

22 Color and Factor of 7

Friday, April 10, 2020 10:51 PM

Today:

Magic Factor of 7
Color

Magic Factor of 7

Here is some advice I got from Larry Talbot, my PhD advisor:

"In research, tasks will take you 7 times longer than you think they should"

You may think that you are a reasonably good project planner, that things may take longer than you plan by a factor of 2 or 3, but a factor of 7? Really? Why?

Everyone acknowledges the difficulty of planning when there are many unknowns.

Used in project planning and risk assessment. You must consider

- □ **Known knowns:** things we know we know. You can make reasonable estimates of time regarding these issues. For example, how long it will take to order a material you need, or carry out an assembly step you have done before.
- □ **Known unknowns:** things we know that we don't know. For example you may know that you will need to learn to use a 3D printer for your projects. 'How to use a 3D printer' is a known unknown.
- □ **Unknown unknowns.** Things you have no way to predict for.
 - ◆ Examples from previous years: A family emergency. A catastrophic laser cutter failure that will take months to repair. A nationwide shortage and backorder of a widget you need. Your friend who was going to help you with 3D printing falls in love and has no more time for you, and there are no more workshops offered this semester.
 - ◆ Example for this year: Coronavirus.

This is a type of epistemology, knowledge about knowledge. "Epistemology is the investigation of what distinguishes justified belief from opinion." <https://www.google.com/search?q=epistemology&ie=utf-8&oe=utf-8>

There is a fourth category sometimes added: unknown knowns, things we deny knowing.

"Unknown unknowns" was made famous in 2002 by Donald Rumsfeld during the Iraqi War w.r.t WMDs, but has been used by NASA and others since the 1950's.

https://en.wikipedia.org/wiki/There_are_known_knowns

For time management and planning, some use a time order-of-magnitude safety factor:

if it should take 1 second, it will take 1 minute

if it should take 1 minute, it will take 1 hour

If it should take 1 hour, it will take 1 day

and etc, for days, weeks, months, years.

Factors of 60, 60, 24, 7, 30 etc. Perhaps excessive.

This may work, but I have found the Magic Factor of 7 to be remarkably accurate for doing anything new, in research or design.

Color

Nomenclature

Digital, photoshop

Pantone <https://en.wikipedia.org/wiki/Pantone>

Additive/subtractive physics

Other aesthetics of color

Texts

Color

Color is used in design to attract attention, group elements, indicate meaning, and enhance aesthetics.

Color can make designs more visually interesting and aesthetic, and can reinforce the organization and meaning of elements in a design. If applied improperly, however, color can seriously harm the form and function of a design. The following guidelines address common issues regarding the use of color.¹

Number of Colors

Use color conservatively. Limit the palette to what the eye can process at one glance (about five colors depending on the complexity of the design). Do not use color as the only means to impart information since a significant portion of the population has limited color vision.

Color Combinations

Achieve aesthetic color combinations by using adjacent colors on the color wheel (analogous), opposing colors on the color wheel (complementary), colors at the corners of a symmetrical polygon circumscribed in the color wheel (triadic and quadratic), or color combinations found in nature. Use warmer colors for foreground elements, and cooler colors for background elements. Light gray is a safe color to use for grouping elements without competing with other colors.

Saturation

Use saturated colors (pure hues) when attracting attention is the priority. Use desaturated colors when performance and efficiency are the priority. Generally, desaturated, bright colors are perceived as friendly and professional; desaturated, dark colors are perceived as serious and professional; and saturated colors are perceived as more exciting and dynamic. Exercise caution when combining saturated colors, as they can visually interfere with one another and increase eye fatigue.

Symbolism

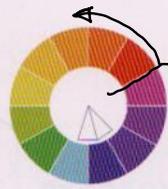
There is no substantive evidence supporting general effects of color on emotion or mood. Similarly, there is no universal symbolism for different colors—different cultures attach different meanings to colors. Therefore, verify the meaning of colors and color combinations for a particular target audience prior to use.²

See also Expectation Effect, Highlighting, Interference Effects, Similarity, and Uniform Connectedness.

