APPENDIX A

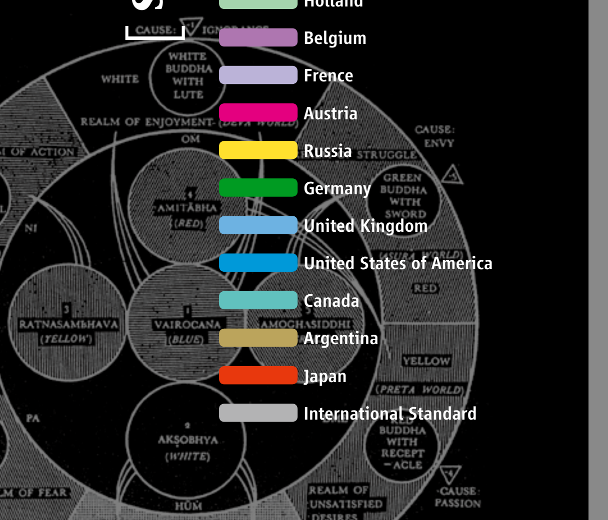
[History of Color Systems]

A feature in this chapter covering color circles omits a large number of other important color system diagrams, since the selection of illustrations focused on diagrams. We therefore arranged the color system diagrams in chronological order.

Studying color systems reveals a wide range of forms devised during the past 3,000 years, with bridge support styles, cones, pyramids, triangular columns, cubes, spheres, hemispheres, and petal shapes, in addition to circles, pointing to the fertile ground of human imagination.

* The diagrams included here are representative, not exhaustive. For further information, please refer to more specialized books or documents.

- 🟩 Greece
- 🟧 Sweden
- 🟩 Holland
- 🟪 Belgium
- 🟪 Frence
- 🟥 Austria
- 🟨 Russia
- 🟩 Germany
- 🟦 United Kingdom
- 🟦 United States of America
- 🟦 Canada
- 🟫 Argentina
- 🟥 Japan
- ⬜ International Standard



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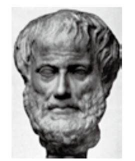
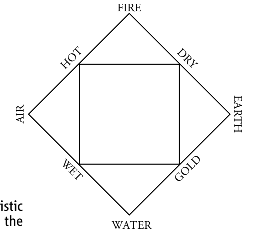
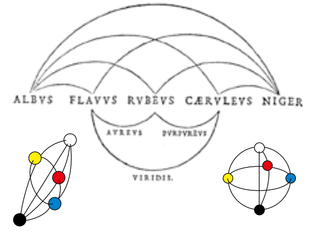



Aristotle
Four-element, four-characteristic diagram created by Aristotle, the polymath of Ancient Greece.

1611

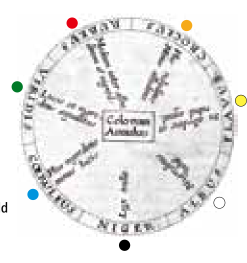

Forsius
Color solid devised by the Swedish mathematician Forsius. This is the world's first color solid. The color names are written by hand, with the center axis representing achromatic colors.

1613



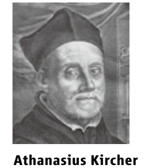
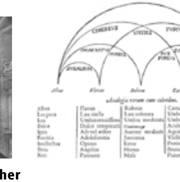
Aguilonius
Light theory scientist Aguilonius devised a color diagram based on Aristotle's theory, also incorporating ideas borrowed from Pythagorean musical scale relationships. Phase-transforming this diagram suggests a six-color color solid.

1629

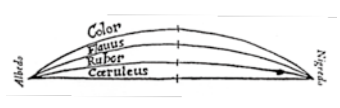
Robert Fludd
British physician and mystic Fludd devised a seven-color (red, orange, yellow, white, black, blue, green) color wheel.

1646

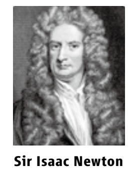
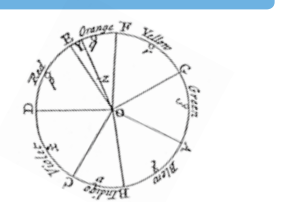
Athanasius Kircher
Learned illusion scientist Kircher explained the diversity of color by expanding on Aguilonius's diagram, which was itself based on Aristotle's

1650

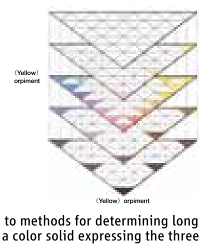
Francis Glisson
Color scale devised by the British physicist Francis Glisson. Blue, red, and yellow are located between black and white extremes, with the horizontal line forming the grayscale.

