

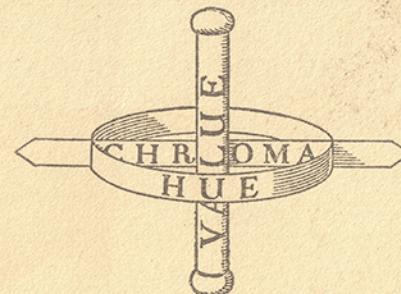
MUNSELL
MANUAL OF COLOR



MUNSELL MANUAL OF COLOR

Defining and Explaining
The Fundamental Characteristics
of Color

By F. G. COOPER



MUNSELL COLOR COMPANY, INC.
BALTIMORE, MARYLAND
1929

FOREWORD

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COLOR is the most persistent quality apparent in Nature and is the strongest single influence pervading our lives from without. It is present wherever the eye can see. No visible thing is without color. Every object is seen only as a color or combination of colors and every contour and detail of every object is seen only as color or colors. This is true even in the case of the color blind, for although their perception of HUE and CHROMA may be impaired or absent, the remaining characteristic of color, VALUE, cannot also be absent from their vision, for then they would have no vision. They would be totally blind.

The vast majority of persons are lacking in adequate color knowledge and must seek for themselves that information relating to its use and appreciation which is the inborn gift of the favored few. But natural taste or aptitude should not be mistaken for organized fundamental knowledge; the naturally gifted cannot accurately communicate their ideas of color without a common language of color, for intelligent discussion of the subject requires mutual understanding of the terms used.

F. G. C.

PREFACE

COLOR systems and methods of describing and classifying colors date back hundreds of years. Chevreul, the pioneer in this field, although he did excellent work, did not influence the practical users of color because his color classification was based arbitrarily on the irregularities of dye and pigment mixture, which are very difficult to retain in one's memory. Only a method of color notation that is *simple to understand* and *easy to remember* can adequately fill the practical needs of present day color users.

The great scientist, Helmholtz, gave considerable thought to this question. He stated that color possesses three simple attributes or dimensions, which are determined directly by the eye, and which have no direct relation to dye or pigment mixtures. As he did not have the opportunity to illustrate just how these three dimensions were to be visualized, however, nor what standards should be set up for developing a general color language, his work remained for a time buried in the archives of science.

In the late nineties, it occurred to an instructor of art, Mr. Albert H. Munsell, to utilize the possibilities opened up by Helmholtz in practical color study. Mr. Munsell decided that the best way to bring about a popular understanding of this subject was to illustrate the three dimensions of color graphically on a color sphere. He

therefore planned a series of color charts presenting carefully standardized scales of HUE, VALUE, and CHROMA.

Seven years of study and experimentation finally made possible his first color chart, which appeared in 1905. This chart was accompanied by a text book* describing the simple basis on which this and the succeeding charts were to be built, and suggesting the application of the proposed language of color to the field of art education. Eight more years of patient work resulted in the completion of fifteen standard color charts, which in 1913 were assembled in the "Atlas of the Munsell Color System." This useful piece of work immediately aroused widespread interest.

By 1913, the strain of carrying on not only the specifications of these color charts, but the presentation of this subject to audiences both in this country and abroad, in addition to his regular duties at the Massachusetts School of Art, showed itself in the weakening of an unusually robust constitution, and in a protracted period of invalidism which finally resulted in Mr. Munsell's death in 1918.

Shortly before his passing, Mr. Munsell expressed the hope that the work to which he had dedicated his life would be carried on for the benefit of future generations. The Munsell Color Company was formed for this purpose,

* "A Color Notation" by A. H. Munsell, Published by Munsell Color Company, Inc.

and for many years it has been engaged in the work of restandardizing and improving the color charts along the lines foreseen by their originator. The "Atlas of the Munsell Color System" has been replaced by the "Munsell Book of Color," which combines practical teaching experiences, derived from the field of art education, with the rigorous investigation of scientists from the time of Helmholtz down to the present day.

The remarkably simple and lucid article on "Color" which comprises the major portion of this little "Manual of Color" was written and illustrated by Mr. F. G. Cooper, free-lance artist, and illustrator for "Life." Mr. Cooper's article and the "Dictionary of Color Terms" form a portion of the manuscript of the "Munsell Book of Color." They are now reprinted in this inexpensive little booklet in order to give the widest publicity to this subject matter which merits the unqualified interest of all those who wish to increase their knowledge and appreciation of color.

A. E. O. MUNSELL.

Baltimore, Md.
October, 1929.

COLOR

COLOR has three dimensions, HUE, VALUE, and CHROMA, which fully and accurately describe any color as readily as the three dimensions of a box describe its length, breadth, and thickness. Each of these dimensions of color can easily be measured (at a glance, with practice) and stated simply in speech and writing.

HUE

Sunlight is composed of every possible spectrally pure color, so balanced in combination that no one color is dominant and the result is a pure white light. Passing a ray of sunlight through a prism breaks the light up into a band (the spectrum) of its component colors, Red, Yellow, Green, Blue, etc., and this distinguishing by name of any color of the spectrum from the other colors, indicates the HUE, or common name, of that color. Any Red is *Red* in HUE, and any Green is a *Green* HUE, etc. HUE is the first characteristic of a color that the eye detects. It is how we know, for instance, that a Red is Red and not Green or any other color but Red. In notating a color, its HUE is indicated by the initial letter or letters of the color referred to—R for Red, YR for Yellow-Red, Y for Yellow, etc.

