COLOR THEORY- HOW WE SEE COLOR

Seeing Color, Wavelengths
Subtractive and Additive Color Systems- Pigment and Light, Paint and Emulsion
RYB, CMYK, RGB

Color Theory Attributes:
Primaries, Secondaries, Tertiaries
Complementary Color
Hue, Value (tints and shades), Saturation/Intensity
Simultaneous Contrast, Contrast
Analogous Color, Temperature/Warm/Cool, Subjective Color, Monochrome, Gold

Intro to Color in Print, Photography, Digital (more next week)

video:
BBC Yorkshire, World’s Oldest Color Film (Edward Turner, c 1902) Discovered..., 2012
Nature Communications, Photonic Crystals Cause Active Colour Change in Chameleons, 2015,
Sony Bravia ad, 2006
Zhang Yimou, director, Hero, 2002, extended trailer
Blair Neal, Color a Sound, Max/MSP/Jitter, overhead projector, 2010
Engineerguy (youtube), Fiber Optic Cables: How they work, 2011,
https://www.youtube.com/watch?v=0MwMkBET_5I

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1. How We See Color, Color Theory Basics
2. Electromagnetic Spectrum
3. Human Eye, the Retina and Color Vision, web images
4. Refraction & reflection
5. Refracted light
6. Reflected light
7. Dog and human color vision
8. Lisa Jevbratt, Zoomorph, mobile app
9. Nature Communications, Photonic Crystals Cause Active Colour Change in Chameleons,
   2015, video
10. Human color blind test image
11. Afterimage
12. George Seurat, La Parade, 1887/8, oil 100x150 cm, and detail
    stage with a florescent protein, Alba emits a green glow when placed under an ultraviolet lamp, other florescent animals
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44. EngineerGuy (youtube), Fiber Optic Cables: How they work, 2011
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57. Justin Stadel, public art project, Echo park/LA, 2006
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HOW WE SEE COLOR:

The most technically accurate definition of color is: "Color is the visual effect that is caused by the spectral composition of the light emitted, transmitted, or reflected by objects."

Color results from light rays, which are a kind of electromagnetic energy. Our eyes can see the light of wave lengths between 400-700 millimicrons. The human eye + the brain sees the color, it’s a collaboration. Light waves themselves are not colored.

Light enters the eye and hits the retina, where it is absorbed by the rod and cone cells, which in turn transmit signals via the optic nerve directly to the “visual center” at the back of the brain.

White light (the sun) passing through the prism is dispersed into the colors of the visible spectrum> refraction. Other ways of to generate colors include interference, diffraction, polarization, and florescence. Each spectral hue is the complement of the mixture of all the other spectral hues.

When we look at an object/surface and see, say, red- what is happening is that the object absorbs all the spectral colors besides red and reflects only the red.

There is no such thing as perfect color or pure color. Color perception, theories and use of color are all entirely subjective.

When nature/science’s pigments are combined with spectral light millions of shades are produced. Pigments (paint, ink, etc.) are always duller than light.

The experience of color is the result of the eye+brain including culture, light and the eye+“brain” makes the image: examples of engineering a vision

The two main color models are- Additive and Subtractive Color

Additive Color
Color as the direct product of light; film photography (hybrid), digital photography

Subtractive Color
color is perceived as a result of pigment , this is the family for paint pigments and there is also a sub-set of printing ink pigment within the Subtractive Color Model

Primary Colors: can not be created by mixture, and cannot be broken down into component parts

Subtractive color primaries:
for Print- Cyan, magenta, Yellow, Black (CMYK)
for Paint- Red, Yellow, Blue (RYB)

Additive color primaries:
Red, Green, Blue (RGB)
Secondary Colors: are the result of mixing 2 primaries together

Complementary Color:
Directly opposite on the color wheel, and are of extreme contrast. Red absorbs mostly green, etc. Causes vibration.

Split Complement: is a color and the two colors on either side of its complement; produces less contrast than full complements

Simultaneous Contrast:
When 2 colors come into direct contact, the contrast intensifies the difference between them.

The 3 Visual Properties of Color: HUE, SATURATION, VALUE

Hue:
Common name of a color, determined by its specific wavelength

Saturation also called Intensity or Chroma:
The depth or “colorfullness” of a color, its freedom from gray. Strengh or purity of a color. The quality of “light” in a color-brightness and dullness.
Adding a neutral gray changes intensity but not value.

Value:
Relative degree of light and dark properties of a color, achieved through adding white=tint or black=shade.

For example, when you add white to a color it becomes lighter in value but lower in intensity. The most efficient way to change intensity is by mixing its complement.

Monochrome: Containing: just one hue

Color temperature: warm/cool colors

Analogous Color:
Closely related Hues -by positon on the spectrum (& color wheel)

Gold -used to describe spiritual space, devotional, fetishistic use of gold

A SHORT HISTORY OF COLOR THEORIES
1666- Issac Newton discovers that white light going through a prism refracts into the visible spectrum.
1770- Moses Harris observes 3 "primitive" or primary colors, red, yellow and blue. This theory was finally accepted 100 years later.
1810- Johann W. Goethe, who opposed Newtons "optiks", and wrote in "The Doctrine of Colors" that there were only 6 spectral colors, and that color was primarily composed of light and dark. He also observed that yellow sunlight produced violet (its complement) shadows.
1839- M.E. Chevreul, a French chemist, develops his theory of Simultaneous Contrast, which holds that contrast intensifies the difference. Maximum color contrast achieved by placing certain colors side by side. If 2 colors are placed next to each other the difference between them appears at its greatest. But the effect is most striking with complementary colors (the color of the spectrum it bsorbs, i.e., red absorbs mostly green)
1921-1960- Johannes Itten is responsible for our understanding of the 3 "visual dimensions or properties of color”> HUE, VALUE (Tone), AND SATURATION/INTENSITY