1704

Sir Isaac Newton
Newton's color circle with the seven colors of the spectrum appearing around the circumference, demonstrating how mixing the seven colors of light creates white (in the center of the circle) and drawing an explicit parallel to the seven tones of the musical scale.

1745

Tobias Mayer
In addition to contributing to methods for determining longitude, the astronomer Mayer devised a color solid expressing the three primary colors, using pigment names and combining dark and light tones.

1766


Moses Harris
In his work *Natural Color System*, entomologist and engraver Harris devised two different color circles using red, yellow, and blue *(prismatic color circle)* and orange, green, and purple *(compound color circle)*.

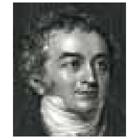
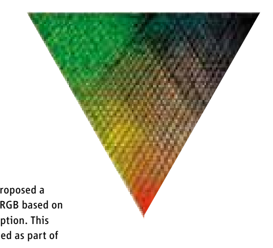
1772


Johann Heinrich Lambert
German physicist and mathematician Johann Heinrich Lambert is renowned for his Lambert projection for mapping. This pyramid-shaped color sample is said to have been created to allow textile craftsmen to check textile stocks.

1772

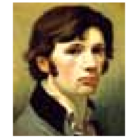
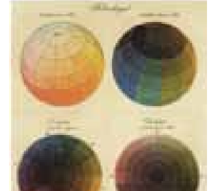
Ignaz Schiffermüller
Austrian entomologist Schiffermüller created what was probably the world's first color circle to use continuous gradations. The four primary colors red, blue, green, and yellow are indicated around the circumference of the color circle, together with secondary colors, for a total of 12 colors.
The diagram includes allegories with rainbow themes at each of the four corners, suggesting Schiffermüller confused mixtures of light and mixtures of pigment colors.

1809

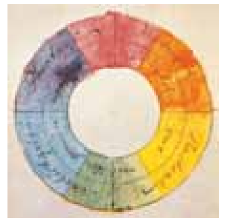
Thomas Young
The able British physician Young proposed a theory of the three primary colors RGB based on his research on the nature of perception. This diagram is a color diagram published as part of his lecture materials.

1810

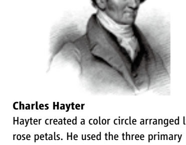
Otto Philipp Runge
Runge, an artist, corresponded with Goethe about color. He assigned the three primary colors of yellow (The Holy Ghost), red (The Son), and blue (The Father) to the Holy Trinity. His color sphere was later praised and adopted by the Bauhaus.

1810

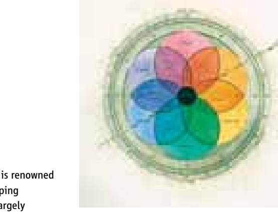
Johann Wolfgang von Goethe
The color circle devised by Goethe used the six colors of crimson, orange, yellow, green, blue, and violet, minus the indigo forced into the system by Newton. This was the first diagram to pair residual complementary colors (crimson/green, orange/blue, and violet/yellow).

1830




Charles Hayter
Hayter created a color circle arranged like rose petals. He used the three primary colors of red, yellow, and blue, three secondary colors of orange, green, and purple, and three tertiary colors of olive, brown, and slate gray (bluish gray).

1841

George Field:
Chromatic researcher Field is renowned for achievements in developing pigments. His color circle largely incorporates Aristotle's theory and Goethe's color circle.

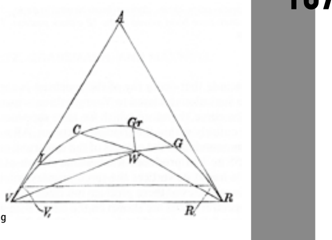
1853


Hermann Günther Grassmann
Grassmann's color circle developed Newton's color circle, moving the division between the red and violet to the 12 o'clock position, and including intermediate colors on the inside aligned with the 12 o'clock position of B and H on the Fraunhofer spectrum resolution diagram.

1861

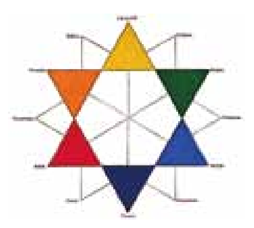

Michel-Eugène Chevreul
Chemist and early color harmony theorist Chevreul devised a color solid to express hue, tone lightness and darkness, and color turbidity. This color solid was hemispherical, with white at the center, pure colors at midpoints, and black at the periphery.

