The Color Atlas

Three Color Scales Unite in a Sphere
A Color Tree Surrounds the Color Sphere
Notation of Colors by Symbols
Charts of the Color System
Balance of Color by a Sphere
THE COLOR ATLAS.

1. THREE COLOR SCALES UNITE IN A SPHERE.
Imagine a colored sphere with white as its north pole, black as its south pole, and its equator running about by a circuit of red, yellow, green, blue, and purple hues—each of which sends imperceptible into its neighbors. Fig. 1. Then the equator traces the horizontal scale of hue, H.
Imagine each equatorial hue as gradiated upward to white and downward to black in regular measured steps. Each hue then presents a scale of values over the surface, while the axis traces the central scale of gray values, V.
Imagine surface colors weakened by additions of neutral gray as they pass inward to disappear in the vertical axis. The sphere is thus filled with gradations of color—lighter shades above the equator, darker shades below. Stronger degrees outward, and weaker degrees inward to the axis, where all color is balanced in neutrality. The degree of color strength at any point is known as value and is measured by radii at right angles to the axis. It represents the gradual emergence of each hue from grayness. Each value serves as a scale of chroma, C.
Every color sensation may be measured and defined by these three scales of hue, value, and chroma. Neglect of either scale—that is, failure to state the hue, the value, or the chroma of a color—creates doubt and confusion.

2. A COLOR TREE SURROUNDS THE COLOR SPHERE.
We have all pigments colors of equal chroma then a sphere would present an ideal of their relations. But pigments are very unequal in strength. Vermilion red, for example, being twice as strong as its opposite complement, blue-green Viridian. This is shown in chart 40. The unequal scales of pigment chroma may be treated as branches of a Color Tree whose trunk is the neutral axis, while its branches of various lengths and at various levels blossom out with the strongest colors. This tree is imagined as compact of colored leaves—darker leaves below, lighter leaves above; most chromatic leaves on the surface and lesser leaves inward to the trunk, which is colorless. The tree also encloses the Color Sphere, which would appear the longer branches tipped off to equalize the length of the smaller branch. Fig. 2.

3. NOTATION OF COLORS BY SYMBOLS.
The place of each leaf of the Color Tree is determined by the measured scales of hue, value and chroma. These scales also furnish an extensive notation, made by the five color initials with their combinations and ten decimal numbers.
The scale of hue is a sequence of red (R), yellow (Y), green (G), blue (B), and purple (P), each in steps of 10°, or .1°, and 1°. The five principal hues melt perceptibly into intermediates by ten steps, of which the middle or fifth step is typical of each hue. The sequence of value is black (K) to 10 (white), and the scale of chroma likewise from 0 (neutral gray) to 10 (strongest permanent pigment so far obtained).

A symbol completely describing the character of any color sensation is composed of its degree of hue, value, and chroma. The symbol for what is commonly known as ultramarine is 5R 1/2 ("five red, four over ten")—the numerals before R showing that it is the fifth step of red in the hue scale, without tendency either to yellow or purple or yellow-purple or ultramarine, showing that its luminosity equals the fourth step in the value scale, and the chroma neutral tone showing that it is of maximum strength. Chart H.
Should the Vermillion be changed by fading or admixture with another pigment, this would appear in the symbol: 6R 1/2 Y 3/4. If 6R 1/2 Y 3/4 indicates a tone of purple a slight addition of gray reduces the chroma to 3R, while the addition of white changes the value to V. Grouping all these changes in the symbol, 6R 1/2 V, shows that the original Vermilion 5R 1/2 is no longer pure, but tinged with yellow, lightened with white, and weakened with gray.

4. CHARTS OF THE COLOR SYSTEM.
The measured scales of hue, value, and chroma are presented in two sets of charts, one made by vertical sections of the Color Tree, and the other by horizontal sections. Figs. 3 and 4.
There are eight vertical charts. Chart H is the hue scale arranged as an index for recording colors singly or in groups. Vermilion appears in the column R at the level four and with the chroma symbol 3/4. Chart V is the value scale upon a lined and perforated card, behind which to test the value of a color sample. Thus Vermilion seen through the perforations is darker than value five and lighter than value three. It matches value step four. Chart C has the chroma scale of red, yellow, green blue, and purple as tree branches whose lengths and grades describe the relations of these maxima to the extremes of white and black. Vermilion appears as the strongest red chroma, and the color is written 5R 1/2. The five vertical remaining charts are plans passed through the axis on opposite sides of which appear the complementary fields of color. Chart R shows the red field with its complementary field of blue-green. By using the symbol 6R 1/2 Vermilion may be balanced with any degree of its opposite blue-green. Chart Y shows yellow with its opposite, purple-blue. Charts G, B, and P show green, blue, and purple with their appropriate complements, red-purple, yellow-red (orange), and green-yellow.
There are seven horizontal charts. The axis opposes on each the neutral gray central of a star-like radial pattern; the lengths of whose radii indicate the chroma of their hues. These sections present colors at a single uniform level of values—thus Chart 50 at the middle of the Color Tree shows only colors which reflect 50 per cent of the luminosity of white, while Charts 40, 30, and 20 show darker levels, and Charts 60, 70, 80, and 90 show the lighter levels of color.

