

Dennis M. Puhalla PhD
Professor of Design

Demystifying Color Selection Process[©]

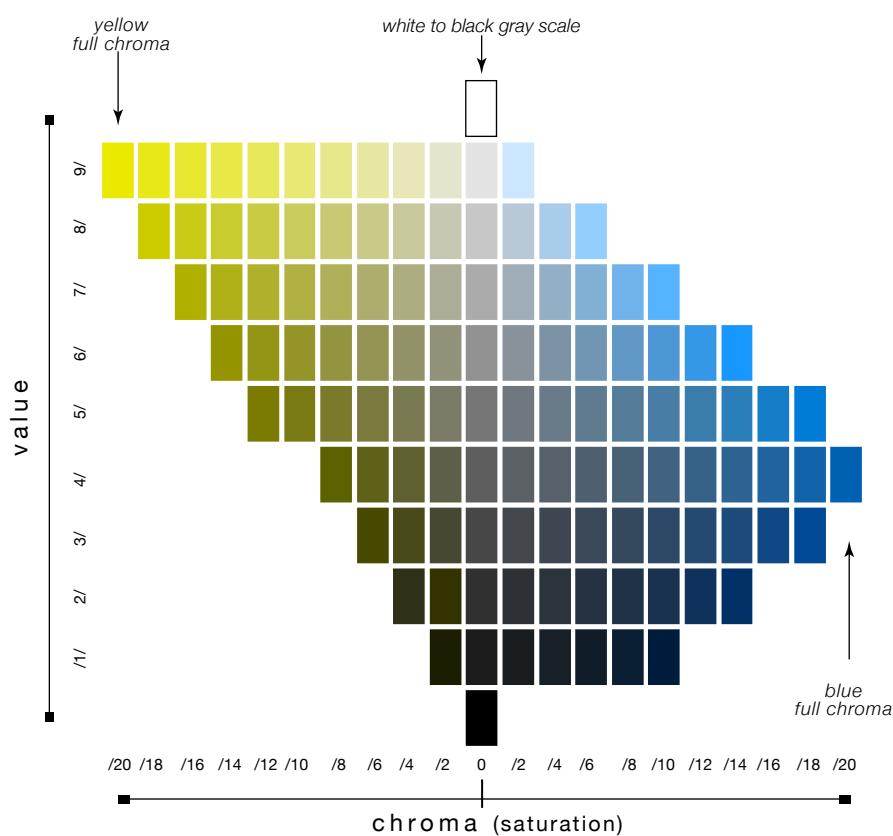
Color Structure and Organization

Table 2.2: Color Theory: Chronology of Organizational Systems (condensed).

