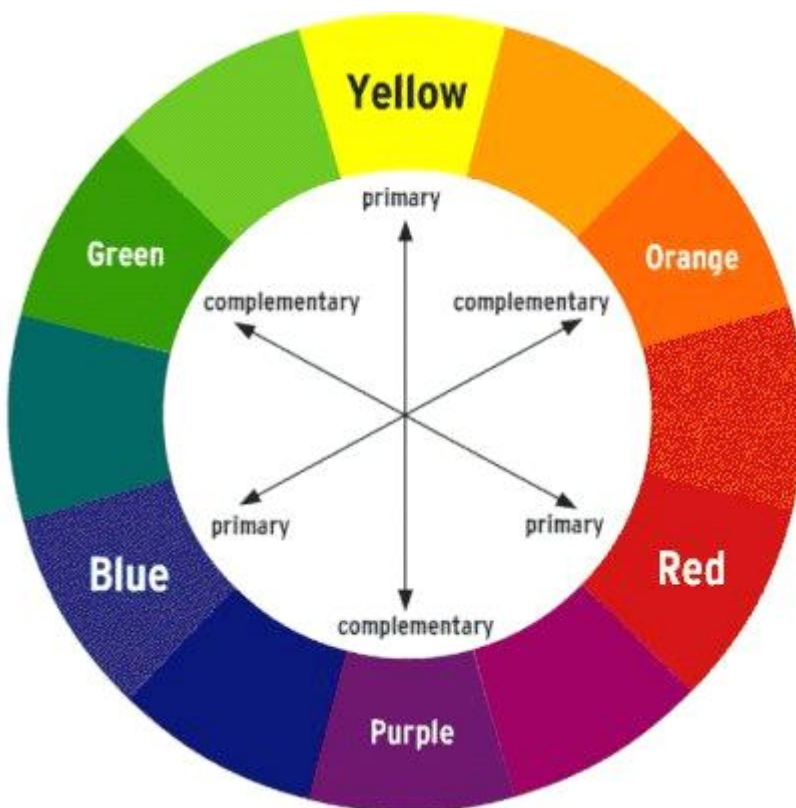
In the visual arts, color theory is a body of practical guidance to color mixing and the visual impacts of specific color combinations.

When you are referring to light theory and doing digital art, RGB are your primaries. But in terms of pigments, CMY are your primaries.

Specifically, color is light, and light is composed of many colors--those we are the colors of the visual spectrum:

- Red
- Orange
- Yellow
- Green
- Blue
- Violet

Objects absorb certain wavelengths and reflect others back to the viewer. We perceive these wavelengths as color.



The Artist's Primaries

Artists generally regard red, yellow, and blue as the most basic colors. But from Greek and Roman times to the Renaissance, most people thought green should be included, too.

The idea of a primary color is that it should be possible to mix every other color out of the three

primaries.

If you ask most people to match three tubes of paint to match their mental image of the primary colors, they will most likely pick something like cadmium red, cadmium yellow and ultramarine blue.

You may have noticed that with those colors you can mix clear oranges, but the greens and violets are very dull.

The traditional artist's color wheel presents yellow, red, and blue spaced out at even thirds around the color wheel.

Mixtures of the red, blue and yellow primary colors create Secondary Colors.

Secondary Colors are violet, green, and orange.

Complements

Any color that holds a position directly across the wheel is known as a complement.

In the world of pigments and color mixing, the color pairs are:

- Yellow-Violet
- Red-Green
- Blue-Orange

When pigmentary complements are mixed together, they result in a neutral gray, that is a gray with no hue identity.

In the realm of afterimages and visual perception, the pairings are slightly different. Blue is opposite yellow, not orange.

Chroma

Chrome is the perceived strength of a surface color, seen in relation to white. It is essentially the purity of a color.