VALUE

Pure White is so light that no color can be seen in it. Pure Black is so dark that no color can be seen in it. But between the two can be distinguished various degrees of light strength, ranging from the darkest gray just above Black to the lightest gray just below White, and colors can be seen at these various intermediate levels of light strength. For instance, Yellow is usually a light color, nearer to White than to Black. Purple-Blue is usually a dark color, nearer to Black than to White. This variable light strength is called VALUE, most Yellows being rather high in VALUE, and most Purple-Blues being rather low in VALUE although of course Yellow *can* be very dark and Purple-Blue *can* be very light.

The eye can readily distinguish and memorize ten different steps of VALUE, graduated from Black at the bottom up to White at the top. It is not difficult to estimate with the unaided eye the approximate VALUE of any color, and it can be done accurately by comparing the color with the VALUE scale.

Theoretically perfect White and theoretically perfect Black are practically unattainable, though they can be very closely approached.* Perfect Black is indicated by the numeral O at the

* For instance, pure magnesium oxide is 9.7 to 9.9 in VALUE. Practically pure Black is obtained by lining the interior of a box with Black velvet and looking into it through a hole in the cover.

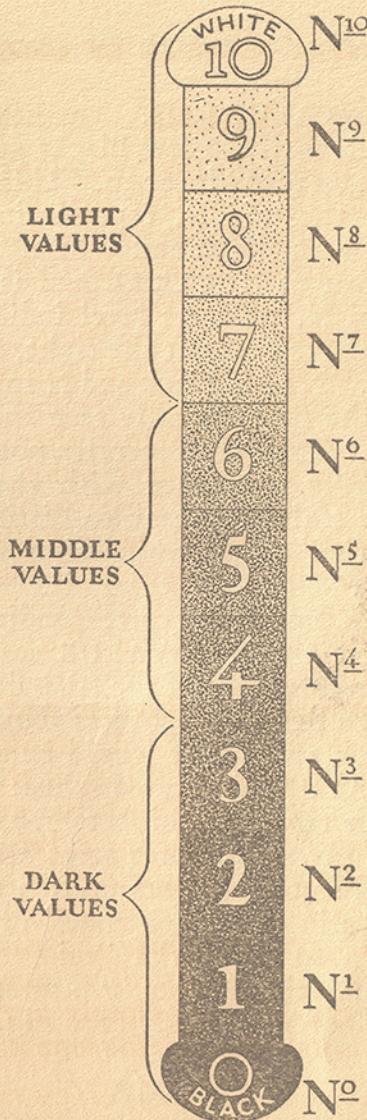


FIG. 1—Diagram of the VALUE scale. Note on the left the indication of the three zones; Light, Middle, and Dark; and on the right the notation of NEUTRAL at the various levels of VALUE.

bottom of the VALUE scale. The next step upward is 1 (below which few Blacks go), then 2, 3, 4 and so on up to White at 10. This places the fifth step at the middle, representing a Gray half-way between Black and White. Any pure Gray is known as NEUTRAL and is indicated by the initial N, with its level indicated by a numeral set above a line at the right, as N 2/, N 3/, N 7/, etc. N 0/ is Black and N 10/ is White, but N 1/ is the Black usually seen and N 9/ the usual White. They are generally notated so.

By comparing any color with the different Grays of the scale it is easy to distinguish the VALUE of that color, which simply indicates how *light* or *dark* that color is. VALUE is notated by a numeral (corresponding to the numbered levels in the VALUE scale) placed above a line to the right of the HUE designation. For instance, a Red of a lightness about half-way between Black and White would be at the fifth level of VALUE, indicated thus: R 5/. A Yellow about two steps higher, Y 7/. A dark Purple-Blue, say about three steps above Black, PB 3/. And so on. Colors up to 3 in VALUE are said to be in the "dark zone" of VALUES, those from 4 to 6, in the "middle zone" of VALUES, and those from 7 upward, in the "light zone" of VALUES. (See Fig. 1.)

CHROMA

Two colors may be the same in HUE (for instance, both Red) and the same in VALUE

(that is, neither is lighter nor darker than the other), and yet be different in color *strength*. One may be a *strong* Red and the other a *weak*, *grayish* Red. This difference is in the dimension of CHROMA, by which the degree of color strength (intensity) is measured and indicated.

HUE is the *name* of a color. VALUE is the amount of *light* in a color. CHROMA is the degree of *strength* in a color.

A step in CHROMA is the unit of measure of change in a HUE between NEUTRAL Gray and the maximum CHROMA of that HUE. Experiment has shown that it can readily be distinguished and remembered. These steps are graduated from NEUTRAL Gray out to the strongest CHROMA obtainable in any HUE at any given level of VALUE. The steps are numbered outward from N, toward the maximum CHROMA (See Fig. 2), and in notating the color the numeral is placed below the line, under the numeral of VALUE. For instance, a Red midway between White and Black, and five steps out in CHROMA, would be written R 5/5. A Red at the sixth level of VALUE and three steps out in CHROMA would be written R 6/3. The color commonly known as "rose" is a grayish Red, a Red that is weak in CHROMA, generally in the neighborhood of R 6/4. Thus the arrangement in notation of HUE, VALUE, and CHROMA is H V/C.

The CHROMAS close to NEUTRAL are known as *weak* CHROMAS: those at or near maximum strength are called *strong* CHROMAS;

and those between the weak and the strong are known as *moderate CHROMAS*.

Red is a very powerful color at the fourth level of VALUE and can be graduated through a dozen or more distinguishable steps of CHROMA, but up at the eighth level it cannot be carried out more than a third as far.