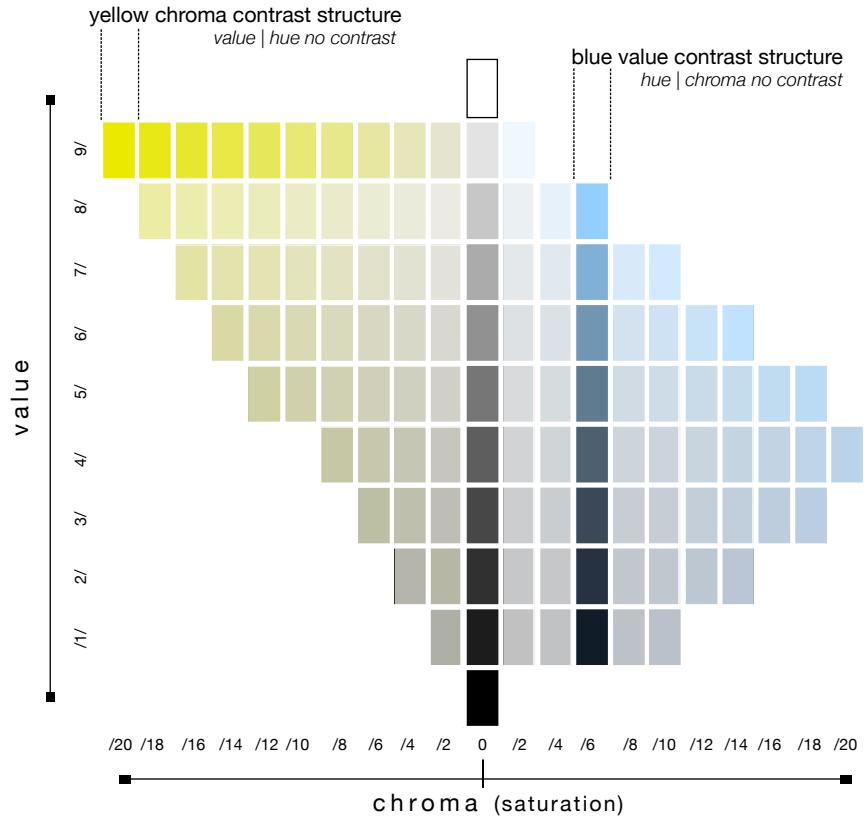
COLOR THEORY CHRONOLOGY

1672	Isaac Newton (1642-1726) Scientist	England	Published: "A new theory of light and colours"
1772	J. Heinrich Lambert (1728-1777) Astronomer	Germany	Three-dimensional color-system.
1772	Ignaz Schiffermüller (1727-1806)	Austria	Color-circle: red, blue, green and yellow
1775	Tobias Mayer (1723-1762) Mathematician / Astronomer	Germany	Color triangle Color theory by math
1809	Philipp Otto Runge (1777-1810) Painter	Germany	Color wheel primary colors: red, yellow, and blue plus black for shades.
1809	James Sowerby (1757 - 1822) Author: botany and natural history	England	Published: <i>A New Elucidation of Colours, Original Prismatic and Material</i>
1810	Johann Wolfgang Goethe (1749-1832) Scientist	Germany	Color wheel: double intersecting triangle. Published 1400-page treatise on color theory.
1839	Michel Eugène Chevreul (1786-1889) Chemist	France	Twelve-step color wheel
1859	James Clerck Maxwell (1831-1879) Physicist	England	Published: "Theory of Colour Vision", seen as the origin of colorimetry. (quantitative color measurement).
1868	William Benson Architect	England	Cuboid system
1874	Wilhelm von Bezold (1837-1907) Physicist	Germany	Color-cone: red, green and blue.
1874	Wilhelm Wundt (1832-1920) Psychologist / Philosopher	Germany	Color-sphere of eight basic colors: white and black placed at the poles, the equator comprises eight colors-green, green-blue, blue, violet, purple, red, yellow and yellow-green which form a circle with grey at its center.
1878	Ewald Hering (1834-1918) Physiologist	Austria	Three opposing sets of colors theory: yellow and blue, red and green, and black / white.
1879	Nicholas Odgen Rood (1831-1902) Physicist	USA	Scientific color-circle: double cone color model – white on top, black at the bottom, red, green and blue formed the triad.
1905	Albert Henry Munsell (1858-1918) Painter	USA	A numerical system – eight colors with white and gray.
1915	Albert Henry Munsell (1858-1918) Painter	USA	Published: <i>The Color Atlas</i> – organization of numbered hues within a color sphere in hue, value and chroma categories.
1916	Wilhelm Ostwald (1853-1932) Nobel-prize winner for chemistry	Germany	<i>The Colour Primer</i> : color circle composed of two cones that met at the flat circumferences of the top circles.
1921	Johannes Itten (1888-1967) Painter	Switzerland	Color circle is based on 12 paint colors; the primary colors Red-Yellow-Blue.
1942	Richard Sewall Hunter (1909-1991) An American instrument maker	USA	Created the widely used <i>delta E</i> for color differences.
1982	Harald Küppers (1928 - ...) Reproduction Technology Engineer	Germany	Published first US edition: <i>Basic Law of Color Theory</i> .

Munsell Color Notation System



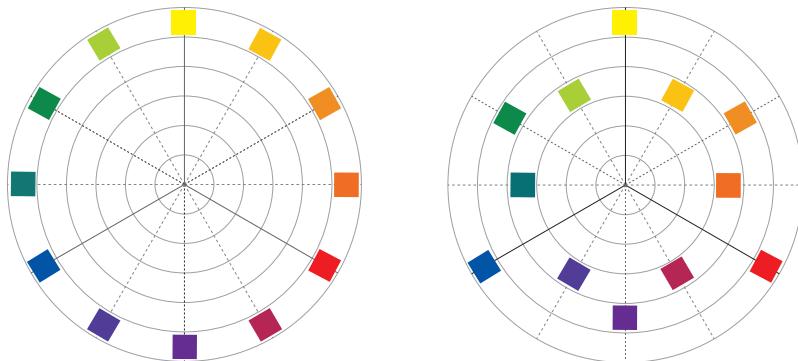
Munsell Color Notation System
color contrast relationships



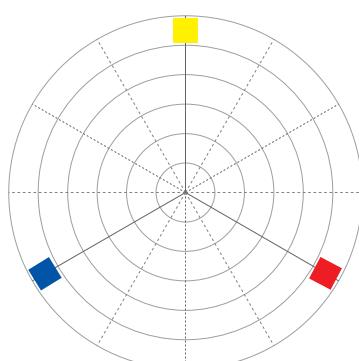
Color Organization Principles[®]

Color Harmony Structures[®]

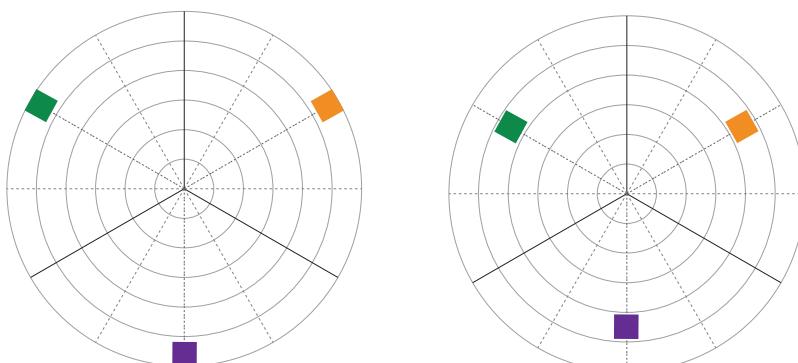
12 Step Color Wheel Hue Sequence



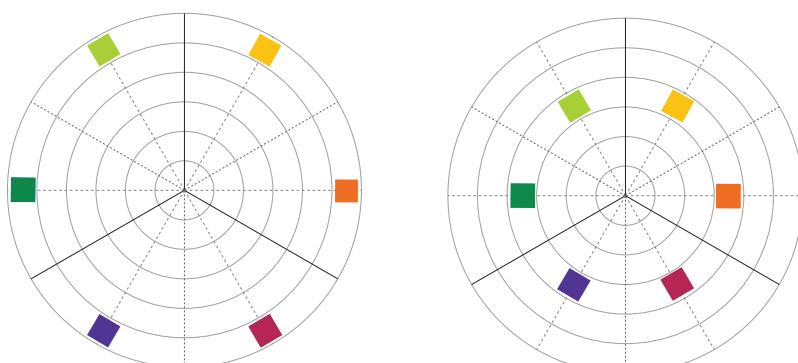
12 hues single layer
primary/secondary/tertiary layers