5. BALANCE OF COLOR BY A SPHERE.
The sphere typifies balance of color. White and black balance at the center on midblue gray, N 0. Balanced colors appear at the ends of any diameter passing through the center of the sphere. Also, a lighter color balances a darker, but when unequal values or chromas are employed the color of weaker chroma must be given the larger area. The symbols on each of these color charts indicate the proportions needed to produce balance, as suggested in "For further information the reader is referred to the author's "A Color Notation," M.rib. Bull. 1913."
"Vermilion of the subject of inquiry is the most chromatic of permanent color.
(See Chart V, page 37 of "A Color Notation.")
Chart H

Scale of Hues.

Index for color notation: hue, value and chroma.
## Chart H

### INDEX FOR COLOR NOTATION

If this chart were laid out as the three faces of a cylindrical envelope, it would reveal a accurate chart of the globe, each face taking the place of a meridional and each color level representing a parallel of latitude, while the colors maintain their relationship to altitude.

When the envelope is opened as in the red-purple meridian (RP), it would spread out to form like the Chart, green being at the center with yellow and red. (Olive) being to the right and the cool blue blue and purple to the left.

Colored shown on the chart from the 136 colors in the Munsell color book and the intermediate degrees of color are indicated at the two ends, between which and the neutral gray, which are the neutral gray, which represent the successive chart H, Y, G, B, P, and 20. 30. 40. 50. 60. 70. 80. 90. of the system.

### AVOID DUST, HANDLING AND EXPOSURE TO STRONG LIGHT.

<table>
<thead>
<tr>
<th>Scale of Hues</th>
<th>RP</th>
<th>PE</th>
<th>PB</th>
<th>B</th>
<th>BG</th>
<th>G</th>
<th>GS</th>
<th>GY</th>
<th>Y</th>
<th>YR</th>
<th>R</th>
<th>RP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale of Values</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
</tbody>
</table>
Chart V

Axis of the Color Tree.

Value, i.e. the amount of light reflected from pigments, is the second dimension or quality of color.
Chart C

Chromatic Branches of the Color Tree.

Chroma, i.e. the strength of pigment colors, is the third dimension of color.
MUNSELL COLOR SYSTEM

ATLAS
COLOR CHARTS.

Copyright by A. H. Munsell, Inc.,
PUBLISHED AUGUST 1, 1908.

CHART C
CHROMATIC BRANCHES OF THE COLOR TREE

CHROMA, i.e., the strength of pigments, is the third dimension of color, for which two
being LIGHT and VALUE.

CHROMA is represented by the branches of the color tree, which extend downward from the top
into the thickest colors at their extremities. These branches are all uniform length because
pigments of the same chroma are always alike in appearance.
The chromatic scale of 15 purples (1-15) stem outward from a central gray of the same value
(4), while all colors above and below them represent slightly lighter or darker tints. The chromatic scale of yellow
yellow (9) steps outward from a gray of the same value (8), while all colors above and below them
represent slightly lighter or darker shades. These scales are not due to personal bias or taste, but to
physiological laws which have been scientifically established. They reflect the natural process of perception. The scale starts from the
beginning of the color sphere, which all colors are located.

CHROMA makes it possible to define a color with precision.

PROTECT THE CHART FROM DUST AND HANDLING.
Chart R

Scale of Chromas. Red and Blue-Green Chart.

This chart presents a vertical plane passed through the axis of the color solid and bearing the complementary hues, red and blue-green.
RED AND BLUE-GREEN CHART.

This chart presents a vertical plane passed through the axis of the color solid and having the complementary axes, red and blue-green. This part of space here shown as the region without color from black to white, and from gray to the starp as their mode of unique opposition.

VALUES of red and blue-green range vertically from black (0) to white (10). CHROMAS or strengths of color range horizontally from neutral gray to the maximum (10).