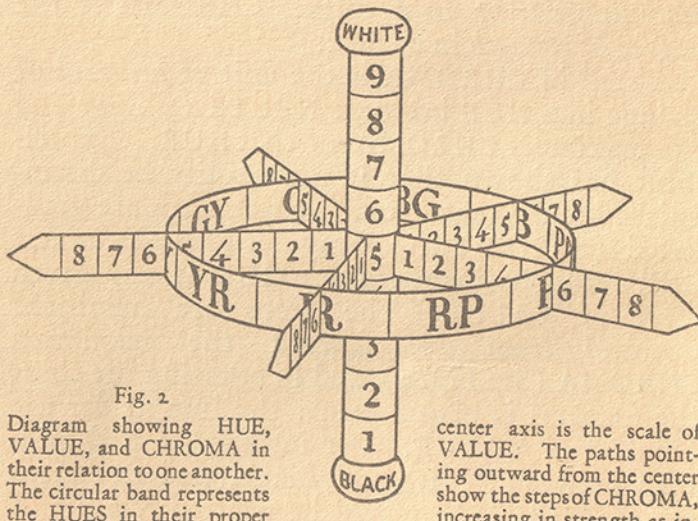


Fig. 2

Diagram showing HUE, VALUE, and CHROMA in their relation to one another. The circular band represents the HUES in their proper sequence. The upright

center axis is the scale of VALUE. The paths pointing outward from the center show the steps of CHROMA, increasing in strength as indicated by the numerals.

The strongest possible CHROMA obtainable in practically non-fading color substances varies with different HUES, and at different levels of VALUE. Yellow, for instance, which is strongest only when it is light, can be divided into more distinguishable steps of CHROMA at a high level of VALUE (say the eighth) than it can at any of the lower levels; and the reverse is

true of Purple-Blue, which is strongest in CHROMA at a comparatively low level of VALUE but cannot be carried out many distinguishable steps of CHROMA at a high level. This variation in maximum CHROMA at different levels of VALUE is due simply to the vagaries of Nature—there is no one level of VALUE at which all HUES reach their strongest CHROMA. The level at which a HUE reaches its maximum CHROMA is called its "home" VALUE, but this may vary in the same HUE, in different pigments, dyes, etc.

THE COLOR SPHERE

Since the three dimensions of color must be as readily understood as the three dimensions of a box, it is necessary to have in mind some simple, orderly arrangement of all colors, in which HUE, VALUE, and CHROMA are separately identified and yet comprehended together. A sphere serves this purpose. (See Fig. 3.) The top pole of the Color Sphere is White, the bottom pole Black, and the axis is the graduated scale of NEUTRAL Grays, which places N 5/ in the exact center of the Sphere. Clockwise, or "westward," around the equator of the Sphere (as seen from the top pole), and at equal distances apart, are the five Principal HUES—Red, Yellow, Green, Blue, and Purple. Spaced evenly between each two of these, in the order named, are the five Intermediate HUES—Yellow-Red, Green-Yellow, Blue-Green, Purple-Blue, and Red-

Purple. These ten HUES are called the Major HUES.

Comparing the Color Sphere to a peeled orange

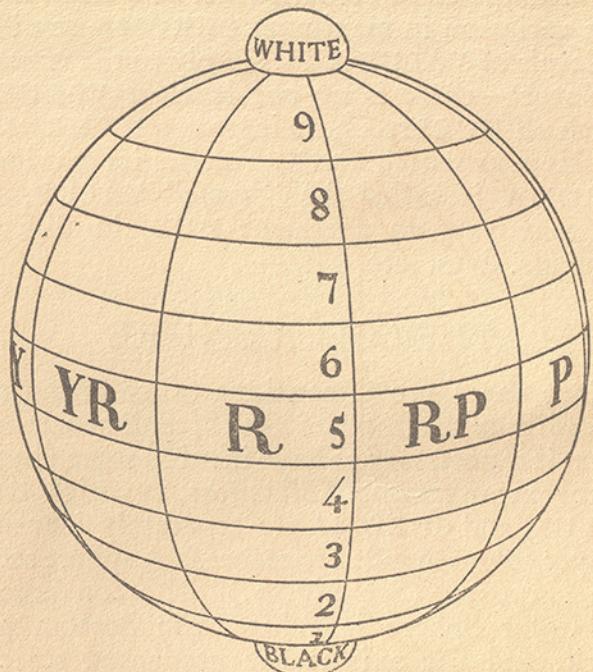


FIG. 3—The Color Sphere. The HUES are placed in sequence around the NEUTRAL axis. The axis and all the HUES surrounding it are all of the same VALUE (lightness or darkness) at any given level, increasingly lighter to White at the top and increasingly darker to Black at the bottom. From NEUTRAL gray at the center axis, the HUES increase in color strength or intensity (CHROMA) as the distance outward from the axis is increased.

composed of ten segments (See Fig. 4), each of the ten Major HUES would occupy one segment, its upper half blending through lighter VALUES

to White at the top and its lower half blending through darker VALUES to Black at the bottom. Its inner edge, along the perpendicular axis of the Sphere, would be the graduated series of

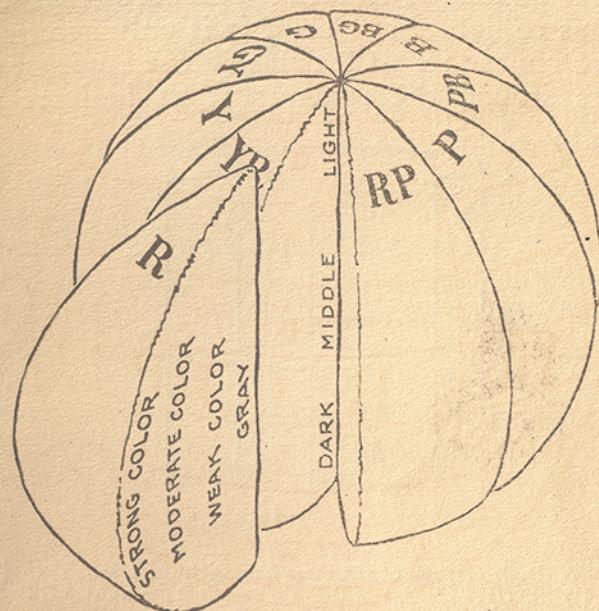


FIG. 4—An orange assumed to represent the Color Sphere, with a segment displaced to show the NEUTRAL gray center, which is Black at the bottom and blends upward through increasing lightness to White at the top. Note the change in color strength (CHROMA) outward from the center.