primary hues single layer
primary hues layer 1

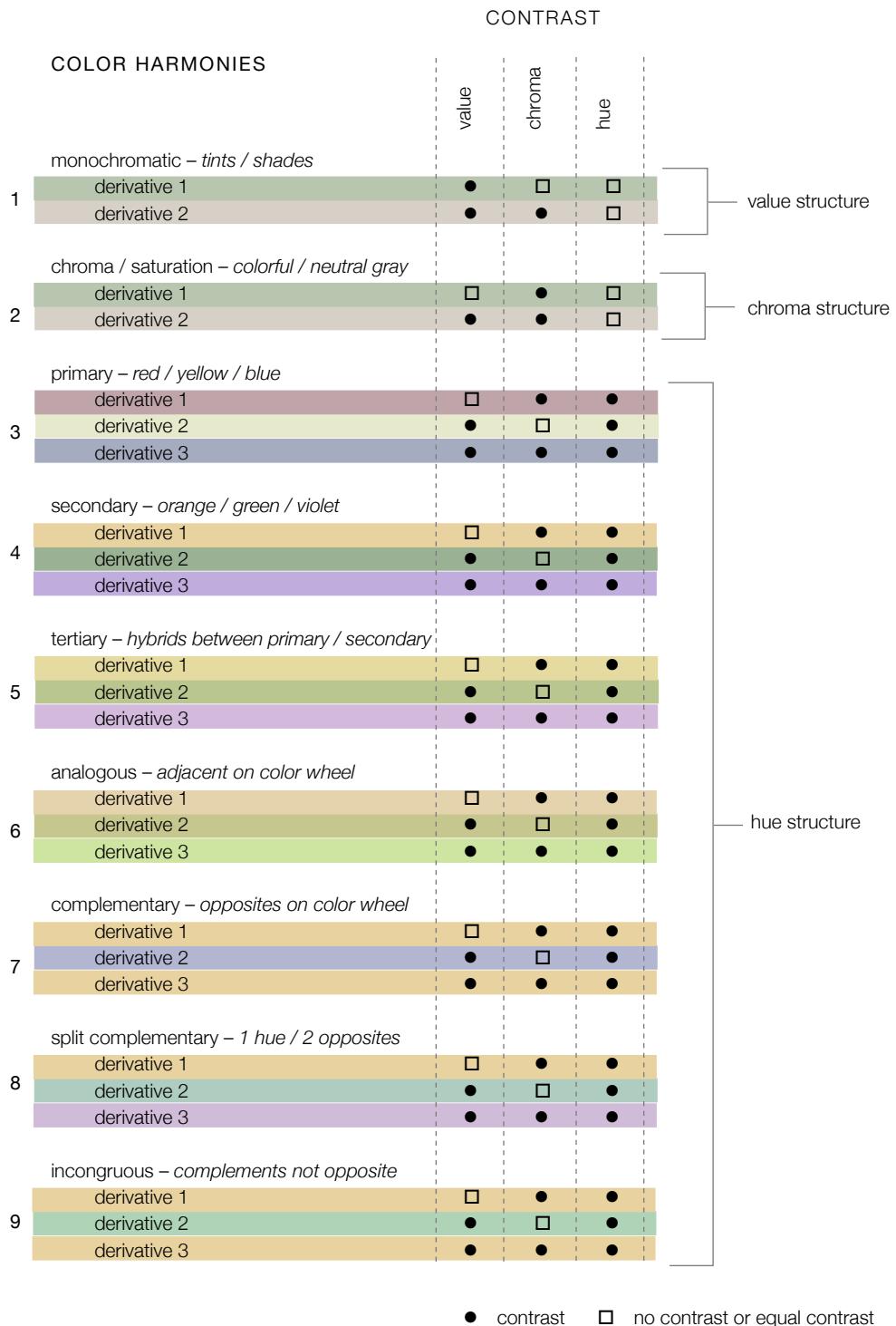


secondary hues single layer
secondary hues layer 2



tertiary hues single layer
tertiary hues layer 3

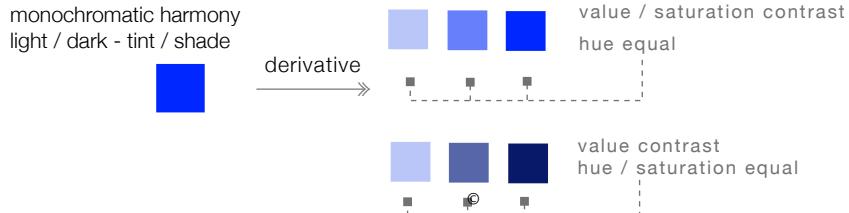
Color Harmony Structures ©



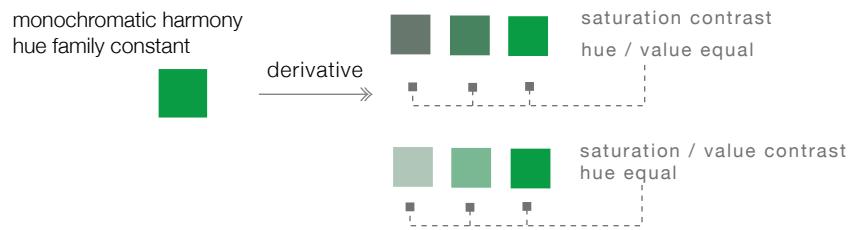
Color Organization Principles[©]

Color Harmony Structures[©]