1867

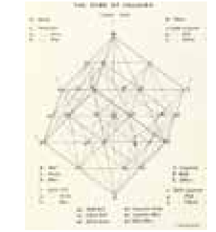
Hermann von Helmholtz
Helmholtz reevaluated Thomas Young's three-primary color theory, which did not win wide recognition or acclaim when first published, publishing the Young-Helmholtz theory. The diagram on the right was created by overlaying Maxwell's physiological three-primary color triangular shape and spectrum locus.

1867

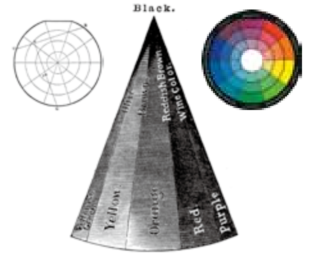
Charles Blanc
Art critic and historian Blanc included the color circle called Chromatic Rose, resembling a flower, in his practical guide *Grammaire des Arts due Dessin*.

1868



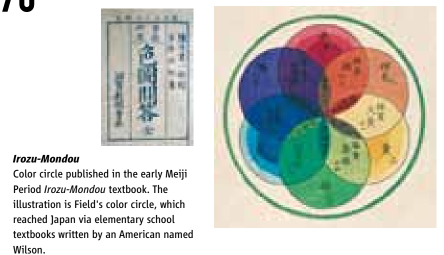
William Benson
British architect William Benson published the Cube of Colors model in his work *Principles of the Science of Colour*, likely the first three-dimensional color system.
A number of center axes intersect to form the interior of the solid.
The colors at the intersections are indicated on the periphery of the diagram.
Despite a distant resemblance to the 216-color Web safe RGB color cube, the colors are not assigned numerical values.
The colors at the intersections are given pigment color names.

1876



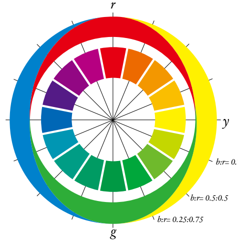
Wilhelm von Bezold:
Color circle published in 1876 by Bezold in his work Color Theory (right). The center diagram provides an exterior view of the color solid, while the diagram above shows the base. The apex of the cone is black. The diagram on the left predicts mixed colors on the color circle based on Newton's laws on gravity.

1876



Irozu-Mondou
Color circle published in the early Meiji Period *Irozu-Mondou* textbook. The illustration is Field's color circle, which reached Japan via elementary school textbooks written by an American named Wilson.

1878

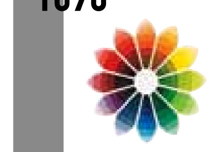



Ewald Hering
Physiologist Ewald Hering's psychological four-color diagram. The two color circles created by Hering are easily understood when overlaid as shown on the right.

1889

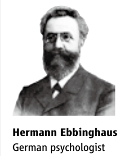
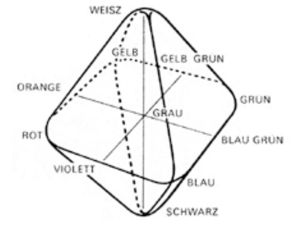

Charles Henry
Henry's color circle placed black at the circumference, a clear debt to Chevreul. The pure colors for each hue were presumably arranged midway in the circle, but this is unclear due to limitations involving printing technologies.

1890



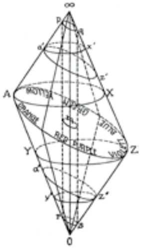

Charles Lacouture
Botanist Lacouture created a color chart evoking flower petals, clearly intended to serve as a chart for practical use rather than as a color system.

1893

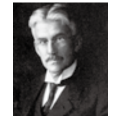
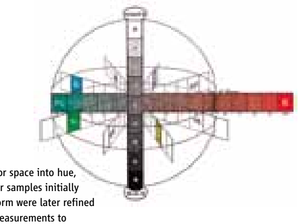
Hermann Ebbinghaus
German psychologist Ebbinghaus devised a color solid formed of two square pyramids arranged base to base.