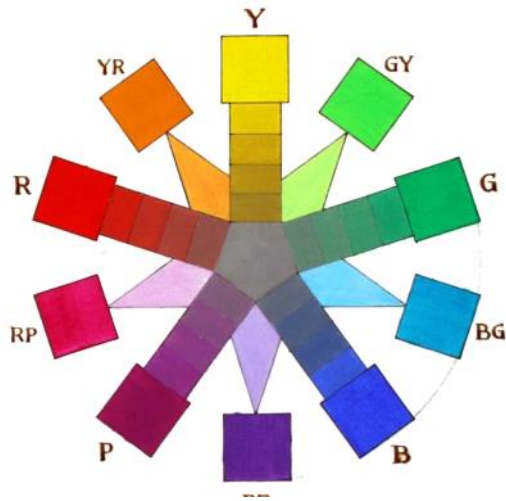
A hue with high chrome has no black, white, or gray added to it. Conversely, adding white, black, or gray reduces its chroma.

A gray color is a neutral -- an extreme low chroma.

A fire engine red may be a high chroma.

Brick red may be a middle-chroma red.

As the color swatches progress from the hub to the rim of the color wheel, the colors increase in chrome. At the center is neutral gray.



The Traditional Wheel

There are a few problems with the traditional wheel. First, the idea that red, yellow, and blue are primaries are not set in stone. Any of the infinite hues on the outer rim of the gradating wheel could make an equal claim as a primary.

In addition, none of the hues are secondary or composite by their nature. Green is no more secondary than blue is.

The third problem is that the spacing of the colors on the traditional wheel is out of proportion, like a clock face with some of the numbers bunched up in one corner. It expands the yellow-orange-red spectrum too much. This uneven distribution came about partly because our eyes are more sensitive to small differences among the yellow/orange/red hues and partly because pigments are more numerous for warm colors, compared to cool ones.

There have always been many available pigments for the oranges and reds, but few for the violets and greens. The precious pigments vermilion and ultramarine became our mental image for red and blue.

The Munsell System

Many contemporary realist painters use the system developed by Albert Munsell about a century ago.

Instead of divisions of threes and twelves, the structure is based on ten evenly spaced spectral hues.

This is much more useful wheel than the traditional artist's color wheel because it allows for exact numerical descriptions of color notes.

Students of the Munsell system must become accustomed to the 10 basic hues:

- Yellow (Y)
- Green-Yellow (GY)
- Green (G)
- Blue-Green (BG)
- Blue (B)
- Purple-Blue (PB)
- Purple (P)
- Red-Purple (RP)
- Red (R)

- Yellow-Red (YR)

Cyan, Magenta, and Yellow

In the world of printing and photography, the three colors that mix the widest range of high-chrome colors are cyan, magenta, and yellow.

These printer's primaries, together with black (K) are known by the short-hand CMYK. They are used throughout the industries of offset lithography, computer printing, and film photography.

Red, Green, and Blue

Lighting designers and computer graphics artists consider RGB as their primaries and CMY as their secondaries.

Red, Green, Blue are the primary colors of light, as opposed to pigment.

Mixing red, green, and blue lights together on a theatrical stage or a computer screen results in a white light.

The "Yurmby" Wheel

Placing RGB on the wheel evenly between the CMY creates a universal color wheel, useful in many different settings.

Think of these are six equal primaries:

- Yellow
- Red
- Blue
- Cyan
- Magenta
- Green

Counting clockwise from the top of the wheel they are YRMBCG (Yellow, Red, Magenta, Blue, Cyan, Green)

You can remember them as "Yurmby" or "You Ride My Bus, Cousin Gus"

Should painters adopt this six primary color wheel? It is good to learn this mental image of the ideal color wheel, regardless of what pigments you actually use as primaries.

What is important is that you know where the colors you are using actually belong on a mathematically accurate color wheel.

Chroma and Value

Whenever you paint directly from observation, you have to translate the wide range of tones that meet your eye. The colors on the palette often can't match the wide range of tones in a given scene.

Every color can be defined in terms of two dimensions: hue--where it appears around the edge of the color wheel, and chroma--how pure or grayed-down it appears.

The third dimension to consider for any color mixture is the value or lightness. This value dimension is generally represented along the vertical above and below the color wheel, creating a spherical, cylindrical, or double-cone shape.

Since, it is a three-dimensional volume, it is also called a color space or color solid.

One of Albert Munsell's contributions to the understanding and practical use of color was his numerical classification system for all possible colors according to these three dimensions:

- Hue
- Value
- Chroma

Instead of trying to describe a given color as a "beige" or a "maroon", one could unambiguously define them as YR 7/2 or a R 3/6.