Each step in these color scales bears an approximate equal division in light and its strength. Note R5, 6, or 7, for example; the standard color of the system, which includes 100% of the hue strength and 3% of the total light. R5 (or 7) reflects the same percentage of light but only 2% of chroma. To balance this part the same must be equally in the chroma, i.e., twice as much as the blue-green in the usual case is required to balance. Attention to these details leads to pleasing combinations.

Any choice made of red and blue-green upon this chart may be balanced by noting these symbols: red light blue-green (BG) balances blue-red (BR) when the areas are inserted as the portion at the symbol toward parts of light blue-green and twenty-four parts of dark red.

Chapter VII and IV of the handbook, "A Color System," describe these relations and their combinations with other tones.

The symbol on each color step is its NAME, a measure of its hue and strength by which it is to be recognized, written and recombined.

AVOID DUST, HANDLING AND EXPOSURE TO STRONG LIGHT.
Chart Y

Scale of Chromas. Yellow and Purple-Blue Chart.

This chart presents a vertical plane passed through the axis of the color solid and bearing the complementary hues, yellow and purple-blue.
MUNSELL COLOR SYSTEM

ATLAS

COLOR CHARTS.

CHART Y

YELLOW AND PURPLE-BLUE CHART.

This chart presents a vertical plane passed through the axis of the color wheel and locating the complementsaries, pure yellow and purple-blue. The pure of any point is shown in regular measured scale from black to white, and from grey to the strong, on scales marked in white against.

VALUES of yellow and purple-blue range vertically from black (0) to white (10). COORDINATES of colors range horizontally (3) from neutral grey to the extreme (10).

Each step in these color scales locates an appropriate shade by light and its strength. This Y2 is pure yellow, the strongest permanent yellow, which saturates (0) all chromatic strength and reflects (0) all the incident light. Its opposite (P3) reflects the same percentage of light but only 20% of chroma. To balance this pair the same must be true of the chromas, i.e., three purple-blue is but two steps as strong as pure yellow. It requires one part of purple-blue to balance two parts of the yellow.

Attention to these normal rules of mixing conclusions:

Any chosen step of yellow and purple-blue upon the chart may be balanced by noting their symbols: thus light yellow (Y1) balances light purple-blue (P1); where the size are nearest as the product of the symbols via twenty-seven parts of light yellow and seventy-two parts of dark purple-blue.

Chapters II and IV of the handbook, "A Color Spectrum," describe these balance and their combinations with other hues. The symbol on each color step is in NAME, a measure of its light and strength by which it is to be recognized, written, and reproduced.

AVOID DUST, HANDLING AND EXPOSURE TO STRONG LIGHT.
Chart G

Scale of Chromas. Green and Red-Purple Chart.

This chart presents a vertical plane passed through the axis of the color solid and bearing the complementary hues, green and red-purple.
GREEN AND RED-PURPLE CHART.

This chart presents a vertical plane passed through the axis of the color solid and shows the intermediary blues, greens, and reds. This plane of cross sections is shown in regular rectangular scales from black at white and from grayness to the strongest color shade at black pigment.

VALUES of green and red-purples range vertically from black (0) to white (10). CHROMAS or strength of color range horizontally from neutral gray to the maximum (10). Each step in these color scales has an approximate equal division in light and in strength. Thus, 0 is neutral gray, the strongest permanent green, which absorbs 20% of chromatic strength and reflects 80% of the incident light. Its opposite (GP) allows the same percentage of light but only 80% of chromas. To balance this pair, the same must be true for the chromas, i.e., black red-purple is twice as strong as green; hence parts of red-purple will balance parts of the green. Attention to these measures builds into pleasing combinations.

Any chosen step of green and red-purple on this chart may be balanced by using their symmetrical, thus light green (GP), balanced red and purple (BP), where the areas are inversely to the product of the symmetricals, i.e., full parts of dark red-purple and four parts of light green.

Chapters III and IV of the handbook, "A Color nomenclature," describe these balance and their combinations with other hues. The symbol on each color step is an AMEL or the light and strength by which it is to be identified, written and reproduced.

AVOID DUST, HANDLING AND EXPOSURE TO STRONG LIGHT.
Chart B

Scale of Chromas. Blue and Yellow-Red Chart.

This chart presents a vertical plane passed through the axis of the color solid and bearing the complementary hues, blue and yellow-red.
BLUE AND YELLOW-RED CHART.