1895

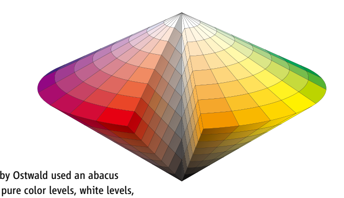
August Kirschmann:
German psychologist Kirschmann, a descendant of the great Wundt, devised a color solid involving an inclined color circle on the center equator (with yellow closer to white), based on the notion that purple was darker and therefore closer to black than yellow

1905

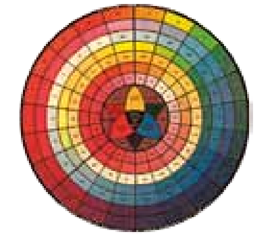
Albert Henry Munsell
Art teacher Munsell divided color space into hue, lightness, and chroma. The color samples initially created to be perceptually uniform were later refined and corrected based on color measurements to become the representative color system for expressing colors using the interchangeable XYZ format.

1916

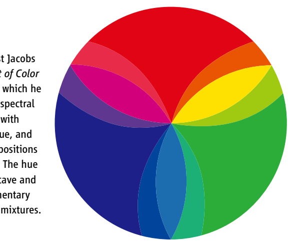
Wilhelm Ostwald
The color solid devised by Ostwald used an abacus bead shape comprising pure color levels, white levels, and black levels for 24 hues. It was designed using Hering's four-color theory and the Weber-Fechner law for correlations between perception and stimulus in the grayscale.

1918



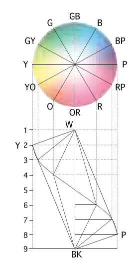
Albert Bourges
A pioneer of standardization of colors in this field, American photographer, sculptor, and inventor Bourges published *A Notation System* in 1918, which used the polychrome system to distinguish colors and explain how these colors could be used in graphic art.

1923



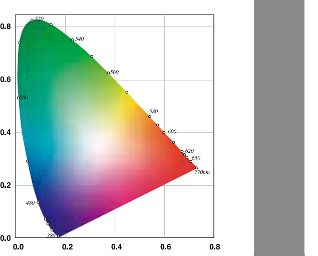
Michel Jacobs
Canadian-born sculptor and artist Jacobs published a book entitled *The Art of Color* in 1923, proposing a color circle which he called "open petals." It featured spectral primary colors on the periphery, with three secondary colors yellow, blue, and carmine positioned at opposing positions from the center to the periphery. The hue arrangement used opposing concave and convex shapes, forming complementary color pairs, resulting in six color mixtures.

1929



Arthur Pope
This is the double cone-shaped color solid devised by art teacher Pope. From above, it features 12 pure colors as in Itten's work, but when viewed from the side, it features a center achromatic axis in nine gradations from white to black, numbered in reverse of Munsell's scheme. The pure color equator is inclined in accordance with darkness, producing an irregular shape. This solid was created based on Pope's color order system and color harmony theory.

1931

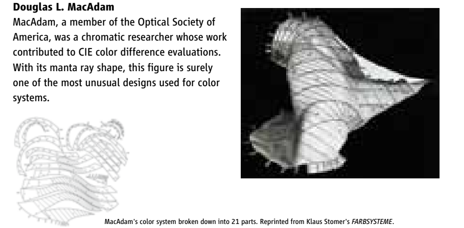


CIE 1931
The CIE (Commission Internationale de l'Eclairage) produced a color system expressing colors in two dimensions on a graph independent of intensity. Plotting the wavelengths of the visible spectrum converted to x-y coordinates creates a horseshoe-shaped spectral figure on which all visible colors can be plotted. CIE 1931 is one of the most widely used of color systems.

1934


Faber Birren
Color solid devised by Faber Birren, who contributed to industrial color research in the 20th century. It consists of uniform hue patches for pure color, white, and black, with the center turbid colors named as tones. The upper left diagram indicates the relationship for the seven elementary terms within the hue cross-section.

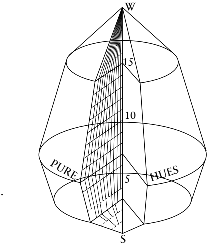
1944



Douglas L. MacAdam
MacAdam, a member of the Optical Society of America, was a chromatic researcher whose work contributed to CIE color difference evaluations. With its manta ray shape, this figure is surely one of the most unusual designs used for color systems.

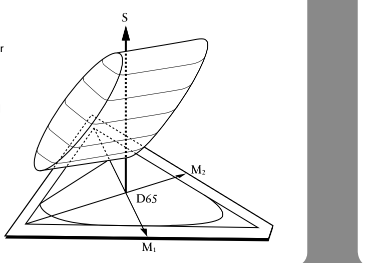
MacAdam's color system broken down into 21 parts. Reprinted from Klaus Stomer's *FARBSYSTEME*.