NEUTRAL Grays from Black up to White. Outward horizontally (at a right angle) from the NEUTRAL axis, at any level of VALUE, the color would become more intense in color strength, in measured steps of CHROMA. The

HUES become lighter as they go upward in VALUE; darker as they go downward in VALUE; weaker in CHROMA as they go inward toward the NEUTRAL axis; and stronger in CHROMA as they go outward toward maximum strength.

Thus to notate any color it is only necessary (1) to choose its HUE name in the sequence of colors around the Sphere; (2) to indicate its

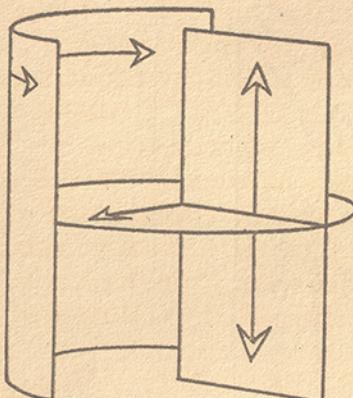


FIG. 5—A simple diagram of the three dimensions of color. *Around the center, HUES. Up and down, VALUE. Outward from the center, CHROMA.*

VALUE according to the NEUTRAL scale axis of the Sphere; and (3) to indicate its CHROMA according to the CHROMA scales of color strength. The MUNSELL BOOK OF COLOR provides accurate, scientific charts for this purpose.

SECOND INTERMEDIATE HUES

The device of the Color Sphere is used as an aid to orderly thinking. After mastering the basic idea of HUE, VALUE, and CHROMA and their relation to the Color Sphere, there are certain details concerning it which may now be considered.

Ten HUES have been mentioned as placed around the axis of the Sphere, but obviously they are not enough, for there is possible a much larger choice of color HUES, without reference to the qualities of VALUE and CHROMA. To facilitate the ready identification of "in-between" HUES, second intermediate HUES are added in logical sequence in the succession of Principal and Intermediate HUES around the Color Sphere. Reading clockwise from Red, the sequence is: Red, Red Yellow-Red, Yellow-Red, Yellow-Red Yellow, Yellow, Yellow Green-Yellow, and so forth (R-YR, YR, YR-Y, Y, Y-GY, etc.). See any chart of Constant VALUE for the complete gamut. (Also see Fig. 6.) Note that in the Second Intermediate HUES, which include three initial letters, the letter which occurs twice is that of the adjoining Principal HUE, but it does not occur twice in succession in naming any of the Second Intermediate HUES. For instance, R-YR is correct, but YR-R is incorrect. YR-Y is correct, but Y-YR is incorrect.

SPECIAL INTERMEDIATE HUES

To facilitate the identification of *special intermediate* HUES, a hundred numerals (ten sets of

ten each) are placed in clockwise sequence around the Color Sphere. And since further combinations of HUE initials (beyond three as used in a Second Intermediate HUE) would be clumsy,

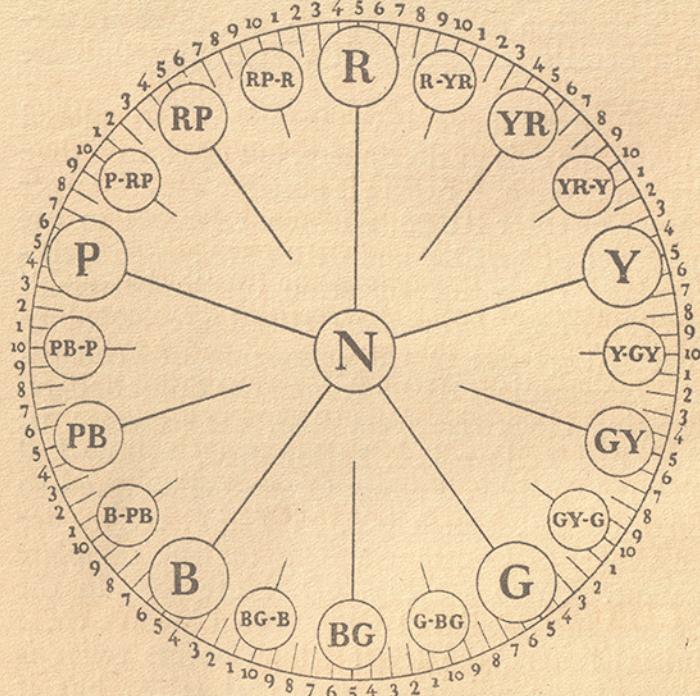


FIG. 6.—Diagram showing the 5 Principal HUES, the 5 Intermediate HUES, the 10 Second Intermediate HUES, and the 80 Special Intermediate HUES (indicated by the numerals, 1, 2, 3, 4, and 6, 7, 8, 9), in the 100 HUE circuit.

each of the ten Major HUES has ten numerals (1 to 10) assigned to it, indicating graduated steps of HUE changes from one HUE to another around the Sphere, horizontally. Number 1 of

every Major HUE is placed four steps before the exact center of that HUE, which places the number 5 directly on the HUE itself. The numbers 6, 7, 8, etc. proceed in a clockwise direction, bringing ten directly on the Second Intermediate HUE. In notating colors the HUE number is placed before the HUE initial, as 2R, 7Y, 9YR, etc. Any Principal or Intermediate HUE is understood as being the number 5 of that HUE series of ten numbers, but any Second Intermediate HUE is understood as being the number 10 of the preceding Principal or Intermediate HUE. The reason for this is that most requirements of color description are accommodated simply by the initials of the Principal, Intermediate, or Second Intermediate HUES, the use of numerical HUE notation being confined to the relatively few cases where such fine HUE distinctions are required. Of course any fractional step of HUE, VALUE, or CHROMA can be written decimaly.