This chart presents a vertical plane passed through the core of the color wheel and shows the complementary bars, blue and yellow-red. This part of opposite bars is shown in regular measured units from black to white and from green to the strongest red color made to stand upright.

VALUES of blue and yellow-red range vertically from black (0) to white (9). CHROMAS in shades of color range horizontally from neutral gray to the maximum (10).

Each row of these color shades has approximately equal chromatic light and its strength. The row 9 is included, the strongest presence blue, equivalent to 100% of chromatic strength and others 20% of the former light. To appear, 150% of the purest chromatic light and 900% of mixture. Thus the true shades must be accurately in the column — 10 parts.

The yellow-red yellow is just two steps from the blue, six parts of the yellow and still balance four parts of blue. Remember its extreme shade in glowing conditions.

Any chromatic shade of blue and yellow-red upon this chart may be balanced by testing their complements (half-light yellow-red (YR)) between equal gray (GR). When the two are balanced, the product of the two will be the part of the project.

Chapter III and IV of the handbook, "A Color Notation," discuss these balances and their implications with other hues.

The symbol on each color strip is its NAME, a measure of its light and strength by which it is to be measured, written and reproduced.

AVOID GLOVE HANDLING AND EXPOSURE TO STRONG LIGHT.
Chart P

Scale of Chromas. Purple and Green-Yellow Chart.

This chart presents a vertical plane passed through the axis of the color solid and bearing the complementary hues, purple and green-yellow.
MUNSELL COLOR SYSTEM
ATLAS
COLOR CHARTS.

PURPLE AND GREEN-YELLOW CHART.

This chart presents a vertical plane passed through the face of the color solid wall limiting the complementary hues, purples and greens. The pair of opposite hues is shown in regular rectangular order from black to white and from purple to the strongest color shade in middle gray.

VALUES of purple and green-yellow range vertically from black (0) to white (10). CHROMAS or strength of color range horizontally from neutral gray to the maximum (10).

Each row in these color shades has an approximate visual thresholding by the eye to the next. This P is a composed purple, the strongest pigment color, which exhibits 60% of chromatic strength and 40% of the incident light. Intensities (10) exhibit the same percentage of light but only 50% of chroma.

To balance the two hues, the color must be visually as the chroma. E.g., there is one part of hue for every part of the green-yellow.

Avoid dust, handling, and exposure to strong light.
Chart 20

Dark Scales of Hue and Chroma, Reflecting 20% of the Incident Light.

This chart is a horizontal section through the color solid, similar to chart 50 except that the shorter radii describe a loss of chroma as colors darken.
CHART 20.

BARK SCALES OF HUE AND CHROMA, REFLECTING 25% OF THE INCIDENT LIGHT.

This chart is a horizontal section through the color solid, similar to chart 50 except that the chart here depicts a line of chromes at various depths.

Each color on the chart here shows the hue and chroma of the color that is balanced by the color of the chart and response. For example, the color at the center of the chart is given the equal and measured color, so that the symbol [s] indicates that the particular color reflects 25% of the maximum white light and 85% of the strength of the maximum standard stimulus.

To balance any pair of opposite colors on this chart, such as [s] and [t] (dark enough) the hue of each color should be indicated by its hue in the chart, i.e., base part of [s] with base part of [t].

To balance the dark [s] with its corresponding light [t] (equal) the hue of each color should be indicated by its hue in the chart. The hue of each color should be indicated as in the case of the symbol. Equal parts of the line chroma balance any parts of other hue.

The proportions for the matching opposite and opposite of colors which appear on chart 50 are also applicable here, as indicated in charts 50 and 25 of the hand book, "A Color Handbook."
Chart 30

Dark Value Scales of Hue and Chroma.

This chart is a horizontal section through the color solid, similar to that of chart 50 except all its colors reflect 30% of the incident light.
MUNSELL COLOR SYSTEM

ATLAS
COLOR CHARTS.

CHART 30

CHART 30.

DARK VALUE RANGES OF HUE AND CHROMA.

This chart is a horizontal section through the color solid, similar to that of chart 30 except that all its values reflect but 50% of the maximum.

The outer circle is divided into ten equal parts, each representing one-tenth the width of the entire chart. Thence, the outer circle is divided into ten equal parts, each representing one-tenth the width of the inner circle. The inner circle is divided into ten equal parts, each representing one-tenth the width of the outer circle. The center of the chart is divided into ten equal parts, each representing one-tenth the width of the inner circle.

Each concentric circle forms a ring of equal chroma. A sequence of regularly changing chromas may be traced from the outer circle to the inner circle.