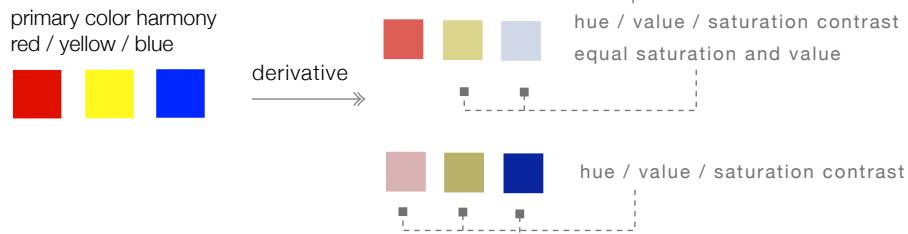
VALUE CONTRAST



CHROMA CONTRAST



HUE CONTRAST

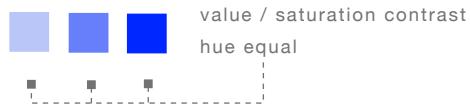


VALUE CONTRAST

monochromatic harmony
light / dark - tint / shade



derivative →

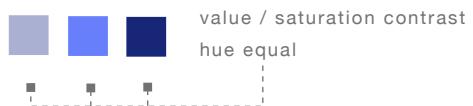


CHROMA CONTRAST

monochromatic harmony
tonal derivatives

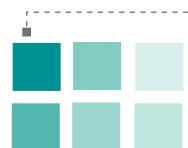


derivative →



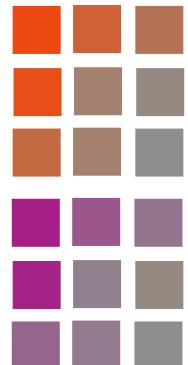
Color Harmony Structures ©

1 monochromatic color harmony (tints/shades)

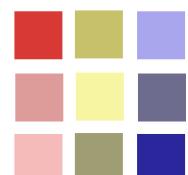


value/chroma contrast

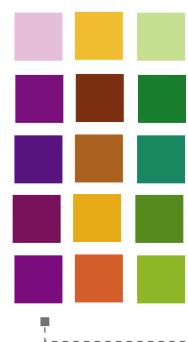
2 chroma/saturation (colorful/neutral gray)



3 primary color harmony

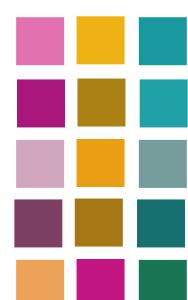


4 secondary color harmony



chroma contrast (series towards yellow side)

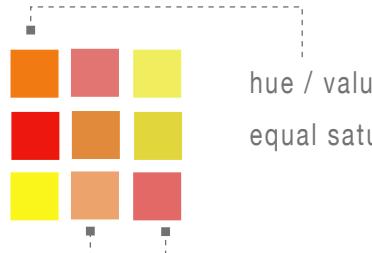
5 tertiary color harmony



Color Harmony Structures ©

6 analogous color harmony

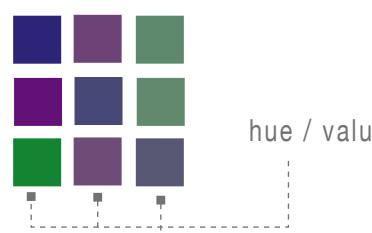
red/orange/yellow



hue / value saturation contrast

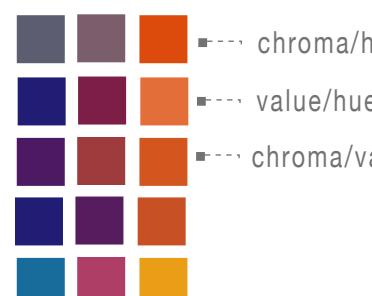
equal saturation and value

blue/violet/green



hue / value / saturation contrast

7 complementary color harmony

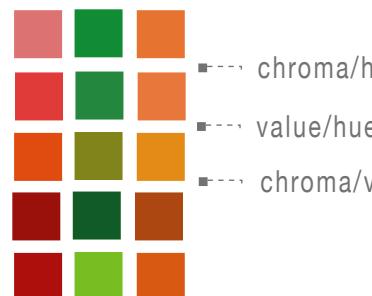


chroma/hue contrast

value/hue contrast

chroma/value/hue contrast

8 split complementary color harmony

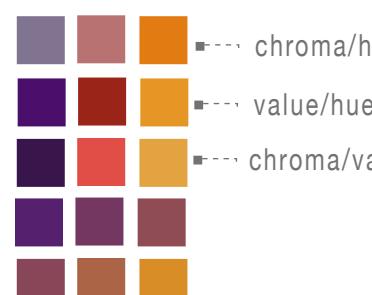


chroma/hue contrast

value/hue contrast

chroma/value/hue contrast (towards yellow)

9 incongruous color harmony

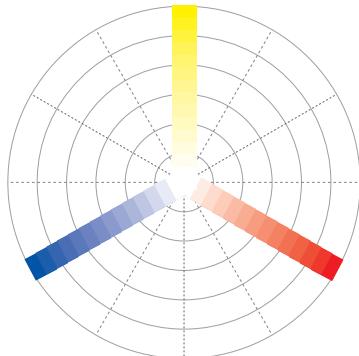


chroma/hue contrast

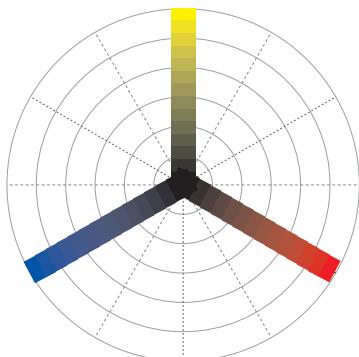
value/hue contrast

chroma/value/hue contrast (towards yellow)

