Design Fundamentals: Notes on Color (Theory)

Written by: Rose Gonnella
Illustrated by: Max Friedman
These are my notes from Color Theory 101 class. I tried to include all the key points and exercises with my illustrations. The class website has some great information as well. www.design-fundamentals.com

This notebook is dedicated to my grandfather Mitchel Friedman.
COLOR PHYSICALLY SURROUNDS US.
OVERARCHING LEARNING OUTCOMES FOR THIS COURSE

RECOGNIZE THE PHYSICAL NATURE OF LIGHT & COLOR.

DEMONSTRATE AN UNDERSTANDING OF COLOR RELATIONSHIPS AND INTERACTION.

DESIGN AFFECTIVE ARRANGEMENTS OF COLOR (W/ EXQUISITE SUBLTILITY OR PANACHE).

RECOGNIZE COLOR DIVERSITY OF SYMBOLISM & CULTURAL CONTEXT.

COMMUNICATE MEANINGFULLY AND EXPRESSIVELY WITH COLOR.

METHODS OF LEARNING

• LISTEN, SEEK, REPORT: GUIDANCE ACCELERATES LEARNING

• ACTIVE IMPLEMENTATION: LEARN BY DOING

• SELF-INITIATED: REQUIREMENTS:
  • A PLAYFUL, WIDE OPEN MIND
  • A NOTEBOOK
  • PINTEREST (NOTES ON COLOR)

JOSEF ALBERS (1888-1976). MASTER EDUCATOR AND COLOR THEORIST AT YALE UNIVERSITY IN THE 1950s. LEO A GENERATIONAL STUDY IN THE "INTERACTION OF COLOR.

NOTES ON COLOR:

- COLOR HAS A DIVERSE HISTORY.
- COLOR ENCOMPASSES THE SCIENCES AND HUMANITIES.
- COLOR SATURATES OUR SENSES & IGNITES US EMOTIONALLY.
- COLOR CONSCIOUSLY AND SUBCONSCIOUSLY OCCUPIES OUR MINDS.
- COLOR IS A COMPLEX (PHYSICAL) ELEMENT OF DESIGN.
- COLOR IS ICONOGRAPHIC.
- COLOR COMPELS COMMERCIAL.
- COLOR IS A FULL AND EXPANSIVE VISUAL LANGUAGE.
NAME THAT COLOR

WORLD CULTURES PAST & PRESENT HAVE A RICH VOCABULARY OF COLOR NAMES THAT ARE INDICATIVE OF THEIR CUSTOMS, BELIEFS AND ENVIRONMENT. THESE NAMES ALSO PROVIDE CLUES TO HUMAN RESPONSE TO COLOR.

BASIC COLOR NAMES IN ENGLISH CORRESPOND WITH THE VISIBLE SPECTRUM ALONG WITH BLACK, WHITE, AND GRAY.

COMBINING BASIC COLORS YIELDS COMPOUND NAMES: RED-ORANGE, YELLOW-ORANGE, BLUE-GREEN, ETC.

THE BASIC LIST EXPANDS WITH COLORS IN FREQUENT USE: BROWN, PINK, MAGENTA, LILAC, ETC.

COLOR NAMES CARRY ASSOCIATIONS TO HISTORIC LANGUAGES, SOCIETIES, & EVENTS.

BLUE: FROM THE MIDDLE ENGLISH BLEW, OR BLEWE.

MAGENTA: A REFERENCE TO MAGENTA, ITALY (AND THE BLOODY BATTLE OF 1569)

BUT NAMES TRAVEL:
BRITISH RACING GREEN, CELADON GREEN - A CHINESE CERAMIC GLAZE - ARE IN USE ACROSS CULTURES.
Pigment substances also originate color names:

- **Natural Minerals of Earth:**
  - Burnt Umber (Brown)

- **Plants:**
  - Red Madder

- **Synthetic Pigments:**
  - Phthalo (cyanine) Green & Blue

The vast majority of color names come from descriptive comparison, descriptive names are often relative only to a particular environment and culture and so can get confusing: sea green, what sea?

In commerce and to persuade consumers, descriptive color names have no boundaries. Names are meant to stir emotions rather than describe a hue:

- Wuzzy Wuzzy Blue
- Tulip Pink
- Candy Apple Red

Descriptive names create emotional connections with consumers.

But a standardized naming system is needed to create order in industries involved with color.

Human eyes can detect 10 million colors but the brain cannot remember them with accuracy for more than a few seconds. Standardized systems are necessary to identify (and remember) color.