CHROMAS BEYOND the SURFACE of the SPHERE

At the middle level of VALUE, the fifth step in CHROMA is placed at the surface of the Sphere, but HUES of stronger CHROMA extend some steps out beyond the surface (See Fig. 7), like immense buildings (always at right angles to the axis) on a very small Earth; or like level

limbs on a Color Tree* extending through and beyond the surface of a sphere within which the tree has grown. The Color Sphere does not contain all colors compressed into a symmetrically spherical form, but it is the basic idea for an orderly arrangement presenting the three dimensions of color—HUE, VALUE, and CHROMA. Let the fifth or sixth step of

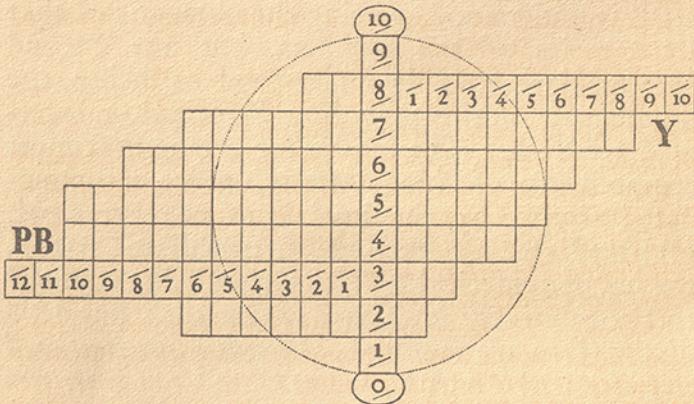


FIG. 7—Diagram showing characteristic CHROMAS extending beyond the surface of the Color Sphere, the Yellow reaching its strongest CHROMA at the 8th level of VALUE, while its opposite, Purple-Blue, reaches its strongest CHROMA at VALUE 3.

CHROMA serve as a "checking station" in memorizing the various steps in CHROMA of any HUE. Memorizing even approximately the HUES at the fifth level of VALUE and the sixth step of CHROMA is of great help in judging colors generally.

F. G. COOPER.

* See the description of the Color Tree on page 25.

A DICTIONARY OF COLOR TERMS

ABSOLUTE BLACK: A color of the lowest VALUE. It possesses neither HUE nor CHROMA. It is seen when looking through a small aperture into a hollow black velvet-lined box. *See Black.*

ABSOLUTE WHITE: A color of the very highest VALUE. It possesses neither HUE nor CHROMA. It is closely approximated by viewing a freshly-cleaned block of magnesia. *See White.*

ACHROMATIC COLORS: *See Neutral Colors.*

ATTRIBUTES of Color: *See Color Dimensions.*

BALANCE of Color: *See Color Balance.*

BLACK: A Neutral Color of very low VALUE, usually about one and one-half in VALUE. *See Absolute Black.*

BLINDNESS to Color: *See Color Blindness.*

CHART of Color: *See Color Chart.*

CHROMA: *The strength or weakness of a Chromatic Color.* In terms of CHROMA, color is described as *Weak*, *Moderate*, or *Strong*. The notation of CHROMA is shown in Fig. 2 on Page 15 of the text. Synonyms: Saturation; Intensity (Purity). *See Chromatic Colors.*

CHROMATIC COLORS*: Include all colors other than Neutral Colors. (*See Neutral Colors.*) They are characterized by the presence of both HUE and CHROMA. *See also Color.*

COLOR: *Anything seen by the eye*, such as Black, White, Red, Yellow, Green, Blue, or Purple. The form of an object is recognized only because of the contrast between the color or colors of this object and the color or colors of the background. Color is accompanied by an excitation

* Note: When the meaning is perfectly clear, we can and do use the word *Color* in the sense of *Chromatic Color*. Terms such as *Color Blindness*, *Color Photography*, or *Color Printing* intrinsically are perfectly understandable. It is only in a technical treatise that one should use the terms *Chromatic Color Blindness*, *Chromatic Color Photography*, *Chromatic Color Printing*, etc.

of the retina and brain by beams of light. *See Chromatic Colors; Neutral Colors.*

COLOR BALANCE: 1. In its broadest meaning, color balance is an aesthetic term referring to the feeling of balance, continuity, and fitness which is found in beautiful color schemes.

2. In a more restricted sense, it applies to the physical balance of a color scheme in Gray. In such a case the colors in a color scheme are assembled on a disc in pie-shaped areas or sectors. The size of each of these sectors is proportional to the area of each color in the color scheme. If the disc areas blend to a Neutral Gray when the disc is rotated, the color scheme is said to balance. With experience this form of physical Color Balance can be detected by the unaided eye.

Studies and exercises in Color Balance will broaden one's experience and improve one's color technique just as studies and exercises in Musical Harmony broaden one's experience and improve one's musical technique. It is not suggested that studies and exercises be limited to Color Balance, since such studies are but the stepping stones leading to the study of Color Dominance. *See Color Dominance.*

COLOR BLINDNESS: The inability to distinguish colors properly which is associated with a subnormal perception of HUE and CHROMA. It may be either congenital or due to injury to the eye.