¹ A nice treatment of color theory is *Interaction of Color* by Josef Albers, Yale University Press, 1963. For a more applied treatment, see *The Art of Color: The Subjective Experience and Objective Rationale of Color* by Johannes Itten, John Wiley & Sons, 1997; and *Human-Computer Interaction* by Jenny Preece, et al., Addison Wesley, 1994.

² It is reasonable to assume that dark colors will make people sleepy, light colors will make people lively, and irritating colors will make people irritated. Otherwise, the only observable influence of color on behavior is its ability to lead people to repaint walls unnecessarily. For those determined to try to calm drunks and win football games through the application of color, see *The Power of Color* by Morton Walker, Avery Publishing, 1991.

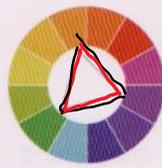
Girl-Boy Pink-Blue preferences are from cultural training. Pink used to be boy color before 1930s; from diluted blood (red was male color)



Analogous



Example from Nature



Triadic



Example from Nature

Analogous color combinations use colors that are next to each other on the color wheel.

Triadic color combinations use colors at the corners of an equilateral triangle circumscribed in the color wheel.



Complementary



Example from Nature



Quadratic



Example from Nature

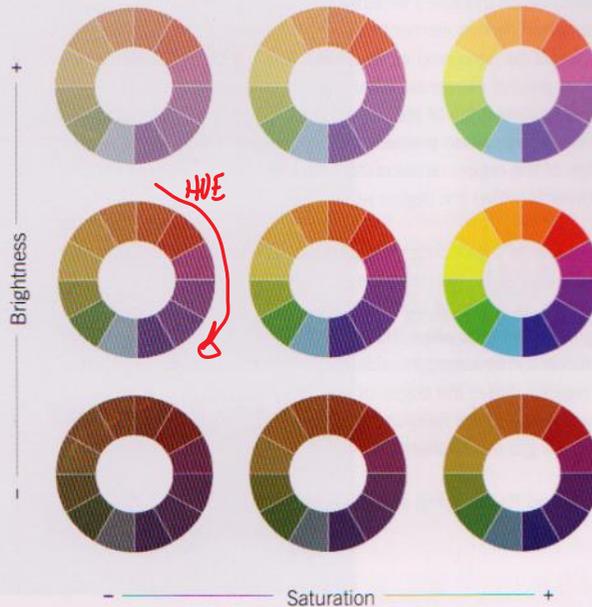
Complementary color combinations use two colors that are directly across from each other on the color wheel.

Quadratic color combinations use colors at the corners of a square or rectangle circumscribed in the color wheel.



Hues from yellow to red-violet on the color wheel are warm. Hues from violet to green-yellow are cool.

Saturation refers to the amount of gray added to a hue. As saturation increases, the amount of gray decreases. Brightness refers to the amount of white added to a hue—as brightness increases, the amount of white increases.



