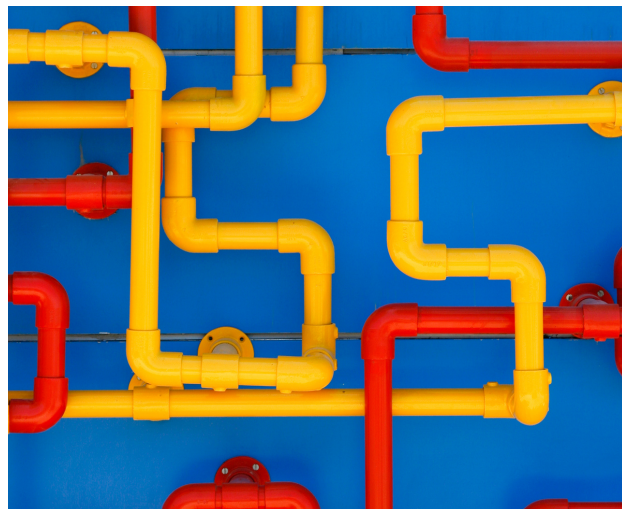


Did You Know Series: Understanding Color 101

Color is a phenomenon so rich and complex in scope that it touches all human activity.

It is the attribute of visual sensation or, by extension, an object or light that can be described by such terms as red, green, blue, yellow, white, black, etc.

Color is as common in our environment as the air we breathe, in fact, it is so prevalent that we are not always aware of just how much we depend on it.



Color vision in humans is based on the additive color theory. This theory states that all perceivable colors can be made by mixing different amounts of red, green, and blue light, the primary color of the additive color system. The three additive primaries are at the center

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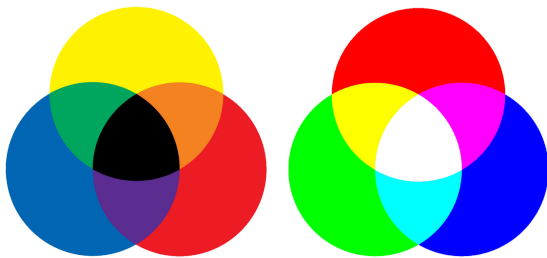


Subtractive Color Mixing

is the kind of mixing you get if you illuminate colored filters with white light from behind.

The commonly used subtractive primary colors are: cyan, magenta, and yellow.

If you overlap all three in an effectively equal mixture, all the light is subtracted giving black.



Describe Color Using Subjective Terms:

- "Make it Warmer"
- "Make it Cooler/Colder"
- "It Needs to be Bolder"
- "Make it Have More Life"

COLOR ... The Challenge

It can be complex, elusive, powerful, fickle and demanding.

It stirs emotions, starts arguments and sells products.

Our Challenge is to control it and to achieve Consistent Quality.



To respond to our customers quickly; producing products in an efficient manner that allows our customer to keep their product costs in line without sacrificing quality or consistency.

Metamerism ... A Phenomenon

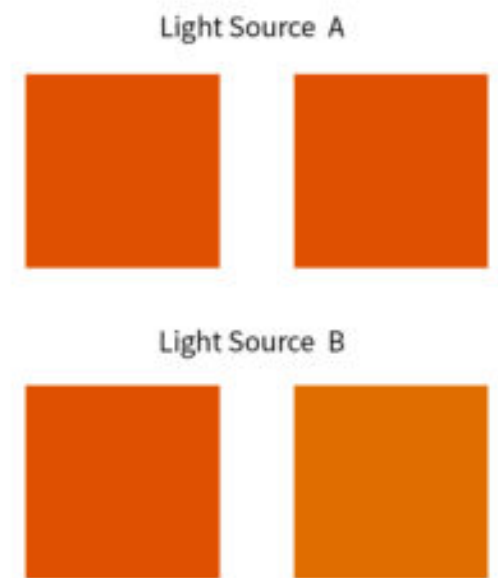
A term used in the color industry for the phenomenon exhibited by two surfaces/samples/targets that appear to be the same color under one light source

(e.g. Daylight), but which do not match in color when viewed under a different light source (e.g. Incandescent).

Today's color computer software provides the color matcher with tools to minimize metamerism and arrive at formulations that offer an acceptable match under a variety of lighting conditions.

A Guide To Mixing Colorants

Additive Mixing occurs when colored lights are superimposed to achieve a different color. The three primary additive colors (red, green, blue) are mixed evenly, white light is achieved. There is no black or gray in additive mixing. A color television screen is an example of additive mixing.