With a standardized naming system, there can be consistency across the industries of: Ink, art materials, fabrics, paint, cosmetics, medical supplies, plastics, etc.
NO SYSTEM CAN DISPLAY MILLIONS OF COLORS.

INSTEAD, A SYSTEM WORKS WITH A LIMITED RANGE OF HUES, A STANDARDIZED SUBSTRATE (PAPER, FABRIC, PLASTIC, METAL) AND A SEQUENCE FOR WHICH THE COLORS ARE DISPLAYED.

NUMBERING SYSTEMS, SUCH AS IN USE BY THE PANTONE OR TRUMATCH COMPANIES, ARE MOST COMMON.
**The Hexadecimal Numeral System Establishes Order for Identifying Screen-Based Color.** The base 16 or hex system uses combinations of numbers and letters:

0-10 + Letters A-F = 16

C25A7C designates RGB mixture percentages: R/194, G/90, B/12

A.K.A. Name = Tulip Red
(There is no hiding from descriptiveness)


Recognize the Potential Problem & Test Colors in All Platforms to Establish Consistency. Don’t Fall in Love With a Very Specific Hue Thinking It’s Perfect; Your Uncle in Italy May See It Differently...

I Love Hue!

NOTE:
COLOR PROPERTIES!

Naming and systemizing color continues with the recognition and use of the 3 Dimensions of Color Perception, A.K.A. Color Properties.

These properties vary in name but are generally agreed upon in definition.

1. Hue (H)
   Chromatic Color: the pure color (proper name) without tint or shade or tone.
   E.g. Red, Green, Blue

2. Saturation (S)
   Or intensity: level of clarity, depth, or richness of color.
   Additional names for this property: brilliance, chroma, tone.
   E.g. Bright Blue, Dull Blue, Deep Blue

3. Brightness (B)
   Value or luminance: level of bright/lightness (tint) or level of darkness (shade).
   E.g. Dark Blue, Light Blue.
   Monochromatic: one hue with a range of values.

Hue: 5 PB

Chart VIII
HOMAGE TO MATISSE

HARMONY RED

HIGHLY SATURATED
SPECIAL PROPERTIES OF COLOR

ACHROMATIC or NEUTRAL: W/o HUE.
- BLACK, WHITE, & GRAY ARE COLORS BUT NOT HUES
- BROWN TOO

PASTELS: HUES BOTH LIGHT AND BRIGHT

FLUORESCENT: ULTRA BRIGHT

IRIDESCENT: HUES RELATIVE TO THE ANGLE OF THE ILLUMINATION — LIKE SAP BUBBLES.

METALLIC: SHINY DUE TO ACTUAL OR SIMULATED METAL ARTICLES

TRANSlucent: SEMI-TRANSPARENT

FLUORESCENT PIGMENT ON THE MOVE

AFTER PAUL KLEE “CANTERA OSTERMUNDINGEN” (1879 - 1940)
Color and Temperature

- Color temperature refers to a purely visual sensation that does not relate to applied heat.

- Temperature is a property of color and helps to identify and describe it.

And, color temperature is not fixed. A single hue will fluctuate in temperature relative to the colors that are adjacent to it. Yellow will look warmer when surrounded by orange or red, but will look less warm when placed with greens & blues.

Ready to mix it up or pick it out? (Of the chaos)

Recognition of color properties leads to a facility for mixing colors on screen or with subtractive color media. Systems are necessary for selecting colors with consistency across a variety of industries or simply for selecting paint colors for a home.
4. SUMMARY & LEARNING OUTCOMES

We understand our world through comparison and connection. The describing and naming of color relates to their historic use, pigment sources, cultures, and environments.

Colorful names also drive much of our economy by creating emotional connections to the consumer. To establish order out of the chaos of descriptive names, color systems identify and classify for universal use.

Buttered toast anyone?

+ Differentiate and organize names of color relative to culture and environments.
+ Classify and exemplify color identity systems.
+ Identify and demonstrate color properties.
+ Create and design with color properties in mind.

EXERCISES & PROJECTS

I. NAME THAT COLOR

GROUP ACTIVITY

A. COLOR NAME SURVEY: Design a survey to chart responses to color naming.

SUPPLIES: Use paint swatches, color aid paper, or other printed matter as samples for use in the survey. Also needed is a laptop with graphics software and color printer and compatible paper.

COMPOSE AND SHARE RESULTS

Form teams of two or three members.

- Determine demographic of the group to be surveyed.
- Create two control groups to compare on the basis of gender, age, and ethnicity.
- Write and format a survey that asks basic color naming questions.
  - Name the color.
  - What associations do you have with this color?
  - Do you like it? (the color sample)
  - Name your favorite color.
- Gather or make color swatches.
- Implement survey; record results.
- Design a chart that visually displays (infographic) results. Print.
- Share and analyze results in a full group critique.

