

Seeing the Light: Color in Theory and Practice

THE GERM of *Seeing the Light* was a presentation given last term with Beverly Acha for her Studio Art course in painting. Ms. Acha wanted to introduce her students to ways color has been explained and classified before they used it in their work. Our selection of books and prints sparked a good discussion. Many of these are in the present display, now expanded to include other examples of how color has been used.

Among the ancients, color was variously explained as the result of some sort of emanation from the eyes and from the object observed, or as an inherent property of an object. Specific colors were related to the traditional “elements” – earth (yellow), air (blue), fire (red), and water (green). Or color might be thought of as derived from the interaction of light (white) and dark (black): that is, if white light is darkened a little it becomes red, if darkened a little more it becomes green, if still more it becomes blue.

Such philosophies were influential, but artists thought of what we now call color theory in more practical terms as they dealt with pigments. Leonardo da Vinci, for example, considered white the source of color and black its absence, while otherwise listing yellow, green, blue, and red as the colors with which a painter has to work. In addition, Leonardo observed that color was subjective as perceived by the eye, varying not only with light and shadow but also distance from an object.

WAYNE G. HAMMOND, *Chapin Librarian*

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Robert Hooke, 1635–1703

Micrographia, or, Some Physiological Descriptions of Minute Bodies Made by Magnifying Glasses, with Observations and Inquiries Thereupon
London: Printed for John Martyn, 1667

Gift of Alfred C. Chapin, Class of 1869

Isaac Newton, 1642–1727

Opticks, or, A Treatise of the Reflections, Refractions, Inflexions and Colours of Light; Also Two Treatises of the Species and Magnitude of Curvilinear Figures
London: Printed for Samuel Smith, and Benjamin Walford, 1704

Copy 1, *Gift of Alfred C. Chapin, Class of 1869*;
Copy 2, *On deposit from James L. FitzGerald, M.D.*

In the 17th century, thinkers such as René Descartes and Robert Boyle suggested that different colors were produced by light moving through and being modified by a mass of invisible particles, as well as by the objects from which it was reflected or refracted (bent). Robert Hooke argued in his *Micrographia* that color depends upon the angle at which pulses of light reach the eye, and that all colors are derived, through “infinite gradations or degrees”, from two colors only, red and blue. Moreover, Hooke maintained, as did others, that white light is colorless, but is given color by passing through a glass lens or prism.

In 1666, Isaac Newton used a prism to refract a narrow beam of sunlight, producing an elongated spectrum (fig. 1 shown in his *Opticks*). He also used a second prism to recombine the colors produced by the first back into the original white. Through his experiments, he showed – among much else – that color is not produced by modifying light, but is contained *within* light; that different colors are refracted in different degrees; and that color is a property of the light that reflects from objects, not of the objects themselves. The spectrum Newton produced with his prism was continuous; nevertheless, he chose to identify and diagram, as the first color-wheel (fig. 11 in the foldout plate), seven segments by analogy with the seven notes of the musical scale: red, orange, yellow, green, blue, indigo, and violet. All other colors, he thought, were derived from these.

Johann Wolfgang von Goethe, 1749–1832

Goethe's Theory of Colours

Translated from the German,
with notes by Charles Lock Eastlake
London: John Murray, 1840

Library purchase

Robert Hooke and others criticized Newton's early results with light and color when they were sent to the Royal Society in 1672. The criticism was so intense that Newton withdrew from the debate but continued his work, and did not publish his *Opticks* until 1704, after Hooke had died and Newton had become President of the Royal Society. His strongest critic, however, was Johann Wolfgang von Goethe, best known as the author of *Faust* but who was also concerned with the nature of color and how it is perceived. Goethe's view, presented in his *Zur Farbenlehre (Theory of Colors)*, returned to the ancient idea of colors as manifestations of light and dark, with the two fundamental colors being yellow (next to the light) and blue (next to the dark). Red, he believed, was achieved when the two extremes of yellow and blue were combined. Although Goethe had no concern for science, his interest in the human experience of color and the emotions generated by colors prefigured the study of the physiology and psychology of color.