⇒ HSB color space or Lightness

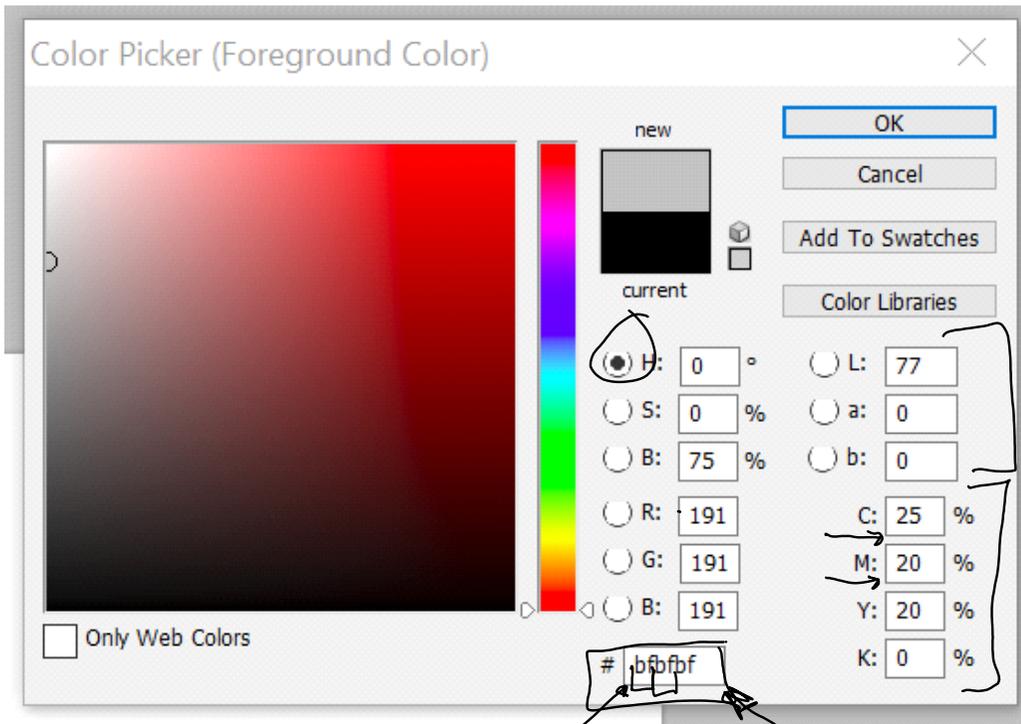
Color Nomenclature

Color space = method of defining a specific color.

Gamut = Range of colors that can be produced by a technology

Matching across devices, technologies = color management

From Photoshop:



RGB
in
hexadecimal

4 color spaces
0 - 9 A B C D E F

0 - 255

4 color
spaces;
HSB, RGB,
LAB, CMYK

Printing
Cyan
Magenta
Yellow
Black

<http://colorizer.org/>

Shows conversion between many color spaces. Also shows complementary, triad, square etc. pairings

Another site for choosing palettes, from Olivia: <https://colors.co/>

Adobe Color - similar

Pantone <https://en.wikipedia.org/wiki/Pantone>

Another color nomenclature and color management system. Common in design world.

Color of the Year

Since 2000,^[18] the Pantone Color Institute declares a particular color "Color of the Year". Twice a year the company hosts, in a European capital, a secret meeting of representatives from various nations' color standards groups. After two days of presentations and debate, they choose a color for the following year; for example, the color for summer 2013 was chosen in London in the spring of 2012.^[19] The color purportedly connects with the [zeitgeist](#); for example, the press release declaring Honeysuckle the color of 2011 said "In times of stress, we need something to lift our spirits. Honeysuckle is a captivating, stimulating color that gets the adrenaline going – perfect to ward off the blues."^[20] The results of the meeting are published in *Pantone View* (\$750), which fashion designers, florists, and many other consumer-oriented companies purchase to help guide their designs and planning for future products.

From https://en.wikipedia.org/wiki/Pantone#Pantone_Goe_System

Dye manufacturers prepare to sell quantities of the Color of the Year in advance, so products (plastics, textiles) are ready to sell.



PANTONE 16-1546 Living Coral
Introduction

2019



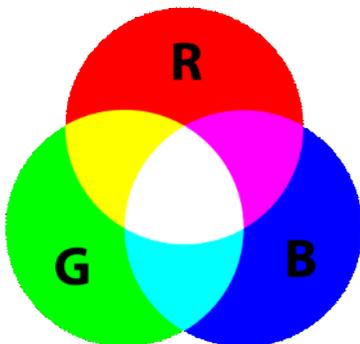
PANTONE 19-4052 Classic Blue
Introduction
Political?

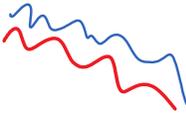


In 2013 Subaru started offering a tangerine colored Crosstrek. No coincidence.

Additive/subtractive color

Additive color = light.