COLOR CHART: A series of Color Scales (*See Color Scale*), so arranged that any two dimensions of color vary in a regular manner, while the third dimension remains constant. *See Color Dimensions.*

COLOR, CHROMATIC: *See Chromatic Colors.*

COLOR DESCRIPTION: The delineation of color by means of words. A vocabulary of but fourteen words is sufficient for a simple description of any color. HUE is comprehended by five words—*Red, Yellow, Green, Blue, and Purple*—used either singly or in conjunction with each other. (*See Major Hues.*) The terms, *Black, Gray, and White* are used when HUE and CHROMA are absent.

VALUE is comprehended by three words—*dark, middle, and light*, CHROMA is comprehended by three words—*weak, moderate, and strong*. The word describing VALUE may well be placed first, the HUE second, and the CHROMA third, as “*a Dark Red of moderate CHROMA*,” i.e., a Maroon. For a graphical picture of what these fourteen words represent, refer in the text to Figure 4. *See also Color Notation; Hue; Value; Chroma.*

COLOR DIMENSIONS: HUE, VALUE, and CHROMA. These three dimensions describe any color as accurately and as readily as the three dimensions of a box describe its length, breadth, and thickness. Synonyms: Color Attributes; Color Qualities. *See Color.*

COLOR DOMINANCE: This is found in a color scheme in which some one HUE predominates. Intelligently employed, it suggests different moods or atmospheres, typified in various cases by Valor, Inspiration, Fruitfulness, Truth, Royalty, etc.

There is no better training for the effective handling of Color Dominance than the study of Color Balance. *See Color Balance.*

COLOR NOTATION: An exact and specific description of a color, using symbols and numerals, written HUE VALUE/CHROMA. For example a typical Maroon is notated as “*5R 3/4.*” *See Hue, Value, Chroma for notations of each.* *See also Color Description.*

COLOR SCALE: A series of colors, exhibiting a regular change or gradation in one dimension, while the other two dimensions are constant. For instance, a VALUE Scale progresses by evenly-graded steps from Black to White. (*See Value Scale.*) A CHROMA Scale progresses by evenly-graded steps from Neutral Gray to a strong color. (*See Chroma.*) A HUE Circle is a Scale of evenly-spaced Hues. (*See Hue Circle.*) *See also Color Dimensions.*

COLOR SPHERE: *See text, page 15.*

COLOR TREE: A conception used in advanced color study which is very useful as a supplement to the idea of a

Color Sphere. The vertical trunk of this tree corresponds to the vertical value-scale axis of the sphere. The branches extend outward horizontally from the trunk. Each branch represents a series of colors of constant HUE and constant VALUE but increasing in CHROMA as the distance from the Neutral Gray trunk becomes greater. Those branches which originate at the same height on the trunk bear colors of equal VALUE, dark colors being found on the lower levels and light colors on the higher levels. Those branches which point in the same direction from the trunk bear colors of the same HUE. The branches which represent the ten major HUES are spaced at equal intervals around the trunk. Each branch is in reality a CHROMA scale, beginning in Neutral Gray at the trunk of the tree, and ending in the strongest available CHROMA of the particular HUE and VALUE represented by that branch. If the number of branches is infinitely increased the tree will expand into a complete color solid.

COMPLEMENTARY HUES: Two HUES which differ most radically from each other. Pairs of Complementary HUES are shown directly opposite each other, on the Radial Charts of constant VALUE in the Standard Edition of the Munsell Book of Color.

COOL COLORS: Green, Blue-Green, Blue, and Purple-Blue. *See Warm Colors.*

DARK COLOR: A color of low VALUE, found in or adjacent to the lower third of the VALUE Scale. *See Value.*

DESCRIPTION of Color: *See Color Description.*

DIMENSIONS of Color: *See Color Dimensions.*

DOMINANCE, Color: *See Color Dominance.*

GRAY: 1. A color which possesses neither HUE nor CHROMA, i.e., a Neutral Color. (*See Neutral Color.*) Where considerable clarity is desired, this meaning of Gray may be expressed as Neutral Gray. 2. Traditionally, Grays are colors between Black and White, in the region from zero to about one step of CHROMA.

HOME VALUE LEVEL: The VALUE level at which the maximum CHROMA is reached in some particular HUE. It varies for different HUES, i.e., in Yellow, it is at the eighth level; in Green, at the fifth level; and in Purple-Blue at the third level. The "home" level also varies for different color mediums. *See Maximum Color.*

HUE: The distinctive primary characteristic of any Chromatic Color. In terms of HUE we describe a color as Red, Yellow, Green, Blue, or Purple. For the notation of HUE see Fig. 6 on page 20 of the text. *See also Chromatic Colors.*

HUE CIRCLE: Exhibits a progressively-graded series of HUES, equally spaced to the eye, and of constant VALUE and CHROMA. *See Hue Circuit.*

HUE CIRCUIT: Exhibits a progressively-graded series of HUES, equally spaced to the eye. VALUE and CHROMA are not necessarily constant. *See Hue Circle.*

HUES: *See Principal Hues; Intermediate Hues; Major Hues; Second Intermediate Hues; Special Intermediate Hues.* *See also Complementary Hues.*

INTERMEDIATE HUES: Yellow-Red, Green-Yellow, Blue-Green, Purple-Blue, and Red-Purple. These five HUES are placed at the visually determined mid-points between the five Principal Hues. (*See Principal Hues.*) *See also Hue; Major Hues.*

Description	Notation
Yellow-Red (YR).....	5 YR
Green-Yellow (GY).....	5 GY
Blue-Green (BG).....	5 BG
Purple-Blue (PB).....	5 PB
Red-Purple (RP).....	5 RP

LIGHT: 1. Relates to nerve currents, set up in the optic nerve and brain by the stimulation of the retina due to the visible portion of the radiant energy thrown out by such a source as the sun. 2. The luminous energy which gives rise to color. 3. Energy times visibility.