Michel Eugène Chevreul, 1786–1889

The Laws of Contrast of Colour and Their Application to the Arts of Painting, Decoration of Buildings, Mosaic Work, Tapestry and Carpet Weaving, Calico Printing, Dress, Paper Staining, Printing, Illumination, Landscape, and Flower Gardening
Translated from the French by John Spanton
New edition

London: Routledge, Warnes, and Routledge, 1859

Purchased on the Mary L. Hurt Richmond Fund

Newton's *Opticks* and Goethe's *Theory of Colors* are two of the cornerstone books dealing with color. A third is *De la loi du contraste simultané des*

couleurs (The Laws of Contrast of Color) by Michel Eugène Chevreul. Chevreul was a chemist and naturalist, concerned with organic substances to produce dyes. His book on color and harmony, first published in 1839, introduced the important "law of simultaneous contrast of colors":

If we look at the same time at two stripes of unequal tints of the same color, or at two stripes of equal tints of different colors, in juxtaposition . . . the eye will perceive, if the stripes be not too wide, certain modifications; in the first case affecting the intensity of the two tints, in the second, the optical composition of the two colors so placed.

This is illustrated in various ways in the plate shown. At top, for example, the two lighter panels at left have an identical tone, as do the two darker panels at right, but each panel in the center appears to be lighter in juxtaposition, light next to dark, than when the panels are seen separately.

Thomas Maitland Cleland, 1880–1964

A Grammar of Color: Arrangements of Strathmore Papers in a Variety of Printed Color Combinations According to the Munsell Color System
Introduction by A.H. Munsell
Explanatory text by T.M. Cleland
Mittineague, Massachusetts: Strathmore Paper Co., 1921

Purchased on the H. Richard Archer Fund

In the early 20th century, Albert H. Munsell (1858–1918) developed the color standard system which bears his name. It specifies colors according to three dimensions: *hue*, *value* (lightness), and *chroma* (color purity). It was adopted by the United States Department of Agriculture as the official color system for soil research in the 1930s, and is still in use for various purposes. The *Grammar of Color* issued by the Strathmore Paper Company explains the system and demonstrates its use to achieve harmony of colors, especially as printed on Strathmore products.

British Colour Council

Horticultural Colour Chart

London: British Colour Council in collaboration with the Royal Horticultural Society, 1938–41
2 vols. (two sheets displayed)

Library purchase

Winsor & Newton

Tint Book and Notes on the Permanence of Winsor & Newton's Artists' Oil and Water Colours
London: Winsor & Newton, [1924?]

Gift of the Family of Herman Rosse

Louis Prang, 1824–1909

Mary Dana Hicks, 1836–1927

John S. Clark, 1835–1920

Color Instruction: Suggestions for a Course of Instruction in Color for Public Schools
Boston: Prang Educational Company, 1893

Purchased on the W. Edward Archer Fund

Classification schemes and printed color charts allow writers to communicate precise color values without resorting to elaborate or subjective description – What exactly is “canary yellow”? How blue is a lobelia? Each of the sheets of the *Horticultural Colour Chart* includes four colors based on actual samples, and cross-references the color to other schemes where appropriate. So that the user can distinguish each color block more readily, without interference from its neighbors, a black sheet with a cutout window is supplied.

The Winsor & Newton book is typical of the sets of “chips” by which artists can choose their supplies – or homeowners decide which color to paint their walls. The two charts in the Prang-Hicks-Clark book on color instruction in public schools, one with “twelve standard normal colors”, the other with twenty-four, may remind viewers of the sets of crayons they used as children, some maybe with the Prang brand. The larger range of colors is meant for “more advanced work” and adds intermediates from red-red-orange to red-red-violet.

Josef Albers, 1888–1976

Interaction of Color

New Haven: Yale University Press, 1963

Purchased on the W. Edward Archer Fund

Formulation, Articulation

New York: Harry N. Abrams;

New Haven: Ives-Stillman, 1972

Gift of Madeleine Plonsker

No one in modern times has explored the art, science, and psychology of color more dramatically than Josef Albers. His 1963 work, *Interaction of Color*, is still used in teaching. Albers wrote: “In visual perception a color is almost never seen as it really is – as it physically is. This fact makes color the most relative medium in art.” Rather than “mechanically applying or merely implying laws and rules of color harmony”, Albers felt that one should study color in action, develop “an eye for color”, by placing “practice before theory”. “Just as the knowledge of acoustics does not make one musical . . . so no color system by itself can develop one’s sensitivity for color.” *Interaction of Color* presents practical exercises to “demonstrate through color deception (illusion) the relativity and instability of color”.