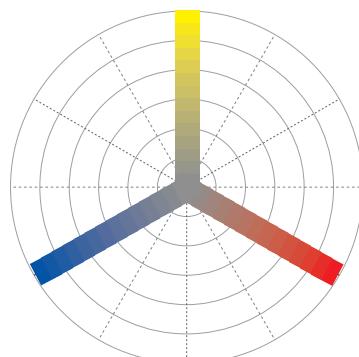
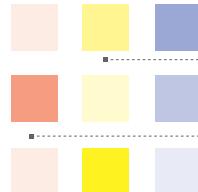
Color Harmony Structures ©



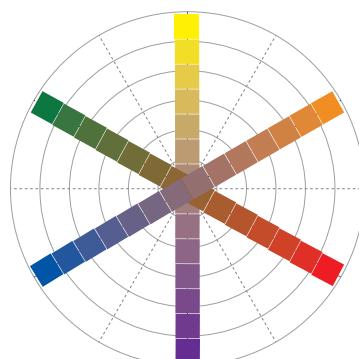
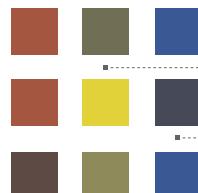
primary hue harmony



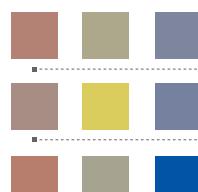
tints with white



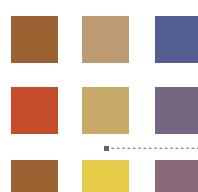
shades with black



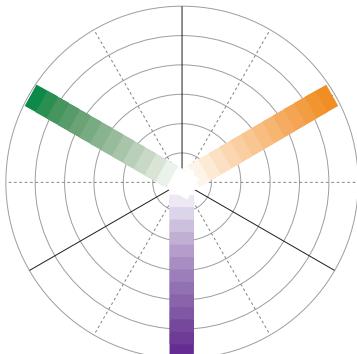
tones with gray



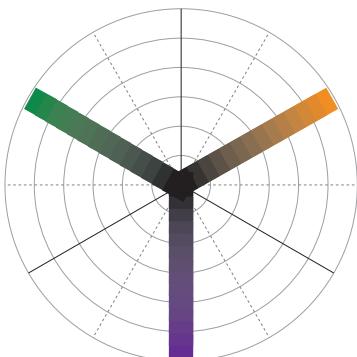
tones with complements



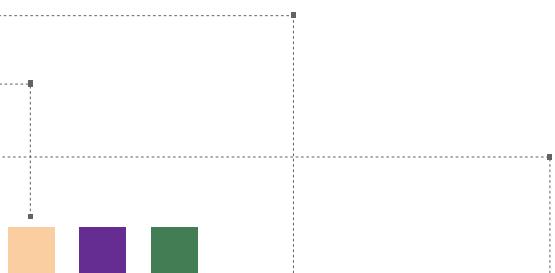
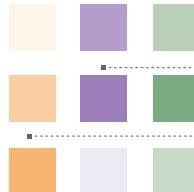
Color Harmony Structures ©



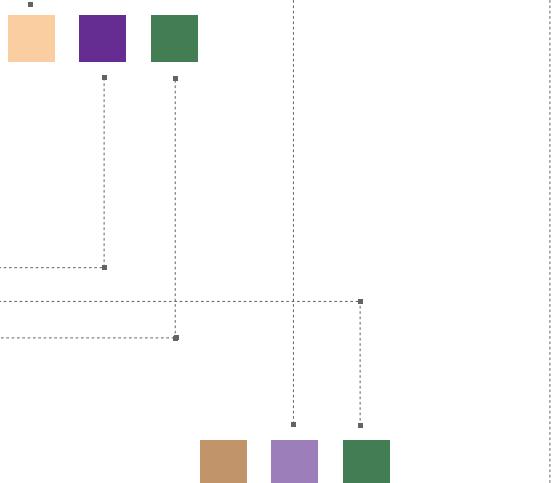
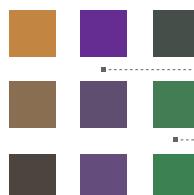
secondary hue harmony



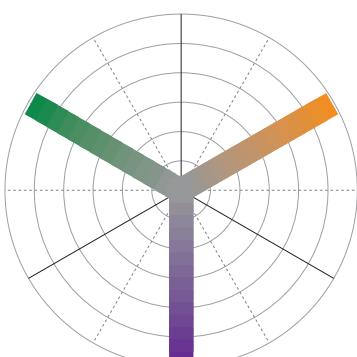
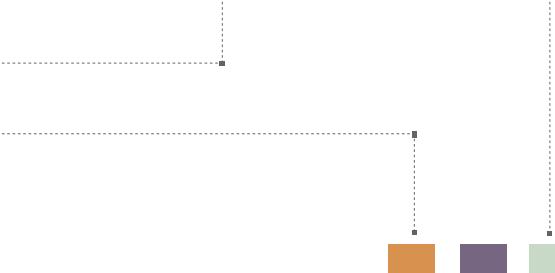
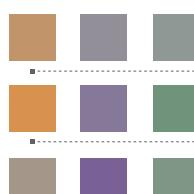
tints with white



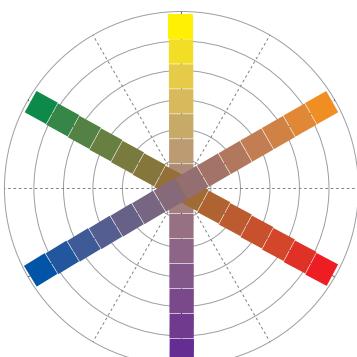
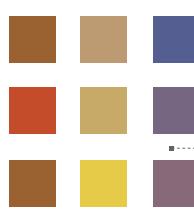
shades with black