Light Source: Consistency is critical

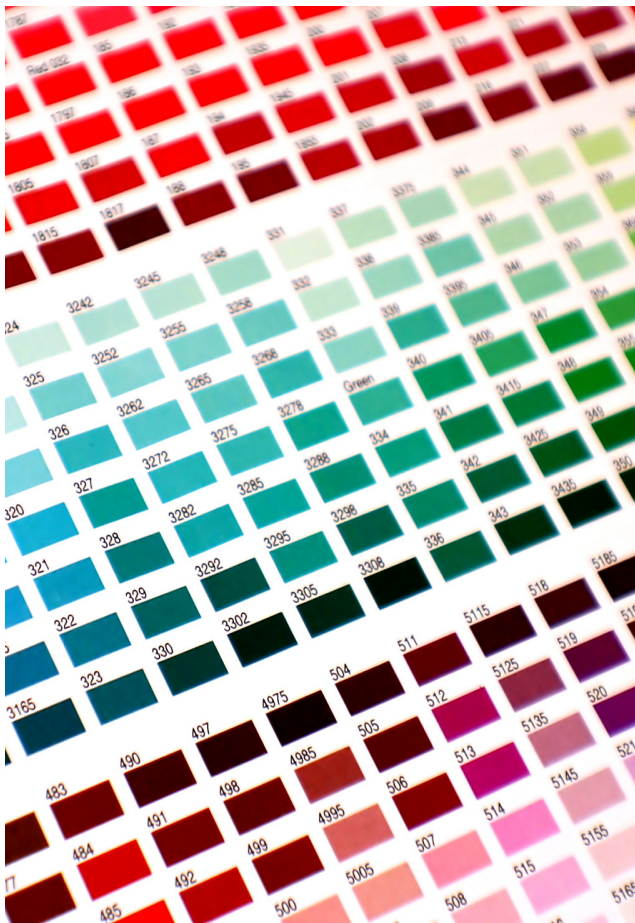
The color you see is also affected by the type of light source. These light sources were designed to bring consistency into color matching and to accentuate the color of a product on display.

A Guide To Mixing Colorants Cont.

Subtractive Mixing is the most common type of color mixing. This occurs when pigments and dyes are mixed to achieve an object color.

If the three primary subtractive colors (Cyan, Magenta, Yellow) are mixed evenly, all light is subtracted, producing black.

Opaque objects are examples of subtractive mixing. The plastic industry works in this area.



Colorant Terminology

Because colors can evoke an emotional response, colors are often described in subjective terms such as “warm” or “bold” or “peachy”, which leads to confusion when people who work with color talk to each other.

The artist and art professor Albert H. Munsell recognized the need for objective, measurable terminology and published his Munsell Color Chart back in 1905. In the Munsell system, color is described in terms of three color coordinates, “Hue”, “Value”, and “Chroma”.

Colorant Terminology

Hue is color. is red, yellow, green, blue – the actual color you see.

Value is lightness or darkness of the color; it relates the color to a gray scale between black and white.

Chroma is vivid colors and dull colors and everything between. Chroma measures the purity or intensity of a color.

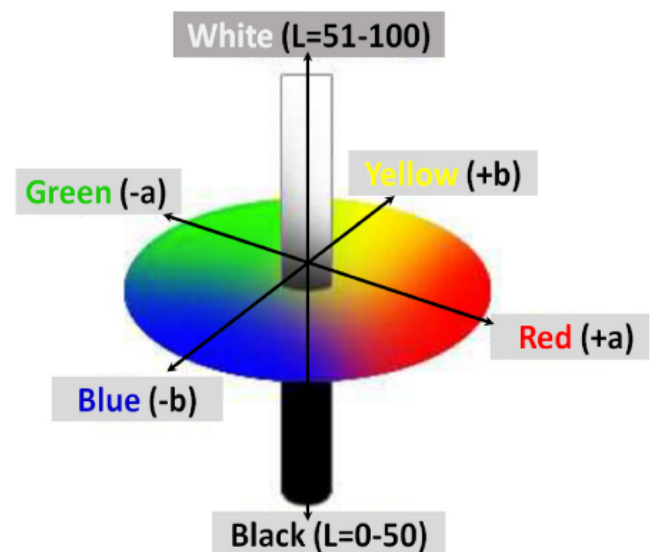
Color Measurement

The 3 color dimensions introduced by Munsell, can be visualized using an $L^*a^*b^*$ chart, as shown to the right.

Lightness/darkness or “Value” is shown on the L^* axis, which varies from 0(black) to 100(white).

Color or “Hue” is measured in the plane determined by the a^* and b^* axes.

- Positive values of a^* indicate red
- negative values of a^* indicate green.
- Positive values of b^* indicate yellow,
- Negative values of b^* indicate blue.



Color purity or “Chroma” is measured by the magnitude of a^* and b^* . “Candy Apple Red”, for example, has a very large positive a^* value.