LIGHT COLOR: A color of high VALUE, found in or adjacent to the upper third of the VALUE Scale. *See Value.*

LIGHT PRIMARIES: Three spectrally pure beams of light, by the blending of which a great number of colors can be seen. Three wave-lengths frequently used are $650\text{ m}\mu$, $550\text{ m}\mu$, and $460\text{ m}\mu$, corresponding in general to the hues RP-R, GY-G, and PB-P. *See Primary Colors.*

MAJOR HUES: Ten HUES, made up of the five Principal HUES and the five Intermediate HUES. (*See Principal HUES; Intermediate HUES.*) These ten HUES have been chosen not because they are ten in number—although the Decimal System is very convenient—but because they represent *mutually equidistant Hue-points to the eye*. *See also Hue.*

MAXIMUM COLOR: A color of very strong CHROMA, on a VALUE Level characteristic of the HUE in question —i.e., its "Home" VALUE Level. (*See Home Value Level.*) As a general rule Maximum Yellow is on the eighth level of VALUE, Maximum Purple-Blue on the third level, etc. The reason for this interesting variation of Maxima Colors in different HUES is due not to any physical characteristics or complexities inherent in the colored media which we use, but rather to the sensitive and unique adjustment of the mechanism of the eye and brain.

The word "Maximum" is a relative term, referring to the strongest color in any HUE which can be evoked by some particular color medium. Thus the maximum Color in any single HUE may vary for different color media. The maxima shown on the standard color charts, which have been selected as the strongest colors which are reasonably permanent, represent one class of Maxima; printing inks represent another class of Maxima; and Oil Colors, Dyes, Ceramics, etc., further classes of Maxima. *See Ultimate Color.*

MIDDLE COLOR: a color of middle VALUE, found in or adjacent to the middle third of the VALUE Scale. The word "middle" should be differentiated from the word "moderate" as given in the next definition. *See Moderate Color; Value.*

MODERATE COLOR: A color of moderate CHROMA, found near the fourth to sixth step of CHROMA on the standard Color Charts. *See Middle Color; Chroma.*

NEUTRAL COLORS: Characterized by a complete absence of HUE and CHROMA. They are pure Black, pure White, and the pure Grays lying between. Synonym: Achromatic Colors. *See Color; Chromatic Colors.*

NOTATION of Color: *See Color Notation.*

PIGMENT-MIXTURE PRIMARIES: A Red pigment, a Yellow pigment, and a Purple-Blue pigment. It is assumed that there are three pigments or three dyes, by the intermixture of which a considerable number of colors can be evoked. In practice there are more than three. For instance, two different pigments of the same HUE will act quite differently when mixed with a pigment of some other HUE. Such complexities are due to the multiple absorption of light within the pigment layer, and to the different sizes of the pigment granules.

Pigment-mixture Primaries describe the results of Pigment-mixture and as such are important. They are, however, positively misleading if one attempts to use them to describe color as the eye sees it.

PRIMARY COLORS: These are assumed to be inherently more essential than certain other colors which result from the mixing or blending of the Primary Colors. There are three kinds of Primary Colors: Light Primaries, Pigment-mixture Primaries, and Psychological Primaries. *See Light Primaries; Pigment-Mixture Primaries; Psychological Primaries.*

PRINCIPAL HUES: Red, Yellow, Green, Blue, and Purple. These five HUES have been chosen not because they are five in number, but because they are *visually equidistant from each other in Hue*. *See Intermediate Hues; Major Hues; Hue.*

Description	Notation
Red (R).....	5 R
Yellow (Y).....	5 Y
Green (G).....	5 G
Blue (B).....	5 B
Purple (P).....	5 P

PSYCHOLOGICAL PRIMARIES: Black and White; Yellow and Purple-Blue; Red and Green. Dr. Christine Ladd-Franklin has proposed the very reasonable hypothesis that the simplest eye sees merely achromatic colors (*See Achromatic Colors*); that a more complex eye sees Yellow and Purple-Blue in addition to achromatic colors; and that in fully developed vision the ability to see Yellow splits up into the ability to see Red and Green. Her theory explains in this way how it happens that Red and Green, instead of making a series of reddish Greens (as Red and Purple-Blue make a series of reddish Blues, or Purples), vanish when mixed in proper proportion, and produce Yellow; and that in the same way, Yellow and Purple-Blue produce White. *See Primary Colors.*

QUALITIES OF COLOR: *See Color Dimensions.*

REFLECTION FACTOR: The percentage of incident light reflected from a sample. *See Value.*

SECOND INTERMEDIATE HUES: Additional HUES placed at the visually determined mid-points between each of the ten Major HUES. *See Major Hues; Hue.*

Description	Notation
Red Yellow-Red (R-YR).....	10 R
Yellow-Red Yellow [(YR-Y).....	10 YR
Yellow Green-Yellow (Y-GY).....	10 Y
Green-Yellow Green (GY-G).....	10 GY
Green Blue-Green (G-BG).....	10 G
Blue-Green Blue (BG-B).....	10 BG
Blue Purple-Blue (B-PB).....	10 B
Purple-Blue Purple (PB-P).....	10 PB
Purple Red-Purple (P-RP).....	10 P
Red-Purple Red (RP-R).....	10 RP