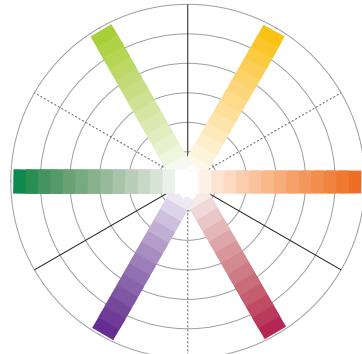
tones with gray



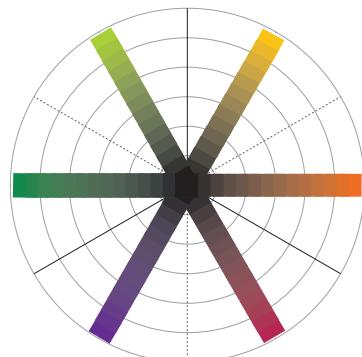
tones with complements



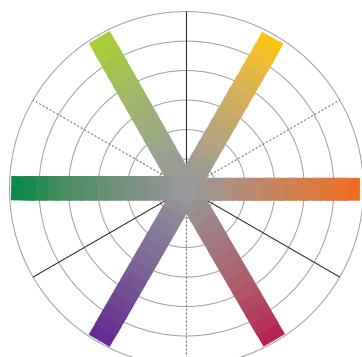
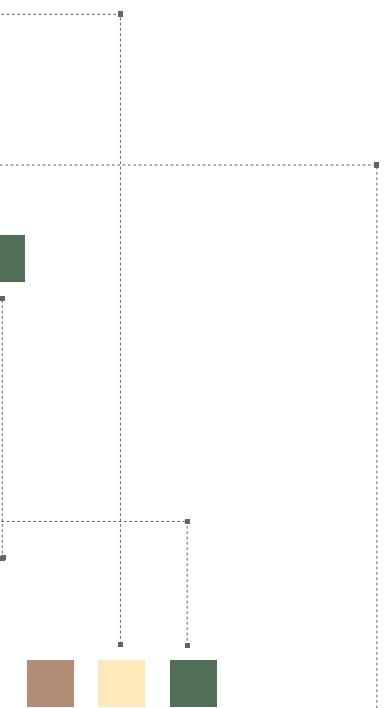
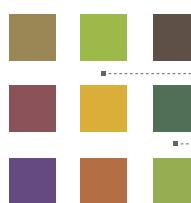
Color Harmony Structures ©



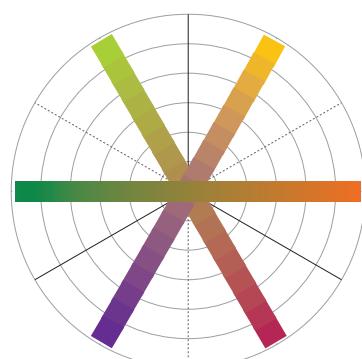
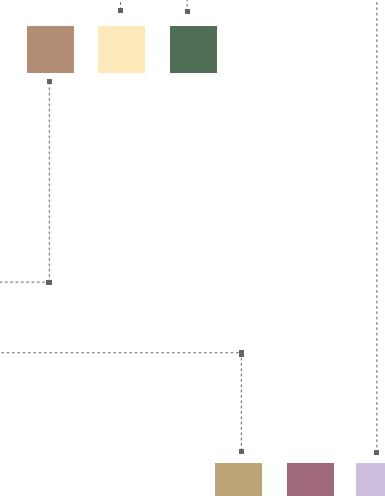
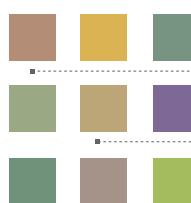
tertiary hue harmony



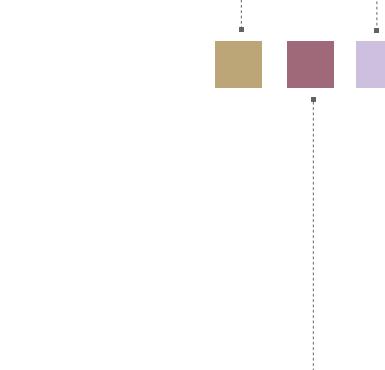
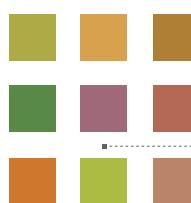
shades with black