The letters "YR" stand for "Yellow-Red". The first number stands for value, ranging from black (0) to white (10). The second number refers to chroma, counting upward to the strongest intensity possible.

Peak Chroma Value

Munsell observed that a given hue reaches its greatest chroma at one particular value, called the home value or the peak chroma value.

That peak value varies from color to color. Yellow, for example, is most intense at a very light value, while blue is strongest when it is very dark. Red reaches maximum chroma at a middle value.

Local Color

Local Color is the color of the surface of an object as it appears close up in white light.

If you held up a matching paint swatch right against it, that swatch would be the local color. However, the color you actually mix to paint that object will usually be different.

Grays and Neutrals

Grays or neutrals are the opposite of intense colors. We sometimes associate grays with blandness or dullness, but they are an artist's best friend. More paintings fail because of too much intense color rather than too much gray.

Grays can provide a setting for bright color accents. They give space and scope to a composition, and they can create a quiet, reflective mood. They can also connect the contrasting blue and red accents by providing transitional notes of soft violets and browns.

There is no single gray color. To the careful observer, gray comes in many subtle variations. It might have a hint of blue or a touch of orange.

A gray can be mixed various combinations of colors. To preserve pleasing variations in grays, it is a good idea to mix them from complementary pairs, rather than from white and black pigments. Try mixing grays from blue and orange, red and green, or violet and yellow.

For a cool gray, mix blue and orange with a little more blue.

For a warm grey, mix blue and orange but add a little more orange.

Gray is the sauce of the color scheme. It is easier to live with a subdued painting than with one that is highly saturated throughout.

The Green Problem

Green is one of the most common colors in nature, but it has presented such a perennial challenge to artists and designers that many have banished it from the palette.

Why is green a problem and how can you solve it?

There is no doubt that green is a fundamentally important color. Many modern psychologists and color theorists regard it as a primary color.

The word "green" occurs more than twice as frequently as "yellow" in modern written English.

The human eye is more sensitive to yellow-green wavelengths than to any other.

In the field of book cover design, there is an old saying "green covers don't sell."

Among the flags of Europe, 79% contain red, but only 16% contain green.

Costume designers have said that green often looks ghastly in stage lighting.

Gallery directors have reports that clients are not attracted to paintings with a strong greenish cast unless it is handled carefully.

Evidently, this was an issue even 150 years ago, when Asher Brown Durand commented on "the common prejudice against green." He said, "I can well understand why it has been denounced by the Artist, for no other color is attended with equal embarrassment. Durand chided his contemporaries for painting so many autumn scenes instead of summer ones to avoid the problem altogether.

In late spring and early summer, the leaves have not developed their full wax cuticle layer, and the chlorophyll has an electric yellow-green. When light shines through new leaves or blades of grass, the green is particularly strident. To faithfully match that color, some artists mix a color they call "vegetable green", a highly chromatic yellow-green, which they use in foliage mixtures.

Tips for Handling Green:

1. You can banish green pigments from the palette and mix them from various blues and yellows. The resulting mixtures will be weaker and more varied, both qualities that you want.
2. Avoid monotony. Vary your mixtures of greens at both the small scale (leaf to leaf) and the large scale (tree to tree).
3. Mix up a supply of pink or reddish gray on your palette and weave it in and out of the greens. Painter Stapleton Kearns calls this method "smuggling reds".
4. Prime the canvas with pinks or reds, so that they show through here and there to enliven the greens.

Gradation

Like a glissando in music, a color gradation transitions smoothly from one note to another. The shift can occur from one hue to another, or from a light color to a dark color, or from a dull color to a saturated one.

Nature contains movement or gradation of color both on the large and the small scale, even down to the smallest brushstroke or pebble.

"Nature will not have one line, nor color, nor one portion nor atom of space without a change in it. There is not one of her shows, tints, or lines that is not in a state of perpetual variation."

Tints

Adding white to a color raises to a tint or a "pastel" color. The quality of lightening is typical of distance hues on a hazy day.

Mural paintings typically succeeds best with paler ranges of colors, which convey a feeling of light.

A tint can be made in 2 ways:

- Adding white, which will often make hues bluer.
 - Whitened reds, for example, become more magenta.
- Apply the color as a thin, transparent layer over white.
 - This usually leads to a more highly chromatic tint.