SHADE: 1. The color evoked when looking at the mixture of a chromatic pigment with a black pigment, or of a chromatic dye with a black dye. 2. The appearance of that portion of a surface which lies in a shadow. *See Tint.*

SPECIAL INTERMEDIATE HUES: All HUES not classified as Principal, Intermediate, or Second Intermediate HUES. The following list of the HUES in the Red group shows the relation of the Special Intermediate HUES to the Major HUES and to the Second Intermediate HUES. *See Hues.*

Notation*	Classification	Description
10 RP	{ SECOND INTERMEDIATE }	Red-Purple Red
1 R	Special Intermediate	Red
2 R	Special Intermediate	
3 R	Special Intermediate	
4 R	Special Intermediate	
5 R	MAJOR	
6 R	Special Intermediate	
7 R	Special Intermediate	
8 R	Special Intermediate	
9 R	Special Intermediate	
10 R	{ SECOND INTERMEDIATE }	Red Yellow-Red

SPECTRALLY PURE COLOR: *The sensation evoked from spectrally pure light (i.e., from but a few closely-adjacent wave-lengths in the spectrum). See Visible Spectrum.*

SPECTRUM, VISIBLE: *See Visible Spectrum.*

STRONG COLOR: A color of pronounced CHROMA, found in the neighborhood of the seventh or eighth steps of CHROMA. Colors of still stronger CHROMA may be described as *very strong*. *See Chroma.*

TINT: 1. The color evoked when looking at the mixture of a chromatic pigment and a white pigment. 2. The color evoked when small amounts of a pigment or dye

* Note: The HUE of a color, which occurs between any two Special Intermediate HUES, may be expressed decimallly.

are thinly applied to a white paper or white cloth surface. *See Shade.*

TREE, COLOR: *See Color Tree.*

ULTIMATE COLOR: A color of very strong CHROMA on any VALUE Level other than the "Home" VALUE Level. *See Home Value Level; Maximum Color.*

VALUE: *The lightness or darkness of any color.* In terms of VALUE we describe all colors as *dark, middle, or light.* The notation of VALUE is shown in Fig. 1 on Page 11 of the text. There are no universally accepted synonyms for VALUE. Among those used to a limited extent are: Brightness; Brilliance; Luminosity.

VALUE LEVEL: A horizontal slice through the Color Sphere or Color Tree, on which all colors are of the same VALUE. *See Color Sphere; Color Tree.*

VALUE SCALE: A series of visually equidistant Neutral Colors, lying between Absolute Black and Absolute White. The revised Munsell VALUE Scale, found on the standard color charts, represents the averaged results obtained by seven experienced observers. The following table shows the relationship between VALUE and Reflection Factor.

VISIBLE SPECTRUM: The result of passing a beam of light through a glass prism. By this means it is broken up into an invariable sequence of increasing wave-lengths of light, evident to the eye as a sequence of colors of subtly varying HUE and of very strong CHROMA. *See Light.*

WARM COLORS: Red-Purple, Red, Yellow-Red, and Yellow. *See Cool Colors.*

WEAK COLOR: A color of reduced CHROMA, found in the neighborhood of the second or third steps of CHROMA. *See Chroma.*

WHITE: A Neutral Color of very high VALUE, usually in the neighborhood of the ninth VALUE Level. *See Absolute White.*

TABLE OF VALUE VERSUS REFLECTION FACTOR

VALUE	REFLECTION FACTOR	VALUE	REFLECTION FACTOR
0.0	0.00%	5.00	18.00%
0.2	0.19%	5.20	19.60%
0.4	0.40%	5.40	21.32%
0.6	0.62%	5.60	23.20%
0.8	0.86%	5.80	25.21%
1.0	1.12%	6.00	27.30%
1.0	1.12%	6.00	27.30%
1.2	1.41%	6.20	29.43%
1.4	1.73%	6.40	31.62%
1.6	2.08%	6.60	33.93%
1.8	2.47%	6.80	36.36%
2.0	2.90%	7.00	38.90%
2.0	2.90%	7.00	38.90%
2.2	3.38%	7.20	41.56%
2.4	3.92%	7.40	44.36%
2.6	4.51%	7.60	47.29%
2.8	5.18%	7.80	50.37%
3.0	5.95%	8.00	53.60%
3.0	5.95%	8.00	53.60%
3.2	6.81%	8.20	57.00%
3.4	7.75%	8.40	60.60%
3.6	8.77%	8.60	64.43%
3.8	9.87%	8.80	68.51%
4.0	11.05%	9.00	72.80%
4.0	11.05%	9.00	72.80%
4.2	12.30%	9.20	77.36%
4.4	13.62%	9.40	82.20%
4.6	15.01%	9.60	87.44%
4.8	16.47%	9.80	93.28%
5.0	18.00%	10.00	100.00%

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The Munsell Book of Color is a fundamental work on color which represents the last word in color standardization.

The Munsell Book of Color presents:

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- (4) a section on traditional color names showing the relation of these names to the Munsell system of color notation;
- (5) a dictionary of color terms.

THE CHARTS

COLORS OF CONSTANT HUE—Ten Charts.

A chart of constant hue shows measured steps of chroma at seven value levels in one particular hue.

COLORS OF CONSTANT VALUE—Six Charts.

A chart of constant value shows twenty hues in measured steps of chroma radiating from the neutral gray axis on one particular value level.

COLORS OF CONSTANT CHROMA—Eight Charts.

A chart of constant chroma shows the sequence of hues at seven levels of value, but at one particular strength of chroma.

SPECIAL HUE CHARTS—Two Charts.

These charts show the sequence of twenty hues at seven levels of value. Each hue is shown in the maximum of chroma which it attains at each level of value.

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