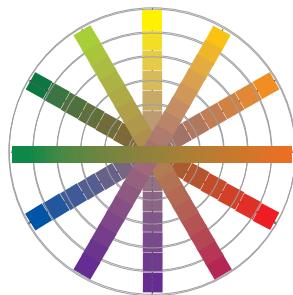
tones with gray



tones with complements



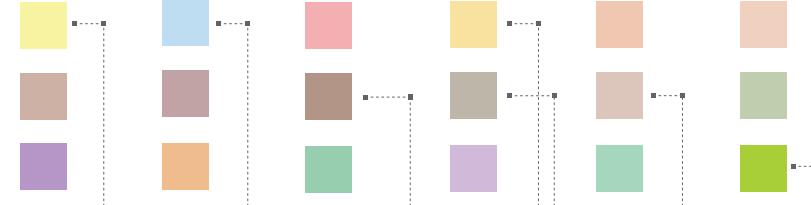
Color Harmony Structures ©



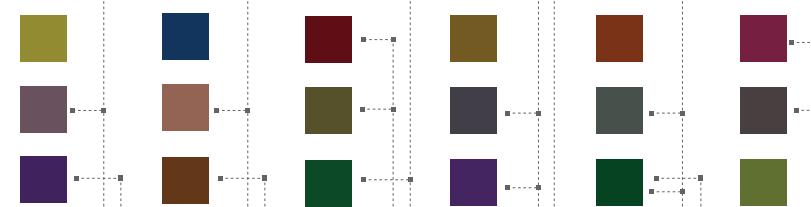
complementary hues harmony



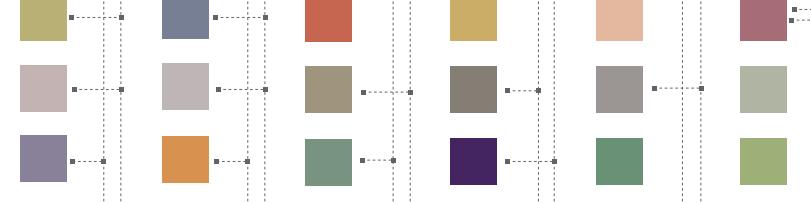
tints with white



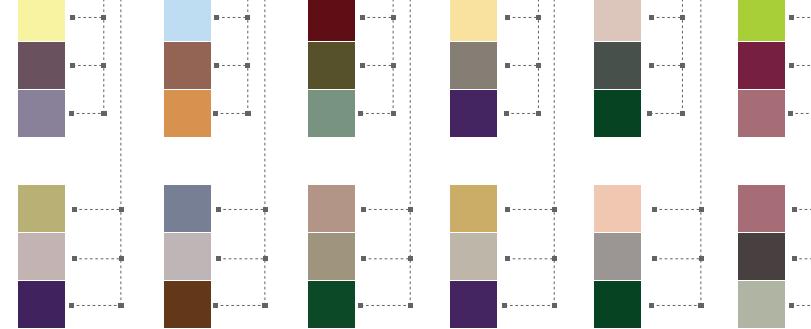
shades with black



tones with gray

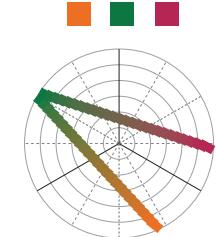
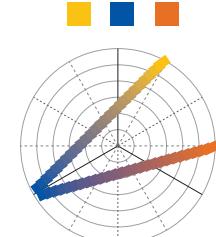
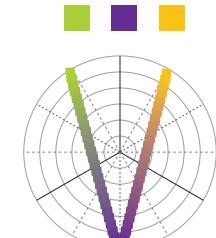
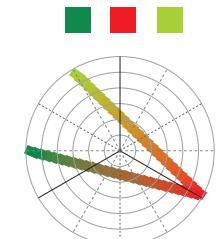
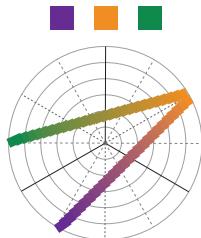