2. ILLUSTRATING COLOR PROPERTIES

GROUP ACTIVITY

A. MUNSELL HUE, VALUE, AND CHROMA CHARTS:
Create a Munsell 3D color wheel (see model on "Notes on Color" Pinterest board).

SUPPLIES: Acrylic paint and related supplies. Or, computer graphics software, color printer and compatible paper. Additional construction materials needed to make the color wheel such as wooden or metal dowels and rigid sheets of clear acrylic.

COMPOSE AND SHARE RESULTS

- Full-class team project.
- Determine distribution of assignments.
- Create color charts — each a single hue with saturation and value scale.
- Construct the 3D wheel.
- Critique success throughout the project.

INDIVIDUAL ACTIVITY

A. EXPRESSIVE PROPERTIES: With a focus on one of the color properties or a group (hue, value, achromatic, etc.), create an image that illustrates the visual dimension and range of the selected property. The image can be a self-portrait or an image of a single object such as an apple, bird, toaster, car, etc.

SUPPLIES: Use of subtractive media (paint) is encouraged. However additive media (light) is acceptable.

COMPOSE AND SHARE RESULTS

- Select a property of color to explore such as value, saturation, or hue, or select a group dimension such as achromatic, monochromatic, or warm or cool temperature.
- Create the image using only one property of color but exploring its full range.
- Critique results with a group.
## INDEX

This index contains key information to help navigate the book for a comprehensive index and additional resources, go to www.design-fundamentals.com

| A | addictive colors, 64–65
|   | Adobe® Kuler software, 126, 136
|   | afterimages, 37–38
|   | Alber’s (Josef) squares, 169
|   | afterimages, 37–38
|   | simultaneous contrast, 162–165
|   | luminosity, 161
|   | optical illusions, 154–156
|   | physiologic reactions, 22–23
|   | responses, 22–23
|   | body/mind connections, 44
|   | interactions providing sight, 3
|   |Chevreul’s Contrasts, 162–165
|   | color interaction, 152–153
|   | Alber’s (Josef) squares, 169
|   | Bezold’s effects, 166–168
|   | brain
|   | body/mind connections, 44
|   | interactions providing sight, 3
|   |Chevreul’s Contrasts, 162–165
|   | color composition
|   | color properties, 177
|   | contrasting colors, 176–179
|   | equilibrium and balance, 180–187
|   | focal points and hierarchy, 176, 178
|   | principles, 174–175
|   | repetition of color, 181–183
|   | rhythm of placement, 178–180
|   | visual unity, 180–181, 187
|   | weights, 184–186
|   | color identity systems, 93–95
|   | hexadecimal numeral system, 96
|   | trademarking colors, 97
|   | coloring agents, 68–69
|   | color interactions, 152–153
|   | Alber’s (Josef) squares, 169
|   | Bezold’s effects, 166–168
|   | Chevreul’s Contrasts, 162–165
|   | optical illusions, 154–156
|   | luminosity, 161
|   | simultaneous contrast, 162–165
|   | overprinting and transparencies, 158–159
|   | physical interactions, 154
|   | spatial effects, 157
|   | pulsing colors, 160
|   | color names and classifications
|   | compound names, 91
|   | sources, 91–92
|   | variety, 88–90
|   | color palettes, 133. See also color wheels/circles
|   | color selection, 135–139
|   | existing palettes, 141
|   | color properties
|   | brightness, 99
|   | color composition, 177
|   | color selection criteria, 136
|   | fluorescent, 103
|   | hues
|   | hue cancellation, 39
|   | relationships, types of, 122–123
|   | saturation/value/temperature, 99–101, 126, 177
|   | simultaneous contrast, 162–165
|   | iridescent, 103
|   | metallic, 103
|   | pastel, 103
|   | translucent, 103
|   | Color Scheme Designer, 126
|   | color schemes and harmony, 120–121
|   | best practices, 123
|   | and design, 124–125, 143
|   | hues
|   | relationships, types of, 122–123
|   | saturations and value variances, 126
|   | neutrals, 143
|   | primary/secondary relationships, 64–65, 143–147, 155, 181
|   | red, black, and white, 144–147
|   | color selection
|   | based on properties or color wheel relationships, 135–139
|   | importance of, 133
|   | for natural or symbolic reasons, 134, 193
|   | objective or expressive colors, 134
|   | color temperature, 78–79, 104–105, 177
|   | color palettes, 110–113, See also color palettes
|   | color selection, 135–136
|   | history of, 114–119
|   | hues
|   | full saturation, 121
|   | relationships, types of, 122–123
|   | saturations and value variances, 126
|   | complementary colors, 122–123
|   | contrasting colors, 176–179
|   | Chevreul’s Contrasts, 162–165
|   | simultaneous contrast, 162–165
|   | cornea, 34–35
|   | cultural and emotional connection to color, 190–192
|   | color symbolism
|   | ancient, 193
|   | contemporary, 194
|   | emotional expressions, 198–199
|   | variations across cultures, 195–197
|   | interpretation by creators and audiences, 200–201
|   | diad hues, 122
|   | diffraction of light, 17
|   | dispersion of light
|   | prisms, 13
|   | electromagnetic spectrum, 11
|   | radiation, 8
|   | visible light, 26
|   | electromagnetism, 8
|   | equilibrium and balance, 180–187
|   | eyes. See human eyes/vision
|   | fluorescent lamps, 76
|   | focal points and hierarchy, 176, 178
|   | hexidecimal colors
|   | color identity systems, 96
|   | digital color pickers, 126
|   | high intensity discharge (HID) lamps, 77
|   | color temperature, 78–79, 104–105, 177
|   | digital color pickers, 126
|   | high intensity discharge (HID) lamps, 77
|   | lighting design, 74–78
|   | manufactured, 74–78
|   | sunlight, 74–75
|   | spectral power distribution (SPD) curves, 75
|   | through prismesspearingintocolororhues, 12–13
|   | visible spectrum of, 11–13
|   | waves, behaviors of, 17
|   | light-emitting diodes (LED), 77
|   | liquid crystal display (LCD), 63
|   | manufactured, 74–78
|   | metamerism, 78–81
|   | monochromatic colors, 99
|   | muted colors, 36
|   | OLED (organic light-emitting diodes), 63, 77
|   | opponent-process phenomenon, 39
|   | overprinting and transparencies, 158–159
|   | luminosity, 161
|   | simultaneous contrast, 162–165
|   | overprinting and transparencies, 158–159
|   | physical interactions, 154
Peripatetic School, founded by Aristotle, 111