Avoid handling and exposure to dust.

NOTE: Handling and exposure to dust.
Chart 40

Scales of Hue and Chroma, Reflecting 40% of the Incident Light.

This chart is a horizontal section through the color solid, similar to chart 50 except that all its colors reflect 10% less light.
NOTICE.
Additional steps of purple are made possible by new color bases which are stable.
Thus one additional step on chart 40 and 2 steps on Charts 50 and 70 are added.

CHART 40.

Scales of hue and chroma, reflecting 40% of the incident light.

This chart is a horizontal section through the color solid, similar to chart 30 except that all its colors reflect 40% less light. It will be noticed by comparison that the areas of the yellow field, while the field of purple hue is greatly increased.

Each of the ten hues visible in wheel of chroma as a radius from the central center (N) to the strongest color obtainable in middle grayness. Thus V2, V2, V2, extends only to the 6th or medium step of chroma, while the powerful P2 extends nearly twice as far.

To balance the angular distance of any opposite pair, the circle must be proportioned to the quadrant directly on the other hue that exist parts of Y1 (balance for partial P1). Each concentric circle traces equal steps of chroma through the hue here, and the suggestions for making color comparisons which appear on the other charts apply here also. See Chapters III and IV of "A. H. Munsell's Color System."

AVOID DUST, HANDLING, AND LONG EXPOSURE TO THE LIGHT.
Chart 50

Middle Value Scales of Hue and Chroma.

This chart is a horizontal section through the color solid, classifying all colors of Middle Value, by measured scales of Hue and Chroma.
Scales of Hue and Chroma Reflecting 60% of the Incident Light.

This chart is a horizontal section through the color solid, similar to chart 50 except that all its colors reflect 10% more light.
MUNSELL COLOR SYSTEM

ATLAS
OF
COLOR CHARTS.

CHART 60

Scales of hue and chroma, reflecting 45° of the incident light.

This chart is a horizontal section through the color wheel, similar to chart 50 except that all its colors reflect 45° of white light.

Between 85° S, the wheel is divided into 85° quadrants. Each quadrant contains 360° of the color wheel.

Each of the ten base colors in Scale of Chroma on a circle from the center outward. No. 1 is the strongest color obtainable at any level in this segment. Th. B. and R.'s have less than two steps of chroma while B. F., Y. G. and G. used in the seventh and eighth steps. This is shown by the symbols printed on each side, when the inner gray line is the value and the lower terminal the chroma.

To balance any separate part, such as G. and B.'s, we should use more part of the weaker B.'s with base parts of the stronger G.'s. The qualities of color which balance are those seen at a glance. Each contains one-third maximal chroma through the circled of the base, and the equation for selecting color segments which appear to the other colors may be applied here. See Chapter III and IV of "Color Notation."

AVOID BLOT, HANDLING, AND LONG EXPOSURE TO LIGHT.
Chart 70

Light Value Scales of Hue and Chroma.

This chart is a horizontal section through the color solid, similar to chart 50 except that all its colors reflect 70% of the incident light.
Chart 80

Light Scales of Hue and Chroma, Reflecting 80% of the Incident Light.

This chart is a horizontal section through the color solid, similar to chart 50 except that the relative chromas change as their hues approximate to white.
MUNSELL COLOR SYSTEM

ATLAS

COLOR CHARTS.

Copyright 1915, Munsell Color Company
Revised January 25, 1916

CHART 80

LIGHT SCALES OF HUE AND CHROMA, REFLECTING 8% OF THE INCIDENT LIGHT.

This chart is a horizontal section through the color solid model to chart 30 except that the relative chroma change is from 0 to 8%. The scale of chroma for hue bars and displays the strength obtained in stable pigments at this level. Each step in the scale is an equal step, by which the color is known and written. For example, if the chroma scale is given two equal and measured steps, so that the symbol Y' shows that this strong yellow reflects 8% of the incident light and M' shows the strength of the maximum reflected color. To balance any part of opposite colors on the chart, such as R and Y' (light example), the area of each color should be equal, i.e., two parts of Y' with each part of R. To balance Y' which is very light and chromatic, with its dark complement PB on chart 20 which is of weak chroma, so that the area of each be inversely as the product of its parts, that four parts of the potential yellow balance one part of the dark blue.

The suggestions for selecting sequences and groups of color which appear on chart 80 are also applicable here, as indicated in AVOID DUST, HANDLING, AND EXPOSURE TO STRONG LIGHT.