derivatives

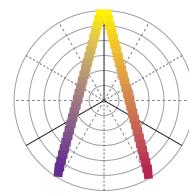


Color Harmony Structures ©

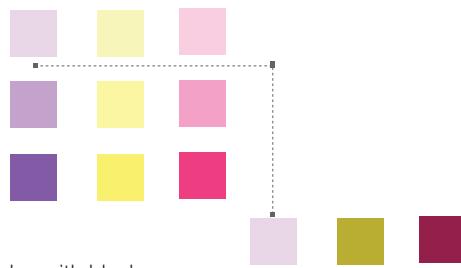
primary and secondary
split complements



split complementary yellow harmony



tints with white



shades with black

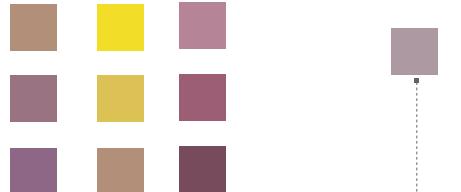


tones with gray

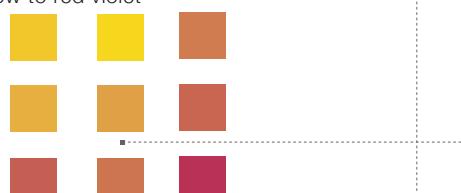


tones with complements

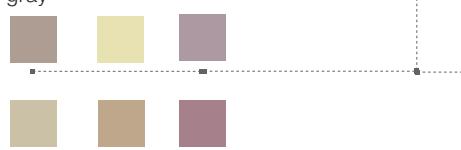
yellow to blue violet



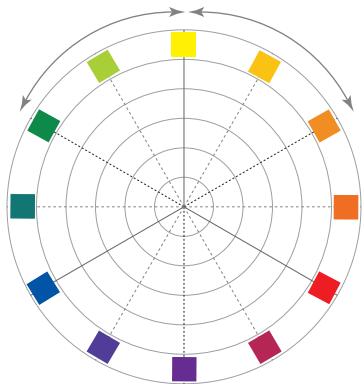
yellow to red violet



yellow to blue violet and red violet
with gray



Color Harmony Structures ©



alalogous hue harmony
yellow to orange



tints with white



shades with black



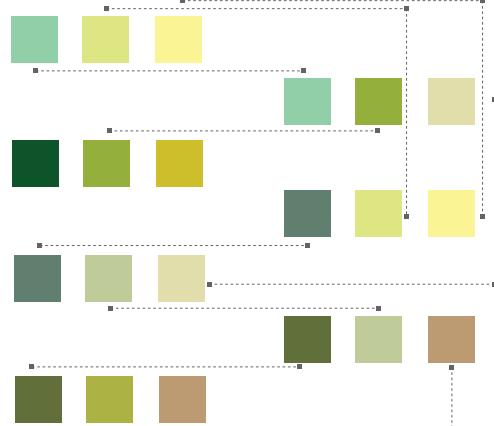
tones with gray



tones with complements



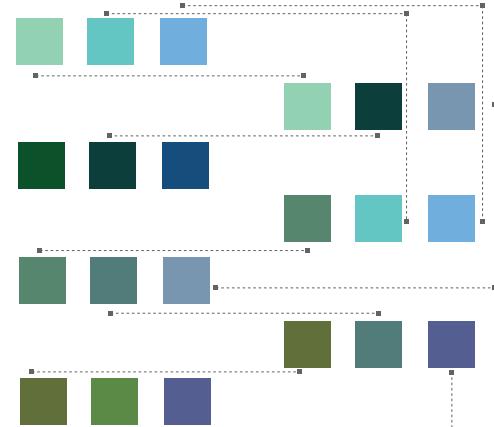
green to yellow



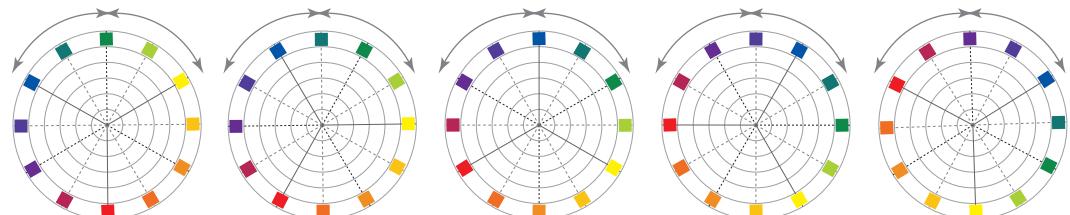
red orange to red violet



green to blue



alalogous hue harmony rotation



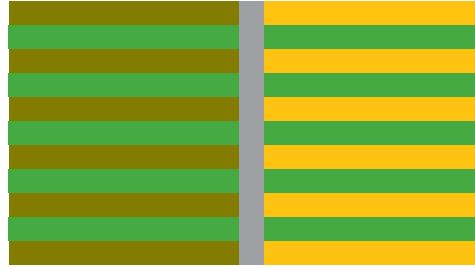
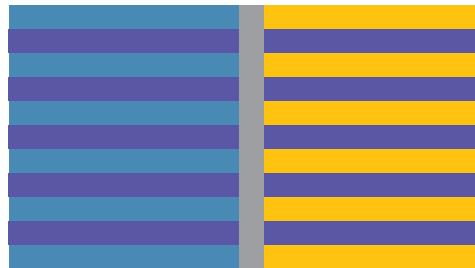
Color | | Interaction



Color Interaction

The Bezold Effect is an optical illusion, named after a German professor of meteorology, Wilhelm von Bezold (1837-1907). Bezold discovered that colors appear different depending on the relation to adjacent colors.

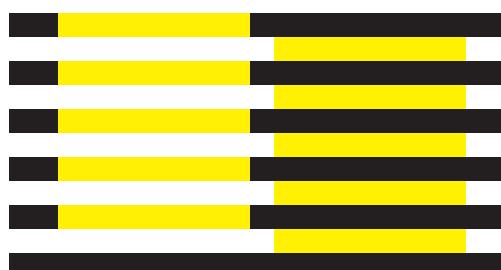
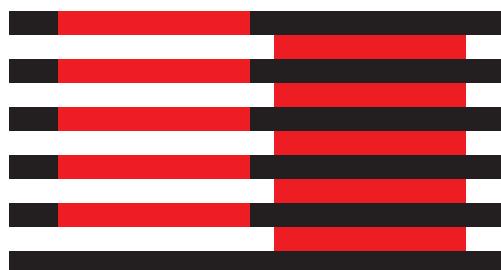
Albers, J. *INTERACTION OF COLOR*



White's illusion is an optical illusion illustrating the fact that the same target luminance can elicit different perceptions of brightness in different contexts.

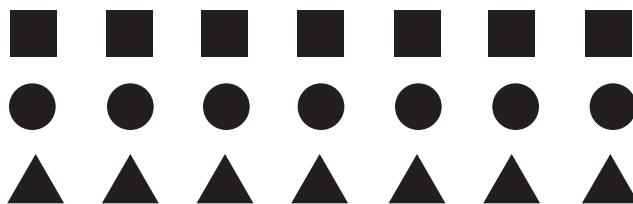
Television screens depend on this visual illusion. Pixels that are not illuminated are seen as black, when they are really the same dim gray seen when the television is turned off.

Brightness

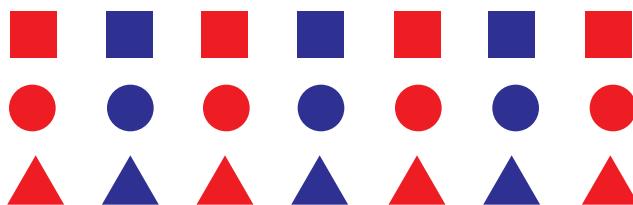


Similar shapes link together and group. Horizontal directional movement occurs.

Grouping



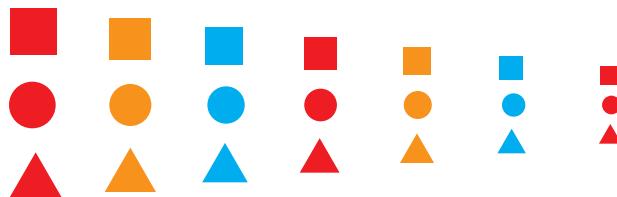
Dissimilar shapes link as color link and group. Vertical directional movement occurs.



Dissimilar shapes link as color link and group. Angular directional movement occurs.



Dissimilar shapes link as size color link and groups. Vertical directional movement occurs.



Dissimilar shapes link as size and color link and groups. Angular directional movement occurs.