CMY colors, 73
paints, dyes, inks, and toners, 68–69
RGB colors, 72
sources of color names and classifications, 91–92
polarizing light, 17
primary colors. See RGB colors
prisms/prismatic colors, 12

reflection
of colors
versus illuminated colors, 31, 57
wavelength factor, 67
of light
colors and human eyes, 26–29
wave behavior, 17, 26, 28–29

refraction of light
prisms, 13
wave behavior, 17
RGB colors, 58, 61
additive colors, 64–65
color composition, 181
cone sensitivity, 61
digital color pickers, 126
primary colors, 59
screen-based systems, 63, 66
secondary colors, 64–65, 155, 181
rhythm of color placement, 178–180
ROYGBIV (colors)
color blindness test, 42
light through prisms, 12
perceptions of and emotions about, 46–51
wavelengths in visible light spectrum, 26
RYB colors
digital color pickers, 126
primary pigments, 72–73

saturation colors, 36
scattering of light, 17
screen-based systems
color calibration, 66
color identity systems, 96–97
illuminated colors, 31, 57
millions of colors, 31, 63
RGB colors, 63, 66
secondary colors, 64–65, 155, 181
self-illuminated colors, 31, 58
spectral power distribution (SPD) curves, 75
subtractive colors, 67
layering techniques, 156
transparencies, 158
synesthesia, 51

tertiary colors, 123
tetrad hues, 122
translucent inks, 73
transparencies and overprinting, 158–159
triad (1 and 2) hues, 122
trichromatic theory, 36

visible light spectrum
definition of, 11, 13
discovery of, 10, 12
and wavelengths
perception of yellow, 62
ROYGBIV (colors), 10–11, 14–15, 26
visual clarity and acuity
body/mind connection, 44
color deficiencies
artists/designers, importance to, 43
critical issue for seniors, 43
detection of gray, 42
levels of, 41
factors determining, 40
visual cortex, 44
vitreous humor, 34–35

watercolors, 156
wavelength and frequency ranges
atomic structure of objects, 28
cone sensitivity, 36, 61
definitions of, 11
direct wavelengths, 31
interactions with objects, 13, 16–17
measured in nanometers (nm), 9
producing seven colors, 12–15
reflected color, 26–29, 56–57
visible light spectrum, 11–13, 26
waves
behaviors of, 12, 16–17
relationship between light/color and
art/design, 19
definition of, 9