Computer screens, other light emitting sources

 your eyes

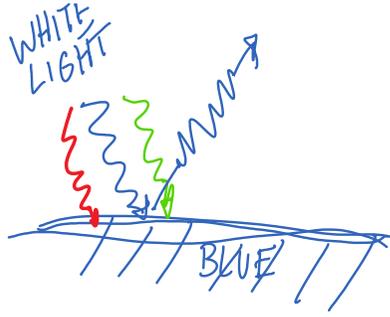
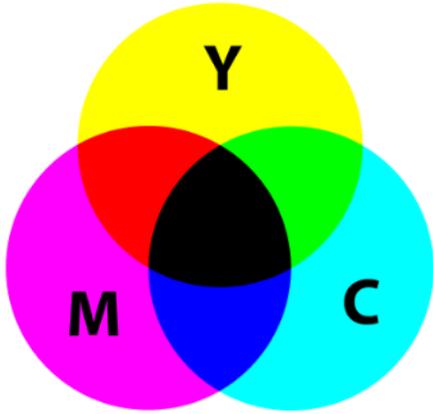
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Subtractive color = surfaces; dyes, pigments, inks. All wavelengths are absorbed except the scattered ones.



WHITE LIGHT


SCATTERED ONES.



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Perception of Color

Classic text: Albers, Josef, and Nicholas Fox Weber. *Interaction of Color: 50th Anniversary Edition*. -50th Anniversary ed. edition. New Haven Connecticut: Yale University Press, 2013. First edition 1963. \$12 paperback

Much has been learned about the physiology of vision; active area of research.

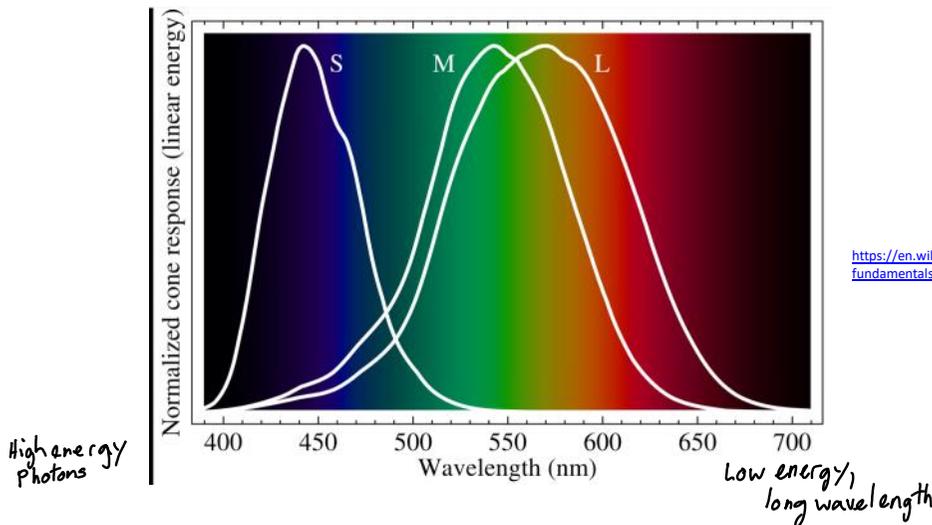
Recommended: Livingstone, Margaret, and David Hubel. *Vision and Art: The Biology of Seeing*. Reprint edition. Abrams, 2008. \$20 paperback.

Topics:

- The eye and color vision
- Luminance and night vision
- Neural processing of color information
- Acuity and spatial resolution
- From 3-D to 2-D: Perspective, Shading and Chiaroscuro, Stereopsis
- Illusions of motion
- Color mixing and color resolution
- Digital color