The print shown from Albers’ collection *Formulation, Articulation* displays two versions of his *Homage to the Square*, “a quartet of four voices which are reversals of each other and which present extreme contrasts in sound and mood. . . . The nonpainter usually notices the outer color first. The painter, since he must paint the central color first and the next color neighbor next, normally reads the outer color – last.”

Book of Hours
Manuscript
[Florence: Workshop of Attavante degli Attavanti,
ca. 1500]

Gift of Donald S. Klopfer, Class of 1922

Apocalypsis Sancti Johannis
Blockbook
[Germany, ca. 1464]

Gift of Alfred C. Chapin, Class of 1869

Joannes de Sacro Bosco, fl. 1230

Sphaera Mundi
[Venice]: Erhard Ratdolt, 1485

Gift of Alfred C. Chapin, Class of 1869

For centuries, before the introduction of printing around 1450, books in the West were produced entirely by hand. Their texts were in script, and colored initials, borders, and other features were added individually by master artists and apprentices. This small book of hours, for example, was produced at the workshop of Attavante degli Attavanti in Florence, Italy, and includes the wealth of color and gold illumination normally afforded to such personal prayer books, together with four double-page spreads with miniatures and various roundels.

Some of the earliest Western books printed from moveable type also included color added by hand, while blockbooks of the same period, like the Chapin *Apocalypse*, were fully colored over printed woodcuts. Color printing of illustrations developed quickly – an important example is the *Sphaera Mundi* by Joannes de Sacro Bosco (John of Holyrood), which includes woodcuts printed in two or three colors – though at this time it cost less to add color by hand than to produce it, more laboriously, in the press.

Sarah Bowdich, 1791–1856

The Fresh-Water Fishes of Great Britain
London: Published for the Authoress, 1828

Gift of Alfred C. Chapin, Class of 1869

Left a penniless widow with three children to raise, Mrs. Bowdich worked to establish herself as a natural history artist. Her *Fresh-Water Fishes of Great Britain* combines letterpress text (printed from type) with illustrations painted directly by the artist, not reproduced from woodcut or copperplate. The story is told of Mrs. Bowdich painting furiously to capture her freshly-caught subject, for the colors of a fish, particularly its iridescence, fade after its death and once in contact with air. Mrs. Bowdich's pictures are notable also for her use of gold and silver foils to represent the sheen of scales.

Horace Walpole, 1717–1797

*Jeffery's Edition of The Castle of Otranto:
A Gothic Story*
New edition

London: Printed by Cooper and Graham, 1796

Gift of Donald S. Klopfer, Class of 1922

This edition of Walpole's popular *Castle of Otranto*, produced for London bookseller Edward Jeffery, includes stipple engravings in four colors by Thomas Medland and A. Birrell. It testifies to the fact that, by 1796, color intaglio printing (from copperplates) was so common and inexpensive that it could be used for a book in pocket format rather than a folio.

Jacob Bigelow, 1786–1879

American Medical Botany: Being a Collection of the Native Medicinal Plants of the United States
Boston: Cummings and Hilliard, 1817–20
Vol. 1 of 3

Transfer from the Williams College Library

Bigelow's *American Medical Botany* was originally issued in six parts, and later bound in three volumes, as for the Chapin copy. Each volume illustrates and describes twenty American plants with medicinal virtues. The first one hundred copies of the first issue of Vol. 1 were illustrated in the traditional manner for natural history books, with the plants outlined in black and colored by hand. But Bigelow found this process too slow, and devised a method using inks applied directly to copperplates. This limited the pictures to two colors, though some have additional hand-coloring. The plate shown, for example, is printed in green and black, with yellow and red added by a colorist.