1947

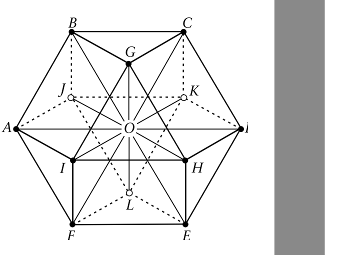
Julio Villalobos:
This acorn-shaped color solid was devised by Argentinean chromatic researcher Villalobos. Among his works, Villalobos proposed a hexagonal color circle called the Chromatic Hexagon and published the *Villalobos Atlas*.

1955



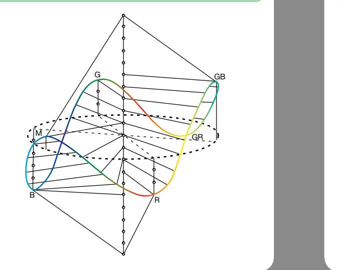
Robert Luther & N.D. Nyberg
Closed three-stimulus value vector space color solid devised by the Austrian physiologist Luther and Russian mathematician Nyberg. All object colors can be contained within this solid shaped like a shark egg sac. This color solid involves angular edges rather than smooth surfaces.

1960



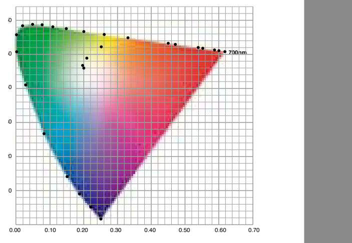
OSA-UCS System:
An ideal color system published in 1960 by the Optical Society of America based on research begun in 1947. Under this system, all perceptually uniform colors can be expressed by points at uniform distances in color space. The structure described by this system was an eight-sided solid formed of 12 equidistant colors (A to L) with color 0 at the center of a rhombohedral lattice. The system did not enter widespread use.

1975



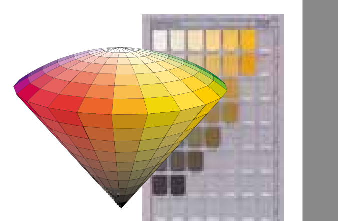
J. Frans Gerritsen
Dutch chromatic researcher and teacher Gerritsen published a three-dimensional hue-intensity-saturation perceptual diagram in his work *Color: Optical Appearance, Physical Phenomenon, Art Expression Medium*. The center axis varies from white to black in 20 gradations, while the primary colors rise and fall in a rollercoaster-like locus.

1976



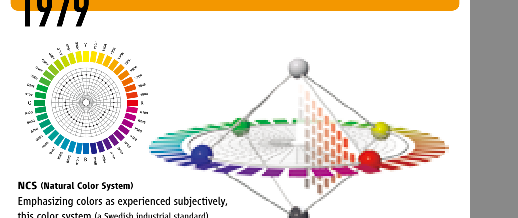
CIE L*u*v color system
The XYZ color system is an excellent system for expressing individual colors, but is not suited to expressing mutual color differences. This is because physical color space does not appear uniform to the human eye. The color space created in 1964 by MacAdam by converting an xy color diagram was used by the CIE to create the CIE L*u*v color system in 1976.

1976



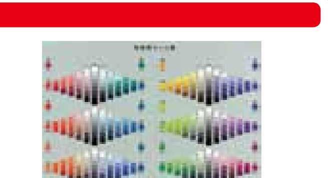
DIN color system
DIN (Deutsche Industrie-Norm Farb Color System) is a modified German industrial standard based on Ostwald's color system. This system was established in 1955. As part of this system, a color chart featuring 589 colors determined by hue, saturation, and intensity was issued in 1960. The DIN color system resembles a cut diamond.

1979



NCS (Natural Color System)
Emphasizing colors as experienced subjectively, this color system (a Swedish industrial standard) extends the ideas of Goethe. It is widely used in Europe and is especially easy to use in design applications.

1999

Akira Kitabatake
A chromatic researcher with an arts background, Akira Kitabatake was involved in devising numerous color order systems and color name systems in Japan. The diagram shows one such system: The Hue & Tone Color System: CCIC *(Chamber of Commerce and Industry Color Coordination Chart 285)*.