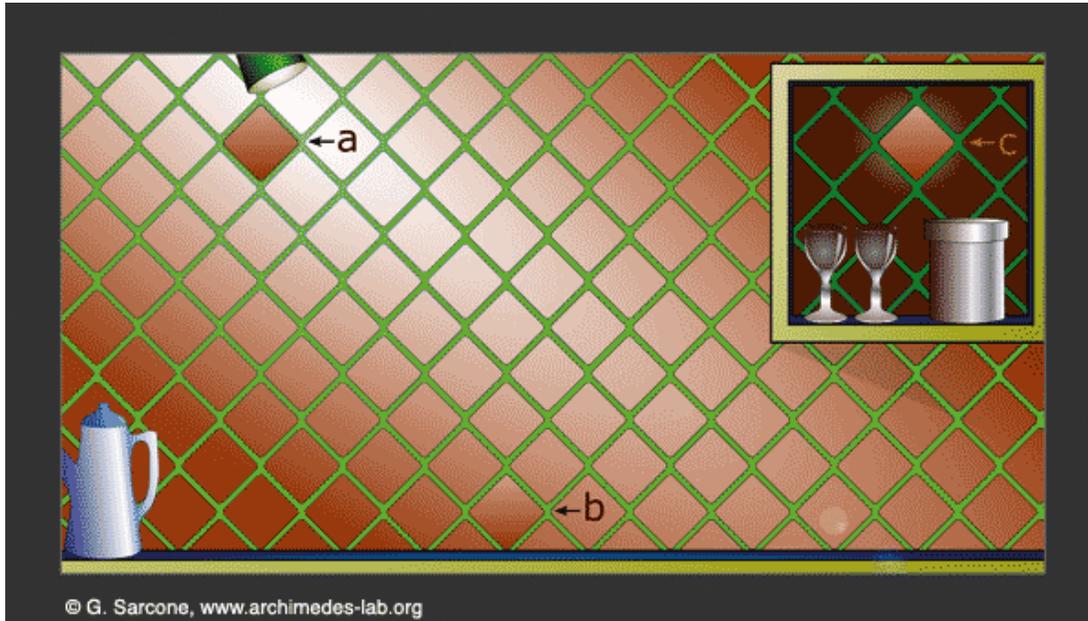
In the sun's spectrum, each color comes from photons of particular energy and wavelength.

Humans only have sensors for a few colors; R,G,B, black and white. Yellow photons trigger our R and G receptors. Sensors are not narrow-band.



Color perception is HIGHLY VARIABLE among humans
Remember the blue/gold dress?

Color illusions: http://www.archimedes-lab.org/color_optical_illusions.html



Tiles a, b and c are identical

Are there universal color preferences/responses?

UPD says yes, Black, White and Red Effects. Some references are provided in text, but admittedly few.

More UPD color effects: Black, white, red, yellow, green and blue:

<https://visme.co/blog/color-meanings/>

Other recent psychology studies say no:

Palmer, Stephen E, Karen B Schloss, and Jonathan Sammartino. "Visual Aesthetics and Human Preference." *Annual Review of Psychology* 64 (January 3, 2013): 77–107. doi:10.1146/annurev-psych-120710-100504.

Abstract

"Human aesthetic preference in the visual domain is reviewed from definitional, methodological, empirical, and theoretical perspectives. Aesthetic science is distinguished from the perception of art and from philosophical treatments of aesthetics. The strengths and weaknesses of important behavioral techniques are presented and discussed, including two-alternative forced-choice, rank order, subjective rating, production/adjustment, indirect, and other tasks. Major findings are reviewed about preferences for colors (single colors, color combinations, and color harmony), spatial structure (low-level spatial properties, shape properties, and spatial composition within a frame), and individual differences in both color and spatial structure. Major theoretical accounts of aesthetic response are outlined and evaluated, including explanations in terms of mere exposure effects, arousal dynamics, categorical prototypes, ecological factors, perceptual and conceptual fluency, and the interaction of multiple components. The results of the review support the conclusion that aesthetic response can be studied rigorously and meaningfully within the framework of scientific psychology."

Summary

Aesthetic response can be + or -

Art is more than just aesthetic response; cultural, social etc.

Art vs aesthetics: "Perhaps the most straightforward difference

is that significant aesthetic experiences can (and do) occur anywhere in response to seeing any sort of object, scene, or event, whereas art is limited to the subset of human artifacts intended to be viewed as art, whether in a museum, a gallery, or one's own living room"

No universal positive response to any specific thing.

BUT: there are plenty of culturally situated responses to color. Know your audience!