Oliver Byrne

The First Six Books of the Elements of Euclid: In Which Coloured Diagrams and Symbols Are Used instead of Letters for the Greater Ease of Learners
London: William Pickering, 1847

Gift of Lois K. Levy

Byrne's *Euclid* is an early and classic example of color used to convey information. Byrne, a mathematician, claimed that the use of color – here achieved with wood-engraved shapes – would allow one to learn Euclid's geometry in one-third the ordinary time and with greater retention. Precise registration was required in printing – that is, aligning each pass through the press for the different colors and black – so that the lines and angles met correctly. Whether or not his book achieved the result Byrne had hoped, it was a commercial failure.

Owen Jones, 1809–1874

The Grammar of Ornament
London: Day and Son, 1856
Four selected plates

Gift of Alfred C. Chapin, Class of 1869

The Grammar of Ornament is one of the landmarks of color printing. First published in 1856, it includes 100 plates and a long preliminary text presenting “general principles in the arrangement of form and colour in architecture and the decorative arts”.

Owen Jones was an architect and designer who studied the polychromy, or art of painting in several colors, as it was practiced in ancient Greece and Egypt and at the Alhambra palace in Spain. His *Plans, Elevations, Sections and Details of the Alhambra* (1842–45, also in the Chapin Library) was the first significant work to be produced using *chromolithography*, an exacting process in which images are printed from multiple lithographic stones, one for each color.

The theories of color and ornament Jones developed from his studies were put to practical use at the Crystal Palace in London for the Great Exhibition of 1851. Later Jones presented them in a series of lectures, and then in *The Grammar of Ornament*, produced by letterpress and chromolithography. Jones details nineteen styles of historic and world ornament, and concludes with a chapter on nature. His aim was to encourage a modern style through studying the underlying design principles, or grammar, of old styles and techniques.

Walter Crane, 1845–1913

The Baby's Own Aesop: Being the Fables Condensed in Rhyme, with Portable Morals
London: George Routledge & Sons, 1887

Library purchase

Charles Buckles Falls, 1874–1960

ABC Book
New York: Doubleday, 1923

Gift of Bedelia C. Falls

Children's books, with their emphasis often on appealing illustration, have long been an important outlet for color printing. Edmund Evans, who produced Walter Crane's *Baby's Own Aesop*, was one of the most successful color printers of the 19th century, having developed efficient techniques which replaced crude hand-colored illustrations from other children's book publishers. Here he combined line engravings with areas of color printed with woodblocks, a process called *chromoxylography*. Walter Crane was a prolific artist who made many books with Evans, always concerned with good design even for comparatively cheap productions and often, as here, influenced by Japanese prints.

C.B. Falls' *ABC Book* was popular for decades, long after its illustrations must have seemed dated or naive. Its success is partly due to its simplicity, but also to its attractive use of flat color, a technique Falls perfected in his experience as one of the best American poster artists of the early 20th century.

D.H. Lawrence, 1895–1930 et al.

Circus: Five Poems on the Circus
Illustrations by Walter Bachinski
Shanty Bay, Ontario: Shanty Bay Press, 2002

Purchased on the W. Edward Archer Fund

The art of applying color with stencils can be dated back to 500 B.C.E. *Pochoir*, a refinement of the stencil technique, was most popular from the late

19th century through the 1930s, when it was used notably in fashion and pattern illustration, and features in prints by artists such as Matisse and Picasso. Although lithography and serigraphy (silk-screen) have largely replaced pochoir, it is still occasionally practiced to colorful effect, here by Canadian artist Walter Bachinski.

Pauline Baynes, 1917–2008

Noah and the Ark
Text from the Revised Standard Version of the Bible
London: Methuen, 1988

Book and original art

Bequest of Mrs. Pauline Gasch

Finally in this display is an example of the most common form of color printing today: offset lithography. In this method, colored art is photographed and its colors separated so that four plates can be made for printing in the CMYK system: cyan, magenta, yellow, and key (black). These inks, when combined in the correct proportions, can reproduce, or perhaps one should say approximate, any color.

Pauline Baynes was always concerned about the quality of reproduction of her art, and as a prolific illustrator needed to be philosophical when the result differed from the original. Here, in *Noah and the Ark*, the reproductions are fairly close, though not as sharp as the original gouache (opaque watercolor) paintings and with some variation of color, especially in the greens.

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SEEING THE LIGHT:
COLOR IN THEORY AND PRACTICE
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